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Agricultural Knowledge and Innovation Systems (AKIS)

in North Macedonia

National Report and Proposed Draft Action Plan

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1. Short introduction

This study builds forth on the results from the past SWG RRD-JRC projects ‘Study on the research, innovation and technology transfer capacities and on the recent agricultural policy developments in the context of the EU approximation process in the pre-accession countries’ (Phase I) and ‘Study on the research, innovation and technology transfer capacities’ (Phase II). The current project or Phase III: ‘Germany - Western Balkans Agricultural Policy Dialogue (APD-WB)’ has a main objective to strengthen policy frameworks for agriculture and rural development in Western Balkan countries/territories for the implementation of the EU-Green Agenda for Western Balkans and the alignment with CAP 2020 reforms, with one of the three major focus areas in Knowledge Transfer and Innovation/AKIS.

While the objective of the first phase has been to assess RITT capacities and the second phase has been to enhance them, in the third phase the project aims to set framework for creating functional Agriculture Knowledge and Innovation System (AKIS) in the Western Balkan countries, including North Macedonia, as well as setting up a regional network of Western Balkans’ AKIS.

To achieve the goal of this phase, the project requires several activities, including: i) mapping of the national AKIS with its existing and missing institutions and interlinkages between them as a first step towards building a functional and integrated national AKIS; ii) SWOT analysis with a focus of national AKIS to set the groundwork for developing strategic documents for developing a national AKIS; iii) preparation of a Roadmap towards functional national AKIS, and iv) preparation of an Action Plan for developing a functional national AKIS. The national documents shall serve further for proposing regional initiatives for developing a regional AKIS in the Western Balkans.

2. Method

AKIS has been considered a key structure and policy tool for the transfer of RITT in the agri-food sector. The Roadmap developed herein, for constructing a functional and integrated national AKIS, is based on the first and second project's activities, i.e. mapping of the national AKIS with its existing and missing institutions and interlinkages between them and the SWOT analysis with a focus of national AKIS.

The Roadmap is a strategic tool to show the directions on what needs to be done to contribute in the process of AKIS development in a given timeframe i.e. *short-term (up to one years), mid-term (one to three years), and long-term (over three years, but up to five years)*.

The Roadmap uses the SWOT elements in order to:

1. Use the strengths;
2. Fix the weaknesses;
3. Take advantage of the opportunities, and
4. Avoid the threats.

This Roadmap, essentially, takes all the information generated in the SWOT analysis (provided in Chapter 3) and map depiction (provided in Chapter IV) and simplify it into a structured strategy roadmap.

The Roadmap is designed to show the interactions between the various actors/stakeholders and variables and how they can lead to successful results. The Roadmap includes a rough presentation of:

- Objectives;
- Milestones;
- Deliverables;
- Resources available, and
- Project timeline.

Certain other key elements are also included in the roadmap like:

- Flexibility, to help adapt to a dynamic and changing environment;
- Collaboration, to involve actively stakeholders early in the planning process, and
- Early depiction of dependencies between different stakeholders.

This Roadmap is setting the *groundwork for development of an Action Plan* for development of a national AKIS.

3. Mapping of the AKIS

Figures 1 and 2 show the mapping of the national AKIS with its existing and missing institutions and their interlinkages as a first step towards building a functional and integrated national AKIS. The legend of the map is presented below. In addition, Table 1 describes the actors involved in the proposed national AKIS.

Legend:	Existent actor with sufficient capacity to function
	
	Existent actor with insufficient capacity to function
	Non-existent actor
	Functional relationship
	Partly functional relationship
	Non-existent relationship
	Public sector
	Private sector
	NGO
	Other organisation

Figure 1. Agriculture Knowledge and Information System (AKIS) Map: North Macedonia

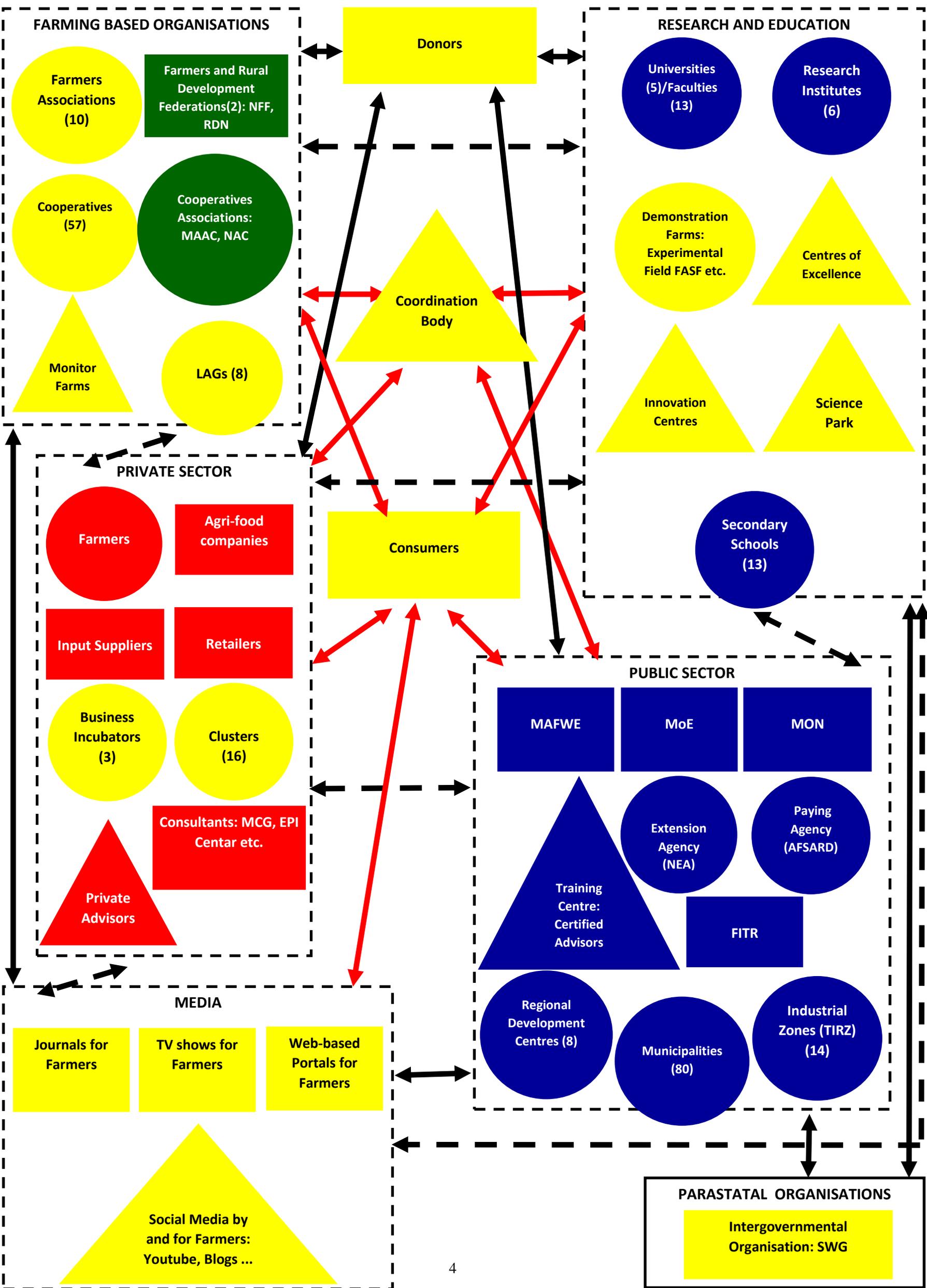


Table 1. Description of AKIS actors presented in the proposed map

Stakeholder group	Actor	Description
<p>Private Sector</p> <p>Actors in the private sector have developed partly functional relationships between each other (the strongest relationship exists between farmers and input suppliers).</p>	Farmers	Small-scale farmers dominate the agriculture structure, mostly disconnected in the AKIS (except for a number of positive cases that are well-integrated in informal networks within the AKIS, cooperating in project-supported activities).
	Agri-food companies	Agri-food companies have a strong position in the value chain, but they are mostly disconnected in the AKIS (except for very small number of cases that are well-integrated in informal networks within the AKIS, cooperating in project-supported activities).
	Input suppliers	Input suppliers have well-developed networks of cooperation with farmers, and they provide advice on production technologies on a commercial basis. They are not integrated with the rest of the AKIS.
	Retailers	Retailers have the strongest position in the agri-food chain, but they are fully disconnected in the AKIS.
	Clusters	Clusters are associations, created with the purpose of “grouping of small enterprises” to better sell on the markets. There is no specific model for the formation and operation of clusters, and they developed on their own path with the support of MoE. They are mostly disconnected from the AKIS system.
	Business incubators	There are three business incubators with a mixed focus. Specialised organizations of this kind are missing for helping start up companies and individual entrepreneurs in agriculture to develop their businesses by providing a full-scale range of services starting with management training and office space and ending with venture capital financing.
	Private advisors	There is not any private advisory service. Private advisors should complement the activities of the NEA.
	Consultants	There are several consultant companies that have developed own informal networks for cooperation within the AKIS (farmers and their organisations, agri-food companies, clusters, academia and public institutions such as MAFWE, NEA, Regional Development Centres and Municipalities), and their cooperation is usually based on project-supported activities.
<p>Public Sector</p> <p>Actors in the public sector have developed partly functional relationships between</p>	MAFWE	MAFWE - Ministry of Agriculture, Forestry and Water Economy is the main institution setting the policy for the agriculture sector and rural development. It is the key institution for setting up the AKIS, starting with its already developed networks of cooperation with other actors and enlarging its network to new necessary actors.

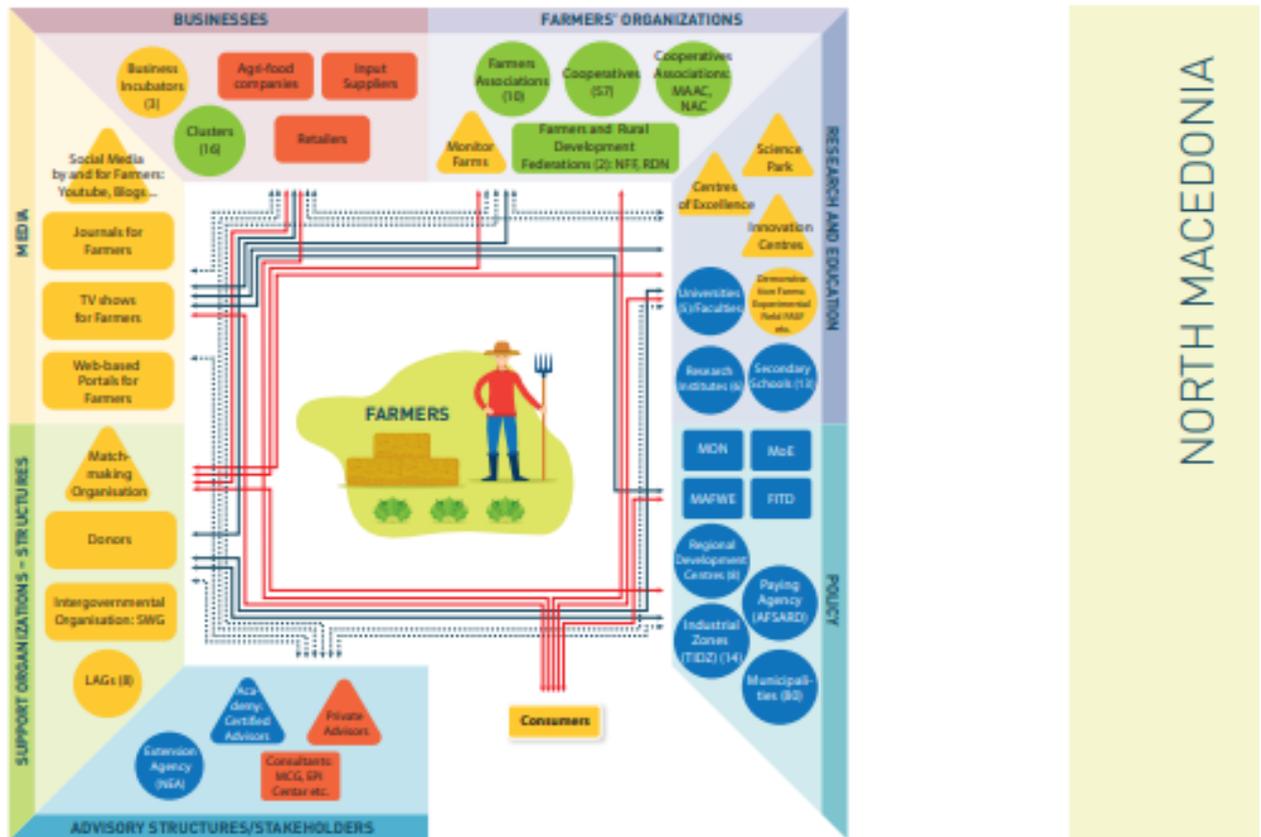
Stakeholder group	Actor	Description
<p>each other (the strongest relationship exists between MAFWE and its counterparts - AFSARD and NEA, while weak relationship exists between different Ministries).</p>	MoE	MoE - Ministry of Economy is the main institution for regulating and supporting clusters and business companies that are not under the support of MAFWE, and it is one of the key institutions for setting up and implementing the Smart Specialisation Strategy.
	MON	MON - Ministry of Education and Science is the main institution for regulating and supporting the research and education segment of the AKIS, and it is one of the key institutions for setting up and implementing the Smart Specialisation Strategy.
	NEA	NEA - National Extension Agency represents the national advisory system, which is one of the most important actor in the AKIS that may serve as a broker between farmers and research and education group of actors.
	AFSARD	AFSARD - Paying Agency is the main institution in providing finance to the private sector from support measures, and although their role in the AKIS is limited, still it is an important actor in the relationship between beneficiaries of the financial support and MAFWE.
	FITR	FITR - Fund for Innovation and Technology Development is the key institution supporting innovations and technology development, providing support only to legal entities (their support in the agriculture sector is so far modest, while somewhat larger support has been given to the food industry).
	Regional Development Centres	There are eight Regional Development Centres for each planning region in the country, whose role is to support activities for regional development, including agriculture and rural development.
	Municipalities	There are 80 municipalities, have an important role in local development, although they underperform in doing this.
	TIRZ - Industrial Zones	There are 14 industrial zones that differ in their level of development; some are well developed and have attracted FDIs, while some are underdeveloped.
	Training Centre (Academy): Certified advisors	There is no institution that provides training (both, theoretical and practical) to future advisors, and that provides certificates that prove the legibility of advisors to operate. This is an important actor in the AKIS that is missing.
<p>Research and Education</p> <p>Different actors in the research and education</p>	Universities/Faculties	<p>There are 13 faculties and six institutes within five universities that offer higher education in agri-food sciences, which often compete with each other, and also have similar study programmes and curricula. They are somewhat integrated into the AKIS, mainly through project activities that support training programmes and</p>
	Research Institutes	

Stakeholder group	Actor	Description
<p>group of stakeholders are missing in the AKIS , and those existing institutions have a low cooperation between each other.</p>		<p>research activities, with little attention to co-innovation with the other actors.</p>
	Secondary Schools	<p>There are 13 secondary schools that offer agri-food education at the high school level. They are even less integrated into the AKIS than higher education institutions (with few exceptions supported through project activities on innovation).</p>
	Demonstration Farms	<p>Demonstration farms, owned and operated by an educational institutions or government ministries, should be an integral part of the AKIS, used primarily to research or demonstrate various agricultural techniques, with any economic gains being an added bonus. But, although some faculties have this kind of facilities (i.e. the Experimental Field at the Faculty of Agricultural Sciences and Food-Skopje - FASF), they often lack resources, especially because of lack of finance, to function properly in the function of its owner and in the AKIS context.</p>
	Innovation Centres	<p>Innovation centres specialized in agri-food do not exist, although they should be an integral part of the AKIS, demonstrating a huge potential for collaborative working between business, academia and public agencies to generate economic impact.</p>
	Science Parks	<p>Science parks do not exist (usually affiliated with a university, and sometimes with government and private research bodies), but they should be an integral part of the AKIS, accommodating and fostering the growth of tenant firms, where knowledge can be shared, innovation promoted, and research outcomes progressed to viable commercial products.</p>
	Centres of Excellence	<p>Centres of Excellence related to agri-food issues do not exist, but they can be a useful segment in the AKIS, where different actors provide together leadership, best practices, research, support and/or training for a focus area.</p>
<p>Parastatal Organisations</p>	<p>Intergovernmental Organisation - SWG</p>	<p>Regional Rural Development Standing Working Group in South Eastern Europe (SWG) is an international intergovernmental organization consisting of governmental institutions in South-eastern Europe, serving as a platform for networking and regional cooperation. It is an important actor in the AKIS, especially for regional initiatives, but as well in the country, connecting different stakeholder groups to work together on project activities.</p>
<p>Farming Based Organisations</p> <p>Actors in this group have developed mainly</p>	<p>Farmers Associations</p>	<p>There are different farmer associations that usually gather together to collaborate on a shared vision. They are important actors in the AKIS, especially because they represent group interests in a focused area. They are excellent platforms for the realisation of certain concepts within the AKIS, such as farmer-to-farmer knowledge exchange</p>

Stakeholder group	Actor	Description
functional relationships with other actors in the AKIS, but their scope should be enlarged to cover larger network of beneficiaries.		(including monitor farms), groups for benchmarking for better farm performance, farmer-led interactive innovation groups, creating social media by and for farmers, levy boards etc.
	Farmers and Rural Development Federations	There is one farmers' federation (the National Federation of Farmers - NFF, that joins together different farmers' associations and individual farmers) and one federation in the rural development area (the Rural Development Network, that works with the LAGs). They are important actors in the AKIS, representing the common interests of farmers at public authorities, and serving as brokers between groups they represent, public institutions, academia and other relevant actors.
	Cooperatives	Cooperatives are still weak forms of organisations for meeting the common economic interests of farmers, and usually have weak links with the other AKIS actors (except for a small number of positive cases that are well-integrated in informal networks within the AKIS, cooperating in project-supported activities).
	Cooperatives Associations	There are two national associations of cooperatives federation (the Macedonian Association of Agricultural Cooperatives - MAAC and the National Association of Cooperatives - NAC) They are important actors in the AKIS, representing common interests of cooperatives at public authorities, and serving as brokers between groups they represent, public institutions, academia and other relevant actors, although their integration in the system is slightly below than the one of the farmers' federations.
	LAGs	There are eight Local Action Groups (LAGs) that are actually still in the early stage of development, but they shall represent useful networks of different actors that share knowledge and co-innovate.
	Monitor Farms	Monitor farms do not exist, although not compulsory, they may be a useful part of the AKIS (as they are in some other countries), bringing together groups of like-minded farmers who wish to improve their businesses by sharing performance information and best practice around a nationwide network of host farms. Monitor farmers host four to six meetings on their farms each year to identify and share challenges and solutions in farming.
<p style="text-align: center;">Media</p> <p>Actors in this group have developed mainly partly functional relationships between each other and with some other actors, such as research and</p>	Journals for Farmers	There are specialized journals (newspapers) dedicated for farmers, covering different aspects of technology development, and innovations in some instances. Journal of this kind is "Moja Zemja" issued by the National Federation of Farmers (NFF), which is mainly disseminated to its members.
	TV shows for farmers	There are few regular TV shows dedicated to agriculture and rural development, which disseminate information to and for farmers,

Stakeholder group	Actor	Description
education institutions and the private sector. Functional relationships exist with public institutions and farmer-based organisations.		covering topics for technology development among others.
	Web-based portals for farmers	There are small number of web-based portals for farmers, where they could reach information on recent novelties in the sector. One of these is “Moja Farma”, a recent media, that shares information, advices and knowledge in the area of agriculture and food.
	Social media by and for farmers	Social media by and for farmers (such as Youtube channels, blogs on social media, etc.) do not exist, although they may be useful showcases to transfer knowledge and experiences of farmers to other farmers, as well as for approaching urban consumers.
Other stakeholders	Donors	Donors are key funders of project activities that gather together different actors to collaborate between each other on different initiatives. They are main drivers of networks creation.
	Consumers	Consumers are integral part of the AKIS, but they are not at all integrated in the system, even though their needs and perceptions should be in the focus of the innovators and technology developers.
	Coordination Body	Although not necessary, a match-making organization (that do not exist in the country) is a useful actor in the AKIS, responsible for forming new groups of farmers and make connections according to compatibility, as well as connecting farmers with research and advisory services.

Figure 2. Agriculture Knowledge and Information System (AKIS) Map: North Macedonia (representation of the map with the input of SWG)



Legend:

- ◻ Existing AKIS players that have sufficient capacity to function properly
- Existing AKIS players that do not have sufficient capacity to function properly
- △ Non-existing AKIS players that are critical for the AKIS system to function properly
- ★ Institutions from the public sector
- ★ Organizations from the private sector
- ★ NGOs
- ★ Other organizations/stakeholders
- ↔ A functional relationship between AKIS players
- ⋯ A non-functional relationship between AKIS players
- ↔ A non-existent, but necessary relationship between AKIS players

List of Abbreviations

AFSARD	Agency for Financial Support of Agriculture and Rural Development	MAAC	Macedonian Association of Agricultural Cooperatives	NAC	National Association of Cooperatives
AKIS	Agriculture Knowledge Innovation System	MAPWE	Ministry of Agriculture, Forestry and Water Economy	NEA	National Extension Agency
ANES	Agriculture National Extension Service	MAFWM	Ministry of Agriculture, Forestry and Water Management	NERDA	Regional Development Agency for North-eastern Bosnia and Herzegovina
ARDA	Agriculture and Rural Development Agency	MAFWM RS	Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska	NFA	National Food Authority
ATTCs	Agriculture Technology Transfer Centers	MARD	Ministry of Agriculture and Rural Development	NFF	National Federation of Farmers
BIH	Bosnia and Herzegovina	MESY	Ministry of Education, Sport and Youth	NGO	Non-Government Organization
CoE	Centre of excellence	MNE	Montenegro	NGOs	Non-Government Organizations
EU	European Union	MoE	Ministry of Economy	POs	Producer Organizations
FKs	Farmers' associations	MoFE	Ministry of Finance and Economy	RDN	Rural Development Network
FAO	Food and Agriculture Organization of United Nations	MoE	Ministry of Education and Science	REDAH	Regional Development Agency for Herzegovina
FASf	Faculty of Agricultural Sciences and Food Development	MoTE	Ministry of Tourism and Environment	SERDA	Sarajevo Economic Regional Development Agency
FITD	Fund for Innovation and Technology Development	MSTDEIS RS	Ministry of Scientific-Technological Development, Higher Education and Information Society of the Republic of Srpska	SWG	Regional Rural Development Standing Working Group in South Eastern Europe
FSI	Food Safety and Veterinary Institute			TIDZ	Technological Industrial Development Zones
GOV	Government Organization				
LAGs	Local Action Groups				

4. SWOT analysis with a focus on the AKIS

A SWOT analysis is a strategic planning tool that helped the project to identify the internal and external factors that are favourable and unfavourable for creating a functional and integrated national AKIS, as well as to provide groundwork for composing the Roadmap and the Action Plan for AKIS. The SWOT analysis was actually initiated as a structured team brainstorming and evaluation tool used to identify the internal strengths and weaknesses and external opportunities and threats. Strengths are the key characteristics, in which the national AKIS is doing well and which provide advantages. Weaknesses are the characteristics, in which the national AKIS is not doing well, and which may hinder the success of creating a functional and integrated AKIS. Opportunities are changes occurring externally, which the national AKIS can take advantage of. Threats are any external factors that are likely out of the control of the national governance that could have a negative impact on creation of a functional and integrated national AKIS.

The elements of the SWOT analysis were prioritised based on the **importance**, **rating** (only for strengths and weaknesses), **probability** (only for opportunities and strengths) and **score**. As for the **strengths and weaknesses**, the *importance* shows how important a strength or a weakness is for the development of a functional and integrated national AKIS. A number from 0.01 to 1.0 is assigned to each strength and weakness i.e. the assigned values range from 0.01 = "Unimportant" to 1.00 = "Extremely important". The sum of these values per group of factors (internal factors as a sum of strengths and weaknesses) should not exceed the value of 1. On the other hand, the *rating* shows how the identified factor is rated i.e. the assigned values ranged from 1 = "Minor" to 3 = "Major" (or simply, if the identified strength and weakness are minor, medium or major). The *score* of different factors is determined by multiplying the importance by rating, and this is a relevant measure to set the priorities of the SWOT elements.

On the other hand, **opportunities and threats** are prioritized by importance, probability and score. The *importance* shows to what degree the external factors affect the organization. The level of importance shows the impact of a given factor, and the assigned numbers range from 0.01 = "No impact" to 1.00 = "Very high impact". The sum of these values per group of factors (external factors as a sum of opportunities and threats) should not exceed the value of 1. The *probability* shows the possible impact an opportunity or threat will have on the creation of a functional and integrated national AKIS i.e. the assigned values ranged from 1 = "Low probability" to 3 = "High probability". By multiplying the importance and probability, the *score* is obtained, by which the opportunities and threats are prioritised.

The focus is put on those internal and external factors with the highest score since they might have a greater effect on developing a functional and integrated national AKIS. The prioritized SWOT analysis, as shown in Table 2, sets the groundwork for developing the Roadmap to functional and integrated national AKIS, presented in Chapter 5, and will further serve as a basis the for development of the Action Plan (as a part of the next activities).

Table 2. SWOT analysis on AKIS: North Macedonia

Internal Factors (Strengths and Weaknesses)				
ID	Identified STRENGTHS	Importance	Rating	Priority score
		(0.01 = unimportant; 1.0 = extremely important)	(1=minor; 3=major)	(Importance x Rating)
S1	Existence of different formal actors relevant to the AKIS (such as, representatives of the public and private sector, research and education sector, non-governmental sector, media and other organizations and bodies), and existing links (although mostly partly functional) between AKIS actors.	0.10	3	0.30
S2	Numerous beneficiaries, representatives from the private sector, of the AKIS support that have a need of knowledge and innovation uptake so to be competitive on the market.	0.09	3	0.27
S3	Existence of informal networks relevant to the AKIS.	0.08	3	0.24
S4	Present donors that fund project activities and thus support creation of networks for knowledge sharing and co-innovation.	0.07	2	0.14
S5	Relatively good territorial coverage of the National Extension Agency (NEA) for dissemination of know-how.	0.05	2	0.10
S6	Existing strategies and legal structure to support parts of the AKIS.	0.03	2	0.06
ID	Identified WEAKNESSES	Importance	Rating	Priority score
		(0.01 = unimportant; 1.0 = extremely important)	(1=minor; 3=major)	(Importance x Rating)
W1	Inactive policymakers and weak performance of Governmental institutions.	0.09	3	0.27
W2	Missing structures within AKIS to support collaboration for knowledge dissemination and co-innovation (such as match-making institutions to connect different actors to cooperate, farmers' initiatives for farmer-led interactive innovation, multi-actor knowledge networks, private advisory services, education-owned entities to boost innovations etc.)	0.09	3	0.27
W3	Weak cooperation between actors from the private sector is mostly competing with each other rather than sharing experiences and knowledge.	0.08	3	0.24
W4	Absence of inter-sectorial coordination.	0.06	3	0.18
W5	Weak capacity of AKIS actors for technology development and innovation (including the insufficient capacity of the advisory services).	0.06	3	0.18

ID	Identified WEAKNESSES	Importance	Rating	Priority score
		(0.01 = unimportant; 1.0 = extremely important)	(1=minor; 3=major)	(Importance x Rating)
W6	Lack of finance to support networking activities, knowledge sharing and co-innovation.	0.08	2	0.16
W7	Weak integration of the consumers' preferences and perspectives in the innovation process.	0.04	3	0.12
W8	Large number of competing agricultural and food faculties and research institutes with similar study programs in agro-food sciences.	0.05	2	0.10
W9	Weak enforcement of the law to support AKIS segments, structures and interactions.	0.03	2	0.06

External Factors (Opportunities and Threats)

ID	Identified OPPORTUNITIES	Importance	Probability	Priority score
		(0.01 = unimportant; 1.0 = extremely important)	(1=minor; 3=major)	(Importance x Rating)
O1	Available EU funds, such as IPARD, Horizon, etc. and other foreign support.	0.15	3	0.45
O2	Internet (easy access to information and a space to create a multi-actor networks - platforms, exchange of experiences and knowledge through YouTube channel and social networks etc.).	0.10	3	0.30
O3	Upcoming national Smart Specialization Strategy S3.	0.10	2	0.20
O4	Increased possibilities for the AKIS actors for regional and international networking for knowledge sharing and innovation (using existing regional and international collaborative networks, EU's Smart Specialization Platform etc.).	0.09	2	0.18
O5	Existence of actors with informal status within the AKIS system.	0.08	1	0.08
ID	Identified THREATS	Importance	Probability	Priority score
		(0.01 = unimportant; 1.0 = extremely important)	(1=minor; 3=major)	(Importance x Rating)
T1	Low motivation and interest in the involvement of young people in agriculture.	0.15	3	0.45
T2	Depopulation of the rural areas.	0.10	3	0.30
T3	Corruption.	0.09	3	0.27

T4	The 'brain drain' of young people.	0.09	2	0.18
T5	Political and economic instability.	0.05	1	0.05

5. Roadmap for developing a national AKIS

This roadmap (provided in the Table 3 below) leads *towards development of a functional and integrated national AKIS through introducing new structures in the AKIS, strengthening the capacities of the AKIS actors, and creating functional relationships between AKIS actors* that would support RITT in the agri-food sector, focusing on consumer preferences. Figure 2 shows the graphical presentation of the priorities of the milestones.

Table 3. Roadmap for AKIS development in North Macedonia

Objective	Milestones	Deliverables	Resources needed	Timeline	Priority score: Importance	Priority score: Feasibility
1. Formalisation of AKIS	1.1. Government decision on formalisation of AKIS	<ul style="list-style-type: none"> - Law and by-laws on the AKIS prepared and adopted - The governing arrangement defined 	MAFWE (with the support of Donors EU funds)	Mid-term goal	High	High
	1.2. Strategy for AKIS formalisation defined (objectives, tasks, regulations, etc.)	<ul style="list-style-type: none"> - The Strategy adopted 	MAFWE (with the support of Donors EU funds)	Mid-term goal	High	High
	1.3. Adoption of the new Law on Advisory Services	<ul style="list-style-type: none"> - Law and by-laws on the Advisory Services prepared and adopted 	MAFWE (with the support of Donors EU funds)	Short-term goal	High	High
2. Strengthen the capacities of AKIS actors	2.1. Enhance human capacities of (the existing public and new private) advisory services (lead by MAFWE in collaboration with NEA)	<ul style="list-style-type: none"> - Developed life-long learning curricula tailored to the needs of farmers - Organised recurrent training for the advisors - Organised study visits, seminars etc. for advisory members 	MAFWE Donors EU funds	Mid-term goal	High	High

	<p>2.2. Enhance the human capacities employed in the research and education sector</p> <p>(lead by MON in collaboration with MAFWE)</p>	<ul style="list-style-type: none"> - Increased participation in joint education and research activities with regional and international institutions - Increased attendance in summer/winter schools, shorter-term courses, study visits etc. - Increased participation on scientific conferences, forums etc. - Improved access to databases, journals, and scientific and professional literature 	<p>MON MAFWE Donors EU funds</p>	<p>Mid-term goal</p>	<p>High</p>	<p>High</p>
	<p>2.3. Enhance human capacities of public institutions in supporting RITT</p> <p>(lead by MAFWE)</p>	<ul style="list-style-type: none"> - Improved inter-sectorial coordination between different public institutions - Increased involvement of Municipalities in the RITT processes jointly with Regional Development Centres and Industrial Zones 	<p>MAFWE ME Municipalities TIRZ Donors EU funds</p>	<p>Mid-term goal</p>	<p>High</p>	<p>High</p>
	<p>2.4. Introduce reforms in agro-food education with a focus on RITT development</p> <p>(lead by MON in collaboration with MAFWE)</p>	<ul style="list-style-type: none"> - Formed advisory board to support the processes of study programmes (re)accreditation of the research and education institutions - Created competitive, but not competing, studies in the agricultural and food sciences - Introduced vocational education in agro0-food sciences 	<p>MON MAFWE Donors EU funds</p>	<p>Mid-term goal</p>	<p>High</p>	<p>Medium</p>
	<p>2.5. Strengthen RITT capacities of research and education institutions</p> <p>(lead by MAFWE in collaboration with MON)</p>	<ul style="list-style-type: none"> - Modern demonstration farms, used primarily to research or demonstrate various agricultural techniques - Strong business incubators that help start-up agro-food companies and individual agricultural entrepreneurs to develop their businesses 	<p>MAFWE MON FITR Donors EU funds</p>	<p>Mid-term goal</p>	<p>High</p>	<p>Medium</p>
	<p>2.6. Strengthen capacities of farming-based organisations in their RITT mediation role between private and other sectors</p> <p>(lead by MAFWE)</p>	<ul style="list-style-type: none"> - Increased membership in farming-based organisations (especially of young people engaged in the private agricultural sector) - Strengthened cooperation between different farming-based organisations - Improved media services (newsletters, professional journals, web portals, social media tools and coverage etc.) of the farming-based organisations in the area of promoting new technologies and innovations - Increased participation of farming-based organisations in RITT's policy dialogues, national working groups etc. 	<p>MAFWE Donors EU funds</p>	<p>Mid-term goal</p>	<p>High</p>	<p>High</p>
	<p>3.1. Establish a private advisory service</p>	<ul style="list-style-type: none"> - Set legislation for private advisory operators 	<p>MAFWE Donors</p>	<p>Mid-term goal</p>	<p>Medium</p>	<p>Medium</p>

3. Introduce new structures in the AKIS	(lead by MAFWE)	<ul style="list-style-type: none"> - Set clear regulations to distinguish between competencies and areas of operation of private and national advisory services to provide complementarities in the system - Set supporting infrastructure for the operation of the private advisory service (preparation of financing models, contracts and bidding documents, a database of certified private advisors etc.) 	EU funds			
	3.2. Establish Academy for certifying advisors (lead by MAFWE)	<ul style="list-style-type: none"> - Set legislation and regulation of the Academy for certifying advisors (for both, public and private advisors) - Created a study programme for certified advisors with different modules (for public and private advisors) - Provided facilities for education purposes (classroom equipped with necessary study materials, study literature, logistics to support practical learning etc.) - Created human resource capacities to run the administration of the Academy and to teach - Provided other supporting infrastructure for the operation of the Academy (preparation of financing models, bidding documents etc.) 	MAFWE Donors EU funds	Mid-term goal	Medium	Medium
	3.3. Establish Science Park (jointly led by MON, MAFWE and ME)	<ul style="list-style-type: none"> - Set legislation and regulation of the Science Park - Selected University(ies) and their properties for the establishment of a Science Park - Provided facilities for the operation of the Science Park (buildings, equipment etc.) - Recruited tenant firms - Created human resource capacities to run the administration of the Science Park - Provided other supporting infrastructure for the operation of the Science Park (bidding documents etc.) 	MON MAFWE ME FITR Donors EU funds	Long-term goal	Medium	Low
	3.4. Establish other institutions/organisations to support research, innovation and technology transfer (RITT) in the agri-food sector (lead by MAFWE in cooperation with MON)	<ul style="list-style-type: none"> - Established Innovation Centres within, between (or independently from) research and education institutions - Established Centres of Excellence (a team, a shared facility or an entity) that provides leadership, best practices, research, support and/or training for a focus area 	MAFWE MON FITR Donors EU funds	Mid-term goal	Medium	Medium

4. Create functional relationships between AKIS actors	4.1. Establish a broker entity (Coordination Body) that supports the creation of functional relationships of the AKIS (lead by MAFWE)	<ul style="list-style-type: none"> - Established match-making organisation to support the formation of multi-actor knowledge networks and co-innovation in the agri-food sector 	MAFWE Donors EU funds	Mid-term goal	High	Medium
	4.2. Encourage farmers-led interactive innovation (lead by MAFWE)	<ul style="list-style-type: none"> - Increased awareness among farmers on the importance to exchange knowledge and co-innovate (with other farmers, agri-food industry, academia, consumers etc.) - Established groups of collaborators, such as benchmarking for better farm performance, field labs for finding lasting solutions to practical problems, monitoring farms, levy boards etc. - Developed thematic programmes on YouTube and blogs on social media by and for farmers 	MAFWE Donors EU funds	Mid-term goal	High	Medium

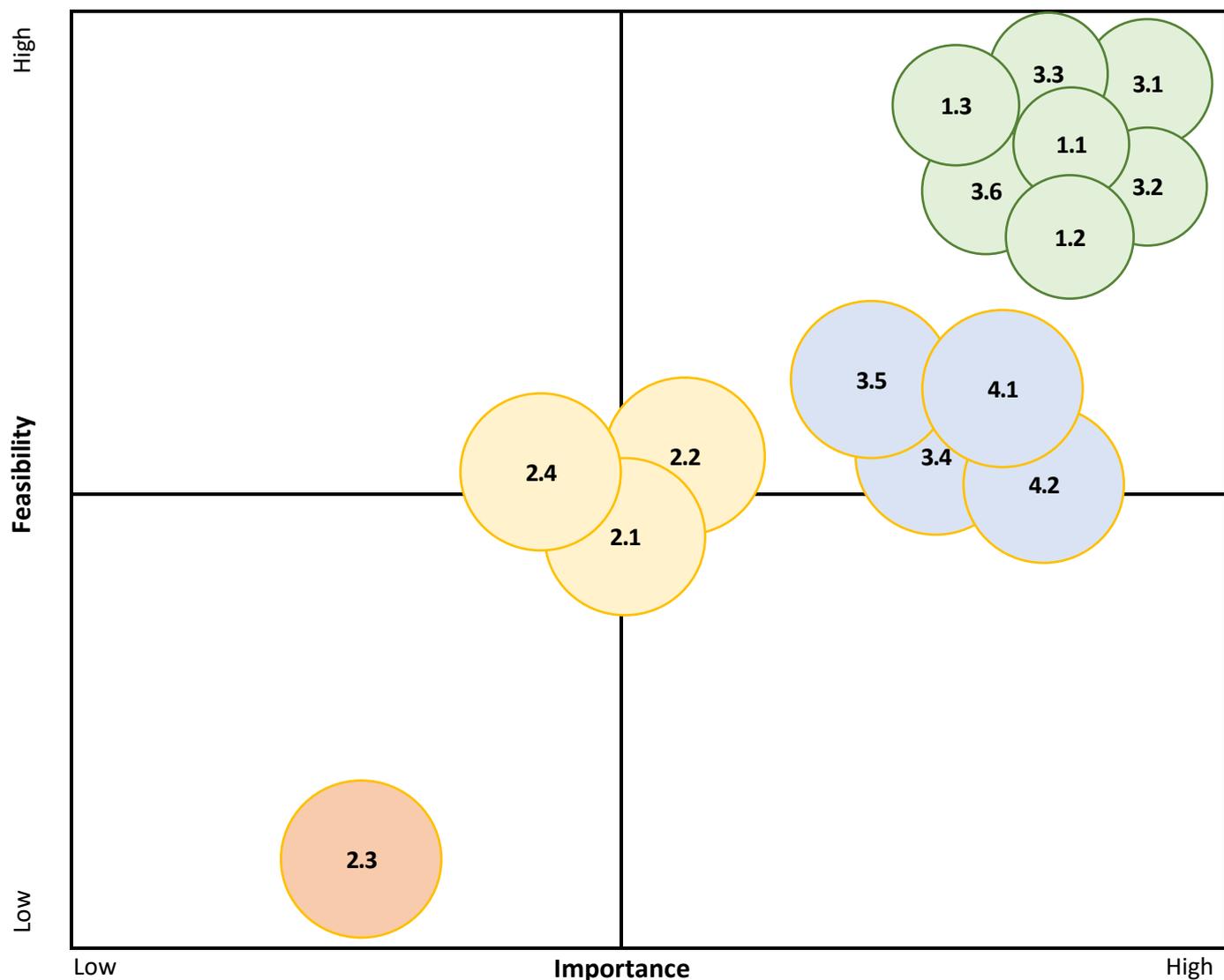


Figure 2. Prioritisation mapping of the Roadmap

Legend:

Milestones		Priority score: Importance	Priority score: Feasibility
1.1.	Government decision on formalisation of AKIS	High	High
1.2.	Strategy for the formalisation defined (objectives, tasks, regulations, etc.)	High	High
1.3.	Adoption of the new Law on Advisory Services	High	High
2.1.	Establish private advisory service	Medium	Medium
2.2.	Establish Academy for certifying advisors	Medium	Medium
2.3.	Establish Science Park	Medium	Low
2.4.	Establish other institutions/organisations to support research, innovation and technology transfer (RITT) in the agri-food sector	Medium	Medium
3.1.	Enhance human capacities of (the existing public and new private) advisory services	High	High
3.2.	Enhance human capacities employed in the research and education sector	High	High
3.3.	Enhance human capacities of public institutions in supporting RITT	High	High
3.4.	Introduce reforms in the agri-food education with focus on RITT development	High	Medium
3.5.	Strengthen RITT capacities of research and education institutions	High	Medium
3.6.	Strengthen capacities of farming based organisations in their RITT mediation role between private and other sectors	High	High
4.1.	Establish a broker entity that supports creation of functional relationships of the AKIS	High	Medium
4.2.	Encourage farmers-led interactive innovation	High	Medium

5.1. Elaboration of Objective 1: *Formalization of AKIS*

The first step in order for the AKIS to be functional, formalization of this system needs to take place. **Introducing a Law on AKIS and the subsequent by-laws** will define the legal framework as well as the roles and jurisdictions of the relevant structures and bodies. A **long-term Strategy on AKIS**, prepared by different stakeholders, will contribute to define the goals and instruments to develop a functional AKIS. A **new Law on the Advisory Services is in the process of adoption**, which regulates different aspects of the functioning of the advisory system. This Law includes certain aspects of AKIS, however these are very narrow (the Law on AKIS should be broader in its scope and content for formalization of a functional AKIS). By-laws on the Advisory Services should define in details on how the Law will become operational.

5.2. Elaboration of Objective 2: *Strengthen the capacities of AKIS actors*

There are different formal actors in the AKIS (such as, representatives of the public and private sector, research and education sector, non-governmental sector, media and other organisations and bodies). However, most of them have a weak capacity for technology development and innovation, which are often not in accordance with consumers' preferences and perspectives. Improving inter-sectorial coordination is necessary. To achieve this objective, in addition, the opportunities of the upcoming national Smart Specialisation Strategy (S3) should be used. This involvement may reinforce possibilities for the AKIS actors to become an integral part of regional and international networks for knowledge sharing and innovation (i.e. part of the EU's Smart Specialisation Platform etc.). To strengthen this networking, already established networks for regional and international collaborative work should be used as well. **SWG is an important actor in increasing regional and international cooperation.**

The capacities of the existing and new AKIS structures should be enhanced, investing primarily in **human resource development**, but also in **access to different resources to support RITT activities in the agri-food sector**. To enhance the capacities of the private sector, **reforms in education in agro-food sciences** should take place in accordance with labour demand. There are a large number of competing agricultural and food faculties and research institutes with similar study programmes in agri-food sciences. **Modernisation of the existing demonstration farms** is necessary, owned and operated by research and education institutions (including higher-education institutions and secondary schools) that will be used primarily to research or demonstrate various agricultural techniques, with any economic gains being an added bonus. Creating **strong business incubators** that help start-up agro-food companies and individual agricultural entrepreneurs is also necessary to develop their businesses by providing a full-scale range of services starting with management training and office space and ending with venture capital financing.

Farming-based organisations are important actors in the AKIS, serving as mediators between the private sector (particularly farmers and agri-food companies) and other sectors (in particular, the public sector and the research and education sector). **Strengthening the capacities of farming-based organisations in their RITT mediation role is necessary**, especially in supporting the enlargement of their membership, especially of those of young people, and networking activities, but also in their media coverage in regard to RITT.

5.3. Elaboration of Objective 3: *Introduce new structures in the AKIS*

There are missing structures within AKIS to support collaboration in knowledge exchange and co-innovation. **Informal networks already exist that may serve as a ground for the development of new structures of the AKIS.** Existing strategies and legal structures exist to support parts of the AKIS, but there are **still missing legal frameworks and legislation to support new AKIS structures and the functioning of the system as**

a whole. Weak enforcement of law and corruption may be obstacles in supporting AKIS segments, structures and interactions. Donors are present that may fund project activities, including the creation of networks for knowledge sharing and co-innovation, and there are available national and EU funds, such as IPARD, Horizon etc. But, still, a lack of finance may prevail in supporting long-term networking activities, knowledge sharing and co-innovation.

First, the capacities of the National Extension Agency (NEA) are limited in providing advice to farmers in different areas of need, considering the large demand from the private sector for knowledge and innovation uptake. Thus, **private advisors should complement the activities of the NEA to provide extension services to strengthen the capacities of a larger mass of beneficiaries (farmers) by empowering them in different aspects.**

Second, **there is no institution that provides theoretical and practical education and training, as well as certification of future advisors**, both public and private advisors, to prove their legibility to operate, and more importantly, to improve the quality of the advisory services. **The relatively good territorial coverage of the NEA is a strength that could be used for reaching a larger mass of beneficiaries in the know-how dissemination process.**

Third, **science parks do not exist, but they should be an integral part of the AKIS.** They are usually affiliated with a university or a group of universities (sometimes with government and private research bodies), accommodating and fostering the growth of tenant firms, where knowledge can be shared, innovation promoted, and research outcomes progressed to viable commercial products. Science parks are also often perceived as contributing to national economic development, stimulating the formation of new high-technology firms, attracting foreign investment and promoting exports.

Fourth, other institutions and organizations to support research, innovation and technology transfer (RITT) in the agri-food sector are missing as well. **Innovation centres** are a demonstration of the huge potential of collaborative working between business, academia and public agencies to generate economic impact, while **centres of excellence** are a team, a shared facility or an entity that provides leadership, best practices, research, support and/or training for a focus area.

5.4. Elaboration of Objective 4: *Create functional relationships between AKIS actors*

The existing links between AKIS actors are mostly partly functional, and some new links should be established, especially those of the new AKIS structures. Supporting the **establishment of a match-making organisation is required to form new groups and make the connection between different actors according to compatibility.** Multi-actor networks are an excellent opportunity for **farmer-led interactive innovation**: farmers learn from researchers about good experimental design and what the scientific arena already knows on the issue, whilst simultaneously farmers help researchers understand the real priorities they have to face; advisers help coordinate groups and farming organisations can get their own network of farmers involved etc.

Next, there is **weak cooperation between actors from the private sector, especially between farmers, that are mostly competing with each other rather than sharing experiences and knowledge.** The awareness among farmers should be increased on the importance to share experiences and knowledge and co-innovate with other farmers, the agro-food industry, academia, consumers etc. There should be special measures to support the creation and operation of farmer-to-farmer collaborative groups. *Benchmarking for better farm performance*, discussed in focus discussion (with up to 10 farmers) to compare different farmers' best practices to improve results (the discussion group leaders are the key persons in this exchange of knowledge since they inform the farmers about new research results, case studies from the best farms and encourage the farmers to

tell more, while the group collects data, finds the best practices and searches for positive changes on a specific topic, starting from the big picture of each farm and ending in searching for the critical points to be overcome for the next 1-1.5 years). Field labs are another kind of membership network of farmers working together to find lasting solutions to practical problems. Next, **monitoring farms** bring together groups of like-minded farmers who wish to improve their businesses by sharing performance information and best practice around a nationwide network of host farms. Monitor farmers host four to six meetings on their farms each year, providing an excellent opportunity to identify and share challenges and solutions between farmers. **Levy Boards may be a good way for farmers to collectively pay for R&D, spreading the cost across each sector.** They are useful forms in the AKIS to support R&D activities (proven to be successful in other countries), but they are not a compulsory actor in the AKIS. The Internet creates opportunities for easy access to information and a space to create multi-actor networks - platforms, exchange of experiences and knowledge through YouTube channels and social networks etc. *Social media by and for farmers* should be also supported to encourage cooperation between these actors, such as thematic YouTube channels by a group of farmers to connect farmers with urban consumers, blogs and shared videos on new research and innovation on social media etc.

6. Action Plan for developing a national AKIS

This Action Plan (provided in Table 4 below) leads *toward the development of a functional and integrated national AKIS through introducing new structures in the AKIS, strengthening the capacities of the AKIS actors, and creating functional relationships between AKIS actors* that would support RITT in the agri-food sector, focusing on consumer preferences.

Table 4. Action Plan for AKIS development in North Macedonia (*1-7, 1 least impact; **1-7; 1 least feasible)

Specified objectives	Required action	Milestones	Deliverables	Resources needed	Deadline	Impact*	Feasibility**
Strategic objective 1: Formalisation of AKIS							
1. Adoption of a Law and by-laws on AKIS (lead by MAFWE in collaboration with relevant stakeholders)	<ul style="list-style-type: none"> - Prepare Law on AKIS - Prepare by-laws on AKIS 	<ul style="list-style-type: none"> - Government decision on the formalisation of AKIS - Establish a working group (with different stakeholders) for the preparation of the Law and the by-laws - Organise meetings and workshops on the Law and by-laws - Public discussion on the prepared Law 	<ul style="list-style-type: none"> - Law and by-laws on the AKIS prepared and adopted 	MAFWE (with the support of Donors EU funds)	2023-2025	7	7
2. Strategy for AKIS (lead by MAFWE in collaboration with relevant stakeholders)	<ul style="list-style-type: none"> - Government decision on preparing a long-term strategy for AKIS - Gather different representatives of AKIS actors in governing the process 	<ul style="list-style-type: none"> - Define objectives, tasks, regulations, roles, jurisdiction etc. on the AKIS 	<ul style="list-style-type: none"> - Strategy on AKIS prepared 	MAFWE (with the support of Donors EU funds)	2023-2025	7	7
3. Adoption of the new Law and by-laws on Advisory Services	<ul style="list-style-type: none"> - Prepare (complete) the Law on Advisory Services 	<ul style="list-style-type: none"> - Complete the process of the Law adoption (round up the public discussion on the Law) 	<ul style="list-style-type: none"> - Law and by-laws on the Advisory Services adopted 	MAFWE (with support of EU funds)	2022-2023	7	7

Specified objectives	Required action	Milestones	Deliverables	Resources needed	Deadline	Impact*	Feasibility**
(lead by MAFWE in collaboration with NEA and other relevant stakeholders /working group)	- Prepare by-laws on Advisory Services	- Organise meetings and workshops on the preparation of the by-laws					
Strategic objective 2: Strengthen the capacities of AKIS actors							
1. Enhance human capacities of advisory services (public and private services)	1.1. Introduce a life-long learning programme for advisors	<ul style="list-style-type: none"> - Develop and accredit a life-long learning curriculum for advisors tailored to the needs of farmers - Adopt and implement the IPARD measure on Advisory Services; and gradually increase of the IPARD budget allocated to the measure on Advisory Services - Introduce a measure on advisory services within the national Rural Development Programme to test the future implementation of the planned IPARD 3 measure on Advisory Services 	<ul style="list-style-type: none"> - Accredited life-long learning programme for advisors - Organised recurrent training for advisors on a yearly basis - Created measure(s) to support AKIS actors (IPARD or National Programme) 	<ul style="list-style-type: none"> - MAFWE (State measure at Rural Development Programme or IPARD) - Donors - EU funds 	2023-2025	7	7
(lead by MAFWE in collaboration with NEA and private advisors)	1.2. Establish Educational Centre for certifying advisors (lead by MAFWE)	<ul style="list-style-type: none"> - Set legislation and regulation of the Educational Centre for certifying advisors - Develop a study programme for certifying advisors, and provide staff, facilities and supporting infrastructure for education purposes - Networking of the national Educational Centre within the regional network of similar Centres 	<ul style="list-style-type: none"> - Accredited programme for advisors with different modules - Fully equipped Educational Centre with necessary staff, organisation, facilities and supporting infrastructure - Developed a regional network of relevant Educational Centres 	<ul style="list-style-type: none"> - MAFWE - Donors - EU funds 	2023-2025	7	6

Specified objectives	Required action	Milestones	Deliverables	Resources needed	Deadline	Impact*	Feasibility**
2. Enhance human capacities employed in the research and education sector (lead by MON in collaboration with MAFWE)	2.1. Enhance research and education	<ul style="list-style-type: none"> - Increase evidence-based and industry real problem-solving research - Participation of researchers in joint research activities with regional and international institutions; participation on scientific conferences, forums, summer/winter schools, etc. - Access to databases, journals, and scientific and professional literature 	<ul style="list-style-type: none"> - Published contemporary research papers in well-recognised journals and other relevant publications - Developed new technologies and innovative products 	<ul style="list-style-type: none"> - MON - MAFWE - Donors - EU funds 	2023-2025	7	4
3. Enhance the human capacities of public institutions in supporting RITT (lead by MAFWE)	3.1. Continuous training for public administration	<ul style="list-style-type: none"> - Training needs assessment of public administration to support AKIS functioning - Allocation of financial resources to support participation on training, study visits etc. of the public administration 	<ul style="list-style-type: none"> - Trained staff to support AKIS functioning 	<ul style="list-style-type: none"> - MAFWE - Donors - EU funds 	2023-2025	7	7
4. Introduce reforms in agro-food education with focus on RITT development (lead by MON in collaboration with MAFWE)	4.1. Study programs to support innovations in the agri-food industry	<ul style="list-style-type: none"> - Form an advisory board to support the processes of study programmes (re)accreditation of the research and education institutions - Introduce new or reaccredited study programmes and vocational education in agro-food sciences - Introduce practical education for students in experimental fields through increased links with the industry - Increase mobility of students and academic staff 	<ul style="list-style-type: none"> - Created competitive, but not competing, studies in the agricultural and food sciences with a focus on innovations 	<ul style="list-style-type: none"> - MON - MAFWE - Donors - EU funds 	2023-2025	7	6

Specified objectives	Required action	Milestones	Deliverables	Resources needed	Deadline	Impact*	Feasibility**
5. Strengthen RITT capacities of research and education institutions (lead by MON in collaboration with MAFWE)	5.1. Modernise demonstration farms	<ul style="list-style-type: none"> - Develop a business plan for modernization - Design measures to support modernisation of demonstration farms within the national Rural Development Programme - Adopt and implement the IPARD measure on Knowledge and Innovation 	<ul style="list-style-type: none"> - Modern demonstration farms - Created measure(s) to support AKIS actors (IPARD or National Programme) 	<ul style="list-style-type: none"> - MAFWE - MON - FITR - Donors - EU funds 	2025-2027	7	5
	5.2. Modernise education facilities	<ul style="list-style-type: none"> - Equip research and education institutions with high-tech classrooms and laboratories - Strengthen the distance learning tools 	<ul style="list-style-type: none"> - Modern teaching and research facilities 	<ul style="list-style-type: none"> - MAFWE - MON - FITR - Donors - EU funds 	2023-2025	7	6
6. Strengthen capacities of farmer-based organisations in their RITT mediation role between private and other sectors (lead by MAFWE)	6.1. Modernise farmer-based organizations	<ul style="list-style-type: none"> - Identification of the innovation needs of farmer-based organisations and design of a specific innovation programme - Increase participation of farming-based organisations in RITT's policy dialogues, national working groups etc. - Support visits to fairs - Improve media services (newsletters, professional journals, web portals, social media tools and coverage etc.) of the farmer based organisations in the area of promoting new technologies and innovations - Introduce a measure on knowledge and innovation within the national Rural Development Programme 	<ul style="list-style-type: none"> - Increased membership in farmer based organisations - Modern farmer based organisations - Created measure(s) to support AKIS actors (National Programme) 	<ul style="list-style-type: none"> - MAFWE (State measure at Rural Development Programme or IPARD) - FITR - Donors - EU funds 	2023-2025	6	6

Specified objectives	Required action	Milestones	Deliverables	Resources needed	Deadline	Impact*	Feasibility**
	6.2. Strengthen cooperation between different farmer-based organisations	<ul style="list-style-type: none"> - Support networking activities of the national farmer-based organisation - Development of digital tools to support coordination and increase the visibility of activities and services provided - Establish a Forum to motivate policy dialogue - Introduce a measure on knowledge and innovation within the national Rural Development Programme 	<ul style="list-style-type: none"> - National platform of farmer based organisations - International network of farmer based organisations - Created measure(s) to support AKIS actors (National Programme) 	<ul style="list-style-type: none"> - MAFWE (State measure at Rural Development Programme or IPARD) - FITR - Donors - EU funds 	2023-2025	6	6
Strategic objective 3: Introduce new structures in the AKIS							
7. Establish a private advisory service (lead by MAFWE)	7.1. Establish appropriate legislation for advisory services	<ul style="list-style-type: none"> - Preparation of law and by-laws for advisory services - Adopt and implement the IPARD measure on Advisory Services - Gradual increase of the IPARD budget allocated to the measure on Advisory Services - Introduce a measure on advisory services within the national Rural Development Programme to test the future implementation of the planned IPARD 3 measure on Advisory Services 	<ul style="list-style-type: none"> - Adopted law and by-laws for advisory services - Created measure(s) on Advisory Services (IPARD or National Programme) 	<ul style="list-style-type: none"> - MAFWE - Donors - EU funds 	2022-2023	7	7
	7.2. Set supporting infrastructure for the operation of the private advisory services	<ul style="list-style-type: none"> - Establish a management committee - Prepare financing models, contracts and bidding documents, databases of advisors etc. - Introduce monitoring models and instruments 	<ul style="list-style-type: none"> - Functional advisory services - Created measure(s) on Advisory Services (IPARD or National Programme) 	<ul style="list-style-type: none"> - MAFWE - Donors - EU funds 	2022-2023	7	7

Specified objectives	Required action	Milestones	Deliverables	Resources needed	Deadline	Impact*	Feasibility**
		<ul style="list-style-type: none"> - Adopt and implement the IPARD measure on Advisory Services - Introduce a measure on advisory services within the national Rural Development Programme to test the future implementation on the planned IPARD 3 measure on Advisory Services 					
8. Establish other institutions/ organisations to support research, innovation and technology transfer (RITT) in the agri-food sector (lead by MAFWE in cooperation with MON)	8.1. Establish business incubators	<ul style="list-style-type: none"> - Develop programme of business incubators' interventions - Develop business model, including strategy to improve visibility to scale-up investors - Develop training modules, including demonstration cases that catalyse new business start-ups - Encourage collaboration between different stakeholders - Adopt the Smart Specialisation Strategy 	<ul style="list-style-type: none"> - Operational business incubators - Improved innovation capacities in the agri-food sector 	<ul style="list-style-type: none"> - MAFWE - MoE - MON - FITR - Donors - EU funds 	2024-2026	6	5
	8.2. Establish Innovation Centres in agro-food industry	<ul style="list-style-type: none"> - Support measure to assist the establishment of Agriculture Innovation Centre(s) - Demonstration centres in major agriculture production regions in the country - Increase involvement of Municipalities in the RITT processes jointly with Regional Development Centres and Industrial Zones - Adopt the Smart Specialisation Strategy 	<ul style="list-style-type: none"> - Operational Agriculture Innovation Centre - Operational Demonstration centres in agri-food industry - Improved innovation capacities in the agri-food sector 	<ul style="list-style-type: none"> - MAFWE - MoE - MON - FITR - TIRZ - Donors - EU funds 	2025-2027	6	5

Specified objectives	Required action	Milestones	Deliverables	Resources needed	Deadline	Impact*	Feasibility**
	8.3. Establish Centres of Excellence in agri-food industry	<ul style="list-style-type: none"> - Mapping and connecting interested and competent stakeholders - Adopt the Smart Specialisation Strategy 	<ul style="list-style-type: none"> - Operational Centres of Excellence in agri-food industry - Improved innovation capacities in the agri-food sector 	<ul style="list-style-type: none"> - MAFWE - MON - FITR - Donors - EU funds 	2025-2027	5	4
Strategic objective 4: Create functional relationships between AKIS actors							
9.Coordination of AKIS (lead by MAFWE)	9.1. Establish a Coordination Body of AKIS	<ul style="list-style-type: none"> - Facilitate networking for coordination, cooperation and exchanges between various institutions involved in AKIS - Develop technical guidelines for operation of the Coordination Body - Inter-sectorial coordination between different public institutions 	<ul style="list-style-type: none"> - Coordination Body established - Functional AKIS 	<ul style="list-style-type: none"> - MAFWE - Donors - EU funds 	2022-2023	7	6
10. Encourage farmers-led interactive innovation (lead by MAFWE)	10.1. Establish groups of farmers for a farmer-led interactive innovation	<ul style="list-style-type: none"> - Increase awareness among farmers on the importance to exchange knowledge and co-innovate (with other farmers, agri-food industry, academia, consumers etc.) - Introduce benchmarking for better farm performance - Introduce field labs for finding lasting solutions to practical problems - Introduce monitor farms - Introduce levy boards etc 	<ul style="list-style-type: none"> - Improved on-farm innovation, farming practices and performances - Created measure(s) to support AKIS actors (IPARD or National Programme) 	<ul style="list-style-type: none"> - MAFWE - Donors - EU funds 	2025-2027	7	5

Specified objectives	Required action	Milestones	Deliverables	Resources needed	Deadline	Impact*	Feasibility**
		<ul style="list-style-type: none"> - Develop thematic programmes on YouTube and blogs on social media by and for farmers - Introduce a measure on knowledge and innovation within the national Rural Development Programme 					

6.1. Elaboration of Strategic Objective 1: *Formalization of AKIS*

The first step in order for the AKIS to be functional, formalization of this system needs to take place. Introducing a **Law on AKIS** and the subsequent **by-laws** will define the legal framework as well as the roles and jurisdictions of the relevant structures and bodies. The required actions include preparation of the Law and its by-laws. For these activities to be realized, first, a political will and government decision are needed. The government through MAFWE should give jurisdictions to a working group appointed for Law preparation, composed of different stakeholders, and organize meetings and workshops on Law and by-laws preparation. To finalize the process (to adopt the Law), MAFWE should also organize a public discussion on the Law and propose its adoption to the Parliament.

A long-term **Strategy on AKIS**, prepared by different stakeholders, will contribute to defining the goals and instruments to develop a functional AKIS. First, a Government decision on preparing a long-term strategy for AKIS by MAFWE is needed. Second, it is necessary to gather different representatives of AKIS actors in governing the process (including different responsible ministries and other governmental, non-governmental and academic institutions, farmers' representatives, different structures and bodies (existing and new) in the informal AKIS system, etc.) to define objectives, tasks, regulations, roles, jurisdiction etc. on the AKIS.

A new **Law on the Advisory Services** is in the process of adoption, which regulates different aspects of the functioning of the advisory system. This Law includes certain aspects of AKIS, however, these are very narrow (the Law on AKIS should be broader in its scope and content for the formalization of a functional AKIS). **By-laws** on the Advisory Services should define in detail how the Law will become operational, which should be prepared in the following period, no later than the end of the year 2022.

6.2. Elaboration of Strategic Objective 2: *Strengthen the capacities of AKIS actors*

There are different formal actors in the AKIS (such as, representatives of the public and private sector, research and education sector, non-governmental sector, media and other organisations and bodies). However, most of them have a weak capacity for technology development and innovation, which are often not in accordance with consumers' preferences and perspectives. Improving the inter-sectorial coordination is necessary. To strengthen this networking, already established networks for regional and international collaborative work should be used as well. **SWG is an important actor for increasing the regional and international cooperation.**

The capacities of the existing and new AKIS structures should be enhanced, investing primarily in **human resource development**, but also in **access to different resources to support RITT activities in the agri-food sector**. A measure on Advisory Services is foreseen within IPARD 3, however the measure still needs to be adopted and implemented. The budget allocated to the **measure on Advisory Services** should also be considered for gradual increase since very small funding is allocated to this measure at the moment. In order to test the success of the future implementation on the planned **IPARD 3 measure on Advisory Services** it might be beneficial to introduce a **measure on Advisory services within the national Rural Development Programme**.

NEA has a relatively good territorial coverage, a prospect which is a clear strength that could be utilized for reaching larger mass of beneficiaries in the know-how dissemination process. However, **human capacities need to be further strengthened** both in size and in continuous knowledge upgrade on yearly basis. The advisors should be updating their knowledge base in the area of their expertise and in accordance to the latest trends of farming practices, technologies, innovation, economic aspects and on urgent topics (i.e. cross-compliance, climate change etc.). In this respect, it is of vital importance to introduce a **life-long learning programme for the advisors**. The curriculum for this program shall be developed and accredited in accordance

to both farmers and advisors needs. Additionally, the certification of advisors (public and private advisors) will need a form of regulation and frame, or within an ***Educational Centre for certifying advisors***. This will require serious approach primarily in the process of constructing and developing the study programme for certifying advisors (for public and private advisors), accredited for advisors with different modules within the Educational Centre. The activities within this part will also need to cope with developing the human administrative and teaching capacities (established management structure and trained teaching staff), as well as in the part of providing technical assistance and other supporting infrastructure to assure functional and operational Educational Centre (preparation of financing and business models, bidding documents etc.). The National Centre should then become part of a regional network of similar Centres with the aim of exchange of experience. The Educational Centre for certifying advisors will also be part and will be regulated in the Law and through the by-laws for advisory services but also receive support from the **IPARD 3 measure on Advisory services**, which is in process of adaptation and implementation, and the accordingly created measure on Advisory Services within the **national Rural Development Programme**.

Research and education are the core base of innovation and up-to-date advisory services, published contemporary research papers in well-recognised journals and other relevant publications and development of new technologies and innovative products. State measures for targeted research should be thus developed to support research and education. Additionally, it is of high essence to motivate research collaboration between research and industry in order to increase evidence-based research and real problem solving. This could be done through more active involvement of MSc and PhD students in the research activities (funded by the industry, mentored by the Universities). Participation of researchers in joint research activities with regional and international institutions should also be enhanced, especially in preparation and application of joint projects (e.g. EU funds). Contemporary research and education (education methods) require participation on scientific conferences, forums, attendance on summer/winter schools, shorter-term courses, study visits, as well as access to databases, journals, and scientific and professional literature etc. At the moment those activities present problem for the researchers and education staff, since the allocated state funding for this purpose is very limited and is dependent on external funding. The measure on **Knowledge and Innovation is not foreseen in IPARD 3**, but its adoption and implementation is very important for the research and education part of the enhancement of human capacities employed in the research and education sector. To bypass the gap period while a similar measure is adopted within the next IPARD planning period, it will be valuable to introduce a measure on knowledge and innovation within the **National Rural Development Programme**.

The ***continuous training for public administration*** will primarily require training needs assessment of public administration that will be key support for the functioning of the overall AKIS. For this purpose, allocation of resources to support participation on training, study visits etc. of the public administration will be necessary.

The first step in the ***reforms in the agri-food education*** is to restructure the study programmes to support innovations in the agri-food industry. The study programmes should be restructured but also developed in accordance to the needs of the sector and within all the education institutions in the field. Practical education for students through increased links with the industry and practical education for students on experimental fields (investments in experimental field) are essential for this process. Support in terms of increased mobility of students and academic staff through Erasmus and other related programs is also a prerogative. The revision of the existing study programmes and the support of the processes of study programmes (re)accreditation of the research and education institutions shall be done through a formed ***advisory board***. Again the adaptation of the **Smart Specialization Strategy** (till 2022 along with the adequate measures that will address the agri-food sector) will be essential in the support of this activity. For continuity in the educational process, vocational education in agri-food sciences should also be introduced.

Modernisation of the existing demonstration farms is necessary, owned and operated by research and education institutions (including higher-education institution and secondary schools) that will be used primarily to research or demonstrate various agricultural techniques, with any economic gains being an added bonus. Creating strong business incubators that help start-up agri-food companies and individual agricultural entrepreneurs is also necessary to develop their businesses by providing a full-scale range of services starting with management training and office space and ending with venture capital financing. Therefore, it is necessary to design measures to support these process. The modernisation will require development of sustainable business plan (for basic purpose and supplementary activities such as organised tours from kindergartens, schools etc.).

The level of *modernization of the education facilities* is still very low, thus there will be need to equip research and education institutions with high-tech (drones etc.) classrooms and laboratories and distance learning tools. Since this modernization of both demonstration farms and education facilities largely contributes to enhancement of knowledge and innovation, these activities will also be closely related to the adoption of the Smart Specialisation Strategy and the earlier mentioned adopt and implement of the **IPARD measure on Knowledge and Innovation** (or measures on knowledge and innovation within the **national Rural Development Programme** which will help the transition period while similar measure is adopted within the next IPARD planning period).

Farmer based organisation are important actors in the AKIS, serving as mediators between the private sector (particularly farmers and agri-food companies) and other sectors (in particular, public sector and research and education sector). Strengthening the capacities of farming based organisations in their RITT mediation role is necessary, especially in supporting enlargement of their membership, especially of those of young people, and networking activities, but also in their media coverage in regard to RITT. *The modernisation of farmer based organisations* is based on the identification of the innovation needs of farmer based organisations and the existent gaps in their capacities and resources to support dissemination of innovation. For this purpose, it is important to design specific innovation programme for farmer based organisations, but also create support measures to motivate innovation of these organizations (development of new products, structures, marketing, business model etc.) to attract young people engagement in the private agricultural sector. Visits to fairs and similar events in this respect. Improvement of the media services (newsletters, professional journals, web-portals, social media tools and coverage etc.) of the farmer based organisations in the area of promoting new technologies and innovations will contribute to the enhancement of their knowledge and innovative thinking. In order to express their real needs, it will be necessary for these organizations to take more active participation in the RITT's policy dialogues, national working groups etc. Here again the implementation of the **IPARD measure on Knowledge and Innovation** is seen as an important instrument of support (or measures on knowledge and innovation within the **national Rural Development Programme** which will help the transition period while similar measure is adopted within the next IPARD planning period).

The cooperation between different farmer based organisations shall be strengthened. Thus, **networking activities of the national farmer based organisation should be supported** financially and technically. For instance, a development of *digital tools* could be used to support coordination and *increase visibility of activities and services* provided by these organisations, as well as *establishing a Forum* composed from members of these organisation so to motivate a policy dialogue. The adoption and implementation of the **IPARD measure on Knowledge and Innovation** may also serve to realise this action, as well as introducing a new measure on knowledge and innovation within the **national Rural Development Programme** (to bypass the gap period while similar measure is adopted within the next IPARD planning period). As a final deliverable is expected to be a National platform of farmer based organisations, which shall be also integrated within an International network of farmer based organisations.

6.3. Elaboration of Strategic Objective 3: *Introduce new structures in the AKIS*

There are missing structures within AKIS to support collaboration in knowledge exchange and co-innovation. **Informal networks already exist that may serve as a ground for development of new structures of the AKIS.** Existing strategies and legal structure exist to support parts of the AKIS, but there are **still missing legal frameworks and legislation to support new AKIS structures and functioning of the system as a whole.** Preparation and adoption of the law and by-laws for advisory services is very important for fulfilling this objective, especially for setting clear regulation to distinguish between competencies and areas of operation of private and national advisory service to provide complementarities in the system. But, weak enforcement of law and corruption may be obstacles in supporting AKIS segments, structures and interactions. Donors are present that may fund project activities, including creation of networks for knowledge sharing and co-innovation, and there are available national and EU funds, Horizon etc. But, still lack of finance may prevail in supporting long-term networking activities, knowledge sharing and co-innovation. Therefore, it is very important to adopt and implement the **IPARD measure on Advisory Services** as soon as possible. It is planned to start within the IPARD 3 programming period, however the budget allocated for this measure is very little, so it is necessary the IPARD budget allocated to the measure on Advisory Services to be gradually increased. During the period while this IPARD measure is fully implemented, it is a good start to introduce a measure on advisory services within the **national Rural Development Programme** to test the future implementation on the planned IPARD 3 measure on Advisory Services.

The capacities of the National Extension Agency (NEA) are limited in providing advices to farmers in different areas of need, considering the large demand from the private sector for knowledge and innovation uptake. Thus, **private advisors** should complement the activities of the NEA to provide extension services to strengthen the capacities of a larger mass of beneficiaries (farmers) by empowering them on different aspects. Set supporting infrastructure for operation of the private advisory services. Besides the legal framework, it is very important to establish a management committee that will coordinate the actions within the entire advisory system. Also, preparation of financing models, contracts and bidding documents, databases of advisors, and introduce monitoring models and instruments is necessary for creation of a functional advisory service.

Finally, **other institutions and organisations to support research, innovation and technology transfer (RITT) in the agri-food sector** are missing as well. In order to introduce these new structures, the adoption and implementation of the **IPARD measure on Knowledge and Innovation** is important for this specified objective. To by-pass the gap period while similar measure is adopted within the next IPARD planning period, it may be useful to introduce a measure on knowledge and innovation within the **national Rural Development Programme**.

There are already three **business incubators** with a mixed focus, but specialised organizations of this kind in agri-food industry are missing. They should help start-up companies and individual entrepreneurs in agriculture to develop their businesses by providing a full-scale range of services starting with management training and office space and ending with venture capital financing. Thus, it is necessary to develop programme of business incubators' interventions, including business model types, training modules with demonstration cases that catalyse new business start-ups. When established, their visibility should be increased to scale-up investors.

Innovation centres specialized in agri-food do not exist, although they should be an integral part of the AKIS, demonstrating a huge potential of collaborative working between business, academia and public agencies to generate economic impact. Therefore, another action within this specified objective is to establish an Innovation Centres in agri-food industry within, between (or independently from) research and education institutions. Creating a new support measure to assist the establishment of Agriculture Innovation Centre(s) is

necessary. These Centre(s) shall provide information, training and direct assistance to agricultural producers in the production, processing and marketing of value added products. In addition, it is necessary to increase the involvement of municipalities in the RITT processes jointly with Regional Development Centres and Industrial Zones in order to establish demonstration centres in major agriculture production regions in the country to improve the overall innovation capacities in the domestic agri-food sector.

Centres of Excellence related to agri-food do not exist, but they can be useful segment in the AKIS, where different actors provide together leadership, best practices, research, support and/or training for a focus area. Centres of excellence are a team, a shared facility or an entity. In order to establish these structures, first, it is necessary to map interested and competent stakeholders, and thus, to provide technical support to connect interested stakeholders. Introducing a support measure to support the establishment of Centres of Excellence in agri-food industry is required to improve the innovation capacities in the domestic agri-food sector.

6.4. Elaboration of Strategic Objective 4: *Create functional relationships between AKIS actors*

The existing links between AKIS actors are mostly partly functional, and some new links should be established, especially those of the new AKIS structures. Supporting establishment of *Coordination Body* as a match-making organisation **is required to form new groups and make connection between different actors according to compatibility**. It shall facilitate networking for coordination, cooperation and exchanges between various institutions involved in AKIS. In fact, it shall be a broker entity that supports formation of multi-actor knowledge networks and co-innovation in the agri-food sector. Thus, it is necessary to develop technical guidelines for operation of the Coordination Body, and to build the capacities (skills) of the innovation brokers engaged at the Coordination Body. This action requires a good inter-sectorial coordination between different public institutions as well.

Multi-actor networks are excellent opportunity for **farmer-led interactive innovation**: farmers learn from researchers about good experimental design and what the scientific arena already knows on the issue, whilst simultaneously farmers help researchers understand the real priorities they have to face; advisers help coordinate groups and farming organisations can get their own network of farmers involved etc. Next, there is a weak cooperation between actors from the private sector, especially between farmers, that are mostly competing between each other rather than sharing experiences and knowledge. The awareness among farmers should be increased on the importance to share experiences and knowledge and co-innovate with other farmers, agri-food industry, academia, consumers etc. There should be special measures to support creation and operation of *farmer-to-farmer collaborative groups* to improve on-farm innovation, farming practices and performances. In order to introduce these new structures, the adoption and implementation of the **IPARD measure on Knowledge and Innovation** is important for this specified objective. To by-pass the gap period while similar measure is adopted within the next IPARD planning period, it may be useful to introduce a measure on knowledge and innovation within the **national Rural Development Programme**.

Benchmarking for better farm performance, discussed in focus discussion (with up to 10 farmers) to compare different farmers' best practices to improve results (the discussion group leaders are the key persons in this exchange of knowledge since they inform the farmers about new research results, case studies from the best farms and encourage the farmers to tell more, while the group collects data, finds the best practices and searches for positive changes on a specific topic, starting from the big picture of each farm and ending in searching for the critical points to be overcome for the next 1-1.5 years). Field labs are other kind of membership networks of farmers working together to find lasting solutions to practical problems.

Monitor farms bring together groups of like-minded farmers who wish to improve their businesses by sharing performance information and best practice around a nationwide network of host farms. Monitor farmers host four to six meetings on their farms each year, providing an excellent opportunity to identify and share challenges and solutions between farmers.

Levy Boards may be a good way for farmers to collectively pay for R&D, spreading cost across each sector. They are useful forms in the AKIS to support R&D activities (proven to be successful in other countries), but they are not a compulsory actor in the AKIS. Internet creates opportunity for easy access to information and a space to create a multi-actor networks - platforms, exchange of experiences and knowledge through Youtube channel and social networks etc.

Social media by and for farmers should be also supported to encourage cooperation between these actors, such as thematic youtube channel by group of farmers to connect farmers with urban consumers, blogs and shared videos on new research and innovation on social media etc.

Table 5. Prioritisation of the required actions from the AKIS Action Plan

Rank	Required action	Deadline	Impact*	Feasibility**
1	1.1. Adoption of Law and by-laws on AKIS	2023-2025	7	7
1	1.2. Strategy for AKIS	2023-2025	7	7
1	1.3. Adoption of a new Law and by-laws on Advisory Services	2022-2023	7	7
1	7.1. Establish appropriate legislation for advisory services	2022-2023	7	7
1	7.2. Set supporting infrastructure for the operation of the private advisory services	2022-2023	7	7
1	2.1. Introduce a life-long learning programme for advisors	2023-2025	7	7
1	4.1. Continuous training for public administration	2023-2025	7	7
2	2.2. Establish Educational Centre for certifying advisors	2023-2025	7	6
2	10.1. Establish a Coordination Body of AKIS	2022-2023	7	6
2	5.1. Study programmes to support innovations in the agri-food industry	2023-2025	7	6
2	6.2. Modernise education facilities	2023-2025	7	6
3	6.1. Modernise demonstration farms	2025-2027	7	5
3	11.1. Establish groups of farmers for a farmer-led interactive innovation	2025-2027	7	5
4	3.1. Enhance research and education	2023-2025	7	4
5	7.1. Modernise farmer based organisations	2023-2025	6	6
5	7.2. Strengthen cooperation between different farmer based organisations	2023-2025	6	6
6	9.1. Establish business incubators	2024-2026	6	5
6	9.2. Establish Innovation Centres in agri-food industry	2025-2027	6	5
7	9.3. Establish Centres of Excellence in agri-food industry	2025-2027	5	4

7. Recommendations for the Regional and sectoral/thematic AKIS

- Development of a **Regional AKIS** with reference to possible cross-country AKIS links:

One recommendation for establishing a regional AKIS is to **establish a Regional Education Centre** for certifying advisors (including all interested countries/territories that have this kind of need). This Education

- A virtual institution (platform) that combines expertise from WB countries, especially agricultural universities to train advisors as key AKIS actors and basic digitalization could be ensured on all levels (e.g. blended learning, integration of videos) to open up channels of communication.
- Joint curricula for certifying advisors could be developed for all involved parties in the region, which will be based on the specific expertise in the different WB countries/territories.
- Regional experiences are to be shared on different topics at jointly organised training, workshops and seminars.

Another recommendation for supporting Regional AKIS is to introduce **compatible national measures in each country/territory** to encourage regional cooperation of different AKIS actors (such as regional dissemination of knowledge and innovation through fair visits, study visit, demonstration farm etc.).

- Development of a **Sectoral and Thematic AKIS:**

One recommendation is to map all the AKIS actors and their links in the **organic honey sector** and to propose a micro AKIS model for this sectoral/thematic AKIS that could be further used as a ground for developing other micro AKIS models for different sectors and themes.

The most of the actors of the honey value chain exist and operate well. Honey producers, especially those certified as organic, are the most educated farmers in the country that follow the latest production technology and innovation and they easily adapt to the proposed actions in the Action Plan.