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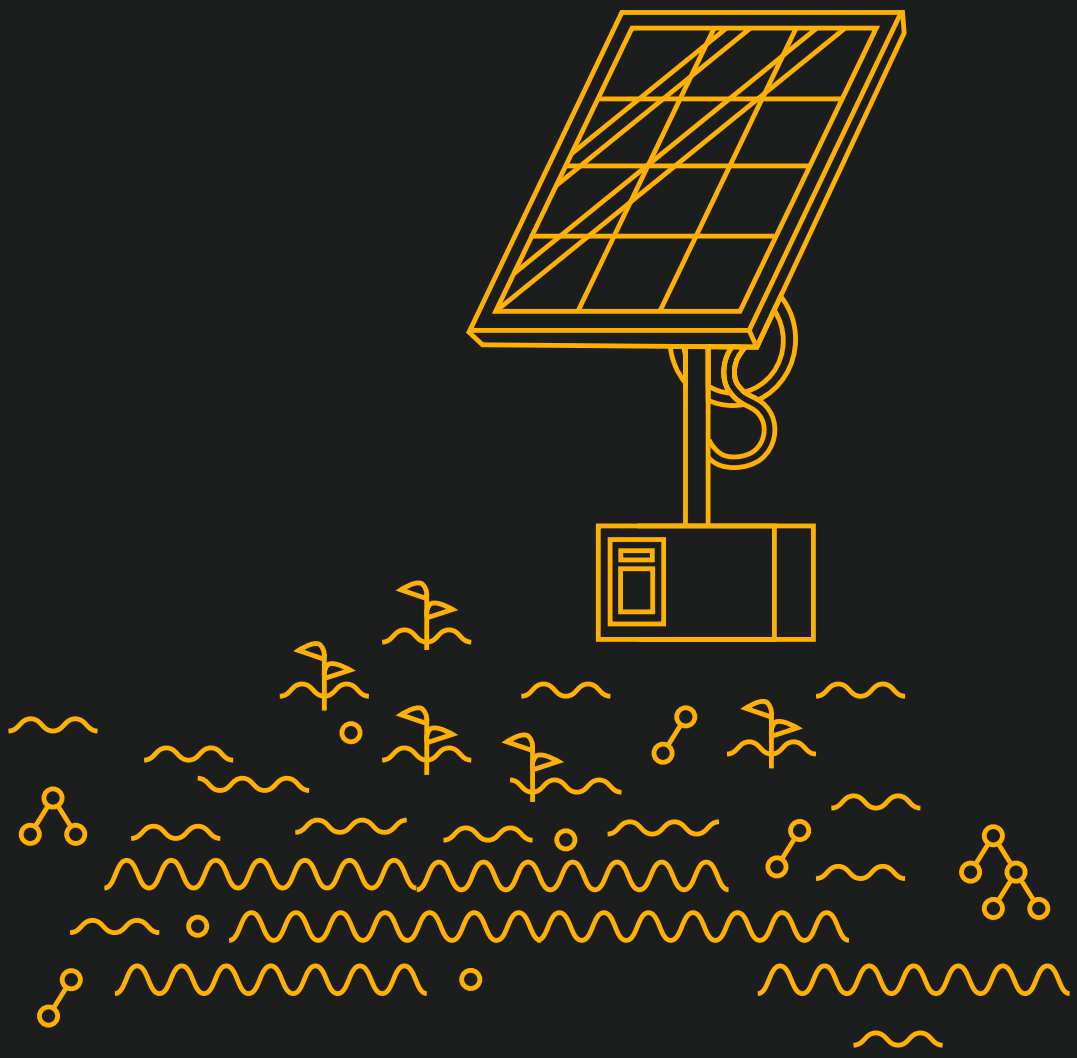
Data Governance in the Agricultural Sector: A Comparative Analysis of Bosnia and Herzegovina, Serbia, and North Macedonia



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LIST OF ACRONYMS

API	Application Programming Interface
BiH	Bosnia and Herzegovina
BHAS	Agency for Statistics of Bosnia and Herzegovina
CEADS	Common European Agricultural Data Space
DaaS	Data as a Service
EU	European Union
FADN	Farm Accountancy Data Network
FAO	Food and Agriculture Organization
GDPR	General Data Protection Regulation
LPDP	Law on Personal Data Protection
LPIS	Land Parcel Identification System
ODIN	Open Data Inventory
OECD	Organisation for Economic Co-operation and Development
SORS	Statistical Office of the Republic of Serbia
SSO	State Statistical Office of the Republic of North Macedonia

ABSTRACT

This paper examines the state of data availability and governance in the agricultural sectors of Bosnia and Herzegovina (BiH), Serbia, and North Macedonia. The paper further identifies institutional frameworks and opportunities for improvement of data governance in these countries and possible cooperation in EU initiatives. Key findings highlight fragmented data ecosystems, limited interoperability among data providers and underinvestment in digital infrastructure, which in turn weakens farmers' and entrepreneurial willingness to invest in adopting digital solutions.

1. INTRODUCTION

Agricultural data is increasingly recognized as a critical resource for improving decision-making and fostering innovation in farming. Effective use of data can enhance productivity, sustainability, and market access, which is crucial for countries in the Western Balkans undergoing agricultural modernization and EU integration. However, fragmented data governance and limited data collection capacity can hinder farmers' willingness to adopt digital tools, thereby reducing the availability of high-quality agricultural data for policy creation and innovation (OECD, 2020). A key challenge is to moderate a balance between safeguarding the privacy of farmers' data and economic interests in data and leveraging data for growth. This paper examines the current state of agricultural data availability in Bosnia and Herzegovina (BiH), Serbia, and North Macedonia. It identifies major gaps and proposes recommendations drawing on European Union (EU) frameworks along with discussing on models how agricultural data can be commercialized. By comparing these three countries, which share regional context, it can be observed that they differ in the level of data collection, data openness and dissemination. The paper further highlights progress, challenges, and opportunities to align with EU initiatives and to unlock the potentials, opportunities and risks related to collection and dissemination of agricultural data.

Agricultural sector in all three countries remains largely under digitized compared to other sectors. However, disparities in data governance - rooted in institutional fragmentation, legacy systems, and resource constraints – hinder the progress towards catching with the rest of Europe and modernization of the systems necessary for automation of data exchange, like the Application Programming Interface - API. This paper further evaluates data availability in these three Western Balkan countries, contextualizing findings with the OECD's paper on data governance (OECD, 2020).

This report is part of a broader research initiative within the Smart Labor project that investigates the conditions for effective digital knowledge transfer in agriculture and skills required for this transformation. An extensive mapping of stakeholders helped identify context-specific challenges, gaps, and promising practices. This process was instrumental in detecting data governance as a challenge for advancing smart agriculture in the region. The value of agricultural data for the agri-food sector is immense, particularly in addressing issues of data governance which is crucial to the digital transformation in agriculture.

Through this collaborative regional approach, the initiative aims to generate evidence-based insights to foster inclusive, sustainable, and digitally driven agriculture across the Western Balkans.

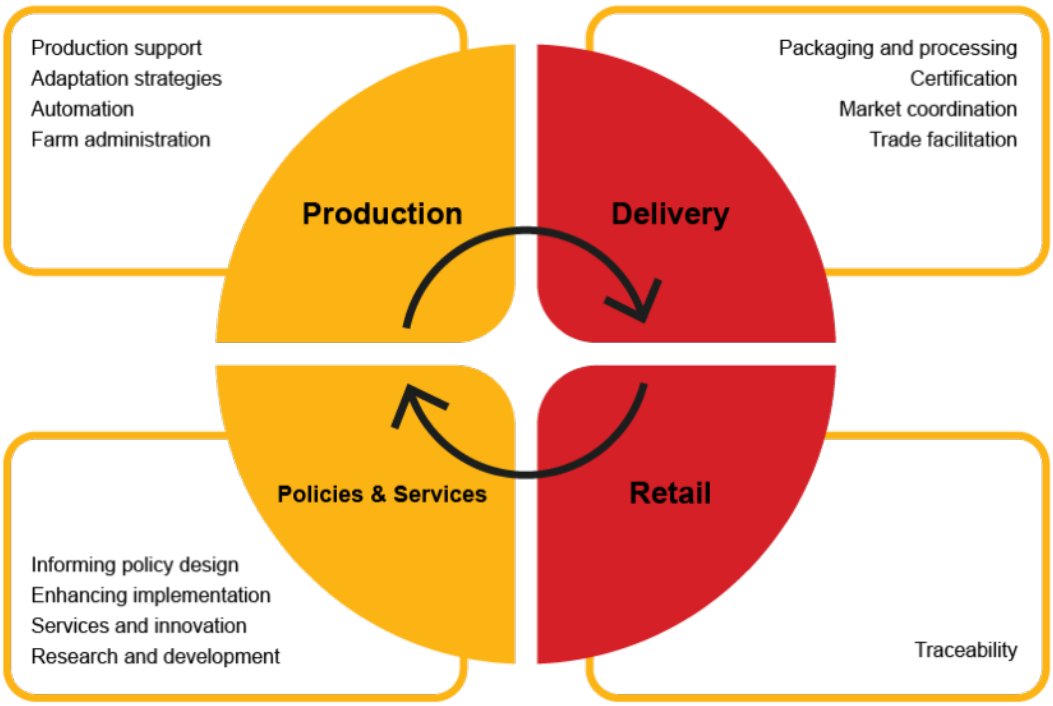
2. UNDERSTANDING THE VALUE OF AGRICULTURAL DATA IN AGRI-FOOD SYSTEMS

In the context of accelerating digital transformation in agriculture, data has emerged as a critical asset for improving productivity, sustainability, and resilience across agri-food systems. From real-time insights at the farm level to national-level strategic planning, agricultural data fuels smarter decision-making and

enables more efficient use of resources. Yet, the ways in which this data generates value—and for whom—remain uneven and often poorly understood, particularly in the context of smallholder farms and developing economies.

Figure 1 below provides a conceptual overview of the multiple value pathways created by agricultural data. Adapted from an OECD framework (2020), the figure maps how data circulates through different stakeholders—from farmers and agri-tech firms to researchers and policymakers—impacting everything from crop yields and risk management to market access and policy design. Understanding this ecosystem is vital for shaping equitable and effective data governance strategies that ensure benefits are widely shared and that data does not become a source of exclusion or exploitation.

Figure 1: The value of agricultural data for agro-food sectors



Source: Modified from the paper: Issues around data governance in the digital transformation of agriculture: The farmers' perspective; OECD, 2020

The figure above breaks down the value of data into several interrelated dimensions:

Operational Optimization: At the farm level, real-time data (e.g., soil health, weather, crop performance) helps optimize input use, increase yields, reduce environmental impact, and cut costs through precision agriculture techniques. Real-time data allows farmers to make informed decisions, optimize resource use, and improve yields

Market Integration: Data enhances farmers' access to markets by improving traceability, ensuring compliance with food safety standards, and enabling price forecasting, thereby strengthening their bargaining position. Data helps farmers and agri-businesses integrate more effectively into domestic and global markets

Driving Innovation and R&D: Aggregated data feeds into research institutions and agribusiness R&D to drive innovation—such as breeding climate-resilient crops, designing adaptive farm machinery, or developing AI-driven advisory tools.

Policy and Public Services: For governments, agricultural data supports the design of evidence-based policies. Governments use agricultural data to monitor environmental performance, and manage subsidy, insurance, and risk programs more effectively.

Trust and Governance: The figure also highlights how the governance of data—including who owns, accesses, and benefits from it—shapes trust among stakeholders and determines the equitable distribution of value derived from digital transformation. Without trust and clear rules, the full potential of digital agriculture cannot be realized.

This visual framework underscores that the value of agricultural data is not only technical or economic, but also social and political, requiring inclusive, transparent, and secure governance models to ensure that all actors in the food system - particularly smallholders can benefit.

3. DATA AVAILABILITY

Statistical data availability in this section refers to the extent to which statistical data and indicators are available, accessible, reliable and usable for analysis and decision-making. Through a comparison among the three statistical offices of Bosnia and Herzegovina, North Macedonia and Serbia, we assess the presence of well-documented datasets, sources that hold agricultural statistics. Statistical data availability is also essential for empirical research, policy formulation and public accountability, as it enables various stakeholders to validate the findings, perform independent analyses, and derive meaningful insights.

3.1 Statistical data availability in Bosnia and Herzegovina

Bosnia and Herzegovina features a decentralized data governance which complicates data collection and publication from one source. Responsibilities are split among two entities (Republika Srpska and the Federation of BiH) and the Brčko District. Agricultural data is currently distributed across various sources, with no centralized repository or database to store all the datasets in one location. The Agency for Statistics of BiH although a centralized institution, publishes limited datasets on agricultural and often not disaggregated on local level.

Bosnia and Herzegovina face significant challenges in agricultural data availability due to historical and institutional factors. Crucially, BiH has not yet conducted a full agricultural census[1]. A pilot agricultural census has been planned for Bosnia and Herzegovina, and the current period is scheduled to take place between October and 15 December 2025[2]. This long delay meant that basic structural data on farms, such as number of farm holdings, land use, and livestock inventories, are not comprehensively documented, undermining the accuracy of agricultural statistics. Instead, current data relies on fragmented sources: administrative data from entity ministries, sample surveys and research from think tanks, or the business sector. However, these are insufficient substitutes for a full census and often result in incomplete coverage and potential inconsistencies among data holders (JRC, 2016). For example, estimates of total crop areas or herd sizes may vary by source, reflecting gaps and lack of harmonization between entities.

[1] European Commission: Bosnia and Herzegovina 2024 Report

[2] Source: Council of Ministers of Bosnia and Herzegovina; accesses on 12 March 2025

3.2 Statistical data availability in North Macedonia

North Macedonia's agricultural data system is somewhere between BiH and Serbia in development. The country has undertaken significant statistical efforts but faces a need for updates. North Macedonia carried out a Census of Agriculture in 2007, the first full agricultural census since independence. The Census provided a comprehensive overview of the agricultural sector, including the number and size of farms, land use patterns, crop areas, livestock counts, machinery, and farm labor. The census data of 2007 has been the cornerstone for subsequent agricultural statistics and starting point for creating national legal frameworks and strategies. However, notably, North Macedonia has not conducted a follow-up agricultural census in the past 15 years. As a result, most of the structural data may be outdated given changes over time (e.g., strong migration from rural areas and farms abandonment).

Additionally, State Statistical Office (SSO) conducts annual agricultural surveys to estimate production of main crops and livestock. These types of publications use sampling methods and are aligned with methodologies used in EU member states. Moreover, administrative data from the Ministry of Agriculture, Forestry and Water Economy – such as the farm register and subsidy programs – supplement statistics from the statistical office. Types of data available include: annual outputs of key crops (cereal, vegetables, fruits) and livestock products, derived from sample surveys; data on sown areas and harvest areas; number of livestock by category (cattle, sheep, pigs, etc.) annually; and external trade statistics in agri-food products. The country also maintains a farm register, updated through its implementation of rural development and subsidy measures, such as Agency for Financial Support to Agriculture and Rural Development, which provides information on registered farm holdings (though registration is not yet universal among small farmers).

North Macedonia also utilizes modern dissemination tools and has an open data portal (www.data.gov.mk) containing some agriculture-related datasets, however not technically suitable for many datasets, as the portal is not updated regularly.

North Macedonia's ongoing EU accession process is driving renewed investments in statistical capacity, which should address many of these issues in the near future. This is especially important for conducting a modern farm economic survey similar to the EU FADN database.

3.3 Statistical data availability in the Republic of Serbia

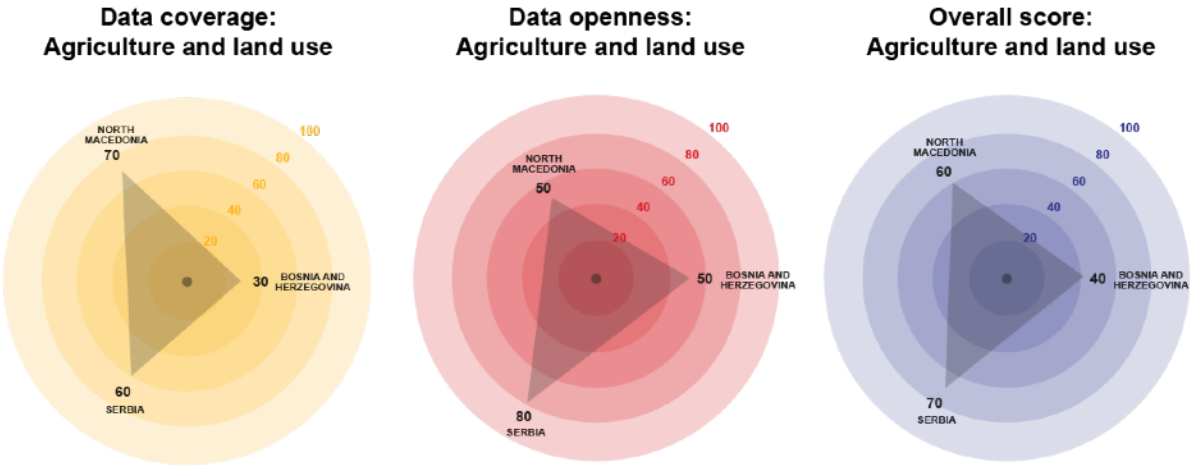
Republic of Serbia has made substantial progress in building its agricultural data capacity over the past decade. A full Census of Agriculture was carried out in 2012, which provided a detailed snapshot of farm structure, land use, livestock, labor force, and equipment. Subsequently, the country undertook another Agricultural Census in 2023, using modern digital data collection methods and complying with EU methodology. The preliminary results of the 2023 census indicate there are about 508,000 agricultural holdings in Serbia (of which 99.6% are family farms), reflecting the richness of captured data. This recent census, supported by EU technical assistance, was notably digitized - enumerators used tablets and e-questionnaires, thus improving data quality and timeliness of processing.

Beyond structural data, Serbia has established continuous data collection systems. The **Statistical Office of the Republic of Serbia (SORS)** conducts extensive annual surveys on crop production, yields, and livestock numbers. These are integrated with administrative data (e.g., the farm register and veterinary records), yielding relatively robust annual estimates. Serbia has also developed the **Farm Accountancy Data Network (FADN)** with EU assistance. FADN is an EU survey that collects detailed financial and economic data from a sample of farms. By 2018, Serbia's FADN was operational, providing insights into farm incomes, costs, and performance that are invaluable for policy evaluation, which illustrates Serbia's progress in aligning with EU data standards.

More important is that Serbia is well prepared[3] to implement **land parcel identification system (LPIS)** and a registry of agricultural holdings, which not only administer subsidies but also generate data on land area, ownership, and crop types. These administrative databases feed into statistics and ensure consistency across different data sources.

3.4 Comparison of agriculture and land use statistics

The Open Data Inventory (ODIN) measures how complete a country's statistical offerings are and whether their data meet international standards of openness. The radar charts presented below compare the performance of Bosnia and Herzegovina, North Macedonia, and Serbia across two key dimensions: **data coverage** and **data openness**. These metrics are then aggregated to derive an **overall score** within the agriculture and land use sector.



Source: ODIN, author's visualization

3.5 Comparison of data availability through Application Programming Interface (API)

Application Programming Interfaces (APIs) are software intermediaries that allow different applications to communicate with each other through defined requests and responses. In the context of national statistics, APIs enables the public and developers to retrieve statistical data directly from a statistical office's databases in a machine-readable format. Key concepts in evaluating an API offering include:

- **Data coverage:** The granularity of data available via the API (e.g. how many datasets or indicators are covered).
- **Openness:** How freely accessible and usable the data/API is (availability in open, machine-readable formats, free usage, open license).

[3] Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia, accessed on 14 March 2025

- **Integration:** The ease with which the API/data can be integrated into other systems or tools (supported formats, standards, and documentation).

APIs in National Statistical Offices: Country Overviews

Bosnia and Herzegovina – Agency for Statistics (BHAS)

No dedicated public API is currently provided by the Agency for Statistics of Bosnia and Herzegovina (BHAS). Currently, BHAS disseminates data through publications, PDF reports, and web tables on its website, rather than via an interactive API service. There is an open data portal (podaci.gov.ba) for Bosnia and Herzegovina, but the statistical data available there is limited, and BHAS itself has not rolled out an official API for its databases. The desk research however found that the entity agencies like the Institute of Statistics of the Republic of Srpska and the Federal Statistical Office have a databases of agricultural indicators with limited capabilities, yet with no API for automatic retrieval of data.

North Macedonia – State Statistical Office (SSO)

North Macedonia's State Statistical Office offers a full API for its data. The SSO runs the MAKSTAT online database, which fully supports open data access through a PX-Web API. This means users and developers can query the SSO's statistical database electronically. North Macedonia explicitly advertises that users can access the data in the MAKSTAT database via an API (Application Programming Interface). The API exists as part of the PX-Web system (a Swedish platform for statistical databases).

Serbia – Statistical Office of the Republic of Serbia (SORS)

Serbia's Statistical Office provides open access to its data, primarily via an Open Data portal. SORS has launched an Open Data Portal that gives the public access to datasets of official statistical indicators. While SORS doesn't refer to it as a "API", the portal effectively serves the same purpose by allowing users to obtain data in bulk and in machine-readable formats. The SORS Open Data portal is freely accessible online (data.stat.gov.rs) and contains a catalog of datasets covering various agricultural and land use related statistical indicators. All data in this catalog are free to use and reuse for commercial or non-commercial purposes, indicating an open license and no cost barrier. This setup allows analysts to integrate Serbian data into their workflows without manual data entry. For example, a researcher could regularly query the latest consumer price index and match with other indicator from different source for data analysis.

To summarize the similarities and differences among the three national statistical offices, the table below compares key aspects of their API/databases:

Table 1: Comparison: Statistical Offices APIs and Open Data Features

	Bosnia & Herzegovina (BHAS)	North Macedonia (SSO)	Serbia (SORS)
API Existence	No dedicated public API. Data are released via website reports and the open data portal, but no official API endpoint is provided for BHAS's databases.	Yes – MakStat API. The SSO provides an open API to its MakStat statistical database, allowing programmatic access to data.	Yes – Open Data Portal. SORS offers an open data portal (and a stat database) that serves API-like functionality for accessing datasets.
Types of API	None directly. Users must download static files (PDF, Excel) manually. (Note: The Federation's entity-level stats office uses a PX-Web database, showing potential for API usage, but the state NSO itself has not implemented one.)	REST PX-Web API. The API supports standard requests to query the database and returns data in formats like JSON, CSV, XML, or PX (PC-Axis format).	Open Data API / OData. Data are exposed in machine-readable format through the database portal. www.data.stat.gov.rs
Functionality	Manual data access only. No query interface; users get pre-made tables from reports or the website. Cannot filter or retrieve subsets of data dynamically via API.	Full database querying. Users can retrieve entire tables or specific subsets (e.g., select years, regions, indicators) programmatically. The system also allows basic computations and custom table building, for example pivoting the table before download.	Dataset downloads and queries. Users can download complete datasets (time series, indicators). The stat database interface additionally allows custom queries of data.
Data Coverage	Partial. Only high-level indicators are available in open data format, and even those may be published as PDFs or Excel files rather than via API. Many detailed datasets (microdata, detailed breakdowns) are not openly accessible.	Comprehensive. The API covers the entire MakStat database. Data series are regularly updated on the database, so the API provides current figures as soon as they are published. Historical data are also available, often in long time series, via the same API.	Comprehensive. The presence of both an open data catalog and a query able database means virtually all published data can be obtained in machine-readable form.

Source: Nationals statistical offices of Bosnia and Herzegovina, North Macedonia and Serbia

In conclusion of this section, it can be noted that the State Statistical Offices of North Macedonia and Serbia have made significant steps in maintaining and streamlining data via APIs or machine -readable formats, whereas Bosnia and Herzegovina's national office has yet to implement a comparable solution. North Macedonia's SSO stands out for its fully functional MakStat API, which adheres to international standards. Serbia's SORS has embraced open data portal with links for data exporting in various formats, thus ensuring that its data are available in machine-readable format and can be integrated into other systems.

4. COMMERCIALIZATION OF AGRICULTURAL DATA: IS IT POSSIBLE IN THE WESTERN BALKANS?

As data availability improves, a crucial question is how agricultural data can be commercialized - that is, transformed into value-added products, services, or revenues. Commercialization not only creates economic opportunities but also incentivizes further data collection and sharing by demonstrating tangible benefits to data providers (farmers) and data entrepreneurs. Around the world, data has been named as the "*new oil*" for its potential to drive innovation and potentials for revenues. In the Western Balkan context, leveraging agricultural data commercially could boost farm profitability, spur agri-tech sector growth, and attract investments in the sector. However, it must be done in a way that equitably shares value with farmers and maintains trust, given concerns about data misuse and fairness.

There are several models through which agricultural data can be commercialized, as evidenced by similar real cases from developed countries.

Data-driven farm advisory services - One of the most widespread commercial uses of farm data is in delivering personalized advice or decision-support tools. For example, services like Yara Digital Farming from Norway offer nutrient management advice based on aggregated soil and yield data. In these models, raw farm data (e.g., soil tests, yield maps) is commercialized indirectly: farmers exchange their data for agronomic insights.

Platforms and marketplaces for farm data - Initiatives from nonprofits like JoinData from the Netherlands illustrate a trust-based data exchange among agri-cooperatives and tech firms, where farmers decide who can use their data and in return get integrated services. Also, projects under the EU's Horizon research programs have explored "data marketplaces" for agriculture. A real outcome is the concept of "Data as a Service" (DaaS) where companies offer to manage a farmer's data (via IoT devices) and then share profits from any insights or sales derived.

Overview of the Common European Agricultural Data Space (CEADS)

The AgriDataSpace project (2022–2024) laid the groundwork for the Common European Agricultural Data Space, with key objectives including: mapping existing agricultural data-sharing initiatives, developing a multi-stakeholder governance model, exploring sustainable business models for data exchange, and creating a reference architecture for the data space. The project's vision is to "pave the way for a European data space for agriculture" that ensures data is shared and processed in a secure and trusted manner while unlocking innovation. In practical terms, this means establishing common standards, legal frameworks, and technical infrastructure so that data (e.g. on crop performance, soil, weather, markets) can be easily and safely exchanged across Europe. The outcome will be a federated network of agricultural data platforms (a decentralised system rather than a single central database) enabling interoperability among many local and national initiatives. By maintaining high privacy and ethics standards, the data space will empower farmers to control their data (through consent and permission management) and encourage broad participation.

Source: European Commission

Cases from the region

LoginEKO is a Serbian startup that has made significant strides in data-driven agriculture. LoginEKO uses advanced technology, including sensors, weather stations, and drones, to collect and analyze data, which helps optimize farming practices. Their innovative approach has led to the development of a farm management software platform that assists farmers in efficiently managing all aspects of their operations.

EarthCare.ai based in North Macedonia, is another startup leveraging data for use in agriculture. This platform aggregates climate data from various sources, including satellite imagery and weather stations, to provide actionable insights for businesses. EarthCare.ai aims to help companies incorporate relevant climate data into their strategies, offering detailed analyses and predictions about climate risks. Their goal is to mitigate the impact of climate change on agriculture and other industries by making climate data accessible and understandable.

5. DATA PROTECTION ISSUES AND NEED FOR ACTION

Data privacy laws are regulations governing the collection, processing, storage, and sharing of personal information. They aim to ensure individuals' privacy rights by imposing obligations on those who process personal data. Data protection refers to the measures and policies that safeguard personal data from unauthorized access or misuse. In the context of agriculture, the increasing use of digital technologies (farm management software, sensors, farm accountancy data networks, etc.) means that large amounts of data about farms and farmers are collected. This raises important questions about how that data is protected under national laws. Farmers' personal information, farm production data, and other need to be handled in compliance with data privacy regulations to prevent misuse and build trust in agricultural data systems.

Law on Protection of Personal Data in Bosnia and Herzegovina

Bosnia and Herzegovina, currently relies on the Law on Protection of Personal Data, which was originally adopted in 2006. The law was published in the Official Gazette of BiH 49/06, and later amended in 2011 (OG 76/11 and 89/11). The 2006 law was modeled on the older European Data Protection Directive 95/46/EC (the pre-GDPR framework) and as a result, it is not aligned with the EU GDPR. Recognizing this, Bosnian authorities initiated work on a new, GDPR-compliant law and have prepared new Law on Protection of Personal Data (Official Gazette 12/25) which is expected to enter in force later in 2025. Personal Data Protection Agency of BiH is an independent state-level agency responsible for overseeing and enforcing personal data regulations. The Agency handles complaints and ensures that organizations comply with the law.

North Macedonia's data protection framework is governed by several international mechanisms ratified in the Parliament and domestic ones, such as the Constitution of the Republic of North Macedonia and the Law on Personal Data Protection (Official Gazette of No. 42/20), and an amendment in Official Gazette 294/21. The law is largely harmonized with the EU GDPR and mirrors GDPR's principles, lawful bases for processing, data subject rights, and obligations for data controllers and processors. The Agency for Protection of Personal Data is the national authority supervising the lawfulness of the data processing.

Serbia's primary data privacy law is the Law on Personal Data Protection (LPDP). The current law was enacted in 2018 (Official Gazette of RS No. 87/2018) and took effect in August 2019. The content of the new law is largely harmonized with the EU GDPR. The Serbian data protection authority is the Commissioner for Information of Public Importance and Protection of Personal Data.

All three countries' legal frameworks address cross-border data transfers, but with restrictions. Under GDPR-modeled laws (Serbia, North Macedonia and new BiH's forthcoming law), personal data can only be transferred out of the country if the destination provides adequate level of protection or certain

safeguards (standard clauses, etc.) are in place. BiH's current law allowed transfers given "adequate safeguards" but criteria are based on the older EU standards and require Agency's approval in some cases.

A good governance of data would be applying the PIA - A Privacy Impact Assessment in agri-food companies to protect data that are valuable as farmer's data. PIA is a process which assists organizations in identifying and managing the privacy risks arising from new projects, initiatives, systems, processes, strategies, policies, business relationships etc. By applying this method, the agri-food sector may prevent the loses of valuable datasets and apply robust and relevant data protection system.

Agricultural data perspective: European and regional farming organizations are increasingly aware of data protection concerns. Serbia's farmers' unions and conferences related to agriculture have occasionally touched on data issues. The EU Code of Conduct on Agricultural Data Sharing by Contractual Agreement (2020) - a voluntary set of guidelines developed by EU farmers' and agri-business associations, which in this sense is highly relevant. It encourages agribusiness companies to be transparent about how they use farmers' data and to ensure farmers retain certain rights over data generated on their farms. While Serbia, BiH, and North Macedonia are not EU members, their agricultural sectors trade with the EU and often follow EU-led initiatives. Thus, agritech startups or cooperatives in all three countries is advisably to adopt this Code of Conduct to build trust among farmers and other relevant stakeholders.

6. POLICY RECOMMENDATIONS

Building on the key insights from the analysis, this chapter outlines actionable recommendations aimed at strengthening the governance of agricultural data and supporting inclusive digitalization across the agri-food sector. As the digital transition accelerates, targeted interventions are essential to ensure farmer-centric innovation, and cross-sectoral collaboration. They are intended to inform policymakers, development partners, private sector actors, associations and intermediaries active in the agriculture and committed to enabling sustainable digital future for agriculture.

Regular agricultural censuses are key for better planning. Bosnia and Herzegovina should start with its first full Agricultural census in 2025, while North Macedonia should prioritize its delayed second Agricultural census. Keeping a consistent schedule helps fill data gaps and keeps information up-to-date. Support from the EU can make this process smoother and more effective.

Align with EU Standards. The countries under scrutiny should harmonize statistical methods and definitions with Eurostat guidelines to ensure data comparability and quality. Serbia's established integration with Eurostat can serve as a model for North Macedonia and BiH.

Enhance data infrastructure. Western Balkan countries should establish integrated databases combining surveys, censuses, and administrative data. A centralized farm register can merge subsidy, veterinary, and census information for a comprehensive sector overview. Land Parcel Identification Systems (LPIS) should be utilized not only for subsidy management but also as a statistical tool. Preparing for connectivity with the EU's agricultural data space requires standard formats, APIs, and compliance with privacy regulations. This can be done trough interoperability among various ministries and institutions.

Enhance data quality by addressing gaps through targeted surveys and integration of administrative data. For instance, BiH and North Macedonia should accelerate FADN implementation to monitor farm economics. Collaboration with ministries to collect agri-environmental indicators is recommended, alongside leveraging Copernicus satellite data for improved agricultural statistics. Additionally, national statistical offices should be consulted in all the process when implementing digital tools for data collection.

Foster institutional coordination and data sharing. Fragmentation among institutions, especially in BiH, necessitates formalized coordination mechanisms. It is recommended to formalize coordination mechanisms involving the national statistical agency, agriculture ministry or statistical bodies, research

institutes, and farmer representatives, to periodically review data needs and agree on responsibilities. In North Macedonia and Serbia, integrating data from subsidy programs with statistical agencies will enhance accuracy; this requires data-sharing agreements that respect confidentiality but allow matched analyses.

Improve farmer engagement and data literacy. Even the best statistical system relies on producer cooperation for data gathering. Therefore, building trust with farmers is essential. Governments should emphasize that data collected will be used transparently to form policies that benefit the sector. Moreover, data privacy must be safeguarded – applying anonymization and data minimization that individual farm data will not be misused so it can raise concerns.

Promote Open Data and transparency principles. In line with EU trends, the countries should bolster their open data portals with as much agricultural data as possible, in machine-readable formats. This could include publishing microdata samples (anonymized) for research purposes, which would enable local universities and think-tanks to generate insights and solutions. The European Data Portal and the forthcoming common European Agricultural Data Space emphasize openness and data-driven innovation. Aligning with this, national statistical agencies should improve metadata, and documentation.

In conclusion, unlocking the full potential of digital transformation in agriculture requires more than technological advancement—it demands inclusive governance, shared standards, and sustained investment in digital infrastructure and human capital. Ensuring that data-driven innovation serves farmers, agri-businesses and rural communities, is critical for fostering long-term sustainability in the agri-food system. By aligning efforts across sectors and borders, the Western Balkans can chart a path toward a digitally empowered agriculture

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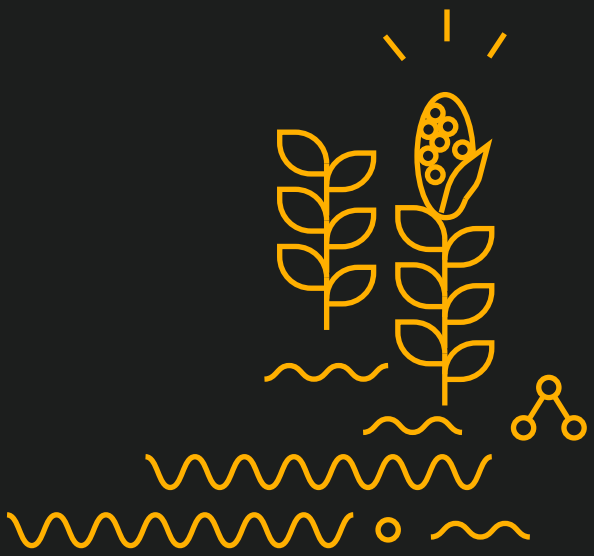

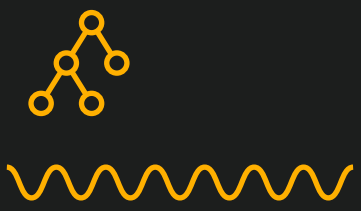

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