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Agricultural Knowledge and Innovation Systems (AKIS)

in the Republic of Srpska, BiH

National Report and Proposed Draft Action Plan

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Abbreviations

AES	Agricultural Extension Service
AKIS	Agriculture Knowledge Innovation System
BiH	Bosnia and Herzegovina
BD BiH	Brcko District of BiH
CB	Coordination board
CEFTA	Central European Free Trade Agreement
ERA	European Research Area
EU	European Union
EUR	Currency of the European Union
FBiH	The Federation of Bosnia and Herzegovina
GDP	Gross domestic product
IFAD	International Fund for Agricultural Development
IPARD	Institutional Prerecession Fund for Rural Development
IS RS	Institute of Statistics of the Republic of Srpska
ICT	Information communication technology
IT	Information technology
KM	Convertible mark (currency of BiH)
MAFWM RS	Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska
MAWMF FBiH	Ministry of Agriculture, Water Management and Forestry of the Federation of Bosnia and Herzegovina
MSTDHEIS RS	Ministry of Scientific-Technological Development, Higher Education and Information Society of the Republic of Srpska
PPP	Public-private partnership
R&D	Research and development
R&T	Research and technology
RITT	Research and Innovation Technology Transfer
RoS	The Republic of Srpska
SAA	Stabilisation and Association Agreement
SDC	Swiss Development Cooperation
SIDA	Swedish International Development Agency
SITC	Standard International Trade Classification

SME	Small and Medium Enterprise
SSS	Smart Specialisation Strategy
SFRY	Socialistic Federal Republic of Yugoslavia
UNDP	United Nation Development Program
USA	United States of America
USAID	United State Aid
WB	World Bank

Introduction

Bosnia and Herzegovina (BiH) consists of two entities, the Federation of Bosnia and Herzegovina (FBiH) and the Republic of Srpska (RoS) and one district Brcko District of BiH (BD BiH). The entities have a high level of autonomy and issues of education, science and agriculture are legally regulated and administratively and managed at the entity level. As a state, BiH does not have state ministers of science, education and agriculture.

Surface of the Republic of Srpska is 24,641 km² and the total population is 1.136 million (IS RS, 2021a). Since 2003, the natural population growth in RS has been negative. GDP per capita is EUR 5,009 (IS RS, 2021b).

BiH is one of the newly formed states after the disintegration of the SFRY. Its independence was accompanied by the civil war (1992-1995) and the process of transition from a socialistic planned to a market economy. These two facts significantly influenced the level of development of agriculture and science in BiH. Even in socialistic Yugoslavia, BiH was one of the underdeveloped republics whose development was supported by other more developed regions. War and transition have further regressed productive, human and other resources, so BiH remains significantly dependent on aid and assistance from abroad. The disadvantage economic situation has affected the increased rural-urban migrations and to abroad. It is unfavourable that in recent years the younger higher education workforce has been migrating the most.

The Republic of Srpska has Strategy of scientific and technological development of the Republic of Srpska 2017-2021 with a motto “Knowledge for Development” (GRS, 2017) with five objectives: (1) Encouraging scientific research quality and excellence, (2) Encouraging the internationalization of science and innovation, (3) Encouraging cooperation between the scientific research and innovation community and the business sector, (4) Creating conditions for increasing funding for science and innovation, (5) Scientific and innovation human resource development, and (6) Encouraging smart specialization. The adoption of a smart specialization strategy is planned, but it has not been done yet. The RS government recently adopted a new Strategy for the Development of Agriculture and Rural Areas of the Republic of Srpska for the period 2021-2027 (MAFWM RS, 2021) with five objectives: (1) Increasing the volume and productivity of agricultural production, (2) Increasing competitiveness and developing the value chains in the agro-food sector, (3) Environment protection and sustainable use of natural resources, (4)

Revitalization of rural areas; and (5) Improving the institutional and legislative environment for agricultural development. One of priorities within the first objective is (1.5) Application of new technologies and scientific results in agricultural production, with six specific measures leading to achieving that priority. Within fifth objective, one of priorities is (5.4) Improving the AKIS.

1. SWOT analysis

SWOT analysis of the creation and transfer of knowledge and innovations in the agricultural sector in the Republic of Srpska is the basis for planning further actions on establishment of the AKIS (road map and action plan).

Strengths

Agriculture remains an important sector for the RoS economy with its contribution (together with forestry and fishery) of 9% to GDP in 2020, with a stable contribution over the last ten years (IS RS, 2021b). According Labour Force Survey 23.8% of the total working age population are engaged in agriculture (IS RS, 2021b). According to the 2013 census, about 140,000 rural farms in the RoS declared that they are dealing with agriculture in some way, and about 42,000 farms are registered in the farm registry (MAFWM RS, 2021). 34.8% of the average monthly household expenditure went on food and drink (2015 data) (IS RS, 2021b). The RoS has two agricultural faculties and two technological faculties (which are in charge food technology) within two state universities. In total 847 persons were engaged and hired in research and development, of which 295 with PhD in 2020 (IS RS, 2021b). In the field of agricultural and veterinary sciences, about 300 employees of which 150 researchers are concentrated in two public agricultural faculties and three scientific research institutes (Vaško and Bajramović, 2020). There are a five scientific research institutions in the field of agricultural sciences (MSTDHEIS, 2022). They are more engaged in applied research, and less in fundamental research. The RoS has a public agricultural advisory service with 57 advisors (Vaško and Bajramović, 2020). Gross domestic expenditure for research and development is about 20 million KM (10 million EUR) yearly (IS RS, 2021b). 99.5% enterprises and 69.4% of rural households have internet access (IS RS, 2021b). Once a year, the Ministry of Science publishes calls for financing scientific projects, but with a modest budget. The Synergy program is one of innovative calls, which implies joint application and realization of

scientific research between the scientific community and the private business sector. Research projects are funded also within EU programs for support scientific research and through bilateral cooperation with developed countries. Due to the open market and the pressure of competition from abroad, advanced companies and farmers are aware of the inevitable changes in current practices and the necessity of application of the technologies and innovations in their business. Larger companies are investing in the application of innovations and new technologies and they themselves initiate certain research in cooperation with domestic and foreign research institutions and researchers or buying ready know-how. In the transfer of knowledge and new technologies to farmers trading companies stand out accompanying sales equipment, seeds, fertilizers, pesticides, animal feed, etc. with their own advisory service.

Weaknesses

The RoS agricultural sector is dominated by fragmented small-scale agricultural production unsuitable to apply innovation and new technologies. The average size of land holdings of farms registered in the farm registry (these are mainly market-oriented farms) is 4.7 ha (IFAD, 2022). Investment in the agriculture, forestry and fisheries sector amounted to only 2.7% of total investments (IS RS, 2021c), and it is disproportionate to its contribution to generation of the GDP. The agricultural sector is generally uncompetitive when exposed to free international trade. The coverage of overall RS imports by exports in 2020 was 75.9%, but the coverage of imports of food and live animals by their exports was only 31.5% (according to SITC) (IS RS, 2021b). A large number of farms are not able to undertake and finance new investments leading to the introduction of innovations and application of new technologies with their own funds, and subsidies for this type of investment are limited. There are no special budgetary support for the innovations transfer in agriculture, and general budgetary support (subsidies) for competitiveness improvement was in 2018 at the level of EUR 3.5 million yearly (10% of total agricultural budget) (SWG RRR).

A common feature of fragmented AKIS is the weak connection of AKIS actors. Many farmers still do not understand the contribution of knowledge and innovations to its position in improving their production and business results, and give preference to investments in physical assets. In the RoS allocation for R&D is about 0.2% of GDP, of which from the RoS budget about 0.03% of GDP (MSTDHEIS RS, 2017). There was a significant drop in the percentage of allocations for R&D, from 0.32 in 2013 to 0.19 in 2018 (MSTDHEIS, 2022). The allocation for scientific research in

the field of agricultural sciences are about 15% of the total allocation (MSTDHEIS, 2022). The results of already conducted research useful for food producers and processors are insufficiently available and poorly transferred to practice (scientific and professional conferences are poorly attended by practitioners, scientific papers are published in prestigious international journals that are not read by farmers, the websites of scientific institutions are poorly suited by research results). Scientific research is mainly focused on narrow scientific areas or specific topic, conducted by small groups of researchers from same institution (financial support to research projects are often channelled in that way), and multidisciplinary researches in which several scientific research institutions would participate simultaneously are rare (mostly enabled and conditioned EU calls). The number of those who obtain the PhD title in the field of agricultural sciences is modest and ranges from 2 to 4 per year (MSTDHEIS, 2022). There are indications that the largest number of published papers is predominantly in the function of scientific and teaching progress in the title of professor and assistant at higher education institutions, and not in the function of addressing and solving development problems in various areas of development of the RoS (MSTDHEIS, 2022). 3.71% of the total number of students study agriculture with a declining number of students (MSTDHEIS, 2022). Regional and international cooperation between RS research institutions and foreign partner institutions is weak. Cooperation is established on an ad hoc basis and is not stable (it is often limited to the duration of a joint project, and depends on the possibility of external funding). Researchers have problems with access to sources of new knowledge (subscriptions to scientific databases, referenced scientific journals, etc.). Insufficient number of researchers participate in international mobility programs, which is a missed opportunity for their post-education specialisation. Not all researchers are equally and sufficiently motivated to improve their personal competencies. Researchers' scientific productivity is poor (patent registration, publishing books, publishing papers in indexed scientific journals, participation in international scientific conferences), but it is often correlated with limited financial resources. Scientific research institutions face the problem of lack of equipment and its incompleteness and obsolescence. There are few applied researches focused on solving the problems and needs of known beneficiaries from business sector (farmers of small and medium enterprises), and more researches that researchers conduct mainly for themselves.

Opportunities

The opportunity for the agricultural sector are EU pre-accession funds, which should be in full capacity when BiH receives candidate status. Opportunity is also better utilization of other EU programs for supporting research and development activities (HORIZON, Life, ERASMUS+) and SMEs (COSME, Innovation Fund, etc.). In addition, there are a number of bilateral programs of developed countries that provide assistance to BiH through a combination of various interventions, with the expectation that their interest in being present in BiH will not disappear. They are focused on some sub-sectors, regions or target groups, but they are an important complement to government programs and interventions in development of agricultural sector. In the future, it is expected to increase awareness among all actors in the agricultural sector about the need to apply modern scientific achievements, motivated by various factors, including increasing competitiveness. Although the application of certain protectionist measures for the safeguard of less competitive agricultural production is desired, free trade regimes (SAA, CEFTA, Open Balkans) will remain to be a reality. The RoS scientific research capacities are modest and the chance (and necessity) to eliminate this shortcoming is to connect domestic researchers and research institutions with researchers and institutions in the region, Europe and the World. The chance for that is certain EU research programs as well as bilateral cooperation programs. Some of them are already utilized, and some have yet to be accomplished. An advanced form of this cooperation would be the establishment of a center of excellence in agricultural research under the mentorship of some more advanced scientific partners. The precedence for the domestic science and business sector are also youth educated abroad (especially at the MSc and PhD studies), and their utilization after their return into the country or through cooperation with R&D institutions abroad where they are employed. Better use of limited financial and other resources will be achieved by concentrating on carefully selected scientific priorities (smart specialization strategy). In order to make the results of scientific research and new technologies easier and faster applied, financial support in the form of subsidies is needed, which increase (from national and pre-accession funds) is expected in the future. Not only money is important factor for the application of new technologies in agriculture, but also qualified staff who know how to apply these technologies. The existence of educational institutions that educate such staff is also a chance, as well as support for their employment (trainee employment programs, etc.). Foreign direct

investments in the agricultural sector are also an opportunity for accelerating transfer of new technologies and increased investment in innovation.

Threats

One of the main threats to the development of RoS in general, and thus in its agriculture, is the low level of economic development, which has many consequences. Most developed countries have no interest in cooperating with a small, underdeveloped country as BiH on an equal basis. They are mostly interested in the import of raw materials and skilled labor, and less in joint ventures, especially in the field of agriculture, due to the dominance of small-scale production. The economic environment is burdened by a complex and tense political situation. Climate change has and will have an increasing negative impact on agricultural development. An additional negative impact factor is the pandemic, with uncertain duration and ending outcome. Agriculture and the farming profession have a bad image. Depopulation of rural areas is a general threat to the rural economy, and especially to the development of agriculture. Educated youth, dissatisfied with the current situation, and encouraged by the favorable immigration policy in Western Europe, are emigrating. So low funding for scientific research are stagnating and further decreasing due to imposing new priorities for distribution limited budgets. The economic crisis and pandemic have caused further financial destruction of scientific institutions. The opening of the market for duty-free food imports is a constant threat that causes a reduction and termination of domestic food production. The export of domestic origin food, which is price competitive, is prevented due to non-compliance with demanding EU and other standards. The climate for innovation is unfavorable due to a lack of understanding of its importance and due to limited financial and human resources to create changes. Scientific research and its application today are largely relies on the application of IT technology but the level of IT literacy, especially of the rural population, is low.

Table 1. SWOT analysis of the presence and development of AKIS in the Republic of Srpska

Strengths	Weaknesses
<ul style="list-style-type: none"> – high importance of the agricultural sector for the overall economy; – a large number of population depending on agriculture; – the existence of all levels of agricultural education; – the existence of scientific research institutions and a certain level of applied research; – the existence of personal and institutional links between scientists and scientific institutions; – the presence of proven experts in some scientific fields; – existence of a public advisory service (present on the entire territory of RoS); – formalized legal framework for scientific research and innovation; – some experiences with programs connecting the farmers and business sector with the scientific community (e.g., Sinergija programme); – the need and desire of some stakeholders to introduce changes (as a motive for the introduction of new technologies and innovations); – increasing the number of successful private companies interested in RITT; – the presence of large trading companies for equipment and inputs for agriculture (which provide certain advisory services to customers); – the trend of increasing the availability and use of IT facility in rural areas (with at the same time the smallest coverage of all WB countries). 	<ul style="list-style-type: none"> – dominance of fragmented small-scale agricultural production unsuitable to introduce innovations and new technologies; – low productivity in agriculture; – low level of investment in the agriculture sector; – low level of budgetary funds for research and innovation transfer; – insufficient transfer of scientific research results into practice; – declining interest in agricultural education; – lack of practice-oriented creative learning in education; – insufficient regional and international institutional cooperation; – poor mobility of researchers, teachers and students, and low level of exchange of new knowledge and experiences; – insufficient motivation and personal capacity building of some researchers; – unsatisfactory level and quality of scientific productivity; – poor access to new knowledge (databases of scientific journals, etc.); – lack of systematic training and certification of advisors; – low level of cooperation of the scientific community with the business sector; – lack of financial resources to finance the application of new technologies (weak investment power of farmers); – lack of capacity for innovation in SMEs; – non-understanding of AKIS; – weak connection between AKIS stakeholders.

Opportunities	Threats
<ul style="list-style-type: none"> – better connection between all AKIS stakeholders; – proven benefits of networking and coordination; – pre-accession and other EU funds (IPARD, HORIZON; COSME, Innovation Fund, etc.); – presence of various donors and funds in BiH ready to partly support RITT (UNDP, USAID, SIDA, SDC, JICA, etc.); – increasing the awareness among all actors in agricultural production about the need to apply modern scientific achievements (modern technologies, new products, the fight against climate change, etc.); – leveraging the experience of the international scientific community; – better allocation of existing funds for scientific research; – better utilisation of investment in research; – research and innovation transfer via agricultural clusters; – youth education abroad; – increasing subsidies for agriculture (especially those for modernization of production capacities); – education and employment of staff specialize in certain types of agricultural production; – increasing market pressure to introduce innovation; – knowledge transfer digitalization; – technology transfer through FDI. 	<ul style="list-style-type: none"> – low level of economic development of BiH; – frequent crises caused by political, climate, health and other factors; – lack of interest in cooperating with small less developed countries; – further financial destruction of scientific institutions due to the economic crisis, pandemic, etc.; – stagnation and reduction of allocations for scientific research; – brain drain; – labor force migration, especially youth; – institutional bureaucracy and technocracy; – unfavorable climate for innovation (invention, diffusion and application); – poor image of agriculture and farmers; – more pronounced climate change; – challenges of the open market and insufficient competitiveness of domestic producers; – demanding standards for the export of agricultural and food products to the market of developed countries; – depopulation of rural areas and its devastating impact on agricultural development; – insufficiently IT illiterate rural population.

2. AKIS mapping

The ministry responsible for managing and funding scientific research in general, so also scientific research related to food and agriculture is the **Ministry of Scientific-Technological Development, Higher Education and Information Society of the Republic of Srpska** (MSTDHEIS RS) (former Ministry of Science and Technology). The same ministry is in charge for higher education, while secondary education is under jurisdiction of the Ministry of Education and Culture. The **Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska** (MAFWM RS) is in charge for design and implementation agricultural policy and also for agricultural extension (via its Department for Agricultural Extension Services). Specific education linked to agriculture and food production starts with specialized **agricultural secondary schools** (there are three in RoS) and continuous with university education within two regional **public universities**, the University of Banja Luka and the University of East Sarajevo. Both universities have faculties of agriculture with several specialized study programs, and faculties of technology with food processing study program. Beside of its educational role, universities are in the same time research centers. They are engaged in scientific research in the field of agriculture together with three independent **scientific research institutes**, the Agricultural Institute of the Republic of Srpska and the Veterinary Institute "Dr Vaso Butozan" and the Institute for Genetic Resources (which is belong to the University of Banja Luka). Mentioned ministers and educational and research institutions are part of AKIS responsible for scientific research in agriculture. Relations and cooperation between these AKIS actors are fragmented and weak, except the relation between the Ministry of Agriculture and the **Public Agricultural Extension Service**, which is logical because this service is an integral part of the ministry. Only public Agricultural Extension Service has permanent and intense cooperation with farmers, and in some extent research institutes. Cooperation between universities and farmers and agricultural secondary schools and farmers is weak and lacking. The providers of **private advisory services** are sporadic, based on for-profit interests, which most of small farmers cannot afford, and their awareness of the benefit of such costs is also low. **Veterinarians** (the entire veterinary service in RoS has been privatized) act as a kind of private advisors within livestock health care services. **Input traders**, suppliers of farmers by, mainly imported, inputs (seeds, fertilizers, pesticides, animal feed, etc.) and equipment are to some extent providers of knowledge and innovation transfer into the agricultural sector, guided primarily by their business interests influencing on the choice of farmers in favor of the

brands they represent and sell. Some food processors have contractual relations with farmers and they are trying to improve farmers' knowledge and practices in order to obtain better quality of agricultural products and increase the profitability of farmers, in order to gain them for cooperation. They directly supply farmers with inputs (often new varieties or breeds) and teach them how to apply new technologies, thus change their traditional production practices.

Agricultural engineers, the most educated part of the farmers' community, are gathered within the **Chamber of Agricultural Engineers**, which occasionally organizes education of agricultural engineers, as part of their lifelong learning, in cooperation with universities. Farmers are grouped in numerous general or specialized farmers' associations, at the local, regional or entity level. These associations primarily lobbying for the interests of certain groups of farmers in ministries, local governments and other institutions. Some **farmers' associations** occasionally organize trainings for their members in cooperation with experts from the universities and institutes. Some (more successful) **agricultural cooperatives** also mediate in the implementation of training for their members in cooperation with various providers. The new model of organizing farmers and other stakeholders in RS agriculture are **agricultural clusters**. They are currently in the early stages of development, relying on the financial support of IFAD project, and could be one of the new actors in the transfer of knowledge and innovation in the agricultural sector in the future.

The transitional and postwar stage of development BiH has been the basis for the implementation of numerous international **programs and projects** in various fields, including agriculture. There are two types of projects, on a credit (WB, IFAD) or on a donor (EU, USAID, SIDA, SDC and other bilateral donors) basis. Most of these projects aimed to integrate the value chains and increase productivity and competitiveness, which means modernizing production capacity and changing previous production practices, by organizing trainings and study tours, demonstrating new technologies and distributing modern equipment and inputs of more advanced capability. Thus, these projects, although of limited duration, are integral part of the AKIS in RS. Significant financial and technical assistance for the improvement agricultural sector in BiH should be EU pre-accession funds, primarily the IPARD program and support for improving the capacity of institutions relevant to the agricultural sector. BiH still does not have full access to IPARD funds, and some support is available according to the IPARD-like model, mediated by UNDP.

The **media** are an important provider in dissemination of knowledge and information about innovations in agriculture. There are many TV and radio stations in RS that broadcast special thematic programs dedicated to agriculture. There are a mix of good examples from practice and advises of competent experts. An additional benefit is that farmers in BiH can follow such programs in neighboring countries, due to the lack of language barriers. Lately, the dissemination of information through web-based portals and social networks is becoming more and more frequent, representing a widely available and cheap way of disseminating new knowledge.

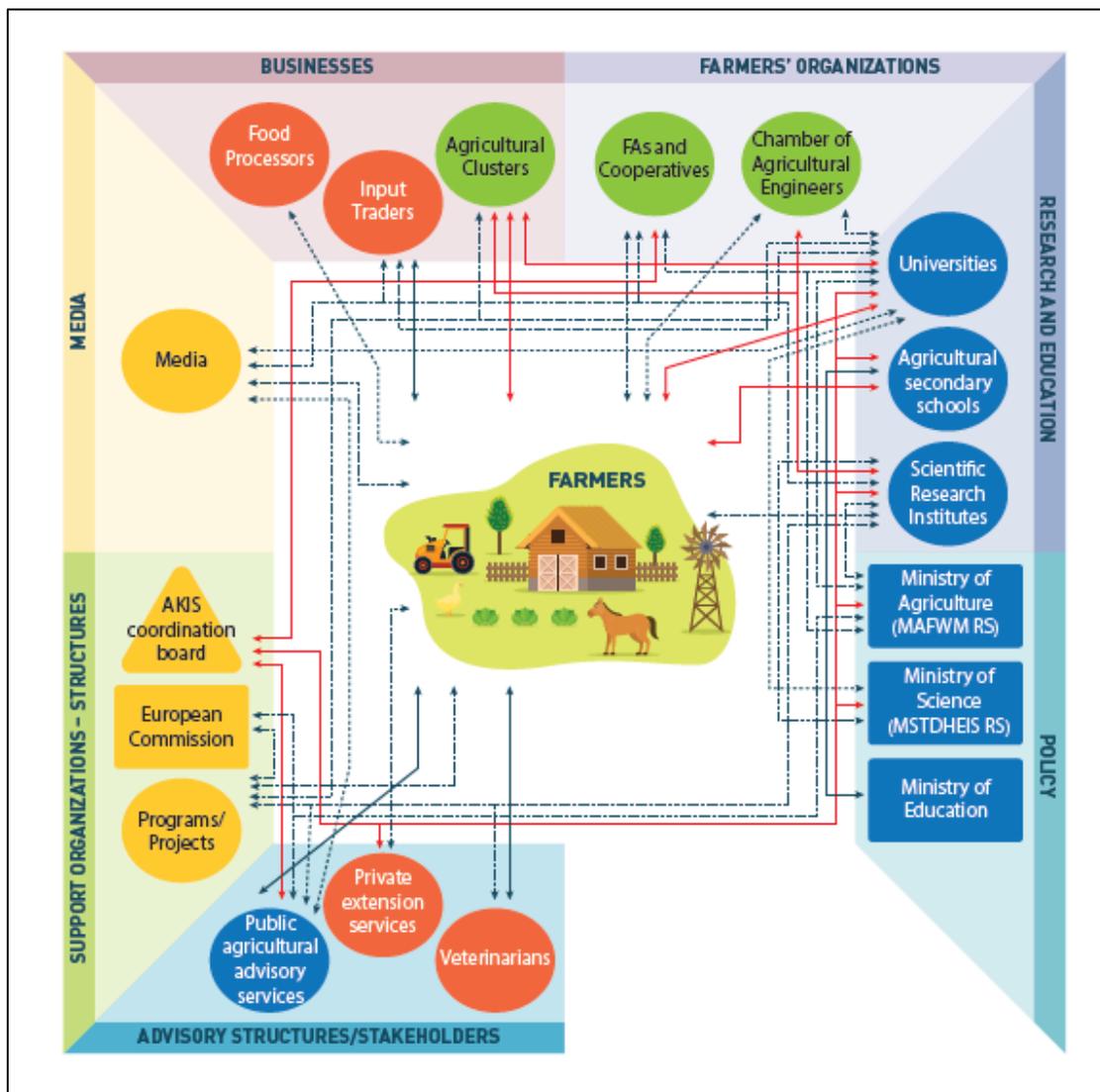


Figure 1. The Republic of Srpska AKIS map¹

¹ In AKIS mapping, some shapes, colors and line types have the following meanings:

- by rectangles are presented existent AKIS players that have sufficient capacity to function properly;

All the mentioned participants, who come from different interest groups, should be better connected in a way that the connections between them are stronger and more functional, so that together they are one system, AKIS.

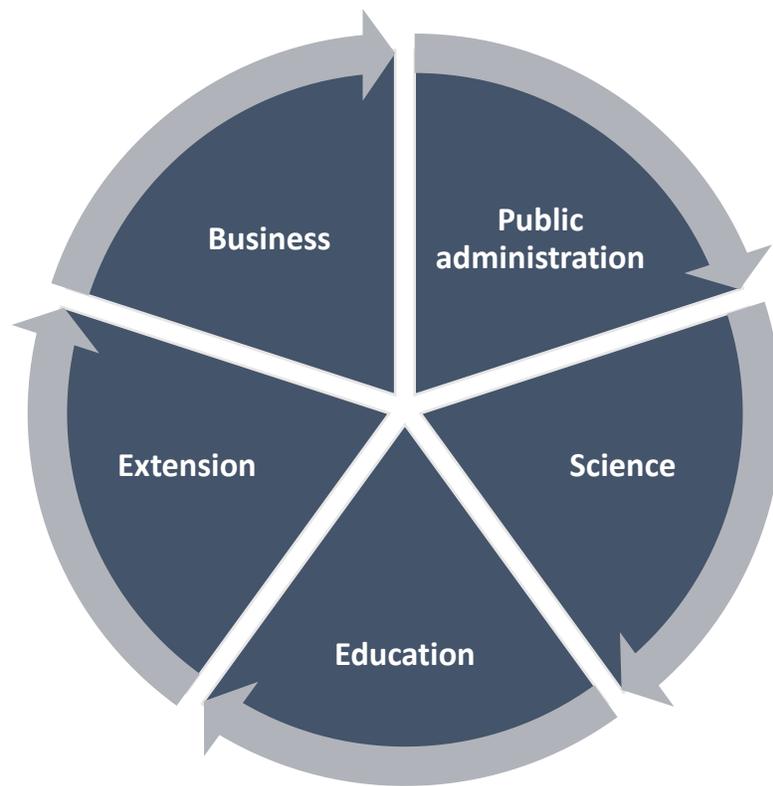


Figure 2. The Republic of Srpska AKIS stakeholders' wheel

3. Road Map

The Road Map of strengthening AKIS in the Republic of Srpska with objectives, milestones and deliverables are elaborated in the table 2.

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- by circles are presented existent AKIS players that do not have sufficient capacity to function properly;
 - by triangles are presented non-existent AKIS players that are critical for the AKIS system to function properly;
 - blue color represents institutions from the public sector;
 - red color represents organizations from the private sector;
 - green color represents stakeholders from NGO sector;
 - yellow color represents other organizations/stakeholders;
 - full black line represents a functional relationship between AKIS players;
 - dashed black line represents partially functional relationship between AKIS players;
 - full red line represents a non-existent, but necessary relationship between AKIS players.

Table 2. Road Map of establishment and strengthening AKIS in the Republic of Srpska

<i>Objective</i>	<i>Milestones</i>	<i>Deliverables</i>	<i>Resources needed</i>	<i>Timeline</i>
1. Formalisation of AKIS	Sensitized and mobilized various multi-actors on the need to formalize an integrated AKIS system	AKIS campaign conducted	Political weal, Expert support, Legal support	Short-time
	AKIS Coordination Board established	The decision on the appointment of AKIS CB	Political support, Legal support	Short-term
	Achieved consensus on AKIS structure and priorities by all AKIS stakeholders	The AKIS platform agreed	Administrative and technical support, Facility for meetings,	Short-term
	The AKIS strategy drafted	AKIS strategy adopted	Expert support, Funding	Mid-term
	AKIS results and impact regularly monitored and evaluated	AKIS evaluation reports	Expert support, Funding	Mid-term
2. Ensure coherence between the business sector and the scientific community	Smart Specialization Strategy prepared	Smart Specialization Strategy adopted	Expert support, Funding	Mid-term
	Applied research in the agribusiness sector supported from the RS program for scientific research	Allocation for research in the agribusiness sector by the Ministry of Science	Funding, Procedural arrangements	Mid-term
	Applied research in agribusiness sector supported from the agricultural budget	Allocation for R&D in agricultural budget	Funding, Procedural arrangements	Mid-term
	Scientific research directed towards the needs of the agricultural sector	The Agricultural Research Standing Committee formalized and operational	Facility for meetings, Professional support	Mid-term
	Increased number of research projects based on business sector needs	Joint projects financed from national funds for scientific research	Funding, Cooperation arrangements	Mid-term
	Benefit-driven cooperation between the business sector and the scientific community	Projects based on business sector initiatives implemented (target min. 10%)	Capital, Cooperation agreements	Mid-term

<i>Objective</i>	<i>Milestones</i>	<i>Deliverables</i>	<i>Resources needed</i>	<i>Timeline</i>
	Agricultural scientific research regionalized and internationalized – regional priority	ERA, cross-border and bilateral cooperation projects implemented	Human resources, Institutional resources, Funding	Long-term
	Scientific results more and better visible	Knowledge-exchange platforms and repositories	Legal support, Professional support	Mid-term
3. Reforming agricultural education towards creative and innovative education	Revision and update of educational curricula	Updated curricula	Political weal, Human resources,	Long-term
	Introduction of more practical and creative oriented learning	Practical teaching modules	Human resources, Institutional support	Mid-term
	Fulfilment of technical preconditions for practical teaching	Functional laboratories and demonstration fields within educational institutions	Funding, Institutional arrangements	Long-term
	Improvement of teaching staff soft and other skills	Qualifications of teaching staff	Institutional arrangements	Long-term
4. Strengthening the capacities and role of Agricultural Extension Service				
	Strengthening the technical capacity of the public Agricultural Extension Service	Extension service capable of performing services	Funding	Long-term
	Delivered regular training of extension staff – regional priority	Advisors with advanced knowledge and skills	Organizational solutions, Partnership	Mid-term
	Licensing of agricultural advisors	Licensed advisors (target 100%)	Institutional arrangements, Legal arrangements	Mid-term
	Improved cooperation between public and private agricultural extension service	Public-private cooperation arrangements (target min. 2 per year)	Institutional arrangements, Managerial decisions	Mid-term
	Enhance interactions between advisors and farmers	Farmers participation in extension services planning and evaluation	Partnership	Mid-term

<i>Objective</i>	<i>Milestones</i>	<i>Deliverables</i>	<i>Resources needed</i>	<i>Timeline</i>
	Enhance interactions between advisors and researchers	Extension-research cooperation arrangements (target min. 50%)	Partnership, Organizational solutions	Mid-term
	Digitalization of extension services	Digitized and freely available new knowledge and advices (target. min. 50%)	IT equipment, Human resources	Long-term
5. Encouraging the transfer of new technologies and innovations into the agribusiness sector	Establishment of demo farms and other forms of R&T transfer demonstrations	Demo, leading and other type of leading farms (target 50)	Funding, Partnership	Mid-term
	In the country and cross-country best practice dissemination events and networks – regional priority	Exchange visits and networks implemented	Funding, Partnership arrangement, Organizational solutions	Mid-term
	Increase co-financing for on-farm investments and transfer of new technologies and innovations	Investment subsidy support from Agricultural Budget (target min. 30%)	Funding, Political will	Mid-term
	Leveraging additional grant support for on-farm investment	Grant schemes	Funding, Partnership	Mid-term
	Ensuring credit support for on-farm investment	Credit lines for agribusiness investment	Credit	Mid-term
	Improved soft business infrastructure for the agribusiness sector	Institutional infrastructure	Funding, Legal framework, Technical assistance	Long-term
	Increase business sector investments in R&D research	Joint research projects	Money, Cooperation arrangements	Mid-term

The individual objectives of establishing and improving AKIS are interrelated. Each objective is equally important, so their order in the figure below is more symbolic than necessarily chronologically conditioned.

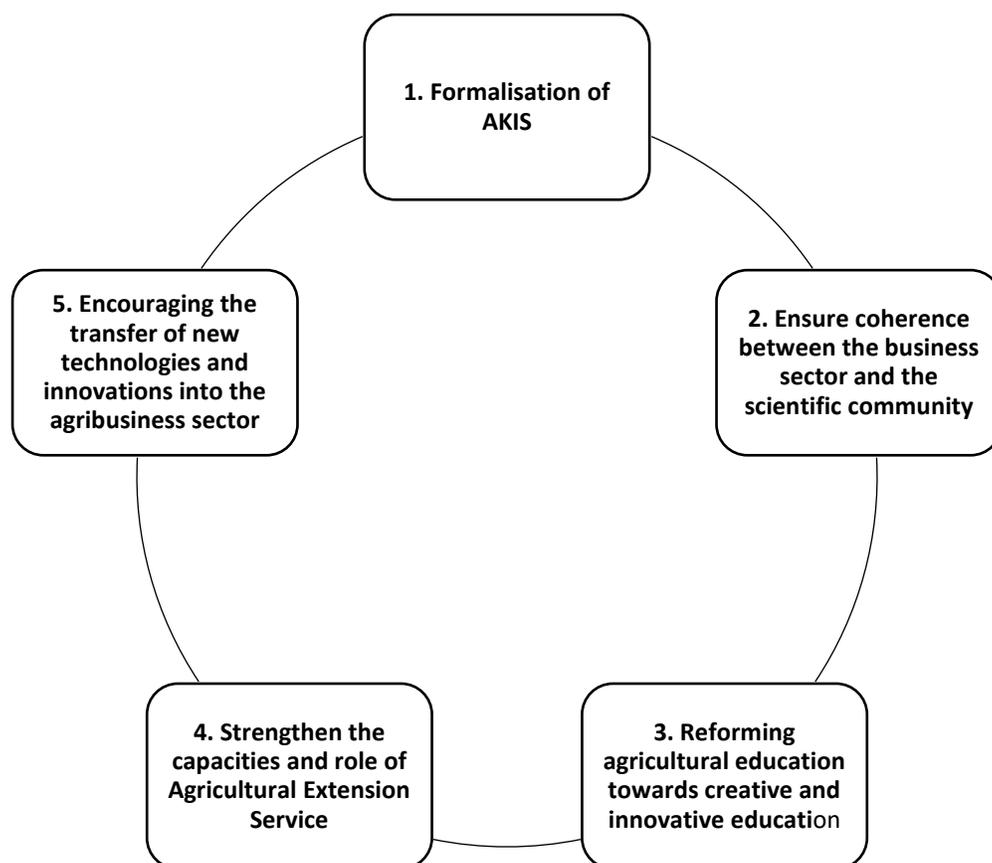


Figure 3. The AKIS objectives in the Republic of Srpska

The first objective in establishing and improving the AKIS system is to **establish a formal AKIS coordination structure**. Since there is a deficit in the understanding of the place and role of AKIS, first of all, it is necessary to *mobilize and sensitize* the various actors about the importance of AKIS and the need to formalize the integrated AKIS. Using the previously created positive atmosphere, *the AKIS Coordination Board* should be established to coordinate the various stakeholders in the long run and achieve synergy of their activities in the field of exchange and application of knowledge and innovation in agriculture. The board will consist of representatives

of institutions (ministries, agencies, etc.), but also representatives of the scientific community, advisors and farmers. Board members should be carefully selected because the success of numerous activities that will be coordinated by the CB will depend on knowledge, experience and interest of its members. The AKIS Coordination Board (as the new institutional body) will discuss the structure and priorities on which AKIS will focus on over time and agree on an **AKIS platform** as a basis for channelling AKIS activities of different stakeholders and preparing an AKIS strategy. The AKIS CB will need expert support to draft the **AKIS strategy**. Later, the CB will conduct regular (at least) annual **evaluations of the implementation of the AKIS strategy**, i.e. the functioning of the entire AKIS system.

The AKIS strategy should be harmonized with the **Smart Specialization Strategy (SSS)** of the Republic of Srpska, the adoption of which is planned by MNRVOID. The AKIS Coordination Board should play a coordinating role in selection and defining the priorities of the agricultural sector in the multi-sectorial Smart Specialization Strategy. Given the degree of R&D findings in the RoS, one of the key preconditions and objectives for the successful realization of the AKIS strategic goals is to **increase funding for all phases of AKIS**. The first source of funding of scientific research in general, and thus in is the biotechnology scientific filed, is the Republic of Srpska budget through several **scientific research support programs** managed by the ministry in charge of science. The allocation of funds for scientific research should be based on the priorities of the valid SSS. An additional source of funding for applied research in agriculture sector should be the Agricultural Budget of the RoS. After the end of the last war in BiH, there have been many **international governmental and non-governmental organizations** that support the reconstruction and development of agriculture, and they should be encouraged to become part of AKIS and financially contribute in implementation some of AKIS components (primarily knowledge dissemination and investment in new technologies and innovation in practice). Additional support is also needed for the **financing agricultural advisory services**, public and private, which transfers knowledge to the business sector.

Strengthening research and improve exchange knowledge between scientific community and business sector is AKIS objective in the research domain. The **knowledge and skills of research staff should be improved**, not only in the purely scientific sphere, but also their soft skills, ability to prepare and manage projects, etc. In the same time, **technical capacity of scientific institutions should be strengthen** because adequate human and technical capacities are a preconditions for

increasing scientific productivity. The *scientific and research productivity* of researchers in all scientific research institutions needs to be improved. The research horizon, knowledge and achievements of researchers will be improved through greater *internationalization of science* (joint projects, scientific gatherings, networks, and other forms of cooperation). Exchange knowledge between researchers is faster and cheaper way of learning than creation of the same knowledge in different locations.

Scientific research must approach the needs of practice, so **scientific research should be more beneficial and applied oriented**. The *Standing Committee on Agricultural Research* could be a useful mediator in identifying and aligning the needs of practice and selection of scientific research topics (at least those financed from national funds). With the mediation of this committee and conditions in public calls for financing or co-financing research, more research projects would be necessarily based on **partnerships between the scientific community and the business sector** (e.g. ongoing Sinergija program). The next step in scientific research should be research projects based on *cooperation between the scientific community and the business sector* led by commercial interests of both partners (public-private or private-private models of partnership).

Agricultural education must be based on scientific research facts, especially higher education, but also on the real farmers' needs ('farmers' needs are evolving quickly'). Success in agricultural business increasingly depends on the use of new technologies and innovations. As knowledge changes rapidly, education needs to keep up with these changes, which means more often *review and update of its curricula*. At the same time, the agricultural education system must evolve in favour of a *greater practical and creative orientation of teaching and learning*. Not only the readiness for more practical education is enough, but also the technical conditions (e.g. laboratories, workshops, land, buildings, animals, etc.). Teaching staff in higher education should create knowledge, not just reproduce it. Therefore, the combination of **research and teaching** (and in some cases advising) should be a model for the teaching staff career development.

Agricultural Extension Service is important part of AKIS in the Republic of Srpska. Apropos, **strengthening the capacities of Agricultural Extension Service and dissemination of research, knowledge and technology** is one of objective of establishment functional AKIS in the Republic of Srpska. Public AES should be strengthened in two ways, strengthen its *technical capacity* (equipment, etc.) and strengthen its staff, i.e. *human capacity*. In RoS parallel exist public

and private agricultural extension service (in different forms) and ***cooperation of public and private extension service should be enlarged***. The knowledge and agricultural practices, as well as regulations, are change, and advisors need to be up to date with those changes. Therefore, ***training of advisors*** by different experts should become a mandatory part of their lifelong learning, with periodic validations of successfully innovated knowledge through ***licensing of advisors***. Advisory trainings should be structured and planned, and licensing officially formalized. Way of delivery extension services have to be improved, based on demand driven instead of supply drive approach. The AES's activities should be tailor according to farmer's needs and with their involvement in process of planning and evaluation extension services, so ***interactions between advisors and farmers*** should be improved. ***Interconnection of advisors and researchers*** should be also encouraged. Universities and other scientific institutions should be some kind of back office of advisory service, a permanent address for exchanging information and looking for the best advices for the problems and needs of farmers. Intensive ***digitization*** has also touched the science and advising. Today, it is much easier and cheaper to reach beneficiaries using different ICT solutions, so scientific institutions and advisory services should as much as more use ***digital platforms and other digital tools*** (video presentations, computing applications, etc.) in their work.

The final AKIS objective is ***application of new technologies and innovations in the agribusiness sector***. In order to transfer an innovation or new technology into practical application, it is first necessary to know that they exist. One of the effective ways to get farmers to change is to establish ***demo farms and other forms of R&T transfer demonstrators*** that play the role of change agents. They are leaders who motivate other farmers to follow them. A cheaper way to demonstrate the application of innovations and new technologies are to show them via ***exchange visits*** to those who are already applying them, in the country or abroad. When many farmers become acquainted with the possibilities and benefits of transferring new knowledge and solutions, the followers who want to invest and apply them on their own farms stand out. The both, financial and logistic support is needed to strengthen the transfer of new technologies and innovations into practice. Existing ***subsidies for on-farm investments and the transfer of new technologies and innovations*** should be increased. The remaining part of the investments must be financed by farmers from their own or from borrowed capital. Regardless of the overtime increase in investment subsidies, they are still insufficient in absolute terms, so ***leveraging other sources of granting on-farm investment*** is essential. Primarily, in the future it should be IPARD pre-

accession funds, and currently these are some substitutes such as the EU4Agri program and other IPARD like forms of assistance. Often own funds and subsidies are insufficient to finance the total investment, so farmers depend on borrowing capital. Therefore, the existence of *credit lines for support investments on farms* significantly increases the volume of investment, and contribute to the application of new technologies (e.g. new machinery, irrigation, digitalization, etc.). In addition to money, farmers and associated SMEs need professional and logistic support to prepare and implement their business plans. These are various services providers such as development agencies, business incubators, technology parks or specific tailored projects (IFAD, WB, etc.) with a focus on improving competitiveness and entire agribusiness environment, commonly called *soft business infrastructure*. In addition to investing in the use of new technologies and innovations, larger and more advanced companies in the agribusiness sector should start *investing in own creation of innovations and new technologies* in cooperation with scientific research institutions (which are mostly private in the RoS, so this would be a form of private-public partnership in scientific research area).

6. Action Plan

Described the AKIS Road Map is further developed into AKIS action plan. The five main objectives of establishing the AKIS system in the Republic of Srpska are divided into 17 specific objectives, retaining earlier set milestones and deliverables.

The Action Plan was supplemented with a personal assessment of the impact of each of the goals on the effectiveness of the AKIS system and the feasibility of their achievement.

Table 3. Action plan of strengthening AKIS in the Republic of Srpska

<i>Specific objectives</i>	<i>Required action</i>	<i>Milestones</i>	<i>Deliverables</i>	<i>Resources needed</i>	<i>Deadline</i>	<i>Impact</i>	<i>Feasibility</i>
Objective 1: Formalisation of AKIS							
Conducting a campaign on the need to establish AKIS	Identify the leader and other stakeholders for AKIS campaign and prepare and implement a communication plan	Sensitized and mobilized various multi-actors on the need to formalize an integrated AKIS system	AKIS campaign conducted	Political weal, Expert support, Legal support	The end of 2022	5	5
Have an operational AKIS Coordination Structure	Collect the nominations of the representatives of the institutions and appoint a the AKIS CB by the RS Government	The AKIS Coordination Board established	The decision on the appointment of AKIS CB	Political support, Legal support	March 2023	7	4
	Define priorities and the working method the CB and hold regular meetings	Achieved consensus on AKIS structure and priorities by all AKIS stakeholders	The AKIS platform agreed	Administrative and technical support, Facility for meetings,	May 2023 and continuous updating	6	5
Adoptatton and monitoring and evaluation of implementation of AKIS strategy	Nominate a expert group to draft AKIS strategy and carry out the necessary consultations in process of its adoption	AKIS strategy drafted	AKIS strategy adopted	Expert support, Funding	July 2023	6	5
	Coordinate the exchange of data between all parties involved and prepare annual reports on the implementation of AKIS	AKIS results and impact regularly monitored and evaluated	AKIS evaluation reports	Expert support, Funding	October 2023 (for plan) and March 2024 (for report) and continuous updating	5	5

<i>Specific objectives</i>	<i>Required action</i>	<i>Milestones</i>	<i>Deliverables</i>	<i>Resources needed</i>	<i>Deadline</i>	<i>Impact</i>	<i>Feasibility</i>
Objective 2: Ensure coherence between the business sector and the scientific community							
Incorporation specific priorities of agricultural sector into Smart Specialization Strategy	Coordinate the preparation and adaptation of the SSS with various stakeholders	Smart Specialization Strategy prepared	Smart Specialization Strategy adopted	Expert support, Funding	October 2023	6	4
Ensuring sufficient budgetary support for applied research in the agribusiness sector	Strengthen budgetary support for applied research in the agribusiness sector	Applied research in the agribusiness sector supported from the RS program for scientific research	Allocation for research in the agribusiness sector by the Ministry of Science	Funding, Procedural arrangements	December 2024 and onwards	6	4
	Establish a new funding programs for applied research	Applied research in agribusiness sector supported from the agricultural budget	Allocation for R&D in agricultural budget	Funding, Procedural arrangements	December 2023 and onwards	6	5
To make agricultural scientific research more practically oriented	Coordinate cooperation between research institutions and the business sector on research priorities	Scientific research directed towards the needs of the agricultural sector	The Agricultural Research Standing Committee formalized and operational	Facility for meetings, Professional support	October 2023 and onwards	4	5
	Modify the funding conditions for applied research in order to have more business sector oriented scientific projects	Increased number of research projects based on business sector needs	Joint projects financed from national funds for scientific research	Funding, Cooperation arrangements	October 2023 and onwards	6	4
	Convince the business sector to start funding research projects for its own needs	Benefit-driven cooperation between the business sector and the scientific community	Projects based on business sector initiatives implemented (target min. 10%)	Capital, Cooperation agreements	December 2023 and onward	5	3

<i>Specific objectives</i>	<i>Required action</i>	<i>Milestones</i>	<i>Deliverables</i>	<i>Resources needed</i>	<i>Deadline</i>	<i>Impact</i>	<i>Feasibility</i>
Regionalization and internationalization of agricultural research – regional priority	Share information and provide technical and financial support to the scientific community to find suitable partners and prepare joint scientific research projects	Agricultural scientific research regionalized and internationalized	ERA, cross-border and bilateral cooperation projects implemented	Human resources, Institutional resources, Funding	October 2023 and onwards	5	4
Improving the visibility and accessibility of scientific research results	Digitalise and by other ways disseminate results of scientific research	Scientific results more and better visible	Knowledge-exchange platforms and repositories	Legal support, Professional support	Continuously	5	6
Objective 3: Reforming agricultural education towards creative and innovative education							
Establishing more interactive learning in the function of creating and transferring innovations	In cooperation with the business community, initiate and implement changes in curricula and educational programs	Revised and updated educational curricula	Updated curricula	Political weal, Human resources,	Every four years	5	4
	Replace part of the theoretical classes with more effective practical lessons	Introduced more practical and creative oriented learning	Practical teaching modules	Human resources, Institutional support	December 2024	6	4
	Acquire or renew laboratories, experimental fields and necessary equipment to support learning based on practical demonstrations	Fulfilled technical preconditions for practical teaching	Functional laboratories and demonstration fields within educational institutions	Funding, Institutional arrangements	Continuously	6	4
Improving qualifications of teachers	Change the conditions and procedures for teacher evaluation and promotion	Improved teaching staff soft and other skills	Qualifications of teaching staff	Institutional arrangements	July 2023	4	4

<i>Specific objectives</i>	<i>Required action</i>	<i>Milestones</i>	<i>Deliverables</i>	<i>Resources needed</i>	<i>Deadline</i>	<i>Impact</i>	<i>Feasibility</i>
Objective 4. Strengthening the capacities and role of Agricultural Extension Service							
Improve technical and human capacities of Agricultural Extension Service	Keep AES well equipped	Strengthened the technical capacity of the Agricultural Extension Service	Extension service capable of performing services	Funding	December 2023 and onward	6	4
	Establish and improve opportunities and conditions for advisors' training	Delivered regular training of extension staff – regional priority	Advisors with advanced knowledge and skills	Organizational solutions, Partnership	Continuously	6	4
	Establish obligatory licensing system of agricultural advisors	Licensed agricultural advisors	Licensed advisors (target 100%)	Institutional arrangements, Legal arrangements	May 2024	5	5
More interactive Agricultural Extension Service	Formalize PPP advisory cooperation, prepare joint advisory packages and agree areas of advising without overlap	Improved cooperation between public and private agricultural extension service	Public-private cooperation arrangements	Institutional arrangements, Managerial decisions	July 2023 and onward	4	4
	Connect each advisor with a specific number of farmers and increase the number of their contacts	Enhanced interactions between advisors and farmers	Farmers participation in extension services planning and evaluation	Partnership	January 2023 and onward	6	6
	Improve cooperation between research institutions and AES and define modalities for such cooperation	Enhanced interactions between advisors and researchers	Extension-research cooperation arrangements	Partnership, Organizational solutions	June 2023	5	5
Greater availability and visibility of advisory services	Digitalize extension services and train advisors to independently use ICT	Digitalized extension services	Digitized and freely available	IT equipment, Human resources	March 2024	6	5

<i>Specific objectives</i>	<i>Required action</i>	<i>Milestones</i>	<i>Deliverables</i>	<i>Resources needed</i>	<i>Deadline</i>	<i>Impact</i>	<i>Feasibility</i>
			new knowledge and advices				
Objective 5. Encouraging the transfer of new technologies and innovations into the agribusiness sector							
Accelerating the dissemination of the results of scientific research and new technologies	Nominate demo farms and provide conditions for demonstrations	Established demo farms and other forms of R&T transfer demonstrations	Demo, leading and other type of leading farms	Funding, Partnership	June 2023 and onward	6	4
	Facilitate the mobility of farmers and businessmen	The best practice disseminated by in the country and cross-country events and networks– regional priority	Exchange visits and networks implemented	Funding, Partnership arrangement, Organizational solutions	December 2022	5	5
Increasing the rate of application of new technologies and innovations	Change the rules on the allocation of incentives	Increased co-financing for on-farm investments and transfer of new technologies and innovations	Investment subsidy support from Agricultural Budget (target min. 30%)	Funding, Political will	December 2022	6	4
	Ensure access to IPARD and other funds	Leveraged additional grant support for on-farm investment	Grant schemes	Funding, Partnership	December 2024	6	4
	Convince FIs to approve loans for on-farm investments with more flexible conditions	Ensured credit support for on-farm investment	Credit lines for agribusiness investment	Credit	December 2023	4	4
Create a more favourable environment for transfer of new	Enable the services needed by entrepreneurs more accessible and cheaper	Improved soft business infrastructure for the agribusiness sector	Institutional infrastructure	Funding, Legal framework, Technical assistance	December 2024	5	4

<i>Specific objectives</i>	<i>Required action</i>	<i>Milestones</i>	<i>Deliverables</i>	<i>Resources needed</i>	<i>Deadline</i>	<i>Impact</i>	<i>Feasibility</i>
technologies and innovations							
Increasing own investment in R&D	Facilitate cooperation between farmers and scientific research institutes	Increase business sector investments in R&D research	Joint research projects	Money, Cooperation arrangements	Mid-term	5	3

Legend:

Rating for impact (1-7): 1 – least impact, 7 – greatest impact;

Rating for feasibility (1-7): 1 - least feasible, 7 – the most feasible.

The first objective in the process of establishment and moving up of the AKIS system in RoS is the **establishment a formal AKIS coordination structure**. Since there is a still lack of the understanding of the place and role of AKIS, it is necessary to launch a *campaign on the need to establish AKIS* and mobilize and sensitize the various actors about the importance of AKIS existence and the need to formalize the integrated AKIS. This implies the determination the key bearers of that campaign and the crating a plan of communication with various actors who can and should contribute to the implementation of AKIS. The campaign should be carried out by holding meetings and disseminating information through various media. Based on the created positive awareness, the AKIS Coordination Board (CB) should be established, which will coordinate the various stakeholders in the long term and accomplish synergy of their activities in the field of creation, exchange and application of knowledge and innovation in agriculture. The result should be the existence of an operational AKIS coordination structure and the establishment of the *AKIS Coordination Board* which will assume a coordinating role in creation and leadership of AKIS. This coordination body is necessary considering the multitude of different actors (shown on map 1), where no existing ministry has the full authority and capacity to successfully take on this role. The CB will consist of representatives of relevant institutions (ministries, agencies, etc.), but also representatives of the scientific community, advisors and farmers. Appointed members should be carefully selected because many AKIS activities will be coordinated by the board, and the success of their planning and implementation will depend on knowledge, experience and interest of the CB board members. The AKIS Coordination Board will discuss the structure and priorities on which AKIS will focus on over time and agree on an *AKIS platform* as a basis for channelling activities of different AKIS stakeholders and preparing an AKIS strategy. The AKIS CB will need expert support to draft the AKIS strategy for the Republic of Srpska. Following strategic planning process, a group of experts will analyse the situation and assist define the AKIS objectives and activities, which will be agreed during the public consultation process. Finally, the AKIS CB as an inter-ministerial body will fine-tune and finalize the strategy and initiate *adoption of AKIS strategy* by the RoS Government. In addition to adopting a strategy, it is important to conduct regular (at least) annual *evaluation of the implementation of the AKIS strategy*, i.e. the functioning of the entire AKIS system. The CB will coordinate the collection and exchange of data between all parties involved in AKIS and prepare M&E reports on the implementation of AKIS and progress achieved in implementation of the AKIS strategy. In that process the CB will use expert support for implementations of those evaluations and preparation of reports.

The second AKIS objective is **ensure coherence between the business sector and the scientific community**. RITT is an important and necessary sub-system in the process of creation of knowledge by scientific community and application of scientific results and innovations in practice by farmers and the entire business sector. Limited financial resources and research capacities must be concentrated on priorities, which is reason why it is necessary to smartly coordinate these priorities through the Smart Specialization Strategy (SSS). The AKIS strategy should be harmonized with the *Smart Specialization Strategy* of the Republic of Srpska, after its adoption which is planned by MNRVOID. The AKIS Coordination Board should play a coordinating role in selection and defining the priorities of the agricultural sector incorporated in the multi-sectorial Smart Specialization Strategy. Considering the current level of funding for research and development in RoS, one of the key preconditions for the successful realization of the strategic objectives of AKIS is an increase in funding in all its phases, from invention to innovation. The first source of funding of scientific research in general, and thus in is the biotechnology scientific filed, is the Republic of Srpska budget through several *scientific research support programs* managed by the ministry in charge of science. The allocation of funds for scientific research should be based on the priorities set in the Smart Specialisation Strategy and should be strengthen budgetary from allocation for applied research in the agribusiness sector. *Funding for applied research in agriculture sector from the agricultural budget* should be an additional source of funding more focused on R&T support aligned with the objectives in the Agriculture Development Strategy. Additional funding from international governmental and non-governmental organizations, especially the transfer of new technologies into agricultural practice, is welcome, but only as additional sources that are usually available ad hoc and cannot be considered as regular sources of funding RITT in RoS. One of specific objectives of AKIS is to make agricultural scientific research more practically oriented, to bring science and practice closer together. In order to achieve this, someone has to *coordinate cooperation between research institutions and the business* sector on research priorities. The role of directing scientific research towards the needs of the agricultural sector should be taken over by the Agricultural Research Standing Committee (already foreseen in the Strategy for the Development of Agriculture and Rural Areas of RoS). The Agricultural Research Standing Committee could be a useful mediator in identifying and aligning the needs of practice and selection of scientific research topics (at least those financed from national funds). In order to make scientific projects more oriented towards the business sector, the conditions for financing applied research should be changed. More projects financed from national funds for scientific research should be based and formally conditioned by the

obligatory partnerships between the scientific community and the business sector (e.g. ongoing Sinergija program). The next step in scientific research should be research projects based on *benefit-driven cooperation between the scientific community and the business sector* lead by commercial interests of both partners (public-private or private-private models of partnership). The private sector cannot just wait for the results of scientific research financed by public money, than the private business sector needs to be convinced to start financing research projects for its own needs. National scientific research capacities are modest and of limited scope (for several reasons). Therefore, the *regionalization and internationalization of scientific research* (which can also be a regional AKIS priority), in general and in the field of biotechnical research, is one of the solutions to overcome the limitations of the domestic scientific community more quickly through the exchange of knowledge and experience and the pooling of financial resources. Sharing information and providing technical and financial support to the scientific community in finding suitable partners and preparing joint scientific research projects is the initial phase of that cooperation. The next phase is the joint implementation of joint research through ERA, cross-border and bilateral cooperation projects. Even now, the scientific community has useful results of its research so far, which few people know about outside that community, and sometimes not even in the scientific community itself (often researched just for research!). Therefore, *increasing the visibility and accessibility of scientific research results* is one of the AKIS priorities. This can be done in several ways, through digitalisation and by other ways disseminate results from scientific research. Various repositories and knowledge-exchange platforms should be publicly available. The results of research paid for with public money must be widely available to the public at no additional cost. The dissemination of information, as part of RITT, today takes place mainly on IT based solutions and the scientific community and the business sector must adapt and change accordingly. Quite simply (but not easily achievable), farmers must listen more to science, and scientists must reach out to farmers more.

One of the components of AKIS is education. Therefore, **reforming agricultural education towards creative and innovative education** is one of the key AKIS objectives. Reforms are best started with education. Education must change in the direction to establishing more interactive, practical oriented creative learning in the function of creating and transferring innovations. Agricultural education must be based on scientific research facts, especially higher education, but also on the real farmers' needs ('farmers' needs are evolving quickly'²), so that

² EU SCAR AKIS (2019), Preparing for Future AKIS in Europe. Brussels, European Commission.

future employees come with the qualifications which are more suitable for the labor market. Success in agricultural business increasingly depends on the use of new technologies and innovations. As knowledge changes rapidly, education needs to keep up with these changes, which means more frequently *review and update of educational curricula*. At the same time, the agricultural education system must evolve in favour of a *greater practical and creative orientation of teaching and learning*. The readiness for more practical education must be accompanied by the technical conditions for it (e.g. laboratories, workshops, land sites, equipment, buildings, animals, etc.). Teaching staff in higher education should create knowledge, not just reproduce it. Therefore, the combination of research and teaching (and in some cases advising) should be a model for the teaching staff career development. A precondition for acquiring a practical qualification during schooling is the fulfilment of *technical assumptions for modern teaching* that most educational institutions do not have at the required level. Equipping laboratories, practical polygons, purchasing equipment, raising perennial crops and breeding animals are some of the issues that need to be resolved in the process of preparing educational institutions for education reform. A part of these prerequisites can be solved by cooperation with the private sector. For institutional reforms, it is necessary to change attitudes and behavior of employees, for education reform, it is necessary to change those attitudes and behavior of educators. The *qualifications of teachers* should be improved. The conditions and procedures for teachers' selection, evaluation and promotion should be changed and qualification of existing staff improved by their life-long learning and their soft and other skills improvement. Extension (advisory) is an important intermediary in the transfer of knowledge and innovations to farmers and other representatives of the business sector. Public Agricultural Extension Service (AES) is important part of AKIS in RoS. Apropos, strengthening the capacities of agricultural extension service and dissemination of research, knowledge and technology is one of objectives in establishment functional AKIS in the Republic of Srpska. Public AES should be strengthened in two ways, strengthen its *technical capacity* (equipment, etc.) and strengthen its staff, i.e. *human capacity*. The equipment used by AES must be renewed, enlarged and modernized. The knowledge of advisors should be also improved. The knowledge gained through education is obsolete and incomplete, so advisors must constantly update their knowledge and skills. The regular *training of advisors* should be part of their work obligation and commitment. A special aspect of those trainings can be the use of regional human and technical facility and cooperation, as, for example, the Regional Advisory Training Academy. Training of advisors should become a mandatory part of their lifelong learning, with periodic validations of successfully innovated knowledge through

licensing of advisors. Advisory trainings should be structured and planned, and licensing officially formalized. The Agricultural Extension Service should become more interactive. In RoS parallel exist public and private agricultural extension service (in different forms) and *cooperation of public and private extension service should be enlarged*. Public and private advisers can coordinate their activities, agree areas of advising without overlapping and jointly prepare some advisory packages. The agricultural conditions and practices, as well as regulations, are change, and advisors need to be up to date with those changes. Way of delivery extension services have to be improved, based on demand driven instead of top-down approach. The AES's activities should be tailored according to farmer's needs and with their involvement in process of planning and evaluation of extension services, so *interactions between advisors and farmers* should be improved. *Interconnection of advisors and researchers* should be also encouraged. Universities and other scientific institutions should be some kind of back office of advisory service, a permanent address for exchanging information and looking for the best solutions for the problems and needs of farmers. Greater availability and visibility of advisory services are one of AKIS priorities. Intensive *digitization* has also touched the science and advisory. Today, it is much easier and cheaper to reach beneficiaries using different ICT solutions, so scientific institutions and advisory services should as much as more use *digital platforms and other digital tools* (video presentations, computing applications, etc.) in their work.

The final and the most important AKIS objective is **application of new technologies and innovations in the agribusiness sector**. In order to transfer an innovation or new technology into practical application, it is first necessary to know that they exists and how it can be introduced. One of the effective ways to get farmers to change is to establish *demo farms and other forms of R&T transfer demonstrators* which play the role of change agents. They can be leaders who motivate other farmers to follow them. A cheaper way to demonstrate the application of innovations and new technologies are to show them via **exchange visits** to those who are already applying them, in the country or abroad. So, by facilitation of the mobility of farmers and businessmen can be speed-up and scale-up transfer of new technology. This can also be a regional priority (regional exchange of knowledge and experiences of farmers). The both, financial and logistic support is needed to strengthen the transfer of new technologies and innovations into practice. Existing *subsidies for on-farm investments and the transfer of new technologies and innovations* should be retained and enlarged. The remaining part of the new investments must be financed by farmers from their own or from borrowed capital. Regardless

of the overtime increase in investment subsidies, they are still insufficient in absolute terms, so ***leveraging other sources of granting on-farm investment*** is essential. Primarily, in the future it should be IPARD pre-accession funds, and currently these are some substitutes such as the EU4Agri program and other IPARD like forms of assistance. Often own funds and subsidies are insufficient to finance the total investment, so farmers depend on borrowing capital. Therefore, the existence of ***credit lines for support investments on farms*** significantly increases the volume of investment, and contribute to the application of new technologies (e.g. new machinery, irrigation, digitalization, etc.). In addition to money, farmers and associated SMEs need professional and logistic support to prepare and implement their business plans. These are various services providers such as development agencies, business incubators, technology parks or specific tailored projects (IFAD, WB, etc.) with a focus on improving competitiveness and entire agribusiness environment, commonly called ***soft business infrastructure***. In addition to investing in the use of new technologies and innovations, larger and more advanced companies in the agribusiness sector should start ***investing in own creation of innovations and new technologies*** in cooperation with scientific research institutions (which are mostly private in RoS, so this would be a form of private-public partnership in scientific research area).

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