Food and Agriculture Organization of the United Nations

Meeting the European Union's digital agriculture requirements

An ITU-FAO compendium for pre-accession countries and territories

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NOTES

The pre-accession countries and territories addressed in this compendium are the Western Balkans (Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, Serbia); Türkiye; and the Associated trio (Georgia, the Republic of Moldova, Ukraine), as well as the others that may apply for membership of the European Union.

*All references to Kosovo should be understood without prejudice to positions on status, and in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence.

CONTENTS

FIGURES

ITU-FAO COMPENDIUM IN A NUTSHELL

Digitalization is a cross-cutting objective of EU agricultural and rural policies, including the Common Agricultural Policy (CAP). The ITU Office for Europe and the FAO Regional Office for Europe and Central Asia have compiled this document primarily for EU pre-accession candidate countries and territories and potential candidates through the process for entry into the European Union (EU), supporting their understanding and the alignment of their policies with the emerging requirements related to digital agriculture, and more specifically, those enshrined in the Common Agricultural Policy 2023-2027 (CAP).

E-agriculture, today commonly referred to as "**digital agriculture**", involves the conceptualization, design, development, evaluation, and application of innovative ways to use Information and Communication Technologies (ICT) in the rural domain, with a primary focus on agriculture. Provisions of standards, norms, methodologies, and tools as well as development of individual and institutional capacities, and policy support are all key components of e-agriculture (adapted from Sylvester, 2016).

The legal requirements related to digital agriculture in the European Union are not enshrined within a single self-standing or separate legal text, but addressed in many items of EU legislation, including those related to the CAP, statistics, data privacy and sharing, and food safety. Compiling some of these requirements is one of the scopes of this compendium.

The specific EU requirements for digital agriculture are interrelated in various thematic clusters and negotiation chapters of the EU pre-accession process, particularly:

- **Cluster 1 – Fundamentals:** Chapter 18 "*Statistics*"
- **Cluster 3 – Competitiveness and inclusive growth**: Chapter 10 "*Information society and media*"
- **Cluster 5 – Resources, agriculture and cohesion**: Chapter 11 "*Agriculture and rural development*" and Chapter 12 "*Food safety, veterinary and phytosanitary policy"*

Among the many phases and steps to be taken on the path to EU accession, Cluster 1 is opened first and closed last, and understanding and meeting the specific requirements in Cluster 5, particularly those stemming from the three CAP legislations for the period 2023-2027, can aid the applicant in anticipating the agreements in the remaining chapters (e.g. statistics).

This compendium has been designed with a view of informing all pre-accession countries and territories, even if their individual path to enter the EU can be a short, medium, or long-term prospective. There are three major procedural phases to access the EU, and applications are subject to approval by all Member States: (Phase 1) becoming an official candidate for membership; (Phase 2) undergoing formal membership negotiations; and (Phase 3) completion of the negotiations and the accompanying reforms to the satisfaction of the necessary parties, and subsequent accession. Based on the current status of their candidacy and the negotiations, readers are recommended to read specific chapters of the content of the compendium.

Pre-accession countries and territories at Phase 1: they applied for membership or have recently become official candidates for EU membership.

Recommended reading:

- **Chapter 3.2 "CAP Strategies and interventions for the digitalizing of agriculture and rural areas"**
- **Chapter 4 "Towards the EU and digital agriculture**
- **Chapter 5 "Funding relevant to digital agriculture"**

Countries and territories at this phase have signed up as official candidates and are just starting to align their administration, statistics and policies with those of the EU through the ENPARD or IPARD programmes, although they may still have a lot to do before they meet the EU acquis in its entirety, and more specifically, in setting up comprehensive information systems for the implementation of such significant policies as CAP Strategic Plans. This means that Chapter 3.1. about the digital information systems for CAP Strategic Plans is of a less immediate relevance for them at this stage, but it will be a source of requirements to be addressed in medium-long period.

Nevertheless, there is much that these candidates can do ahead of time in terms of supporting the digitalization of agri-food systems and rural areas. **Chapter 3.2 can be a source of inspiration of agricultural and rural policy interventions for digitalization.** It is based on the current CAP's 2023-2027 toolbox for digitalizing farming and rural businesses through cooperation, investments, farm

advisory services and overall digitalization strategies. Furthermore, **Chapter 4 and 5** provide a wealth of information about digital enablers (e.g. EU funding and other assistance support for digital agriculture) and shares the experiences of other pre-accession countries with the digitalization of agriculture as a prerequisite for EU accession.

Pre-accession countries and territories at Phase 2 and 3: they are undergoing or completing formal negotiations for EU membership.

Recommended reading:

- **Chapter 3.1: "Digital information systems for CAP management, monitoring, and evaluation".**

Countries that have been assigned candidate status have met the conditions for opening negotiations with the European Union and are ready to start meeting the legal requirements for EU accession. Depending on the level of alignment with the whole EU acquis, in the short-medium period, for example, the electronic or digital information systems for the setting up, management, monitoring and evaluation of National CAP Strategic Plans shall be ready. **Chapter 3.1** provides an overview of these requirements. It goes without saying that these candidates can also benefit and learn from the readings recommended to candidates still at Phase 1.

Check out the National Self-Assessment Checklist in the Annex

Knowledge of EU digital agriculture requirements is one thing, but their implementation remains one of the biggest endeavour ahead for pre-accession candidates and prospected candidates, as well as for many EU Member States. Planning digital transformation roadmaps, developing information systems and software, providing capacity building and exchanges of good practices, and more is needed to walk this long journey. As starting point, FAO and ITU have developed a list of **not-binding self-assessment checklists**, with questions that can guide policy officers and ICT engineers through the design of future information systems and the planning of the steps towards the final harmonization of their country's digital agriculture with CAP.

1 OVERVIEW

Agriculture in the European Union (EU) is undergoing a complex process of digitalization. According to FAO and ITU, digital agriculture refers to the enhancement of agricultural and rural development through improved information and communication processes (adapted from Sylvester, 2016). More specifically, it involves the conceptualization, design, development, evaluation and application of innovative ways to use ICT in the rural domain, with a primary focus on agriculture. Provisions of standards, norms, methodologies, and tools as well as development of individual and institutional capacities, and policy support are all key components.

In the European Union, multiple definitions of digital agriculture exist rather than one official and agreed-upon description, and the efforts to address the regulatory framework surrounding this topic are under continuous development. The new legal requirements related to digital agriculture are scattered across various legal texts, although overall, agricultural policies in the European Union embrace the digitalization efforts and are becoming increasingly intertwined with broader green and digital policies. One obvious example of this is the EU Common Agricultural Policy (CAP), which plays a major but not exclusive role in digital agriculture in the European Union, and is the primary focus of this compendium, which seeks to aid pre-accession countries and territories navigate the diverse requirements. Understanding the latest developments and regulations related to digital agriculture in the European Union is becoming more challenging due to the continuous evolution and deployment of digital technologies and the growing interrelationship between digitalization and agriculture across the whole EU Acquis.[1] For the countries and territories whose negotiations ahead of accession to the European Union are continuing, this represents an additional undertaking, as they are being called on to meet these requirements, or indeed, go beyond them.

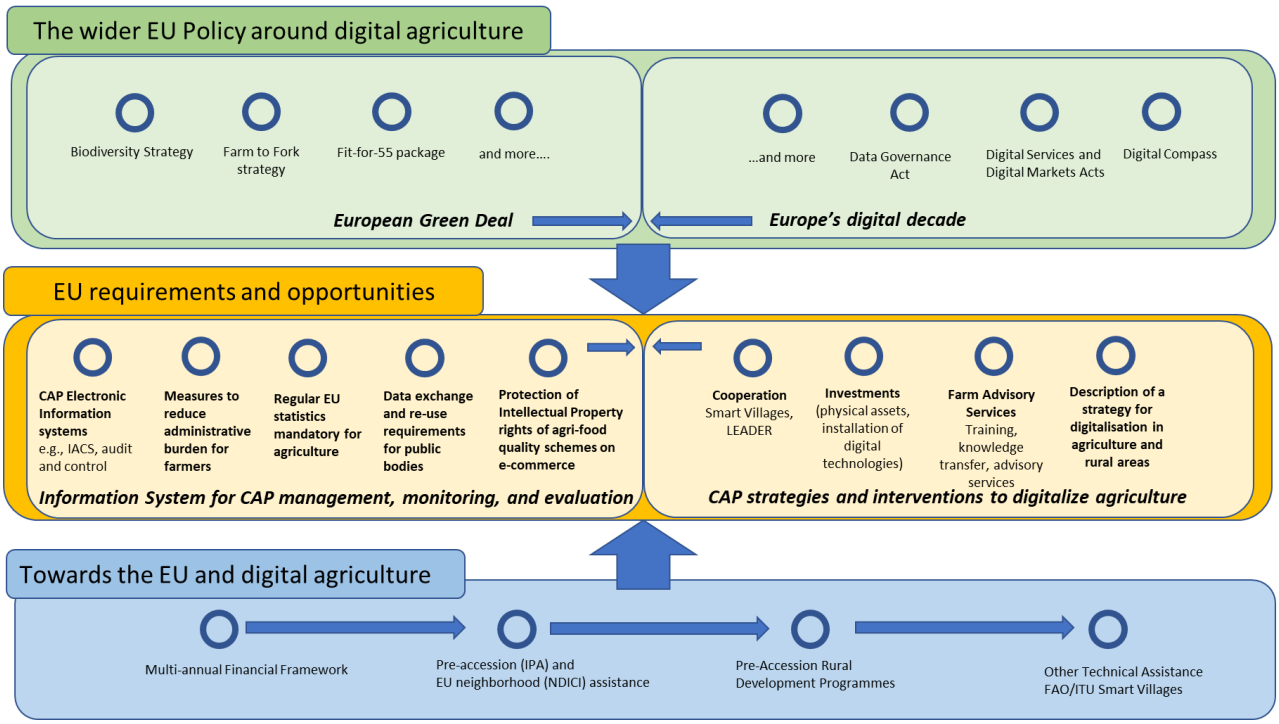
Addressing this issue, this compendium summarizes the EU requirements related to two specific areas of digital agriculture: 1) the **establishment of digital information systems to support CAP management, monitoring and evaluation by government authorities**, from the design phase to the

[1] The EU Acquis is the accumulated body of legislation, legal acts and court decisions that constitutes the body of European Union law.

delivery, auditing, monitoring and evaluation of the systems; and 2) **public strategies and interventions supporting the digitalization of agriculture**, including CAP support for the provision of farm advisory services and investments, and such cooperation projects as smart villages.

The ITU Office for Europe and the FAO Regional Office for Europe and Central Asia co-authored this document to serve primarily as a compendium supporting the entry of EU pre-accession countries[2] to the EU single market and the alignment of their agricultural policies with the emerging EU legislation related to digital agriculture, and more specifically, the CAP and its delivery. On a broader scale, this guide may also aid other countries and actors in coming up with strategies and programmes related to digital agriculture or in the establishment of digital information management systems supporting the application of agricultural policies. Figure 1 provides an overview of the structure of this compendium.

Figure 1: Structure of this document



Source: Author's own elaboration

[2] The pre-accession countries and territories referred to in this document are the Western Balkans (Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, Serbia); Türkiye; the Associated trio (Georgia, Moldova and Ukraine), as well as any others that may apply for membership of the European Union.

Chapter 2 outlines the wider EU policy framework underpinning digital agriculture, contextualizing the policy interrelations that drive agricultural policies towards digitalization, and vice versa. Chapter 3 summarizes the legal requirements related to digital agriculture, as defined in EU legislation, and more prominently in the CAP, as the oldest and one of the largest EU policies dedicated to agriculture and rural development.

To support the application of this overview of legal requirements, Chapter 4 contains self-assessment checklists that facilitate the preparatory works related to pre-accession negotiations, and also the establishment of digital strategies. Chapter 4 further provides guidance on how to navigate the accession process ahead of EU membership, taking into account the requirements and opportunities related to digital agriculture, including the available funding mechanisms, such as pre-accession agricultural support programmes (IPARD and ENPARD), and other ITU and FAO initiatives and programmes that can aid EU pre-accession countries in the development of digital agriculture and smart village strategies, as well as the establishment of e-government systems for agriculture.

What are the legal requirements noted in this compendium?

Legal requirements in the EU can stem from different types of legislation, including regulations, directives, decisions and recommendations. EU requirements can be divided broadly into three categories (European Commission, 2023b):

- Imperative requirements ***oblige*** someone to do or not to do something. They are mandatory and enacted by verbs like "shall" or "must". In this compendium, imperative or mandatory requirements are marked by **red boxes**.
- Permissive requirements ***allow,*** and can therefore be considered as opportunities. They are enacted by verbs like "may". Member States may or may not do something depending on their ultimate decision. Permissive requirements or opportunities are marked by **green boxes**.
- Finally, declarative provisions are those implemented directly by virtue of being declared, for example, definitions or amendments.

NOTE: The legal requirements related to digital agriculture in the European Union are not established as self-standing or separate legal texts referring directly to this agricultural model, but rather can be found in different EU legislations, including agricultural policies like the CAP.

Source: Authors' elaboration based on European Commission texts (2023b)

1.1 Why digital agriculture matters for pre-accession countries and territories

Digital agriculture can be instrumental at many levels, from the field to consumers and policies. Pre-accession countries and territories can deploy digitalization for the effective, transparent, and efficient setting up of their own agricultural policies, including the delivery, monitoring, and evaluation. For instance, in food safety, the use of digital technologies during official food safety control inspections benefit official controls by increasing the detection of non-compliances as well as recording consistent and useable data during inspections for their following analysis. Other examples can be e-certification/or online certification for consignments of food, plants, animals crossing borders. At the same time, pre-accession countries and territories can accompany agri-food-rural actors in grasping the opportunities and overcoming the risks of digitalization for their livelihoods, quality of life, and environment.

In the European Union, pledges[3] related to the digitalization of agricultural policies and agriculture, in general, are increasingly being made to meet the expectations of society in regard to the improvement of efforts to target and tailor policy interventions, or the enhancement of transparency and accountability (European Court of Auditors, 2020). For instance, digitalization is one of the cross-cutting objectives of the CAP in support of its simplification and modernization. New reporting requirements, such as those agreed in the CAP post-2022 legislations or for which negotiations are continuing (e.g. converting the Farm Accountancy Data Network into Farm Sustainability Data Network) reflect the larger political scope of agricultural policies, but also the availability of new digital tools for the collection, transfer, visualization and management of agricultural data in support of policy-making and evaluation.

[3] For more information, in 2019, EU Member States joined forces in this declaration on digitalization for European agriculture and rural areas

Digitalization is considered vital for the sustainability of agricultural practices and rural communities, providing faster and data-driven alternatives to existing issues related to farm management, public monitoring of natural resources, and socio-economic activities embedded in the regional economy. Such a transformation, however, could also come with such undesired trajectories as inequalities, exclusion or the further exploitation of natural resources if not planned well (Scholz et al., 2018; Wallimann-Helmer et al., 2021). The consequences of the digital transformation of agriculture are subject to frequent debate, along with the possible trade-offs, although the process is receiving broad public support in the European Union, particularly the development of the digital infrastructure (e.g. data centers, broadband network roll-outs), the adoption of digital technologies through investments, the integration of digitalization into community development programmes (e.g. LEADER, Smart Villages) and the enhancement of digital skills (training and knowledge transfer).

1.2 A compendium for countries and territories on the EU pre-accession path

EU enlargement is an integral part of the Treaty on the European Union (Maastricht Treaty, Article 49), which states that any European country may apply for membership if it respects the "principles of liberty, democracy, respect for human rights and fundamental freedoms, and the rule of law". The accession criteria that have to be met by the applicant country to obtain candidate country status are included in the Copenhagen criteria, while further requirements are set out in the so-called "Stabilization and Association process" and Stabilization and Association Agreements (SAAs), relating mainly to regional cooperation and good neighbourly relations. For the cases of Ukraine, the Republic of Moldova and Georgia, the criteria are integrated into EU Association Agreements (AAs) and Deep and Comprehensive Free Trade Agreements (DCFTAs).

In February 2020, the European Commission (EC) introduced a communication on "Strengthening the accession process", making it more predictable (with clearer conditions and incentives[4]), more credible (delivering as promised), subject to stronger political steering (top-level meetings and stronger involvement) and more dynamic through the grouping of the 35 negotiation chapters in six clusters,

[4] For example, increased investment opportunities, work for accelerated integration and "phasing-in" to individual EU policies (European Commission 2020a).

making thematic discussions easier. The cluster on fundamentals (rule of law, economic criteria and public administration reform) plays a central role, and without the required progress other clusters cannot be opened. As such, negotiations related to this cluster are opened first and closed last, and the overall pace of the negotiations is determined by their progress (European Commission 2020a).

How are the EU pre-accession process and digital agriculture interrelated?

The main negotiation chapters related to the alignment of the legal framework and institutions with the EU Acquis in the fields of digital agriculture are:

- Cluster 1: Fundamentals: Public administration reform and Chapter 18 - Statistics
- Cluster 3: Competitiveness and inclusive growth: Chapter 10 - Information society and media
- Cluster 5: Resources, agriculture and cohesion: Chapter 11 - Agriculture and rural development
- Chapter 12: Food safety, veterinary and phytosanitary policy

Source: Authors' own elaboration

The steps required to meet the pre-accession negotiation requirements of the chapters related to agriculture and digitalization are many, however, the greatest priority is afforded to the setting up of a CAP electronic information system and the statistical datasets regulated specifically by the CAP regulatory framework (e.g. national statistics). The necessary works required for the establishment and management of the data infrastructure should be carried out in parallel with the broader legal framework harmonization vis-á-vis the EU Acquis. The specific requirements for digital agriculture are discussed in detail in Chapter 3, whereas the steps and criteria governing entry to the European Union while meeting the negotiation chapters related to agriculture, including digitalization, are explained in Chapter 4.

Minding the starting posts: Which are the current pre-accession countries and territories?

While the route to EU accession is, in principle, the same, the starting point is different for neighbouring countries. As of 2023, Albania, the Republic of Moldova, the Republic of North Macedonia, Montenegro, the Republic of Serbia, Bosnia and Herzegovina, Türkiye, Georgia, and Ukraine are recognized as candidate countries for entry to the European Union. Kosovo* has a clear prospect for EU membership but have not yet been granted candidate status.

For the Western Balkans and Türkiye, actions supporting their accession related to digitalization are conducted under the Western Balkans Green Deal. These actions include support to the **institutional harmonization with the EU acquis** in agriculture and are **combined with the CAP-like Instrument for Pre-accession Assistance Rural Development (IPARD) programme in support of farmers.** The approach has proved to be successful in preparing farmers for the transition to the full implementation of the agricultural policies under the CAP umbrella. The interventions and requirements under the IPARD programmes are very similar to those included in the CAP, although other gaps still need to be addressed to grasp the opportunities of digitalization (e.g. legal framework, policy delivery efficiency, compliance and checks, administrative burden for beneficiaries). The accession process with Türkiye has been suspended, although Türkiye continues to be a beneficiary of the Instrument for Pre-accession Assistance (IPA III 2021-2027) fund, the IPARD programme (IPA III 2021-2027) and the European Fund for Sustainable Development Plus (EFSD+).

Though currently not provided, similar instruments can be made available for the **Associated Trio**[5] under the New Eastern partnership agenda, although the interventions require further streamlining to ensure institutional harmonization with the EU acquis, and adjustments need to be made to meet the CAP requirements.

Source: Authors' own elaboration

[5] As proposed by the Euronest Parliamentary Resolution

1.3 EU pre-accession funding, instruments and delivery mechanisms for digital agriculture

The EU funding is provided through several modalities, including grants, procurement contracts, budget support, trust funds, Technical Assistance and Information Exchange (TAIEX) and twinning, guarantees, loans and other financial instruments. EU instruments (e.g. IPA and NDICI) encourage (to a limited extent, and not, to date, in the field of agriculture) **multi-country projects** that can serve to speed up the establishment of the electronic information systems needed for the implementation of EU-compliant agricultural policies.

The European Union has established several mechanisms and implementation modalities for the distribution of funds (regulated by the **Financial Regulation**) through ***direct management***, in which EU funding is **managed directly by the European Commission** through EU delegations; under **shared management,** in which the European Commission and national authorities jointly manage the funding operations; and ***indirect management***, in which EU funds are contracted through intermediaries known as "entrusted entities", or implemented by entrusted national institutions (in the case of the IPARD programme). National and international organizations (or their agencies) such as **FAO and ITU can serve as entrusted entities and** can indirectly manage EU funds and instruments within pre-accession countries and any other final beneficiaries therein. The Western Balkans and Türkiye can access EU funds based on a **direct management** approach through EU institutions and programmes (e.g. InvestEU, Horizon Europe EU Space), while the Associated Trio countries can access such funds under individual agreements with the European Union.

Western Balkans and Türkiye have, for some time, been key players in European agricultural and rural policies, including also digital agriculture. The Western Balkan Strategy, the Green Agenda for the Western Balkans and the Economic and Investment Plan for the Western Balkans are the main drivers of the digital transition At the same time, strengthening and harmonization of the legal environment and institutions offers strong support under the umbrella of the Instrument for Pre-accession Assistance (IPA), with the same instrument being applied for the provision of pre-accession support in agriculture (IPARD).

The "Associated trio" countries are launching their accession processes under the umbrella of the European Neighbourhood Partnership Instrument (ENI) - Eastern partnership. The basis for the collaboration in the case of Georgia would be the Deep and Comprehensive Free Trade Area (DCFTA) and the Association Agreement. In 2020, the EC and the High Representative of the Union for Foreign Affairs and Security Policy presented a proposal on how to bring forward priorities for cooperation with the Eastern partners post-2020, underpinned by an Economic and Investment Plan - a "new Eastern Partnership agenda" - aimed at, among other things, investments in connectivity, support of green and digital transitions, and the promotion of fair, gender-equal and inclusive societies, in which activities are supported through the Neighbourhood, Development and International Cooperation Instrument - Global Europe (NDICI), under specific thematic windows.

EU pre-accession funding available to meet digital agriculture requirements.

The **Western Balkans,** namely Serbia, Montenegro, Albania, North Macedonia, Kosovo*, and Bosnia and Herzegovina.

- **Negotiations:** Serbia, Montenegro, Albania and North Macedonia are all candidate countries that have started their negotiation processes.
- **Candidate status:** Bosnia and Herzegovina has a candidate status, while Kosovo* is a potential candidate.
- **Beneficiaries of EU Funding:** The Republic of Serbia, Montenegro, Albania, the Republic of North Macedonia, Kosovo*, and Bosnia and Herzegovina are beneficiaries of **IPA funding**.
- **Agriculture and Rural development funding:** The Republic of Serbia, Montenegro, Albania and the Republic of North Macedonia are **beneficiary countries of pre-accession rural development support (IPARD);** Kosovo* and Bosnia and Herzegovina may benefit from the IPARD after gaining the necessary legal and institutional capacities.

The "Associated Trio" are the Republic of Moldova, Georgia and Ukraine, based on a memorandum of understanding signed in May 2021:

- **Negotiations:** Negotiations have yet to be started with any of the "Associated Trio"

countries.

- **Candidate status:** the Republic of Moldova and Ukraine gained candidate status in June 2022, while Georgia was granted the same status in December 2023.
- **Beneficiaries of EU funding:** the Republic of Moldova, Ukraine, Georgia, Belarus, Armenia, Azerbaijan and the Regional East are beneficiaries as **Eastern Neighbourhood** partners under the **Neighbourhood, Development and International Cooperation Instrument - Global Europe, more of NDICI.**
- **Agriculture and Rural Development funding:** the Republic of Moldova, Ukraine and Georgia were beneficiaries of the **ENPARD programme.**

Türkiye's accession process was launched in 2005, but the negotiation process was suspended in 2016. **Türkiye is a beneficiary of IPA funding and also the IPARD programme.**

Source: Authors' own elaboration

1.4 ITU and FAO support for the digitalization of agriculture

ITU and FAO have provided support to numerous countries around the world in the development of national strategies and the digitalization of the agriculture sector and rural areas, including such pre-accession countries as Bosnia and Herzegovina and Türkiye. The applied strategies aim to harness the potential of digital technologies with a view to improving agricultural practices, increasing productivity, enhancing food security and promoting sustainable development.

In addition to strategy development, FAO has actively supported several countries in the implementation of e-government systems specific to agriculture, such as farm registries, agriculture market information systems and digital rural advisory services. This assistance has supported EU pre-accession countries in the establishment of such crucial information management systems as the Farm Accountancy Data Network (that later transitioned into the Farm Sustainability Data Network).

Ultimately, the FAO Digital Villages Initiative (DVI) allows countries on the path to EU accession to leverage FAO's expertise in the design of smart village strategies, thus supporting their development of smart and digital villages, and contributing to the benefits of digitalization in rural areas. By embracing

the concept of smart villages, pre-accession countries can narrow the digital-rural divide, enhance rural livelihoods, and contribute to the overall modernization and development of their agricultural sectors and rural areas.

FAO Digital Villages Initiative

Launched by FAO in 2021, the Digital Villages Initiative (DVI) has the ambitious goal of converting at least 1000 villages around the world into Digital Villages. Through DVI, FAO is supporting the digital rural transformation, and in doing so, is addressing the challenges of agri-food systems and improving the livelihoods and resilience of rural communities. Technologies are seen as accelerators that provide leverage to the realization of the enormous value of rural areas in many ways - from increasing agricultural productivity, to supporting a more holistic digital rural transformation under which better access to services, markets, networks, critical knowledge, information and financial opportunities are provided to rural communities.

Source: Authors' own elaboration based on Digital Villages Initiative in Europe and Central Asia (fao.org)

2 THE WIDER EU POLICY RELATED TO DIGITAL AGRICULTURE

This chapter explains the broader EU economic growth model and the basis of the EU policies related to digital agriculture. The European Commission's priorities for the **European economic growth model** include green and digital transitions, and the resulting policies are expected to contribute to both the European Union's general objective of fair and inclusive growth and competitive sustainability, including agriculture.

The European Green Deal sets out a roadmap for the sustainability of the Union's economy in a fair and inclusive manner, while at the same time addressing the challenges related to climate and the environment. In line with the Paris Agreement, the Union has made a commitment to reduce greenhouse gas (GHG) emissions by at least 55 per cent by 2030 when compared to 1990 levels and achieve net zero GHG emissions by 2050. In an effort to mobilize policies and align the current rules with the European Green Deal objectives, the Commission has proposed the "Fit for 55" package at an EU level aimed at revising all the relevant policy instruments.

The European Digital Decade proposes a framework for the achievement of green objectives through the development of synergies in many areas as part of a smart circular economy. The Digital Decade policy programme includes objectives and targets related to digital skills, infrastructure, business and governments. The adoption of innovative digital solutions can support the achievement of the sustainability objectives in various economic sectors (e.g. smart buildings, smart and sustainable mobility systems, digital "product passports", precision farming, etc.).

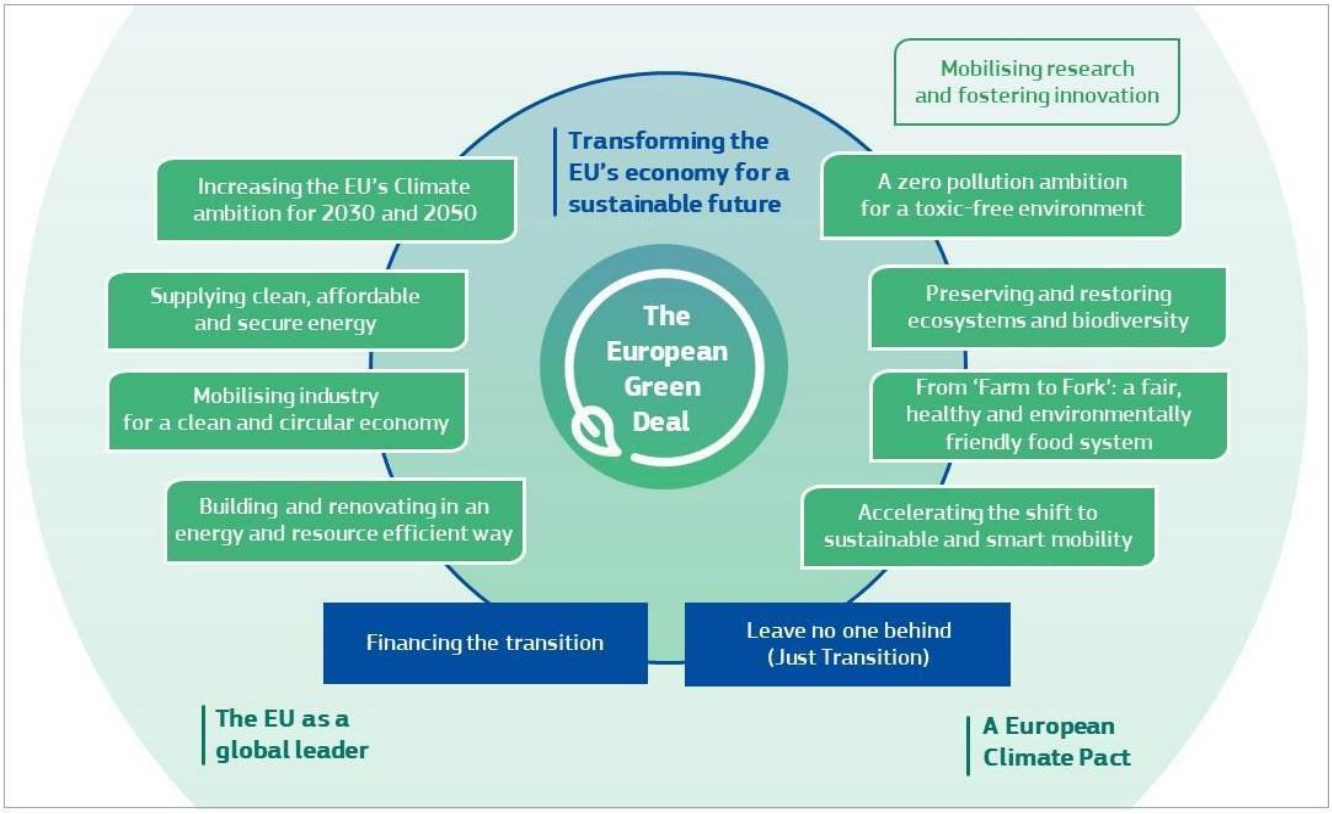
The **European Union strives to intertwine these two policies**, although science and past experience suggest that while such integration is desired, it remains an arduous undertaking (Bianchini et al., 2022; Klerkx et al., 2019; Muench et al., 2022; Verdouw et al., 2021). For instance, the adoption of precision farming technologies in arable farming can achieve savings in herbicides, reduce the area requiring insecticide treatments and reduce weed densities (Anastasiou et al., 2023), thus contributing to the Green Deal targets enshrined in the Farm to Fork and Biodiversity Strategies. Small-scale farmers can streamline their direct sales through appropriate and affordable software, thus capturing higher value added along the food chain. The costs of digital technologies, however,

can exacerbate the inequalities that exist among different agricultural actors, while large-scale adoption can result in the greater overall consumption of synthetic pesticides - an undesired rebound effect known as Jevons' Paradox (Sears et al., 2018).

2.1 European Green Deal

In line with the Paris Agreement, the EU has committed to reducing greenhouse gas (GHG) emissions by at least 55 per cent in 2030 from the baseline 1990 levels. In line with this, in October 2023, the nationally determined contribution (NDC) of the EU and Member States were approved and submitted to the United Nations Framework Convention on Climate Change (UNFCCC) by the Council of the European Union, thus replacing the commitments of 2020. Figure 2 provides an overview of the European Green Deal objectives put in place to meet this commitment.

Figure 2: The European Green Deal



Source: EU Green Deal communication

Under the European Green Deal, the agriculture sector makes significant contributions to the European economy and the key supporting policies. It provides livelihoods through 91 million farms across the European Union, and accounts for approximately 4.5 per cent of employment in the European Union. An estimated 9.4 million people are employed in the agriculture, forestry and fishing sectors, of those, 4.2 per cent worked in agriculture in 2020. The European Union is the world's largest agri-food exporter, as a result of which, the region's activities and actions spearhead global trade.

The Farm to Fork strategy and the Biodiversity Strategy for 2030 under the European Green Deal are two of the most important strategies in the European Union related to agriculture, taking advantage of the potential offered by the European Union's food systems and nature restoration efforts to deliver on the European Green Deal, along with other targets. Robustness and resilience are crucial to ensure the functioning of the food systems in all circumstances; and this necessitates the food systems to shift to sustainable practices. The Farm to Fork strategy aims the European food to become the global standard for sustainability by building on the efforts so far in reducing greenhouse gas (GHG) emissions in agriculture sector by 20% since 1990. It outlines the enablers for the transition to sustainable practices at the production, manufacturing, processing, retailing, packaging and transportation, as well as consumption levels by the farmers, fishers and aquaculture producers, as well as food processors and food services and consumers. At farm level, there is an urgent need to reduce dependency on pesticides and antimicrobials, reduce excess fertilization, increase organic farming, improve animal welfare, and reverse biodiversity loss. While these solutions require human and financial investment, they promise higher returns through the creation of added value and reduced costs.

Figure 3: The EU Farm to Fork Strategy's objectives

Source: Farm-to-Fork Strategy

Sustainability in agriculture contributes to the sustainability of rural areas and communities. The European Union's rural areas are home to 137 million people, representing almost 30 per cent of the total population and over 80 per cent of its territory. The social and economic changes in recent decades have also affected rural areas, and the efforts to address the challenges and concerns arising from these changes also build on the lessons learned from the COVID-19 pandemic.

The Long-term Vision for the Rural Areas (LTVRA) of the European Union was put forward in 2021 by the European Commission as a means of improving quality of life in rural areas, achieving balanced territorial development and stimulating economic growth. To this end, **(i) quality of life is to be improved** through the development of innovative solutions for the provision of services, making the most of the possibilities offered by digital tools, strongly encouraging social innovation, maintaining or improving public transport services and connections, and strengthening digital infrastructures**, (ii) resilience to climate change**, **natural hazards and economic crises is to be increased** through the preservation of natural resources, the restoration of landscapes, including cultural ones, the greening of farming activities and the shortening supply chains, and **(iii) the diversification of economic activities is to be achieved** based on sustainable local economic strategies, including measures to make the location attractive to companies, and to improve digital literacy, thus contributing to the

retention of a fair share of the value generated by agriculture in rural areas. Data, and improved data management in support of multi-level rural development, are prioritized in the LTVRA, and as such, the European Commission has supported such EU-wide data initiatives as the Rural Observatory and Rural Revitalization Platform, which collect and aggregate small-scale data and information from the Member States. Another activity involves the collection of the Digital Economic and Society Index (DESI) data at lower administrative levels to support the analysis and monitoring of the rural digitalization of the rural areas in the European Union.

Both the Farm to Fork strategy and the LTVRA are supported by research, innovation, technology and investments, advisory services, data and knowledge-sharing, skills and service provision, supported by the digital transformation and common data space.[6] Table 1 presents an overview of the elements of the Farm to Fork and LTVRA.

Table 1: Summary of provisions under the Farm to Fork strategy and LTVRA

Goals	
Farm to Fork	Food chain with neutral or positive environmental impacts
	Food security, nutrition and public health
	Affordability of food, while generating fairer economic returns throughout the supply chain
LTVRA	Increased quality of life, encouraging strong social innovation, maintenance or improvement of public transport services and connections, as well as strengthening of digital infrastructures
	Increased resilience to climate change, natural hazards and economic crises
	Diversification of economic activities, based preferably on sustainable local economic strategies, measures to make the location attractive to companies and the improvement of digital literacy

[6] Commission Staff working document - European Research and Innovation for Food and Nutrition Security, SWD 2016/319 and Commission FOOD 2030 High-level Conference background document (2016) - European Research & Innovation for Food & Nutrition Security.

Actors and their commitments			
Actors	Administrations defining agricultural policies	Food producers, processors, organizations and other food chain stakeholders	Rural communities
Roles	**Policy Programming and Implementation** Pre-accession programmes (IPARD, ENPARD) CAP Interventions described in CAP strategic plans	Sustainable food production	Good care of resources for food production, non-agricultural economic activity and social inclusion
Information systems	**Mandatory CAP systems**: Statistics, CAP management, IACS, Vineyard register, Register of organic producers, Database of fruit and vegetable traders	**E-agriculture food production services** AKIS, advisory services, Artificial intelligence in agricultural production and processing, use of EU data space, e-commerce, e-cooperation	**Rural data** Rural observatory, Rural Revitalization Platform, Smart Villages services, Connectivity and cooperation
Fundings and programmes	**E-government services** IPA with IFI (Western Balkans and Türkiye) NDICI with IFI (EU Neighbourhood)	InvestEU, Horizon Europe, EU Space, IPARD, ENPARD	Before accession: IPA, IPARD, NDICI, ENPARD, EIP After accession: CAP, EAFRD, ERDF and ESF+, Interreg

Enabling tools
Research and innovation, Advisory (EU Horizon)
European Agriculture Data Space (EU Space)
Digital transformation (skills, connectivity, integration, e-government) (Digital EU)

Source: Authors' own elaboration

2.2 Europe's Digital Decade

To support the objectives of the European Green Deal, the European Commission published the Shaping Europe's Digital Future strategy, detailing the directions of the digital transformation based on three key objectives with supporting actions:

- **Technology that works for people,** with actions related to Artificial Intelligence (AI), gigabit connectivity, supercomputer capacity, cybersecurity, digital competencies and skills, and cross-border data flows.
- **Fair and competitive economy,** including the European Data Strategy, the Digital Services Act package, the Industrial Strategy Package, Digital Finance and the Consumers Agenda.
- **An open, democratic and sustainable society**, with actions related to the regulation of the internal digital services market, the audio-visual and media sector, the promotion of trusted digital identities for all Europeans, and the establishment of electronic health records based on a common European exchange format.

Table 2 presents an overview of the key actions related to the implementation of this strategy.

Table 2: Summary of key elements of the "Shaping Europe's Digital Future" strategy

Shaping Europe's Digital Future: Key actions
Technology that works for people
• Artificial intelligence (AI) package: the Commission presented its AI package, including the Communication on fostering a European approach to AI, a review of the Coordinated Plan on Artificial Intelligence (with EU Member States), the Proposal for a Regulation laying down harmonized rules on AI (AI Act) with relevant Impact assessments and the Revised EuroHPC Regulation on supercomputing. • Cybersecurity: The EC and the High Representative of the Union for Foreign Affairs and Security Policy presented a new EU Cybersecurity Strategy at the end of 2020 and a Directive on measures related to the establishment of a high common level of cybersecurity across the Union (NIS2 Directive). • Digital Education: the renewed Digital Education Action Plan 2021-2027 for greater cooperation at a European level on digital education, a reinforced Skills Agenda to strengthen digital skills throughout society, and a reinforced Youth Guarantee placing a strong focus on digital skills in early career transitions were adopted in 2020. • EU governments' interoperability strategy was reinforced by linking public services, supporting public policies and delivering public benefits Towards an "Interoperable Europe".
A fair and competitive economy
• European data strategy of February 2020 announced the creation of data spaces in 10 strategic fields: health, agriculture, manufacturing, energy, mobility, finance, public administration, skills and the European Open Science Cloud, with the crosscutting key priority of meeting the Green Deal objectives. • The Data Governance Act regulation was published in May 2022, establishes the governance through the European Data Innovation Board (EDIB), which will assist the Commission in drawing up guidelines for the creation of common European data spaces. • Implementing Regulation on high-value data under the framework of the Open data directive, specifying the High-Value Datasets (HVDs) that public sector organizations are to make available free of charge. • Data Act regulation proposal aims at enabling companies and consumers to maintain better control of data and ensuring a fair distribution of the value generated by data along the data value chain. It lays

down horizontal rules to boost data access and use within and across sectors, thus making a major contribution to the development of the common European data spaces at large.

- Digital Services Act package: two regulations on the Single Market for Digital Services (Digital Services Act) and Digital Markets (Digital Markets Act) were adopted to ensure that large platforms with significant network effects remain fair and contestable for innovators, businesses and new market entrants.
- Industrial Strategy Package Communication, putting forward a range of actions facilitating the transformation of businesses into clean, circular, digital and globally competitive EU industries, including SMEs and the reinforcement of single market rules.
- The creation of a framework supporting convenience, competitivity and security in Digital Finance, including legislative proposals on crypto assets, digital operational and cyber resilience in the finance sector, and a strategy for the creation of an integrated EU payments market that supports pan-European digital payment services and solutions.
- Communication on Business Taxation for the 21st century, taking into account the progress made by the Organization for Economic Co-operation and Development (OECD) in addressing the tax challenges arising from the digitalization of the economy.
- Delivering a new Consumer Agenda, which will empower consumers in making informed choices and play an active role in the digital transformation.

An open, democratic and sustainable society

- Revision of the eIDAS Regulation improving its effectiveness, extending its benefits to the private sector and promoting trusted digital identities for all Europeans.
- Media and audio-visual Action Plan in support of the digital transformation and competitiveness of the audio-visual and media sector, aimed at stimulating access to quality content and media pluralism.
- European Democracy Action Plan to improve the resilience of our democratic systems, support media pluralism and address the threats of external intervention in European elections.
- Destination Earth is an initiative for the development of a high-precision digital model of Earth (a "Digital Twin of the Earth") that would improve Europe's environmental prediction and crisis management capabilities.
- A circular electronics initiative mobilizing existing and new instruments in line with the policy framework

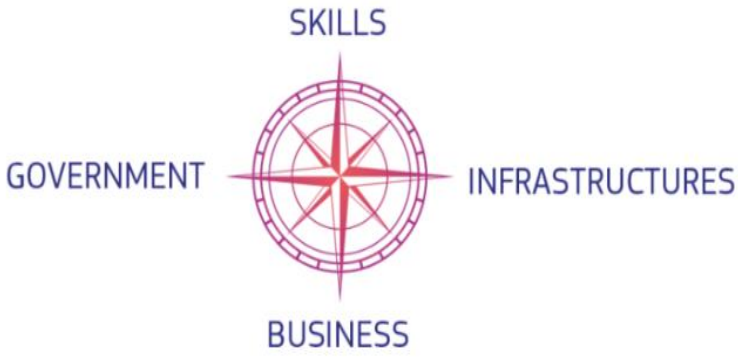
for sustainable products detailed in the forthcoming circular economy action plan, to ensure that devices are designed for durability, maintenance, dismantling, reuse and recycling, including a right to repair or upgrade to extend the lifecycle of electronic devices so as to avoid premature obsolescence.

- Initiatives targeting the achievement of climate-neutral, highly energy-efficient and sustainable data centers by no later than 2030**,** as well as transparency measures for telecom operators on their environmental footprint.
- The promotion of electronic health records based on a common European exchange format, providing European citizens with secure access to health data and supporting the exchange of data across the European Union. A European health data space improving the safety and security of access to health data, allowing for targeted and faster research, diagnosis and treatment.

Source: Authors' own elaboration

In early 2021, the EC proposed the Digital Compass as an operative programme for the translation of the European Union's digital ambitions for 2030 into concrete targets, and to ensure that these objectives will be met. The Compass is built on an enhanced monitoring system based on the Digital Economy and Society Index (DESI) set up by the Commission in 2014, and follows the European Union's trajectory regarding the pace of the digital transformation, the gaps in Europe's strategic digital capacities and the implementation of digital principles.

Figure 4: The Digital Compass



Source: (European Commission, 2021)

The Digital Compass includes the means to deliver the vision, and sets out key milestones along four cardinal points, the first two of which are focused on the digital capacities of infrastructures and education and skills, and the other two on the digital transformation of business and public services.

- **Skills**: **A digitally skilled population and highly skilled digital professionals -** Targets: At least 80 per cent of adults should have basic digital skills, and 20 million information and communication technologies (ICTs) specialists should be employed within the European Union, with more women taking up such jobs.
- **Business: Digital transformation of businesses -** Targets: 75 per cent of companies should use cloud computing services, big data and AI; more than 90 per cent of EU small and medium-sized enterprises should reach at least a basic level of digital intensity; and the number of EU unicorns should double.
- **Infrastructure**: **Secure and performant sustainable digital infrastructures -** Targets: All EU households should have gigabit connectivity and all populated areas should be covered by 5G; the production of cutting-edge and sustainable semiconductors in Europe should make up 20 per cent of worldwide production; 10 000 climate-neutral highly secure edge nodes should be deployed in the European Union, and Europe should have its first quantum computer.
- **Government**: **Digitalization of public services -** Targets: All key public services should be available online; all citizens will have access to their e-medical records, and 80 per cent of citizens should use an electronic identity solution.

2.3 The Common Agricultural Policy (CAP)

Agriculture and rural areas are central elements of Europe's Digital Decade and European Green Deal initiatives, and the CAP is considered a key tool in meeting the ambitions of the Farm to Fork and Biodiversity strategies, and in addressing the challenges to agricultural and rural development, including digitalization. In December 2021, a new CAP legislative framework was agreed upon and published establishing the rules in support of the strategic plans to be drawn up by Member States under the CAP (hereafter referred to as CAP Strategic Plans). The CAP Strategic Plans are financed by

the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD). The CAP 2023-2027 aims to achieve the following three general objectives:

1. To foster a smart, competitive, resilient and diversified agricultural sector, ensuring food security.
2. To support and strengthen environmental protection, including biodiversity, and climate action, and to contribute to the achievement of the environmental and climate-related objectives of the Union, including its commitments under the Paris Agreement.
3. To strengthen the socio-economic fabric in rural areas.

The achievement of these general objectives is pursued through 10 objectives. Figure 5 provides the basis upon which EU Member States have designed their approved National CAP strategic plans.

Figure 5: The CAP 2023-2027 specific objectives

Source: European Commission (2023)

Of the 10 CAP-Specific Objectives, nine are complemented and interconnected with the **cross-cutting objective** of modernizing agriculture and rural areas through the fostering and sharing of knowledge, innovation and digitalization in agriculture and rural areas, and by encouraging their uptake by farmers through improved access to research, innovation, knowledge exchange and training. The design and approval of a single **National CAP Strategic Plan integrating both Pillar I (direct payment and sectoral**

interventions) and Pillar II (rural development interventions) and their related fundings, (i.e., EAGF and EAFRD) was one of the main novelties of the CAP 2023-2027 compared to the previous programming periods. Plans are drawn up after identifying interventions based on a needs assessment. Another significant novelty is the shift in policy focus from compliance with rules to performance, which is monitored based on measurable (output and result) indicators. The overall policy performance against CAP objectives is measured by means of context and impact indicators.

3 EU REQUIREMENTS AND OPPORTUNITIES FOR DIGITAL AGRICULTURE

3.1 Digital information systems for CAP management, monitoring and evaluation

The CAP is the longest-running EU policy to date, and accounts for 31 per cent of the total EU budget for the 2021-2027 period. EU agriculture is regulated and supported through many other legislations and policies with shared competencies across agriculture, food, trade, health, environment, climate and rural development. Figure 6 displays just some of the EU agricultural policies with relevance for digital agriculture, although this list is not exhaustive (as it makes no reference to, for example, statistics, intellectual property rights or labour rights). This is clear evidence that the requirements associated with the interplay between agricultural policies and digitalization are indeed too numerous to be summarized in a single document.

Figure 6: Non-exhaustive overview of the EU legislation and policies related to agriculture

Common Agricultural Policy and state aid support

- CAP Strategic Plans Regulation
- CAP Horizontal Regulation for financing, management, and monitoring
- Common Market Organisation Regulation
- Regulations of State Aid support for agricultural, forestry, fishery and aquaculture sectors

Agri-food products and trade

- Regulation on food and agricultural products
- Directive on unfair trading practices in business-to-business relationships in agri-food supply chains
- Regulation on the promotion of EU farm products
- Regulation on organic production and labelling of organic products

Environment

- Nitrates Directive fighting water pollution from agricultural nitrates
- Birds Directive on the conservation of wild birds
- Habitat Directive on the conservation of natural habitats and of wild fauna and flora

Statistics

- Statistical requirements compendium - 2022 edition
- Pesticide statistics
- Regulation on statistics on agricultural inputs and outputs
- Farm incomes and operations (FADN)

Source: Author's own elaboration

This compendium, therefore, focuses on the legal requirements related to digital agriculture stemming mainly from the three recently approved CAP regulations 2023-2027. The CAP regulations can be considered a central legal framework linking several other EU requirements related to agricultural policy in the digital era, e.g. EU statistics on agricultural inputs and outputs (SAIO), Integrated-Farm Statistics and Economic Accounts of Agriculture. This chapter is presented in two parts, in which the first part addresses the requirements for the digitalization of CAP as a policy with its own management, monitoring and evaluation system (Table 3), while the second part delves into the requirements and opportunities that the CAP strategies and interventions offer in support of the digitalization of agriculture and rural areas (Table 4).

Table 3: Requirements for the digitalization of CAP management, monitoring and evaluation

Requirements	EU Legal References
a) Setting up CAP electronic information systems	• Art. 130 of Regulation (EU) 2021/2115 or the "CAP Strategic Plan Regulation", relating to the purposes of monitoring and evaluation • Chapter II of Regulation (EU) 2021/2116 or the "CAP Horizontal Regulation", relating to the integrated administration and control system, and the several articles of that regulation and its delegated regulation 127/2022 related to finance, management and control systems, and clearance and conformity procedures
b) Setting up measures to reduce the administrative burden of the CAP and to ensure simplification	• Art. 6 of Regulation (EU) 2021/2115, or the "CAP Strategic Plan Regulation"
c) Regular collection of the EU statistics mandatory for agricultural policies	• As established in the Statistical requirements compendium • Regulation (EU) 1217/2009 for FADN and its amendments in Regulation (EU) 2023/2674 • Sector-specific registers (regulations specified in

	Chapter 3.1.3)
d) General Requirements related to the exchange of data and the re-use of public sector information	• Open Data Directive (EU) 2019/1024 and Commission implementing regulation (EU) 2023/138 • Regulation (EU) 2016/679 or the General Data Protection Regulation • Data Governance Act Regulation (EU) 2022/868
e) Protection of intellectual property rights related to agri-food quality schemes applied through e-commerce	• Art. 2 of the Regulation (EU) 2021/2117 or the "Common Market Organisation" Regulation, amending specifically Art. 13 and 24 of Regulation (EU) No 1151/2012

Table 4: CAP requirements and opportunities supporting the digitalization of agriculture and rural areas

Requirements	EU Legal Reference
a) A description of the strategy for the development of digital technologies in agriculture and rural areas and for the use of those technologies to improve the effectiveness and efficiency of the CAP Strategic Plan interventions.	• Art. 114 of Regulation (EU) 2021/2115
b) Support to the farm advisory service […] shall cover at least […] and f) digital technologies in agriculture and rural areas; g) sustainable management of nutrients, including the use of a Farm Sustainability Tool for Nutrients from 2024 at the latest	• Art. 15 of Regulation (EU) 2021/2115
c) Investments	• Article 73 of Regulation (EU) 2021/2115
d) Cooperation (LEADER, Smart Villages)	• Article 77 of Regulation (EU) 2021/2115

3.1.1 Electronic information system for CAP performance monitoring and evaluation

Each Member State shall designate a national Managing Authority (MA) that will be responsible for its CAP Strategic Plan (Article 123 of the CAP Strategic Plan Regulation), and may designate regional managing authorities, depending on their constitutional and institutional provisions. Among their duties, the MA is responsible for the setting up of the electronic information system for the performance monitoring and evaluation of the CAP (hereafter CAP PME-IS), referring to the system for the recording and keeping of key information on the implementation of the CAP Strategic Plans in terms of monitoring and evaluation, including information on each beneficiary and operation.

Key requirement for Managing Authorities: Electronic Information System for the monitoring and evaluation of CAP performance.

Articles 123 and 130 of the CAP Strategic Plan Regulation establish that the MA shall be responsible for the management and implementation of the CAP Strategic Plan in an efficient, effective and correct way. In particular, it shall ensure the maintenance of an electronic information system […] for the recording and keeping of key information on the implementation of the CAP Strategic Plan that is needed for monitoring and evaluation, and in particular, for monitoring progress towards the established objectives and targets, including information on each beneficiary and operation.

3.1.2 Integrated Administration and Control System (IACS)

According to the CAP Horizontal Regulation (Chapter II) and its IACS delegated and implementing regulations (1172/2022 and 1173/2022), Member States must set up and operate an integrated administration and control system (IACS), in short, an "integrated system", as the main building block for the management of mass payments in agriculture. The system has several requisite elements, including an identification system for agricultural parcels; a geo-spatial and an animal-based application system; an area monitoring system; a system for the identification of beneficiaries; a control and penalties system; and, where applicable, a system for the identification and registration of payment entitlements and a system for the identification and registration of animals.

Key requirement for the Member States: Integrated Administration and Control System (IACS)

In accordance with Article 65 of the CAP Horizontal Regulation, each Member State shall set up and operate an integrated administration and control system (the "integrated system") […] The integrated system shall apply to area- and animal-based interventions and […] shall, to the necessary extent, be used also for the management and control of conditionality and interventions in the wine sector. In accordance with Article 66 […] the integrated system shall comprise the following elements:

a) an identification system for agricultural parcels;
b) a geo-spatial application system and, where applicable, an animal-based application system;
c) an area monitoring system;
d) a system for the identification of beneficiaries of the interventions and measures referred to in Article 65(2) of the CAP horizontal regulation;
e) a control and penalty system.

Where applicable, it shall comprise also a system for the identification and registration of payment entitlements; as well as a system for the identification and registration of animals.

The Integrated Administration and Control System (IACS) standardizes the management and control of expenditures linked to an area or animal head and applies also to certain rural development measures (area and animal-related payments with multiannual commitments). IACS is also used to ensure that good management practices and statutory management requirements (GAEC and SMR) are respected by the farmers. Administrative controls are carried out with assistance of **Area monitoring system** and the **Quality assurance system** (Art. 3, 4 and 5 of EU Reg. 1172/2022), which substantially reduce administrative burden, particularly the physical on-the spot controls.

The Integrated Administration and Control System is main source for provision of information on indicators for performance monitoring and evaluation of CAP strategic plans (Annex I of the CAP Strategic Plan Regulation).

Key requirement for Member States: IACS data exchange and integration between electronic databases and geographic information systems

Article 66 of the CAP Horizontal Regulation establishes that the integrated system shall provide information relevant for the reporting on the indicators referred to in Article 7 of CAP Strategic Plan Regulation and […] shall operate on the basis of electronic databases and geographic information systems and shall enable the exchange and integration of data between the electronic databases and the geographic information systems.

The new CAP delivery model emphasizes the integration and coherency of data collection activities through all of the agricultural administration systems - Statistics, FADN, the Integrated Administration and control system, and other administrative systems (such as systems for the payment of non-IACS interventions, which are not paid based on per head or per hectare), and data sets that are not included in statistical Integrated farm structure databases (such as processing facilities, objects for food production, etc.).

Key requirement for Member States: IACS data public sharing requirement

Article 67 of the CAP Horizontal Regulation establishes that Member States shall ensure that data sets collected through the integrated system which are relevant for […] monitoring Union policies are shared free of charge between its public authorities and made publicly available at national level. Member States shall also provide the institutions and bodies of the Union with access to those data sets.

The same article establishes that Member States shall ensure that data sets collected through the integrated system which are relevant for the production of European statistics […] are shared free of charge with Commission (Eurostat), the national statistical institutes and, where necessary, with other national authorities responsible for the production of European statistics.

Finally, Member States shall limit public access to data sets where such access would adversely affect the confidentiality of personal data, in accordance with Regulation (EU) 2016/679. At the

same time, Member States shall set up their systems in such a way to ensure that beneficiaries have access to all relevant data related to them regarding the land they use or intend to use, in order to enable them to submit accurate applications.

Key requirement for Paying Agencies: Accounting and reporting system

In accordance with Article 9(3) of the CAP Horizontal Regulation, the person in charge of the accredited paying agency shall draw up and provide the Commission, among others, with: […] annual accounts of the expenditures incurred as a result of the execution of the tasks entrusted to that accredited paying agency, as provided for in Article 63(5), point (a), of the Financial Regulation, to be accompanied by the requisite information for the clearance in accordance with Article 53 of the CAP Horizontal regulation, […] the annual performance report referred to in Article 54(1) of the CAP Horizontal regulation and Article 134 of the CAP Strategic plan regulation. Annual expenditure accounts are prepared by the Paying agencies yearly and appended to the yearly Management declaration. The content of the annual accounts is defined by the Implementing Regulation (EU) 2022/128, while Article 32 establishes that annual accounts are to be transmitted electronically.

Key requirements for Member States: Linking IACS with other statistics and FADN

In accordance with Art. 143 of the CAP Strategic Plan Regulation, Member States shall provide the Commission with the available information necessary to enable it to perform the monitoring and evaluation of the CAP.

Data needed for the context and impact indicators shall primarily come from established data sources, such as the Farm Accountancy Data Network and Eurostat. Where data for those indicators are not available or not complete, the gaps shall be addressed in the context of the European Statistical Programme established under Regulation (EC) No 223/2009 of the European Parliament and of the Council, the Farm Accountancy Data Network (FADN) established by Council Regulation (EC) No 1217/2009, or through formal agreements with other data providers such as the Joint

Research Centre and the European Environment Agency.

Data from administrative registers, such as the integrated system referred to in Article 65(2) of Regulation (EU) 2021/2116, the identification system for agricultural parcels referred to in Article 68 of that Regulation, and animal and vineyard registers, shall also be used for statistical purposes, in cooperation with statistical authorities in Member States and with Eurostat.

What are the general requirements to be considered when digitalizing the CAP?

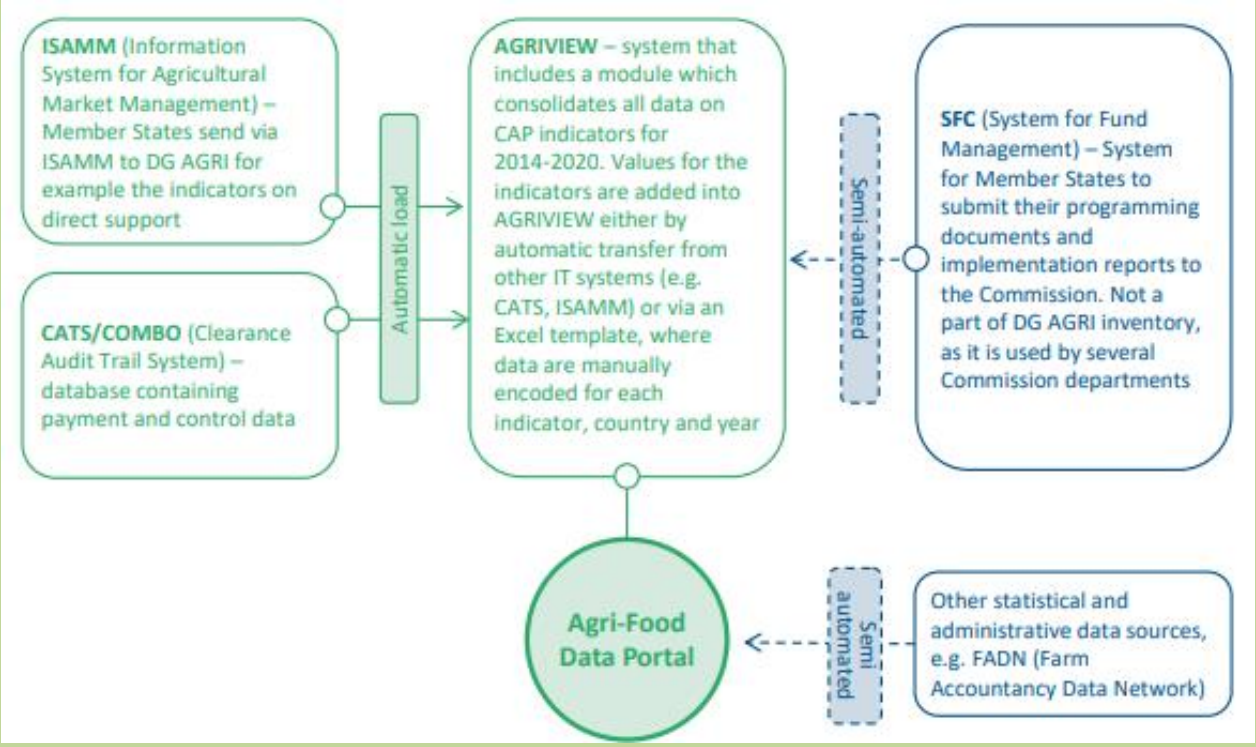
This section addresses some of the most important requirements related to the digitalization of agricultural policy, although the list is non-exhaustive as other general requirements must also be considered when setting up a digital CAP information system, namely:

- Digital data-keeping and sharing (as per Regulation (EU) 2116/2021 Art. 67), which requires all CAP data and documentation on annual outputs to be made available in a digital form and accessible for consultations for 10 calendar or marketing years.
- Accreditation requirements for CAP-Paying Agencies Regulation (EU) 127/2022, covering accounting systems, reporting systems and the management of information security.
- The open publication on a single web page of information relating to the beneficiaries (as per Article 98 of EU. Reg. 2116/2021.

Digital opportunities other than those with a legal basis - Establishing Agri-Food Data Portals

The technological advancements available today in terms of interoperability and data sharing is currently being used by the EC to create new agri-food data portals based on existing data sources.

Figure 7: Example of agri-food data portal combining administrative policy data with EU Statistics



Source: (European Court of Auditor, 2022)

Some examples of portals are the agri-food data portal or CAP dashboards developed by the DG AGRI of the EC for the integration of CAP internal or administrative data with external data sources collected for EU statistical purposes and requirements (e.g. Eurostat, FADN/FSDN). An example of the architecture of these portals is presented in Figure 8.

The coherent gathering and sharing of data can contribute to the establishment of a data platform based on accountable and single sources of truth (MuleSoft, 2023). Such a data platform can contribute to improvements in the efficiency of e-government services by raising the quality level of pre-filled forms, can allow easier access to cooperation support and reduce administrative burdens, etc. Such an integrated data platform can also open up opportunities for the development of new web-based services (for instance, those initiated by farmers for the creation of virtual producers' associations and value chains).

3.1.3 Measures to reduce administrative burden and ensure simplification

Key requirement for Member States: measures to reduce administrative burden and ensure simplification.

Article 6 of the CAP Strategic Plan Regulation establishes that Member States, with the support of the EC, shall take appropriate measures to reduce administrative burdens and ensure simplification in the implementation of the CAP.

Since the start of the CAP reform process, regarding the digitalization of the CAP, the EC has recommended that the administrative systems of Member States be modernized to allow for the integration and exploitation of a wide array of digital information (whether through artificial intelligence, or through data analytics and modelling approaches) so as to reduce costs and clarify policy effectiveness, while enhancing the provision of services and benefits to rural populations. Developing the potential of the IACS based on its current components could support the efforts of public administrations in this domain.

The CAP Strategic Plan Regulation encourages the use of such simplification mechanisms as indices to support the production and income calculations of farmers, while ensuring the appropriate responsiveness of the tools to the farmers' individual performance and avoidance of the overcompensation of losses (Point 82), data re-use through the increased use of pre-filled forms, the use of FADN and statistical data in the calculation of business plans, and the use of simplified cost options (such as unit cost, flat rate financing or lump-sums).

Key requirement for Member States: pre-filled applications for area- and animal-based interventions

Article 69 of the CAP Horizontal Regulation establishes that Member States shall pre-fill applications with information garnered from the integrated system.

Key opportunities for Member States and CAP beneficiaries: automatic claim system

Article 69 of the CAP Horizontal Regulation establishes that Member States may set up an automatic claim system and decide whether it shall cover area-based and animal-based interventions. If a Member State decides to use an automatic claim system, it shall set up a system which enables the administration to make the payments to the beneficiaries on the basis of the existing information in the official computerized databases.

3.1.4 Mandatory data collections and registers

Other than modernizing the data flows for CAP finance, management and monitoring, digitalization also brings requirements related to the data collections and register mandatory for agricultural policies. These requirements relate to:

- The collection of regular agri-statistical data, as described in the Statistical requirements compendium, under the management of national statistical authorities,
- The Farm Accountancy Data Network, as required by the Regulation (EU) 1217/2009, under the management of the national FADN liaison Agency, and amended by Regulation (EU) 2023/267 converting the FADN into the FSDN (Farm Sustainability Data Network).
- Sector-specific registers, including the Vineyard register (as per Regulation (EU) 1308/2013), Organic production registers (as per Regulation (EU) 834/2007 or Regulation (EU) 2018/848) and the Register for traders of fruit and vegetables (as per Regulation (EU) 543/2011**)**, managed by the Ministries of agriculture or appointed bodies.

3.1.4.1 Regular collection of agri-statistical data

The Statistical Requirements Compendium (Eurostat) contains a list of the mandatory statistical data to be collected and submitted by national statistical authorities periodically to Eurostat and other partner organizations. Most important for agriculture are statistics relating to farm structures, agricultural accounts and prices, while other collected statistics refer to crops, livestock, meat and eggs; milk and milk products; organic production and farming; and agri-environmental indicators.

- **Collection and validation of statistics on farm structures**: These data play a key role in the design, implementation, monitoring and evaluation of the CAP. The EU agricultural censuses conducted every 10 years (1990, 2000; 2010, 2020) and the intermediate sample surveys carried out in between form the backbone of the agricultural statistical system, and the system was renewed in 2018 by the legislation on Integrated Farm Statistics (IFS). Data on a list of core variables was collected through a census conducted in 2020, with further samples taken in 2023 and 2026, and data on various modules were collected in the same years, together providing micro-data on such general issues as land cover, livestock, agricultural labour force and other gainful activities, rural development measures, machinery and equipment, irrigation, animal housing and manure management, soil management, vineyards and orchards. They are the statistical basis for other statistics related to land cover and use, livestock and agricultural income. The EU farm typology (linked to both integrated farm statistics and the farm accountancy data network) has been revised in line with the CAP reform. The integration of multiple administrative sources into IACS has been considered useful, especially in reducing the burden on the respondents (Animal identification and registration system, LPIS, Vineyard register and organic farming registers). At its best, the data garnered from registers can lead to a win-win situation, with high-quality statistics produced at low cost without needing to ask anything further from the respondents.
- **Economic accounts for agriculture** (EAA) and Agricultural Price Statistics (APS) play a key role in the design, implementation and monitoring of the CAP, as well as in the evaluation of the impact of the CAP on the economic and financial status of the agricultural community. National EAA data are covered by legal acts, while regional EAA, agricultural price indices and agricultural absolute price data are collected through bilateral non-binding agreements. Agricultural land prices and rent data are covered by a European Statistical System (ESS) agreement; EAA and agricultural labour input (ALI) data are collected and disseminated annually; while price indices are reported quarterly and annually, and absolute prices are reported annually. Agricultural land prices and rent statistics, on the other hand, are collected and disseminated annually. The collection, validation and dissemination of agricultural accounts and prices will continue, and will undergo further modernization.

3.1.4.2 Farm Accountancy Data Network and Farm Sustainability Data Network

The Farm Accountancy Data Network (**FADN**) is an important source of farm-level data, and is essential for the monitoring and evaluation of the achievements of the CAP and the better targeting of CAP support. In November 2023, the Regulation (EU) 2023/2674 was approved by the co-legislator to broaden up the scope of FADN and convert it into the Farm Sustainability Data Network (FSDN). The FSDN adds to the environmental and social dimensions of the FADN and provides an integrated approach to data collection from statistical (IFS) and IACS through the use of harmonized Farm IDs. More specifically, FADN monitors the physical, economic and financial data of agricultural holdings, and is also an important informative source providing clarity to the impact of the measures taken under the CAP. FADN is still the only source of microeconomic data based on harmonized bookkeeping principles. Being based on national surveys, it covers only EU agricultural holdings that, due to their size, can be considered commercial. The sampling is based on the calculation of national statistics.

Article 2 of Council Regulation (EC) No 1217/2009 establishes the basis of the foundation of FADN, a community network for the collection of farm accountancy data. Responsibility for the collection of FADN data rests with the Liaison Agencies of the Member states, often together with agricultural research institutes. MS are responsible for collecting and processing the data provided by FADN participants and submitting it to the EC electronically.

FAO's support to FADN in Montenegro and Albania

In 2022, the Government of Montenegro, with FAO assistance, launched its own **Farm Accountancy and Data Network (FADN)** to facilitate the monitoring of economic development at a farm level, providing a better understanding of the impact of measures taken by the Government is support of different types of agricultural holdings. Leveraging the knowledge and experiences in Montenegro, Albania received similar support for the development of its own FADN system.

The FADN is a unique source of microeconomic and accountancy data, acquired every year from more than 80 000 EU farms, although in 2015 it represented some 4.7 million of the total 10.8 million holdings in the European Union (European Court of Auditor, 2022). FADN has been used to assess the economic and financial statuses of farms since 1965. The Commission provides a harmonized methodology and a common questionnaire, whereas the Member States collect, verify and submit the data. The FSDN Regulation 2023/2674 provides in Article 4 the opportunity for further integration of FSDN with other agri-databases and re-use of administrative databases for compilation of yearly farm returns.

3.1.4.3 Mandatory sector-specific registers

There are a number of mandatory registers to be established to support the CAP market policies related to the wine, fruit and vegetable, and organic sectors. The boxes below provide further details of the requirements of these three sectors.

Key requirement for a vineyard register

Article 145 of Regulation (EU) 1308/2013 requires that the Member States maintain a vineyard register that shall contain updated information on production potential. The updated information contained in the vineyard register shall include, at minimum, the details and specifications set out in Annexes III and IV to Regulation EU 2018/273 for each winegrower. Administrative checks shall, where appropriate, include cross-checks with, inter alia, data from the integrated administration and control system, as established in Art. 37, Point 2 of Regulation EU 2018/273.

Key requirement for the marketing of fruit and vegetables: register of traders

Article 10 of the Commission Implementing Regulation (EU) No 543/2011 requires Member States to set up a database of traders in fruit and vegetables, which shall list, under the conditions established, all traders involved in the marketing of fruit and vegetables for which standards have been laid down pursuant to Article 113 of Regulation (EC) No 1234/2007.

Key requirement for the organic sector: data collection concerning the market availability of organic and in-conversion plant reproductive material, organic animals and organic aquaculture juveniles: Each Member State shall (in accordance with Regulation (EU) 2018/848), ensure that a regularly updated database is established for the listing of the organic and in-conversion plant reproductive materials, excluding seedlings but including seed potatoes, that are available on its territory.

3.1.5 Data exchange and re-use requirement

The EU and national public sectors hold vast amounts of data that cannot always be made available openly because it includes information on individuals or company information (e.g. information on financial systems). The Open Data Directive of June 2019 and its Commission Implementing Regulation (EU) 2023/138 of 21 December 2022 lay down rules on the reuse of public sector information. These two pieces of EU legislation matter for digital agriculture as their scope concerns the public sector as well as datasets of geospatial, earth observation and the environment, meteorological, statistics, companies and company ownership, and mobility data.

Moreover, as of June 2022, the Data Governance Act Regulation (EU) 2022/868 entered into force to complement the Open Data Directive by addressing data that cannot be made available as open data.

Key requirements for public bodies: guarantee privacy and confidentiality

The Regulation (EU) 2016/679 or General Data Protection Regulation ('GDPR') is the overarching legal framework establishing provisions for the processing by an individual, a company or an organization of personal data relating to individuals in the EU. Member States will need to be technically equipped to ensure that privacy and confidentiality are fully respected. This can include a range of tools, from technical solutions, such as anonymization or processing in dedicated infrastructures operated and supervised by the public sector, to legally binding confidentiality agreements to be signed by the re-user. Whenever data is being transferred to a re-user, mechanisms will be in place that ensure compliance with the GDPR and preserve the commercial confidentiality of the data.

3.1.6 Extending and enforcing the protection of intellectual property rights of agri-food quality schemes on electronic commerce

EU agri-food products protected by quality schemes such as geographical indications can face counterfeiting and misleading practices, resulting in significant economic losses for producers and consumers. With the expansion of e-commerce platforms, these practices are likely to occur also in the digital realm. Public bodies governing elements of agricultural policy, like the EU agri-food quality schemes, are required by law to protect both producers and consumers from these unfair trade practices.

Key requirements for Member States: protection of agri-food quality schemes' intellectual property (IP) rights on electronic commerce

The Regulation (EU) 2021/2117 for the Common Market Organisation (CMO Regulation) confers IP rights protection also on electronic commerce as part of the internal market. At the same time, the CMO Regulation 2021/2117 amended Regulation (EU) No 1151/2012 on quality schemes for agricultural products and foodstuffs in the following articles:

- **Art. 4.** Confers agri-food quality scheme holders the right to implement marketing on e-commerce within the internal market, with the specific objective of allowing consumers to identify quality schemes related to products, including also e-commerce platforms.
- **Art. 13.** Confers protection of e-commerce as part of the internal market.
- **Art. 27.** Protects Geographical Indications against any direct or indirect commercial use on e-commerce platforms, even when the use of an Internet domain may evoke a protected quality scheme.
- **Art. 32, 38, and 73.** These articles foresee the task of monitoring, evaluating and reporting the quality schemes in the marketplace (also e-commerce) on behalf of EUIPO, contributing to the fight against counterfeiting and fraudulent practices.
- **Art. 39.** Extends controls to third countries and allows the accreditation of control bodies outside the Union. At an e-commerce level, the new agreement promotes control and

enforcement in the marketplace, namely e-commerce platforms, including the agricultural goods of third countries sold through e-commerce within the European Union.

- **Art. 42.** Complements previous rights by appointing control authorities in every Member State to carry out regular controls of agri-food quality and marketplace schemes at every stage of the supply chain, including e-commerce platforms.
- **Art. 69.** Deals specifically with the protection of IP rights of traditional specialties guaranteed, when sold through e-commerce.

Source: (Campos, 2022)

How to meet the key requirements to protect quality schemes in online markets?

Protecting agri-food quality schemes in e-commerce: The Case of Italy

Italy is among the few EU Member States that has created and owns an IP rights monitoring system for the protection of agri-food quality schemes in e-commerce platforms. Due to the strong economic value of Italy's 870 registered and protected quality schemes, the control body has created its own monitoring and control mechanism in the form of a Memorandum of Understanding that protects agri-food quality schemes' IP rights on e-commerce platforms.

As the responsible entity, the Department of Central Inspectorate for Fraud Repression and Quality Protection of the Agri-food Products and Foodstuffs (ICQRF - https://www.politicheagricole.it) belonging to the Ministry of Agricultural, Food and Forestry Policies (Ministero delle Politiche Agricole Alimentari e Forestali) does the following:

- Establishing cooperation mechanisms with major e-commerce platforms worldwide such as Alibaba, Amazon, eBay and more, to monitor counterfeiting agricultural goods that evoke Italian quality schemes. For example, in 2020, the ICQRF identified 1,142 imitations in eight different countries: seven within the European Union, and one in Canada.

Once falsifications are detected, the ICQRF demands the application of ex-officio measures in the respective countries where Italian quality schemes were misused (ICQRF, 2020).

Source: (Campos, 2022)

3.2 CAP strategies and interventions to digitalize agriculture

In the European Union, the CAP is playing a more active role in supporting the transition towards digital agriculture. This chapter summarizes the menu of CAP interventions that can be deployed in the direction of digital agriculture as defined in the three current Regulations for the CAP 2023-2027. Among these, the mandatory description of a strategy towards digitalization in the CAP Strategic Plans (Art. 114 of Regulation 2021/2115) can be considered as the umbrella legal requirement for Member States. To meet this policy requirement, Member States have the opportunity to use various CAP interventions available for steering agriculture towards digitalization, namely:

- **Farm advisory services** on the use of digital technologies in agriculture and rural areas, as well as the use of a Farm Sustainability Tool for Nutrients from 2024 at the latest (Article 15 of R2021/2115)
- **Investments,** for instance, in digital technologies in agriculture, forestry and rural areas, such as through investments in precision farming, smart villages, rural businesses and information and communication technology infrastructures, such as for broadband (Article 73 of R2021/2115)
- **Knowledge exchange and dissemination of information** (Article 78 of R2021/2115)
- **Cooperation** in the preparation and implementation of local development strategies and Smart Village strategies, as determined by the Member States (Article 77 of R2021/2115), and support also other forms of cooperation enabled by the use of digitalization.

3.2.1 Strategy for digital technologies in agriculture and rural areas

An important provision of the new CAP is that the Member States are requested to elaborate a strategy for the digitalization of agriculture and rural areas.

Key requirement for Member States: Description of a strategy for the development of digital technologies in agriculture and rural areas

Article 114 of the CAP Strategic Plan Regulation establishes that Member States should include "a description of the strategy for the development of digital technologies in agriculture and rural areas and for the use of those technologies to improve the effectiveness and efficiency of the CAP Strategic Plan interventions".

In line with this requirement, each Member State is expected to establish a strategy to demonstrate how digitalization in agriculture and rural areas will be boosted (Recital 85 of Regulation 2021/2115). The strategy can include actions, financial tools and support that go beyond those of the CAP Strategic Plans, and can include also research and innovation programmes, education, telecommunication, etc. Though there are no CAP guidelines for the establishment of such strategies, during the reform process in 2020, the EC issued recommendations to the Member States relating to the design of CAP Strategic Plans that included details of how to develop a strategy for the use of digital technologies in agriculture and rural areas. The recommendations suggested that a strategy should include the following thematic areas:

- The use of the European Union's digital and spatial infrastructure, and collaboration with HORIZON Europe
- Increased effectiveness of knowledge flows and the uptake of applicable research and innovative solutions, as well as experience in the use of good agricultural practices (Advisory and AKIS)
- Support of innovation in agriculture and other activities related to farming and rural areas (EIP-Agri)
- Support of smart specialization strategies
- Development of the potential of the Integrated Administration and Control System (IACS)
- Improvements to e-government and other administrative systems

Several countries in Europe and around the world have developed national digital agriculture or e-agriculture strategies, taking the form of plans developed by governments to leverage ICT in support of the agricultural sector. These strategies typically aim to promote the use of digital technologies with a view to increasing efficiency, productivity and sustainability in the agriculture sector, and improving the livelihoods of farmers and other stakeholders in the value chain.

The main components of national digital agriculture strategies may include:

1. The identification of the necessary upgrades to currently installed information systems to meet the normative requirements for the management of CAP 2023-2027.

2. The identification of opportunities to raise the efficiency and effectiveness of implementations of agri-policy interventions, while reducing the administrative burden through enhanced e-governmental services.
3. The identification of key e-government systems related to agriculture requiring enhancement or introduction, contributing to the simplification and reduction of administrative burdens.
4. The delivery of digital agriculture services that can bring substantial added value and efficiency to the implementation of interventions through digitalization (cooperation, virtual producers' organizations, rural services, etc.)
5. The delivery of digital agriculture services to farmers, such as weather forecasts and alerts, advice on the prevention and treatment of pests and diseases affecting plants, online systems complementing administrative procedures and payments, etc.
6. Provisions expanding the ICT infrastructure to enhance rural connectivity, including mobile networks, electricity, cloud computing, etc.
7. The development of digital skills among the rural population and agricultural stakeholders.
8. The forging of public-private partnerships (PPP) and collaborations among public sector actors, the private sector, civil society and stakeholders across the agriculture value chain to promote the development and adoption of digital technologies.

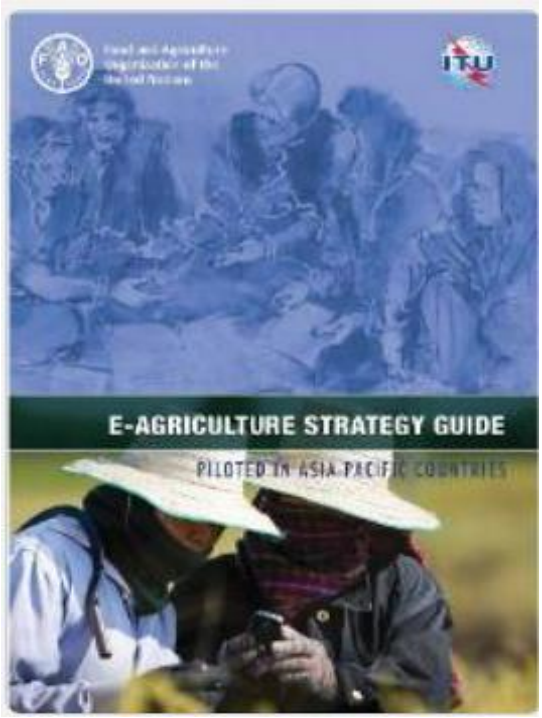
The FAO and ITU have developed an e-Agriculture Strategy guide and toolkit that may aid countries in the development or revitalization of their national digital agriculture strategies by identifying and developing sustainable services and solutions based on the use of ICTs in agriculture.

The FAO-ITU e-agriculture strategy guide, which may also be used to aid the attainment of the CAP requirement to develop a digitalization strategy for agriculture and rural areas

Developed by the Food and Agriculture Organization of the United Nations (FAO) and the International Telecommunication Union (ITU), the e-Agriculture Strategy Guide and Toolkit serves as a framework supporting countries in the development or revitalization of their national digital

agriculture strategies by identifying and developing sustainable services and solutions based on the use of ICTs in agriculture. The guide serves as a valuable resource for policymakers, agricultural stakeholders and development practitioners seeking to leverage technology to improve productivity, enhance sustainability and drive innovation in the agriculture sector.

Figure 8: FAO-ITU's e-Agriculture Strategy Guide



Source: (Sylvester, 2016)

The guide contains a methodology and a set of tools that can steer agriculture and ICT-sector managers in ministries, departments and agencies through the development of a national e-agriculture vision, action plan and implementation strategy in close consultation with the ecosystem. Piloted in Bhutan and Sri Lanka in 2015, the e-Agriculture strategy framework was subsequently implemented in several countries around the world by the ITU and FAO, including Bosnia and Herzegovina and Türkiye.

National digital agriculture strategies can bring various benefits, such as increased productivity and efficiency, reduced costs and improved market access, while promoting sustainability and resilience, and enhancing food security and nutrition. For pre-accession countries and territories, national digital agriculture strategies can include or be used also for programming and delivering existing funding mechanisms (e.g., IPARD).

In the European Union, a key example stems from Spain in the form of the "Digitisation Strategy for the Agri-Food and Forestry Sector and Rural Areas,"[7] which was launched by the Spanish Ministry of Agriculture, Fisheries and Food in 2020 and aims to promote the digital transformation of the agri-food sector and rural areas in Spain. The document outlines the main objectives and actions to be taken to achieve this goal related to the ICT infrastructure, digital services, data management, skills and training, sustainability and resilience, governance and collaboration. Overall, the Spanish Digitalization Strategy for the Forestry Sector and Rural Areas seeks to promote the digital transformation of the agri-food sector and rural Spain, with the aim of enhancing competitiveness, promoting sustainability and improving the quality of life in rural areas.

FAO and ITU support digital agriculture strategies in Bosnia and Herzegovina and Türkiye

In Bosnia and Herzegovina, strategic frameworks that consider the prominent role of the agricultural sector as a key driver of rural development have been developed and applied at state and entity levels. In 2020 and 2021, FAO collected best practices on the use of digital solutions in agriculture and supported the development of the first national digitalization strategy in agriculture. The scope of FAO's assistance included particular focus on encouraging the greater uptake of digital technologies by rural women., and dDeveloping their digital capacities was highlighted as one of the cornerstones of the inclusive digital transformation process.

In Türkiye, as part of a collaboration between FAO, the World Bank, and the Alliance of Biodiversity International and the International Center for Tropical Agriculture (CIAT), an assessment of the digital agriculture landscape was conducted, leading to the publication of a national Digital Agriculture Profile (FAO, CIAT and World Bank, 2021). The study stated that while there exists a well-established digital infrastructure in Türkiye, there are constraints preventing the application of digital agricultural solutions, the most significant of which are related to the collection of and access to data, financial literacy, digital literacy and the digital workforce. Database analytics, mobile phones, blockchain, sensors and the Internet of Things are identified as the most promising technologies for the resolution

[7] digitisationstrategy_tcm30-560059.pdf (mapa.gob.es)

of agricultural issues.

To address some of the identified challenges, FAO supported the Ministry of Agriculture in developing a national digital agriculture strategy that was launched in 2022 as a key reference document defining the national objectives in driving digitalization in agriculture forward. These objectives include the development of interoperable agricultural databases for the delivery of information, advisory services and early warnings, and other e-government systems and actions aimed at stimulating digital literacy and raising awareness.

3.2.2 Farm Advisory Services

As defined in the CAP legal framework, farm advisory services within the Agricultural Knowledge and Innovation System (AKIS) should be strengthened. Article 3 of the CAP Strategic Plan Regulation defines AKIS as "*the combined organization and knowledge flows between persons, organizations and institutions who use and produce knowledge for agriculture and interrelated fields*".

Digital technologies have the potential to contribute greatly to the efficacy and quality of advisory services, supporting the removal of physical and geographical barriers and the delivery of timely, location-specific and near-real-time advice to farmers. For instance, the Horizon-2020 research project, FAIRshare.eu, brings together a number of digital tools applied by farm advisory service providers across Europe.

Key requirement for the Member States: expanding the scope of farm advisory services

Article 15(4) of the CAP Strategic Plan Regulation establishes that "farm advisory services shall be adapted to the various types of production and farms and shall cover: [...] (f) digital technologies in agriculture and rural areas [...] (g) the sustainable management of nutrients, including, from 2024 at the latest, the use of a Farm Sustainability Tool for Nutrients."

Generally speaking, the digitalization of services allows the delivery of farm-specific, real- or near-real-time, and location-specific advisory services to farmers. Through the use of digital tools such as mobile applications, websites and remote sensing devices, custom advice can be delivered to farmers based

on their specific needs related to, for example, their location, soil type, crop type and farming practices, and the information can be used to steer decisions related to planting, harvesting and marketing, resulting in better yields and increased profits.

Digitalization also allows for the use of data analytics, sensing and remote sensing data, and machine learning to analyze data on crop performance and provide personalized advice to farmers. For example, farmers can use sensors to collect data on soil moisture, temperature and other environmental factors that can be analyzed to steer recommendations on irrigation, fertilizer applications and pest control.

Digitalization can further be used to strengthen AKIS and its operability through the creation of a web-based central access point for advisors, the regular publication of web-based content on best agricultural practices, and the web-based certification of advisors by knowledge and research institutions. Digitalization can further facilitate the initiation of European Innovative Partnerships (EIP) by supporting the web-based publication of available advisors, farmers and researchers.

Ultimately, to measure the performance of the cross-cutting objective of "modernizing agriculture and rural areas by fostering and sharing knowledge, innovation and digitalization in agriculture and rural areas and by encouraging their uptake by farmers […]", a common result indicator (R.3) has been established under the CAP - Digitalizing agriculture - which measures the proportion of farms benefitting from support for digital farming technologies through CAP across the Member States. Under this objective, the Member States are required to come up with support mechanisms that incentivize farmers to take up the use of technologies in farming practices, and to report on the number of farms that have accepted such support.

3.2.3 Investments in tangible and intangible assets

Investment grants continue to be a key tool in the strategies of Member States to encourage farmers to make use of new technologies and to scale up and modernize their operations. Since many rural areas in the European Union suffer from structural problems, such as a lack of attractive employment opportunities, skills shortages, underinvestment in infrastructure (including broadband and connectivity), and a lack of essential and social support services, the strengthening of their socio-

economic fabric and the development of rural businesses outside farming and forestry is a priority for their viability and their development.

Key opportunity for Member States: investments in tangible and intangible assets

Article 73 of Regulation (EU) 2021/2115 establishes that Member States may grant support for investments under the conditions set out in this Article, and to achieve the CAP-specific objectives of a) supporting viable farm incomes and the resilience of the agricultural sector and b) enhancing market orientation and increasing farm competitiveness. At the same time, the Member States shall draw up a list of ineligible investments in the CAP Strategic Plans. Overall, the regulation promotes a large array of investments. For digital agriculture, it is worth mentioning, for instance, that investments in large-scale infrastructures, such as for broadband Internet, or the application of digital technologies in agriculture, forestry and rural areas through investments in, for example, precision farming, smart villages, rural businesses, and information and communication technology infrastructures.

Overall, the Member States, in general, finance their broadband rollout through investments funded outside the CAP (Austria, Estonia, Spain, France, Croatia, Ireland, Italy, Poland, Slovenia, Lithuania, Latvia, Czechia, and Slovakia), while the remaining 14 CSPs still envisage still envisage support for actions related to rural connectivity (European Commission, 2023a).

ITU Global Initiative on AI and Data Commons

The Global Initiative on AI and Data Commons provides a collaborative digital platform through which AI innovators and problem owners can learn, build and connect to help identify practical AI solutions that can become publicly useful services and tools supporting the attainment of the United Nations Sustainable Development Goals (SDGs) under a common good perspective

3.2.4 Smart villages

As discussed in previous chapters, there are several EU policies supporting the development of Smart Village initiatives. CAP encourages Member States to promote the development of “smart villages”

across the European countryside, to support rural development, innovation, and digitalization in rural areas.

Key opportunity for Member States: Cooperation

Through cooperation interventions, Member States may grant support, as specified in their CAP Strategic Plans to: [...] (e) prepare and implement smart-village strategies, as determined by the Member States (Article 77 of the CAP Strategic Plan Regulation).

To monitor the uptake of this opportunity, Member States can make use of Common Result Indicator No 40 measuring the number of Smart Villages Strategies supported via the CAP Strategic Plan. According to a recent EC overview report (European Commission, 2023a), smart village strategies and projects have been introduced in several CAP Strategic Plans, either through LEADER local development strategies and/or as stand-alone interventions for infrastructure investments, basic services and cooperation projects, and seven Member States (Sweden, Spain, Finland, Croatia, Lithuania, Italy and Poland) have already set specific targets to support 629 smart village strategies or projects.

The meaning of "smart strategy" is flexible and may be interpreted differently by each Member State. For instance, Poland requires local communities to produce a simple document developed through a participatory process that includes a SWOT analysis, a community inclusion plan and a list of projects. The Smart Rural 21 project presents 21 village strategies that may inspire other rural communities.

What are Smart Villages and how they can be supported?

The Smart Villages concept is relatively recent but has growing importance in European Union policy. Although it has been the subject of much research, discussion and debate, the concept still has no formal or legal definition within EU legislation. Nonetheless, the pilot project "Smart Eco-Social Villages" resulted in a definition that provides a solid reference framework and supports consistent use throughout all Member States for the planning and implementation of the Smart Villages approach.

An inclusive definition of Smart Villages in the European Union

"Smart Villages are communities in rural areas that use innovative solutions to improve their resilience, building on local strengths and opportunities. They rely on a participatory approach to develop and implement their strategy to improve their economic, social and/ or environmental conditions, in particular by mobilizing solutions offered by digital technologies. Smart Villages benefit from cooperation and alliances with other communities and actors in rural and urban areas. The initiation and the implementation of Smart Villages strategies may build on existing initiatives and can be funded by a variety of public and private sources."

Source: European Commission, 2019

The CAP supports Smart Villages as a self-standing form of cooperation, or under the LEADER approach or Community-led Local Development (CLLD) strategies. More practices and capacity are being built around the complementary between CLLD/LEADER and Smart Villages in the EU. Cooperation is between at least two entities with a view to achieving the relevant objectives of the CAP.

At least 5 per cent of the total EAFRD contribution to the CAP Strategic Plan needs to be set aside for LEADER (CAP Strategic Plan Regulation, Art. 92), including the development of Smart Village strategies and linked investments. Possible approaches can be seen in How can LEADER/CLLD support Smart Villages).

The EAFRD supports public authorities in all EU Member States in the development of tailored interventions that support the growth of Smart Villages in their respective countries.

The smart villages concept is one example of how cooperation can blend with digitalization in support of local development strategies. The below box presents the FAO's Digital Villages Initiative, which can support communities, cooperatives, and national or regional authorities that aim to develop smart villages or similar projects at local level.

FAO's Digital Villages initiative (DVI)

Recognizing the opportunities, but also the potential risks, offered by ICT for accelerating agricultural

and rural development, in January 2021 FAO launched the Digital Villages Initiative (DVI) with the ambitious goal to convert at least 1000 villages around the world into digital hubs. With DVI, FAO is supporting a digital rural transformation process to address agrifood systems' challenges and improve the livelihoods and resilience of rural communities.

In DVI, technology is seen as an accelerator that can help increase agricultural productivity and enable a more holistic digital rural transformation that allows better access to services, markets, networks, critical knowledge, information, and financial opportunities for rural communities. DVI addresses three dimensions:

- From the perspective of agricultural production, the initiative focuses on **improving agricultural productivity** by applying various technologies (e.g. internet of things (IoT), artificial intelligence (AI), remote sensing, etc.*)* and devices (e.g. drones, sensors, agrorobots, etc.) that can make farming more precise, automated and environmentally sustainable;
- From the perspective of farmer's livelihood, it focuses on **enhancing farmers' access to services** (advisory, extension and information services, financial and insurance services, public services and social protection, etc.) via digital means, as well as better connecting them to markets and suppliers, hence improving the overall efficiency of food value chains;
- From the perspective of the village, it focuses on supporting a **holistic digital rural transformation***,* enhancing the delivery of services in other sectors, such as health, education, tourism, transport and energy, while fostering digital skills and community initiatives that stimulate innovation, collaboration and co-creation with various actions.

FAO's DVI shares a strong affinity with EU Smart Villages initiatives, with differences primarily in the scope of the interventions. While Smart Villages take an integrated territorial-based and innovation-led approach, FAO's Digital Villages follow a digitally-enabled rural development approach with greater focus on the transformation of a territory's agri-food systems.

Following its launch in 2021, the Digital Villages Initiative was piloted in several countries, including Albania, Bosnia and Herzegovina, Türkiye, and Georgia. The implementation approach in the region

is grounded on FAO's unique strengths and it draws on insight from the European experience with Smart Villages.

Furthermore, to bring rural communities closer together and encourage the creation of links and cooperation, FAO is piloting an innovative "DVI twinning" approach between EU Smart Villages and Digital Villages. Twinning aims to establish formal cooperation between rural communities, institutions and other actors for the promotion and exchange of knowledge, good practices and technology transfer.

Source: Authors' own elaboration based on Digital Villages Initiative in Europe and Central Asia (fao.org)

4 TOWARDS THE EU AND DIGITAL AGRICULTURE

This chapter outlines some hints and enablers to align the pre-accession steps ahead of candidate and potential candidate countries and territories, with the EU requirements and opportunities related to digital agriculture, specifically the CAP.

4.1 Moving towards the European Union

4.1.1 A credible accession perspective

EU enlargement is an integral part of the Treaty on the European Union (Maastricht Treaty, Article 49), which states that any European country may apply for membership if it respects the "principles of liberty, democracy, respect for human rights and fundamental freedoms, and the rule of law". The accession criteria which have to be met by the applicant country to obtain candidate country status are included in the Copenhagen Criteria, and further criteria have been set out in the so-called "Stabilisation and Association process", relating mostly to regional cooperation and good neighbourly relations.

The European Union and its Member States have consistently, since the Feira and Thessaloniki Summits of 2000 and 2003, respectively, expressed their unequivocal support for the European perspective of the Western Balkans, believing the firm, merit-based prospect of full EU membership of the Western Balkans to be in the Union's very own political, security and economic interest. In times of increasing global challenges and divisions, it is considered more than ever a geostrategic investment in a stable, strong and united Europe. A credible accession perspective is the key incentive and driver of transformation in the region, and thus enhances the Union's collective security and prosperity. It is further a key tool for the promotion of democracy, the rule of law and respect for fundamental rights, which are also the main engines of economic integration and an essential anchor supporting regional reconciliation and stability.

The EU accession process is built on strict but fair conditionality, and aims at ensuring that candidate countries and potential candidates meet all membership criteria. The "fundamentals first" principle is at the heart of this process, and the core pillars of the rule of law, fundamental rights and

strengthened democratic institutions; public administration reform at all levels of government; and sustainable economic development and competitiveness remain key. These issues reflect the importance the European Union attaches to its core values and general policy priorities, and all three pillars are closely linked, and properly addressing the fundamentals is thus key to meeting the membership criteria in line with the revised enlargement methodology. The reinforcement of sustainable economic development and investments[8] with the support of the Economic and Investment Plan for the Western Balkans (EIP) continues to be the blueprint for EU assistance, aiming to bridge the socioeconomic gap between the region and the European Union and to support the green and digital transition.[9]

4.1.2 Membership negotiation process

A European country can apply for EU membership if it respects the democratic values of the European Union and commits itself to the promotion of such values. When a country is offered the prospect of membership, it becomes a potential candidate, and should be offered official candidate status when it is ready. The process of joining the European Union (accession) involves many stages.[10] After a country submits its application, it is required to fulfil the basic political, economic and reform criteria (referred to as the Copenhagen Criteria)[11] before it can be accepted as a candidate country, ensuring the "*stability of institutions guaranteeing democracy, the rule of law, human rights, and the respect for and protection of minorities, the existence of a functioning market economy as well as the capacity to cope with competitive pressure and market forces within the Union"* and the *"ability to take on the*

[8] Annex to the Commission Implementing Decision adopting the Instrument for Pre-accession Assistance (IPA III) Programming Framework for the period 2021-2027, https://neighbourhood-enlargement.ec.europa.eu/system/files/2022-01/C_2021_8914_F1_ANNEX_EN_V5_P1_1462290.PDF

[9] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the committee of the regions (2022) communication on the EU enlargement policy, com(2022) 528 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2022:528:FIN

[10] The accession process is as follows: 1. Application submission to the Council, 2. Commission opinion on the application, 3. Unanimous decision of the EU Member States (MS) on the candidate status; 4. After the conditions are met, accession negotiations are opened with the agreement of all MSs. 5. Proposed negotiating framework of the Commission, 6. Negotiations: candidate country prepares to implement EU laws and standards, 7. Commission opinion on the readiness for the admission of the candidate, 8. Unanimous decisions of the MSs, consent of the European Parliament, 9. Signing and ratification by MSs and the candidate country (https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/eu-accession-process_en.pdf).

[11] The Copenhagen Criteria (defined by the Copenhagen European Council in June 1993) are the criteria that applicant countries need to meet as a prerequisite for membership of the EU (https://ec.europa.eu/neighbourhood-enlargement/policy/conditions-membership_en)

obligations of membership, including adherence to the aims of political, economic and monetary union" (SN180/93[12]). Starting the membership negotiation process is another step, and an applicant country can only open accession negotiations upon its fulfilment of the Copenhagen Criteria.

During the negotiation phase, all policy areas are arranged in chapters for discussion between the European Union and the candidate country, and there are certain topics, known as the fundamental areas (such as the rule of law,[13] human rights, public administration reforms, and economic development and competitiveness), that need to be tackled first. For the Western Balkans, regional cooperation is included among the requirements (COM/2018 65 final) - a condition for membership that was set out in the Stabilization and Association Process.[14]

In February 2020, the EC introduced a proposal (COM/2020 57 final) to strengthen the accession negotiation process[15] by making it more predictable (clear conditions and incentives[16]), more credible (delivering as promised), subject to stronger political steering (top-level meetings and stronger involvement) and more dynamic, the latter through the grouping of the 35 chapters into six clusters, making thematic discussions easier. The cluster on fundamentals (rule of law, economic criteria and public administration reform) has a central role, and without the required progress in this cluster, the other clusters cannot be opened. Negotiations related to this cluster will be opened first and closed last, and the overall pace of the negotiations is determined by its progress (European Commission 2020a).

Currently, seven countries and territories are engaged in the EU membership negotiation process, and there are other potential candidates:

- Montenegro (candidate since 2010, negotiations opened in 2012)
- The Republic of Serbia (candidate since 2012, negotiations opened in 2014)

[12] Conclusions from the Copenhagen European Council: excerpt on the EU accession criteria (21-22 June 1993)
[13] The rule of law is a central topic in the enlargement process, as accepted by the Council in December 2011, which means that countries need to deal with issues such as judicial reform and the fight against organised crime and corruption early in accession negotiations (COM(2013) 700 final).
[14] COM(1999)235 final, SN 180/93
[15] The new methodology will be applied to the negotiations with North Macedonia and Albania. The negotiating frameworks already in place for Montenegro and Serbia will remain the same (European Commission 2020).
[16] For instance: increased investment opportunities, work for accelerated integration, and "phasing-in" individual EU policies (European Commission 2020a).

- Albania (candidate since 2014, negotiations opened in 2020)
- North Macedonia (candidate since 2005, negotiations opened in 2020)
- Bosnia and Herzegovina (candidate country since 2022)
- Kosovo* (potential candidate)
- Türkiye (candidate country, negotiations opened in 2005 but were effectively suspended in 2016)
- The Republic of Moldova (candidate country since 2022, negotiations opened in 2023)
- Georgia (candidate country since 2023)
- Ukraine (candidate country since 2022, negotiations opened in 2023)

There are six negotiating clusters within the accession framework that constitute the membership negotiation process. These support the strengthening of the entire accession process, enhancing credibility and trust on both sides and yielding better results on the ground.[17]

Table 5: Clusters of negotiating chapters

1. Fundamentals	23 - Judiciary and fundamental rights 24 - Justice, Freedom and Security Economic criteria Functioning of democratic institutions Public administration reform 5 - Public procurement 18 - Statistics 32 - Financial control
2. Internal Market	1 - Free movement of goods 2 - Freedom of movement for workers 3 - Right of establishment and freedom to provide services 4 - Free movement of capital

[17] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions enhancing the accession process - A credible EU perspective for the Western Balkans, COM/2020/57 final, EUR-Lex - 52020DC0057 - EN - EUR-Lex (europa.eu)

	6 - Company law 7 - Intellectual property law 8 - Competition policy 9 - Financial services 28 - Consumer and health protection
4. Competitiveness and inclusive growth	10 - Information society and media 16 - Taxation 17 - Economic and monetary policy 19 - Social policy and employment 20 - Enterprise and industrial policy 25 - Science and research 26 - Education and culture 29 - Customs union
5. Green agenda and sustainable connectivity	14 - Transport policy 15 - Energy 21 - Trans-European networks 27 - Environment and climate change
6. Resources, agriculture and cohesion	11 - Agriculture and rural development 12 - Food safety, veterinary and phytosanitary policy 13 - Fisheries 22 - Regional policy & coordination of structural instruments 33 - Financial & budgetary provisions
7. External relations	30 - External relations 31 - Foreign, security & defense policy

Source: Enhancing the accession process - A credible EU perspective for the Western Balkans, COM/2020/57 final

There are many specific instruments involved in the membership process, namely: negotiating frameworks, the recommendations included in the enlargement package, the Economic Reform

Programmes (ERPs)[18] and the policy guide agreed upon annually in the joint conclusions, the conclusions of the meetings organized in the context of the (Stabilization and) Association Agreements as well as, the EU-Western Balkans Strategy,[19] and the National programmes for the adoption of the *Acquis*, all of which serve as the basis for the identification and guidance of fundamental reforms.

4.1.3 Rural development programmes under the Instrument of Pre-Accession Assistance (IPARD)

IPARD is part of the instrument for pre-accession assistance (IPA). Along with the other efforts related to the building of institutional capacity and the harmonization of the national legal framework with the broader Acquis, IPARD supports Western Balkans and Türkiye in adapting to the administrative structures and in preparing farmers for the implementation of the CAP.

The measures applied in IPARD programmes are similar to the EU Rural development interventions under the CAP (EAFRD fund). The following measures have been made available in IPARD programmes:

1. Investments into the physical assets of agricultural holdings;
2. Support for the setting up of producer groups;
3. Investments into physical assets related to the processing and marketing of agricultural and fishery products;
4. Agri-environment-climate and organic farming measures;
5. Implementation of local development strategies - LEADER approach;
6. Investments into rural public infrastructures;
7. Farm diversification and business development;
8. Improved training;
9. Technical assistance;

[18] See the ERPs factsheet: https://neighbourhood-enlargement.ec.europa.eu/system/files/2018-05/20180417-erp-factsheet.pdf

[19] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions (6 February 2018) https://ec.europa.eu/commission/sites/beta-political/files/communication-credible-enlargement-perspective-western-balkans_en.pdf

10. Advisory services;
11. Establishment and protection of forests;
12. Financial instruments;
13. Innovation and knowledge transfer.

Each country presents their IPARD Rural Development programmes to the EC for approval. The programmes are developed by the national IPARD managing authorities. Once approved, the programmes are implemented by national IPARD paying agencies, which assess any project proposals, select and approve those that are viable, and transfer the funds to the final recipients. The IPARD approach contributes to the creation of national institutions and governance in rural development that will, in the future, be used for the management of CAP interventions. The Rural development programmes for the 2023-2027 period have been approved,[20] and the measures included in the programmes by countries and the financial allocations are presented in the table below.

Table 6: IPARD measures included in the programmes 2023-2027 by countries, as well as financial allocations.

	Description	Albania	Montenegro	North Macedonia	The Republic of Serbia	Türkiye
(1)	Investments in physical assets of agricultural holdings;	x	x	x	x	x
(2)	Support for the setting up of producer groups;					
(3)	Investments in physical assets concerning the processing and marketing of agricultural and fishery products;	x	x	x	x	x

[20] Programmes can be accessed at: Apply for funding (europa.eu)

	Description	Albania	Montenegro	North Macedonia	The Republic of Serbia	Türkiye
(4)	Agri-environment-climate and organic farming measures;	x	x	x	x	x
(5)	Implementation of local development strategies - LEADER approach;	x	x	x	x	x
(6)	Investments in rural public infrastructures;	x	x	x	x	x
(7)	Farm diversification and business development;	x	x	x	x	x
(8)	Improvement of training;					
(9)	Technical assistance;	x	x	x	x	x
(10)	Advisory services;	x		x		
(11)	Establishment and protection of forests;	x	x			
(12)	Financial instruments;					
(13)	Innovation and knowledge transfer.					

Amounts allocated under IPARD III						
	Albania	Montenegro	North Macedonia	The Republic of Serbia	Türkiye	Total
Amount allocated (EU support) (000 EUR)	112 000	63 000	97 000	288 000	430 000	990 000
Total programme (with national contribution) (000 EUR)	146 410	81 976	128 073	377 186	555 000	1 288 645

Source: IPARD Programmes

4.1.4 The European Neighbourhood Programme for Agriculture and Rural Development (ENPARD)

ENPARD is a policy initiative that is part of the European Union's commitment to inclusive growth and stability in its Neighbourhood and that recognizes the importance of agriculture for food security, sustainable production and rural employment, with the beneficiary countries being those falling under the East and South partnership. ENPARD includes policy actions that resemble those of the CAP - IPARD and can lead to similar actions, and are agreed upon in yearly working programmes. No specific ENPARD programmes have been established (as was the case in the Western Balkans and Türkiye).

The ENPARD Programme for Georgia, supported by the European Union and implemented by FAO

The EU-funded European Neighbourhood Programme for Agriculture and Rural Development (ENPARD) in Georgia supports the implementation of Georgia's agriculture and rural development strategies aimed at accelerating the restructuring of the agricultural sector and the inclusive development of Georgia's rural economy.

As almost half of all Georgians are involved in agriculture, any improvements in farming will have a significant impact. Since 2019, FAO, working together with the European Union, has been applying the European Neighbourhood Programme for Agricultural and Rural Development (ENPARD) with a view to bringing modern and environmentally friendly agriculture techniques to Georgia.

- Reducing the disparities between urban and rural areas through the maximization of agricultural potential and the diversification of the economy in rural areas.
- Supporting smallholders by enhancing productive employment, strengthening livelihoods and agri-food systems, and enabling policies.
- Supporting private sector competitiveness, particularly Micro, Small- and Medium-Sized Enterprises involved in agriculture and food processing.
- Providing policy support to improve the application of food safety standards and the traceability of agricultural products, to ensure better consumer protection and to enhance export opportunities.

- Supporting the government of Georgia in the implementation of the agricultural extension strategy, and strengthening capacity to improve agricultural extension services, with focus on gender-related issues.
- Enhancing the resilience, mitigation and adaptation to climate change of the agri-food sector by strengthening the natural resource management of soil, reducing land degradation, and protecting biodiversity in forestry and fisheries.

Source: Authors' own elaboration

4.2 Steps to align with the digitalization of agricultural policies (CAP)

4.2.1 Institutional and normative alignment in digital agriculture

The National Programmes for the Adoption of the Acquis (NPAAs) and action plans are detailed plans prepared by the candidate countries describing actions by negotiating chapters to harmonize their legal and institutional setups with the Acquis. They include lists of the legal acts to be adopted, the institutions to be adjusted, action milestones and detailed descriptions of the actions. They reflect the negotiating positions, and also address the yearly recommendations of the EC. The main chapters relating to the digitalization of agriculture and rural development are:

- Public administration reform (addressing e-governance in agriculture),
- Chapter 18 - Statistics (addressing the collection of agri-statistics),
- Chapter 11 - Agriculture and Rural Development (addressing the establishment of mandatory information systems for CAP management and the digitalization of CAP), and,
- Chapter 10 - Information society and media (addressing connectivity and skills).
- Chapter 12 - food safety
- Chapter 13 - fisheries and aquaculture

The progress of the candidate countries is reported in the European Union's yearly progress reports (2022 Communication - enlargement package) for the Western Balkans and Türkiye, in analytical reports in the cases of Ukraine, the Republic of Moldova and Georgia (published in 2022), and in an analytical report for Bosnia and Herzegovina (published in 2019), addressing mainly the "fundamentals" criteria with regards to the applications of the countries for candidacy status. An analysis of the digitalization issue can be found in the e-Government benchmark 2022 (for the Western Balkans and Türkiye).

State of play in the Western Balkans and Türkiye regarding the digitalization of CAP and its management, monitoring and evaluation

The recent 2022 Communication (enlargement package) and e-Government benchmark 2022

reports can be summarized as follows:

- **Regarding e-government**, all the Western Balkans have established accountable institutional setups and infrastructures for e-government. The e-government benchmark 2022 Key enablers (EU 27 - 68.7%) Albania 55%, the Republic of Serbia 54%, Türkiye 79%, lower Montenegro 26% and North Macedonia 29%. The User centricity benchmark (EU 27 - 88.3%) - Albania 74%, the Republic of Serbia 77%, Türkiye 93%, Montenegro 69% and North Macedonia 66%.
- **Regarding statistics**, all Western Balkans and Türkiye must strengthen their capacity to produce high-quality statistics in line with the principles laid out in EU law and further elaborated in the European Statistics Code, based on professional independence, impartiality and reliability, as well as transparency and confidentiality. It is also vital to increase the provision of data to Eurostat. (Agricultura Census planned in 2025 in Kosovo*, in Albania and North Macedonia in 2024. In the republic of Serbia and Bosnia Herzegovina, the censuses have been planned for 2023, but are late). Some statistical data related to agriculture is collected regularly and reported to Eurostat.
- **Regarding IACS and the collection of data in agriculture:** A number of Western Balkans and Türkiye keep operational Farm registers that contain records of the beneficiaries of IPARD and national supports.

  LPIS is in use in Montenegro, Kosovo*, North Macedonia and Türkiye, but not in the Republic of Serbia, Bosnia and Herzegovina, or Albania. All the Western Balkans are implementing national direct payments, in only partial compliance with the CAP.

  Geodetic materials (INSPIRE) are available electronically through the national geodetic offices (Republic of Serbia, Albania, Montenegro, North Macedonia and Bosnia and Herzegovina). The collected reference prices are available through the price reference databases of IPARD agencies.
- **Regarding FADN**: Still in development (established in the Republic of Serbia, Türkiye and Kosovo*, piloted in Montenegro, North Macedonia, planned for 2022). The so called “RICA-1” reports from FADN are not published on the EU site.

- **Regarding institutional and legal setups**: Albania, Montenegro, North Macedonia the Republic of Serbia and Türkiye are implementing pre-accession IPARD programmes with similar legal frameworks and institutional setups to those required for CAP.
- **Regarding interventions in agriculture:** interventions in the field of rural development are almost in compliance with those regulated by the CAP. There are, however, opportunities to increase the efficiency of implementations and their re-use under the CAP umbrella.

Assessment of the Associated Trio related to digitalization and agriculture

Associated trio

Based on the **Analytical reports prepared for Ukraine, the Republic of Moldova and Georgia** on their readiness for accession, there is as yet no in-depth information on the individual chapters, other than for those required to obtain the status of candidate country. Digital development country profiles were produced by ITU in 2021 and 2022 (see digital development country profiles the Republic of Moldova, Georgia Ukraine)

- **Regarding e-government**, there has been no assessment of the progress in the public reforms, and the countries are not yet included in the e-government benchmark. There is a need for a detailed assessment of the level of e-governance regarding the administration of policies related to agriculture and rural development.
- **Regarding statistics,** Ukraine, the Republic of Moldova and Georgia have all carried out preparatory works in the area of statistics, and all countries have conducted censuses (Ukraine in 2012, Georgia in 2014, the Republic of Moldova in 2014). On the issue of administrative capacity, the adequacy of resources is a matter of concern, as well as IT and connectivity.
- **Regarding connectivity,** in 2021, 82.7% of households in Ukraine were connected to the Internet, compared to 66.8% in the Republic of Moldova and 88.4% in Georgia in 2022. The frequency of Internet use in Ukraine was 97.9% in 2021, and 83.3% in 2022 in Georgia (population aged 16-74), while no such information is available for the Republic of Moldova

(Eurostat).

- **Regarding agriculture,** all the Associated Trio countries are in early stages of the process to harmonize with the CAP. Some level of cooperation has been established under Chapter 12 of the AA/DCFTA agreements but focused more on production and trade and less on the harmonization of legal and institutional setup for harmonization with *the Acquis*. Funds have been allocated to the agriculture sector in the form of budget support (EU-supported ENPARD programme).
- **Regarding digitalization in agriculture,** the digital development country profiles indicate that substantial support has been provided for institutional building and digitalization, particularly regarding the implementation of DCFTA agreements (Georgia, the Republic of Moldova, Ukraine), the compliance of which will be addressed further in the accession process.
- **The legal and Institutional setups** are in the process of meeting the European Union's institutional requirements, or in some cases go already beyond. However, institutions for the management of agri-policies have been established that can, with adequate technical assistance, be adapted to EU requirements.
- **Regarding administrative systems in the field of agriculture**, there is a lack of information in the analytical reports, although there are systems in development that are being supported by the European Union in collaboration with international organizations (UNDP, FAO), but that are not yet integrated or fully aligned with the EU requirements.

4.2.2 Next steps towards accession in digital agriculture

The new CAP 2023-2027 regulatory framework requires, in comparison to previous CAP reforms, the intensive adoption of digital technologies for the management of the CAP, as well as the use of digital technologies more efficiently in the implementation of interventions (see Chapter 3.1 of this compendium). The digital technologies relating to CAP financing, management and monitoring mostly affect administrative bodies, and are part of institution building, while the use of digital technologies to increase the efficiency of interventions is closely linked to, and part of the design of CAP interventions. It is, therefore, necessary, to consider that the activities in the design of CAP Strategic

Plan interventions are in parallel conducted with the activities regarding the digitalization of those interventions.

The alignment of actions related to the development of CAP interventions and supporting information systems need to be part of the National Programme for the adoption of the Acquis action plans, taking into consideration also the Recommendations to the Member States as regards their Strategic Plans for the EU Common Agricultural Policy. The strategies of the pre-accession countries related to digital technologies in agriculture and rural areas can therefore cover the following specific objectives:

- **The establishment/upgrading of the mandatory CAP information systems**: Statistical systems, FADN, IACS, the CAP strategic plan management system, financial and reporting systems and other mandatory systems, and their standardization in line with the data exchange requirements in the pre-accession phase,
- **Use of EU data and digital infrastructure, and collaboration in HORIZON Europe activities**: Preparations for the use of the European Union's digital and spatial infrastructure and collaboration with HORIZON Europe after accession, but with engagement in activities prior to accession while upgrading the systems.
- **Simplification of E-Government**: Drawing upon lessons learned during the implementation of the pre-accession agricultural programmes, and opportunities identified for the simplification and reduction of administrative burdens (as required by Article 6 of the CAP Horizontal Regulation), in the pre-accession period, to raise the efficiency of programme implementations and their direct re-use under the CAP umbrella (particularly investment measures, and if appropriate, LEADER). The simplification arrangements are described in Chapter No 3 of the published Member State's CAP Strategic Plans.
- **E-Agriculture:** It is advisable to consider the extent to which the digital environment can facilitate interventions included in the post-accession CAP Strategic Plans in the design phase - particularly for the digitalization of cooperation and rural services, and the use of digital technologies and innovations in food production.

- **Digital advisory services and AKIS:** Actions strengthening the use of advisory services and the establishment of AKIS with digital support may also be made more solid during the pre-accession period, and can be described in the CAP strategic plan. Descriptions can be found in chapter no 8 of the published Member State's CAP strategic plans.

FAO and ITU have developed a self-assessment tool (annexed to this document) to guide policy officers and ICT engineers through the design of future agri-information system architectures and the planning of a road map to the final harmonization of digital agriculture with the CAP. The below table provides an example of the steps to be taken, along with the priorities and timing, following also the parallel development of CAP-like policy interventions.

Table 7 Indicative action roadmap and steps to be taken for the phased harmonization of electronic information systems with the those required by the CAP.

		T	T+1	T+2	T+3	T+4	T+5
	1 Harmonization of budgetary structure and interventions - IACS						
	Gap assessment of compliance of interventions						
Adjustment of interventions direct payments	Direct payments (2115/2021 Art 16)						
	National direct payments	National direct payments per area and head					
	The coupled income support	Development of coupled income support schemes					
	The complementary income support for young farmers		Allocation of funds for young farmers				
	Basic income support for sustainability		Development of GAEC, harmonizing SMR				
	The schemes for the climate, the environment and animal welfare				Development of ECO programmes		
	Rural development area based payments (2115/2021 Art 69)						
	Environmental, climate-related and other management commitments		Development of ECM programme				
	Natural or other area-specific constraints			Detremination of ANC and AMR			
	Area-specific disadvantages resulting from certain mandatory requirements;						
	2 Establishment/upgrading of mandatory CAP information systems						
IACS	Gap assessment of implemented information systems in agriculture						
	Strategy for development of digital technologies in agriculture and rural areas						
	IACS						
	Compilation of basic records on food producers, areas and animals in production	National					
	A system for the identification of beneficiaries of the interventions and measures	National	Development of consolidated data sets on farmers				
	An identification system for agricultural parcels (LPIS)	Numeric		Establsihment of LPIS and supporting quality management			
	A geo-spatial application system and, an animal-based application system (GSA)			Use of GSA and development of quality management			
	A control and penalty system & On-the spot control CP&OTS	national		Phased development of CP&OTS systems			
	A system for the identification and registration of animals (AIR)	Integration of AIR with agri-administrative systems					
	An area monitoring system (AMS)				Use of AMS with CP and OTS		
	information for the reporting on the indicators r				Integration in IACS		
	Registers up-to date (Updating and quality management of the registers)						
	IACS data public sharing , data exchange and integration between the electronic databases and GIS						
	IACS data public sharing requirement U Reg. 2116/2021, Article 67, EU Reg. 138/2023			Preparation of data sharing anvironment			
	IACS data exchange and integration between the electronic databases and GIS EU Reg. 2116/2021, Article 66			Further integration and interoperability			
Design of other mandatory CAP information systems	Digital Farm Advisory Services EU Reg.2115/2021 Article 15, and Art. 114						
	Use of a Farm Sustainability Tool for Nutrients at the latest as from 2024						
	Digital support to Knowledge sharing and accesibility if advisory service	Enhancement ofl Advisory service with digital technologies					
	FADN, Statistics, Information system for CAP performance monitoring and evaluation						
	Farm Accountancy Data Network , managed by the national FADN liaison Agency		Establishment		Yearly collections		
	Regular agri-statistical data collections				Reporting to Eurostat		
	The information system for management of CAP-strategic plans EU Reg. 1046/2018 Article 63, EU Reg. 2116/2021 Article 9(3)				Establishment and integration with PA		
	Paying agency systems in accordance accreditattion criteria						
	Paying agency reporting system managed by CAP Paying agencies EU Reg. 1046/2018 Article 63, EU Reg. 2116/2021 Article 9(3)				Development and accreditation of PA IT systems		
	Digitalization in accordance to accreditation requirements EU Reg. 127/2022, Annex 1						
	Sector specific registers						
	Vineyard register EU Reg. 1308/2013, Article 145						
	Organic productions registers EU Regs. 834/2007, 2018/848						
	Register for traders of fruits and vegetables EU Reg. 543/2011, Article 10						
	3 Reduce The Administrative Burden And Ensure Simplification						
Rural development - non IACS	Rural development non IACS interventions (2115/2021 Art 69)						
	Assessment of efficiency of interventions						
	investments, including investments (IPARD M1, M3, M5, M6, M7)	Simplification of existing and development of new interventions					
	setting-up of young farmers and new farmers and rural business start-up						
	risk management tools; (implemented under IACS)			Enhancement of administrative systems			
	cooperation: LEADER, Associations, Short supply chains, Smart Villages, .						
	knowledge exchange and dissemination of information (EIP) an knowledge exchange						
	4 Digital enablers: Internet connectivity, digital skills						
Enablers	Gap assessment of connectivit and digital skills in rural areas						
	Connectivity		Establishment ofdigital enabling environment in rural areas				
	Digital skills			Implementation of programmes for raising of digital skills			

Source: Authors' own elaboration

4.2.3 Experiences of pre-accession countries in the establishment of CAP electronic information systems

The pre-accession countries are opting for different national policy interventions in support of agriculture and rural development for the assurance of the security, safety and quality of food. It is important that while making institutional changes in the pre-accession period, countries ensure a smooth and phased transformation towards EU CAP in parallel with the provision of national support to their food producers:

- **Planning a smooth transition from national agricultural support to CAP-like support takes time** and needs to be carefully planned many years in advance;
- **Creating a CAP-like electronic information system that is in line with the CAP delivery model.** This will ensure access to adequate digital spatial **data quality management and skilled staff in IT**.
- **Registering as many farms, animals and areas as possible** on the policy management system (registers) to ensure broad coverage of the population managed by the policies (addressing all of the categories of food producers), while at the same time supporting a larger scope of collected data.
- **Integrating multiple registers during establishment**, including those of producers, processors and facilities, along with their capacities, locations and equipment, contributing to policy action planning and the simplification of administrative systems with extensive data,
- **Finalize the bolstering of national electronic information systems in support of agricultural policies, allowing their easy retrofitting under the CAP framework**: The systems that support pre-accession programmes (IPARD) are checked by the Commission, and can therefore be re-used later under the CAP after making the appropriate adjustments.

Chapter 4 presents a self-assessment that can inform policy officers and ICT engineers of the data to be collected, the assessment of the quality of the data and the existence of other electronic registers, such as the Vineyard register, the Organic Producers register, and the Register of Traders of Fruit and Vegetables.

4.2.4 Approach towards better e-Government of pre-accession IPARD to post-accession CAP

The institutions established, programmes developed, and experience gained during the implementation of IPARD programme interventions can support the advancement of e-governance in agriculture, considering the use of the developed data collection tools and information systems. e-government refers to the use of ICT in all facets of the operations of governmental organizations. To ensure a smooth transformation, and the exploitation of the synergic effects of the digital environment in the future management and implementation of the CAP strategic plans, gaps must be addressed, and opportunities identified with particular focus on the simplification and greater efficiency of interventions.

Based on an analysis of the ex-ante evaluations for IPARD III programmes, the table below (Table 8) presents the main indicative challenges to the efficient implementation of interventions under IPARD and the smooth transition to the CAP following accession related to digitalization (particularly the enhancement of e-government services). More detailed national self-assessments and political dialogue are required to identify realistic opportunities and needs.

Table 8: Experience in using IPARD funds, and opportunities to increase efficiency through digitalization

Lessons learned and expectations in IPARD	Opportunities for the use of digitalized tools
Experience of IPARD II programmes • Demanding paperwork and restrictive procedures (Montenegro, North Macedonia, Republic of Serbia) • Large number of incomplete applications (Albania) • Insufficient administrative capacity of IPARD structures, long procedures (North Macedonia, Republic of Serbia) • Problems with the documentation of ownership	**Implementation of IPARD** **Simplification, reduction of inflated costs** • Simplification of procedures (instead of investment business plans, development of support system with the use of simplified cost options - i.e. unit cost calculated on the basis of reference price databases)[21], which will contribute to the lower number of incomplete applications, better control over estimated costs and faster processing of applications

[21] MS27 use simplified cost options where possible in new CAP strategic plans, example Slovenia

of land (Albania, Montenegro) • Problems encountered by applicants in obtaining construction permits and authorizations, environmental permits and other certificates from technical bodies (Albania, Montenegro, Republic of Serbia) • Weak assistance to farmers by research and extension service providers • Risk of inflated invoices and payment claims (Albania) • Difficulties for beneficiaries in financing investment costs *a priori,* and delays in reimbursements after investments are made (Albania, Montenegro) • Difficulty in accessing registers, low quality and non-existent registers, and lack of electronic access (Albania, Republic of Serbia, North Macedonia)	**Reducing incomplete applications and administrative burden** • Establishing e-applications with pre-filled data (from Farm register, Cadastre, LPIS) with adequate support provided to raise e-skills • Implementing open rather than closed tenders, particularly for smaller investments (<10 000 Euro) **Data Sharing** • Increasing e-supported communications with technical bodies and external institutions **Advisory** • Increasing access to advisory services through e-supported platforms **Availability of financial resources:** • Allowing digitized access to Invest4U or national guarantee facilities • Establishing connectivity between Agri-data, Banks and farmers
Expectations from IPARD III and CAP (following accession) • **Rural infrastructure**: The lack of labour and skills at a local level may lead to problems in the delivery and implementation of public support to investments in rural areas. • **LEADER**: The lack of labour and skills at a local level may cause problems in the establishment of LAGs. • **Limited access of small farmers to individual investments** for non-viable business plans	**IPARD III and CAP (after accession)** **Rural infrastructure:** • Raising the level of digitalized support in line with PRAG rules for public procurement **LEADER:** • Raising the level of digitalization (pre-filled forms) in the establishment of LAG, including templates for local development strategies and cooperation arrangements **Shared investments:** • To ease the access of small farmers to investments (particularly in equipment), the opportunity is to establish digitized support for joint investments in cooperation with other applicants, and provide support for standardized multi-party contacts with clear rules related to management and the use of joint investments.

Source: Author's own elaboration based on multiple ex-ante evaluations related to the preparation of IPARD III programmes

4.2.5 Highlights of the Associated trio: first steps towards the CAP

Like the Western Balkans and Türkiye, the programmes of the Associated Trio countries in agriculture have to date been focused on building capacity in line with Deep and Comprehensive Free Trade Area (DCFTA) agreements. Furthermore, some institutional building initiatives have been put in place linked to the implementation of CAP-like interventions. The new situation (the approval of new candidate countries) brings challenges to the redesign of support programmes with greater focus on their legal and institutional alignment with the *Acquis*, considering the lessons learned from the Western Balkans and Türkiye.

Table 9: Aligning the Associated Trio to the CAP Requirements

Current status	Possible approach
Institutional and normative progress	
The Legal and Institutional setup is not yet in line with the institutional requirements of the Union. There are, however, established institutions for the management of agri-policies that could, with appropriate technical assistance, adapt quickly to the EU requirements.	Action plans need to be adapted to achieve compliance with the *Acquis* in the areas of digitalization and agriculture. A pre-accession programme for Agricultural and Rural Development, in parallel with the provision of technical support for the adaptation of legal and institutional alignment, as followed by the Western Balkans and Türkiye, can serve as a blueprint for the approaches adopted by the Associated Trio countries
Digitalization: e-Government and Data Governance	
There are no existing information systems that meet the mandatory requirements for the implementation of CAP interventions, although similar systems have been established. Data collection is underway and systems that support the collection of data in the field of agriculture are under development, supported by the European Union in collaboration with international organizations (UNDP, FAO), Although these systems are not yet integrated nor compliant	The establishment of the necessary information systems for the CAP can be difficult, as can be understood from the experiences of the Western Balkans and Türkiye. Even if the systems are established in line with the *Acquis*, they may in time become non-compliant. To support the establishment of mandatory CAP-compliant systems, contributing to an integrated data platform, the lessons learned from IPA-supported actions in e-administration in agriculture may be

with the EU requirements. There are problems with the skilled IT staff of governmental institutions related to the management of data platforms, hardware, infrastructure and information security, but also low availabilities of extension services, agricultural Statistics, state funds to develop support programmes, small holder farming with very small lands and low access to loans from commercial banks play a role here too.	applied in the Associated Trio countries, with emphasis on multicounty projects and with strong support also from the Union's CAP expertise. The intensive training of IT staff in the management of agri-information systems and information security measures is needed to ensure sustainability

4.2.6 Examples of approaches to the development of digital agriculture in rural areas

The following table presents some concrete examples and approaches put in place by the EU Member States regarding the digitalization of agriculture and rural areas.

Table 10: Examples of approaches taken by the EU Member States towards digitalization in rural areas

Item	Use of digitalization	Examples
Resilient food production and supply		
Food production and supply	• Use of public meteorological services: agri-weather forecasts, early warning of adverse climatic conditions; • Precision farming investments, • Use of satellites and drones for monitoring and intelligent cultivation • Digital Farm management, • E-Marketplaces: inputs, trading, logistics, labour, contracting,	Agri-weather Early warning Precision farming Use of satellites and drones Farm management: https://eufarmbook.eu/ E-marketplace India:
Advisory services	• Farming advice: Use of FADN results • Appointments of advisory service providers • Advisory service materials and lessons • Advisory service e-certification (initial and yearly)	Individual farm report - Poland Farm Sustainability Tool List of advisors - Croatia Advisory materials and publications updated - Croatia

Item	Use of digitalization	Examples
		Certificate for extension - Kosovo*
Cooperation - food chain and quality schemes	• Support of digital cooperation in food chain clusters and virtual sectoral producer's organizations. • Shared investments. • Design of Smart Village strategies	**Clusters:** https://mapping.itc-cluster.com/ Digital farmer producers' organizations
AKIS- EIP	• Support for the establishment of EIPs (and partner searches) • Support in the design of EIP initiatives	AKIS-EIP: https://ec.europa.eu/eip/agriculture/en
	• Digital support to AKIS based on the AKIS strategy	
Stronger, Connected, Resilient, Prosperous Rural areas (LTVRA)		
• Revitalizing the rural areas most affected by population loss • Creating a stronger innovation ecosystem for rural areas • Development of sustainable multimodal mobility and digital mobility services • Rural Digital Futures • Addressing climate change in peatland	• Support for the establishment of LEADER action groups, preparation and implementation of local development and smart village strategies	Rural revitalisation platform Smart Village strategies: https://www.smartrural21.eu/ https://www.smartrural27.eu/
	• General services offered by local providers (such as those providing food, home repair services, etc.), Medical services, Social services, Entertainment, Youth services • On-line banking, Local communities administrative support • Access to governmental services	Portal the community - France
	• Support to digital spatial planning	https://digital4planning.com/a-digital-future-for-planning/
	• Digitalization of common local multiservice facilities	Multipurpose hall
	• Electronic support for transport planning/sharing	Rural mobility - Estonia

Item	Use of digitalization	Examples
areas through carbon farming • A soil deal for Europe • Promoting social resilience and women in rural areas • Supporting entrepreneurship and the social economy in rural areas	• Provision of e-training in digital skills at several levels	
	• Working from home support • Diversification (making use of rural services)	https://www.weforum.org/agenda/2022/04/countries-paying-you-to-move-to-countryside/

Source: Authors' own elaboration

ITU tools supporting Smart Villages

ITU has developed a set of tools to aid the development of digital communities.

The **Toolkit on the Digital Transformation for People-oriented Cities and Communities (ITU)** can universally benefit cities and communities, as well as regions and countries, regardless of their level of smart or digital development, or geographical or economic status.

The Toolkit is:

- A one-stop guide to the latest international standards and other ITU and UN resources, publications and reports.
- An endeavour to identify the challenges faced by cities, as well as potential solutions that can be leveraged for maximum positive impact.
- A comprehensive, yet non-exhaustive collation of information that is meant to inspire and support progress toward the SDGs, especially SDG 11, at a local level.

In particular, module 12 is dedicated to digital agriculture: Module 12 - Toolkit on the Digital

Transformation for People-Oriented Cities and Communities (itu.int)

Guidelines for the development of sustainable smart cities - Action plan (ITU-UNECE) provides practical recommendations for the development of Community Profiles and a full, strategic and practical scheme for the implementation of the recommendations. The Guidelines also provide information on the necessary financial resources, the targets and goals of each recommendation/project, and the people or departments responsible for the implementation.

4.3 Digital enablers: Internet connectivity, digital skills, funding and technical assistance

4.3.1 Internet connectivity

The digitalization of public services has been a key topic on the agendas of Western Balkans and the COVID-19 pandemic has increased the sense of urgency. The Digital Agenda for the Western Balkans merges the Western Balkans Investment Framework (WBIF), the Common Regional Market Action Plan and the EU Economic and Investment Plan for the Western Balkans (EIP), establishing a path towards sustainable digital governance for the public administration of the Western Balkans region. SIGMA's 2021 Monitoring reported service delivery to be the area that has witnessed the most substantial improvements in the Western Balkans region since 2017.

Internet coverage rates in the Western Balkans are relatively high, reported to be 80 per cent in Montenegro (2021), 79 per cent in North Macedonia (2020), 81 per cent in the Republic of Serbia (2021), 85 per cent in Albania (2019) and 96 per cent in Kosovo* (2020). There is, however, a **gap between the region's rural and urban areas,** and the share of households in rural areas without a broadband connection is larger (18.5% in the EU 27, 28.7% in Montenegro, 24% in the Republic of Serbia and 30% in North Macedonia). This represents a potential threat to the digitalization of agriculture, and particularly rural development policies.

The coverage rates in the Associated Trio countries are high, and access to the Internet in rural areas appears promising (see 2021, 2022 ITU Digital Development Country Profiles on the Republic of Moldova, Georgia and Ukraine), although a closer analysis of the situation regarding actual utilization

is needed to support the streamlining of actions that will promote the adoption of e-agriculture in rural areas.

The current state of digital connectivity in rural areas needs to be assessed as a priority, and actions should be initiated to raise the level of connectivity and affordability of Internet access and utilization.

Table 11: Examples of approaches to better connectivity in rural areas

Challenges	Political actions	References and examples
Connectivity of rural areas and farmers	Reduce the number of households without fixed Internet access as a priority in investment planning, Attract Internet providers to rural areas through policy actions or public-private partnerships. Establish local Wi-Fi access as a common service in rural locations; Provide affordable or free Internet.	Latvia broadband Kosovo* Rural World Bank Broadband Strategy Toolkit

Source: Author's own elaboration

ITU Digital Connectivity Tools for Rural and Remote Areas

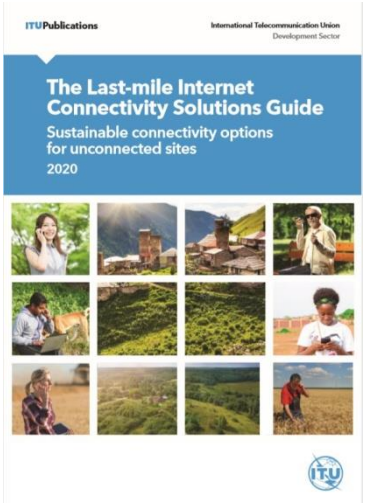
Access to communication services is a prerequisite for the inclusion of rural people in modern society and the improvement of quality of life, however, the current business models need to be appropriately modified if such services are to be effective in connecting rural and remote areas.

The International Telecommunication Union (ITU) has developed a number of tools that can support policymakers, regulatory bodies and private sector actors in the selection of appropriate approaches and solutions for the ICT connection of rural and remote areas and small island states.

ITU **Telecommunications/ICTs for rural and remote areas guidelines** contains a study and guidelines supporting the

selection of appropriate technologies for the connection of rural and remote areas, providing information on the demands, costs and financing mechanisms supporting the deployment of ICTs; the relevant technologies, services and applications; capacity building; as well as the policies required to support the connection of rural and remote areas.

The ITU **Last-mile Internet Connectivity Solutions Guide** and the supporting **Guide for procuring last-mile connectivity data networks** offer advice and practical guidance to policymakers and professionals supporting the selection and customization of appropriate last-mile connectivity solutions, and assist those making requisitions in the procurement of last-mile connectivity networks and services based on the principles of affordability, usage, financial viability, structure and sustainability. The guide presents a step-by-step overview of the process of procuring last-mile connectivity data networks and services.



4.3.2 Digital skills

Digital skills needs of governmental institutions for the design of policies and the management of CAP information systems have not been raised to date as there were no information systems in use by the IPARD agencies for the implementation of pre-accession support. The CAP, however, requires electronic information systems to be in place and certified for the management and implementation of the measures after the post-accession period, which requires adequate organization and appropriate staffing, as well as intensive training for staff at several levels. Table 12 illustrates possible approaches to the raising of digital competencies in public authorities.

Table 12: Possible approaches to the raising of digital skills in public authorities

Challenges	Possible approach	Result
Managing authority Policymakers (decision makers) Policy analysis, programming, monitoring	Awareness-raising training in the use of digital technologies in policy actions linked to the CAP	Inclusion of the use of digital technologies in policy actions, particularly those contributing to better cooperation and quality of life in rural areas
	Training in policy analyses, scenario testing and programming through the use of EU-compliant methodologies	Acquisition of skills in CAP programming and the coordination of tasks related to the CAP strategic plan management information system
Agricultural economics and statistics	Training in the compilation and validation of agri-statistical data through the use of official statistics and agri-databases	Acquisition of skills in the preparation of EU reports and coherent data platforms for policy analyses
FADN Liaison agency	Provision of training in the organization of FADN collection campaigns and the preparation of specifications for FADN, the validation of FADN collections and data exchange with statistics and RICA	Acquisition of advanced skills in the preparation of specifications and test scenarios for FADN, the validation of FADN data, the transmission of data to RICA and the organization of data collection campaigns.
FADN data collectors - agricultural advisory	Provision of training in FADN collection approaches and follow-up communications with farmers	Acquisition of advanced skills in the collection and use of FADN data in the provision of advisory services
FADN data analysis for researchers	Provision of training in the analysis of FADN data, follow-up communications with advisory service providers	Acquisition of advanced skills in the analysis of FADN results and follow-up actions
Researchers	Provision of training in the use of AI and innovative approaches in agriculture	Advanced skills in the acquisition of updated information on the use of AI and innovative approaches in agriculture
Collection and reporting of agricultural market prices	Provision of training in EU market price reporting and the use of advanced tools for the validation of prices	Acquisition of advanced skills in the management and collection of market prices, the validation of collected data and the regular reporting to the EU

Challenges	Possible approach	Result
Paying agency governance and management	Provision of training in the best practices for the management of information systems and the design and management of information systems for the management of the CAP	Design of information system strategies linked to the achievement of the CAP objectives. Design of information security management policies based on threats and risks
Paying Agency - IT management staff	Training in the organizational setup of IT management structures	Design of organizational setups, manuals, procedures and job descriptions for IT staff, with individual position training programmes linked to the risks
Paying agency - IT staff responsible for technical support	Training in the use of manuals and procedures	Skilled technical services for the management of confidentiality, availability and security, including end-to-end information asset management, incident management, capacity management, user and software administration.
Paying Agency - Business owners and IT staff responsible for software development	Training in manuals and written procedures related to end-to-end software development lifecycle	Paying agency staff trained in software development lifecycle management and methodologies for the initiation of projects, the preparation of user and technical specifications, test scenarios and testing, protocols for deployment and change management.
Paying Agency - IT staff responsible for system and database administration	Training in systems and database administration roles and manuals	System and database administrators trained in protocols and operations, including the preparation and administration of separate test, stage and production environments, version management and maintenance
Paying Agency - IT staff responsible for the coordination of IT	Training in internal monitoring and supervision, and the coordination of information security management	Operationalization of routines and protocols for information security management and supervision

Challenges	Possible approach	Result
security policies, operations and supervision	processes	
Paying Agency - Staff responsible for procurement and contracting	Training in the procurement of information assets	Paying agency staff trained in the preparation of user and technical specifications supporting the procurement of information assets and services. More efficient procurements, and procurement specifications prepared on the basis of proven needs
Paying Agency - Staff responsible for procurement and contracting	Training in the writing of Memoranda of Understanding and outsourcing contracts with external institutions and contractors, and their supervision	Paying agency staff trained in the preparation of memoranda of understanding and agreements in line with the accreditation criteria related to Paying agencies
Paying Agency - Staff responsible for IT audits within Internal audit units	Training in Information system's audit	IT auditors with specific skills in CAP information systems

Source: Authors' own elaboration

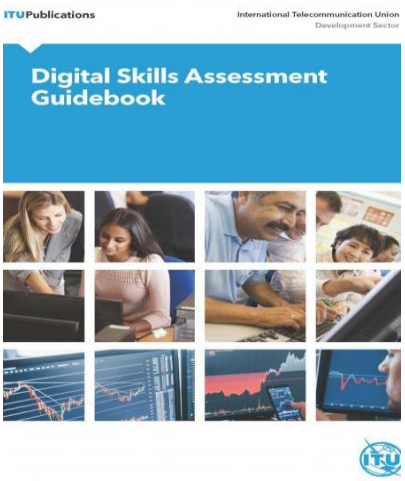
There are differences in the preparedness and technical outsourcing levels of the pre-accession countries, and so a preliminary self-assessment can be considered an appropriate starting point to identify any gaps in the organizational and documentary setups, and in staffing and skills.

The dissemination and efficient implementation of policy actions in rural areas requires a certain level of digital proficiency. There is, however, limited interest in the use of digital technologies in rural areas that can be attributed to a number of different reasons, including the higher than average age of the population, the lack of interest in acquiring new skills, the lower household income, the lack of direct benefits from Internet use and the lack of immediate assistance in the use of digital tools when needed.

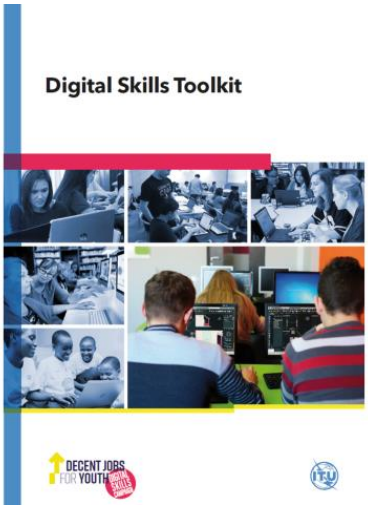
Table 13: Challenges faced in raising digital skills in rural areas

Challenge	Possible approach	Contributes to	References
Use of digital technologies	Promoting the use of digital technologies in rural areas linked to political interventions would clarify the immediate benefits to users.	The use of e-government services and better policy implementation Raised interest and awareness of the rural population of the benefits of digital tools.	
Acquisition of Basic Digital skills in rural areas	Design programmes focusing on target groups and encouraging the rapid learning and use of digital technologies in daily life, targeting: - the elderly population - the young population Encouraging programmes involving intergenerational exchanges for the transfer of digital skills from the younger to older generations; Organize common areas/hubs and transport with free digital infrastructures and skilled assistants; Include basic digital skills programmes in all interventions.	Increased basic e-skills in the adult population in rural areas Raised awareness of smart Villages; Increased inclusion of the older adult population Increased intergenerational dialogue; Increased employment in rural areas linked to social and common services.	Sample: North Sea Region Sample: UK
Advanced Digital skills	Support the acquisition of advanced digital skills linked to rural jobs or remote employment positions in rural areas.	Increased advanced digital skills available in rural areas; Increased employment jobs in rural areas; Increase in the number of young people in rural areas.	Example - support for remote digital rural jobs - Portugal Example advanced digital skills
Rural businesses	Support rural businesses in developing digitized business approaches.	Increased number of SMEs and jobs in rural areas in remote businesses.	Sample: Rural digital hub study
Rural authorities	Raise awareness and increase skills in local authorities to support the design of digitally oriented local development strategies.	Increasing the quality of local development strategies towards smart Villages.	Sample: Workshop

ITU Digital Skills Tools



ITU's Digital Skills Assessment Guidebook is a comprehensive, practical step-by-step tool for the assessment of national digital skills. The guidebook can be used to determine the existing supply of a digitally skilled cohort at a national level, to assess the demand for skills from industry and other sectors, to identify skills gaps, and to develop policies aimed at addressing future digital skills requirements.



The Digital Skills Toolkit developed by ITU provides policymakers and other stakeholders with practical information, examples and step-by-step guidance to support the development of a national digital skills strategy. The topics covered by the toolkit include: engaging the right stakeholders; auditing and assessing existing policies; developing strategies for different proficiency levels; creating strategies for under-represented groups, such as women and persons with disabilities; organizing campaigns and participation in regional or international initiatives; and monitoring and updating strategies. The toolkit converts complex procedures into manageable tasks and offers examples of programmes and frameworks applied around the world to serve as models and to inspire the users of the toolkit.

5 FUNDING RELEVANT TO DIGITAL AGRICULTURE

5.1 EU Funds for digital transformation and agriculture

Strong budgetary support is ensured within EU Multiannual Financial Framework 2021-2027 (MFF), which supports activities and initiatives for the achievement of the objectives of the Shaping Europe's Digital Future strategy.

Shaping Europe's Digital Future: Funding

The Multiannual Financial Framework 2021-2027, supports digital transformation through substantial investments into integrated digital environments:

- The Digital Europe Programme (DEP) supports the digital transformation of Europe's societies and economies through investments in digitally crucial areas (artificial intelligence, supercomputing, cybersecurity, and trust; digitization of public administrations and public services, interoperability, advanced digital skills, the provision of access to technology and know-how to businesses, including the creation and strengthening of digital innovation hubs) (European Commission 2018).
- The Connecting Europe Facility (CEF) develops trans-European networks and digital infrastructures, including the expansion of broadband coverage.
- The InvestEU Fund supports investments into digital infrastructures, digital technology research, and the digitalization of small businesses and the social economy, to maximize the benefits from the digital transformation.
- The European Regional Development and Cohesion Funds (ERDF, CF) create regional networks and systems that promote sustainable transport, smart energy grids, smart cities and high-speed digital access.
- Horizon Europe - a new research and innovation programme - will create synergies with other programmes in such areas as artificial intelligence, robotics, high-performance computing and big data.
- The new European Social Fund Plus (ESF+) helps to develop basic workforce skills for the digital world.
- The EU Space Programme (ESP) aims to provide long-term, state-of-the-art and secure positioning, navigation and timing services, while ensuring service continuity and robustness, through Galileo and the European geostationary navigation overlay service; to deliver accurate and reliable Earth observation data, information and services in integration with other data

sources on a long-term sustainable basis via Copernicus in support the formulation, implementation and monitoring of the European Union and its Member States' policies and actions based on user requirements; and to enhance capabilities in the monitoring, tracking and identification of space objects and space debris through space surveillance and awareness;

Source: Authors' own elaboration

Moreover, candidate and potential candidates can, together with the EC, develop actions related to their institutional, legal, administrative, social, and economic reforms supported by digital transformation.

5.2 Funding instruments for pre-accession assistance (IPA and NDICI)

The multi-financial framework (MFF) covers support to investments in digitalization through the Instrument for Pre-accession Assistance (IPA) – for Western Balkans and Türkiye, and the EU neighbourhood through the Neighbourhood, Development and International Cooperation Instrument (NDICI - Global Europe).

Table 14: Instruments supporting the digital transformation of the Western Balkans and Türkiye and the Eastern Neighbourhood

EU instruments supporting the digital transformation of candidate and potential candidate countries:

- **Instrument for pre-accession assistance (IPA):** The general objective of the IPA III is to support the beneficiaries in adopting and implementing the political, institutional, legal, administrative, social and economic reforms required for their compliance with Union values, and their progressive alignment with the Union rules, standards, policies and practices with a view to Union membership, thereby contributing to their stability, security and prosperity. The IPA III is aligned with the flagships and priorities of the "Economic and Investment Plan for the Western Balkans", the Western Balkan Strategy and the "Enhancing the Accession Process - a credible EU perspective for the Western Balkans" Commission.
- The **NDICI Global Europe instrument** combines several former EU external financing instruments, supporting the countries most in need of overcoming long-term developmental challenges, and contributing to the achievement of international commitments and objectives to which the Union has agreed, in particular the 2030 Agenda and its Sustainable Development Goals, and the Paris Agreement. The candidate countries and potential candidate countries can, together with the EC, develop actions that support the advancement of their institutional, legal, administrative, social and economic reforms

to comply with those of the European Union with support of investment programmes "new Eastern Partnership" with its agenda and "new Agenda for the Mediterranean".

Source: DG NEAR

Regarding the Western Balkans, there have been a number of actions which support efficient accession and digital transformation. The "Western Balkans Strategy": for 'A credible enlargement perspective for and enhanced EU engagement with the Western Balkans' (and the Annex with Action Plan), adopted in February 2018, confirmed the European future of the region as a geostrategic investment in a stable, strong and united Europe based on common values. It spells out the priorities and areas of **jointly reinforced cooperation,** addressing the specific challenges the Western Balkans face, in particular the need for **fundamental reforms** and **good neighbourly relations. The action plan also includes the launch of digital agenda for the Western Balkans as one of** six flagship initiatives of the Western Balkans Strategy.

The Economic and Investment Plan for the Western Balkans (EIP), launched in 2020, and the corresponding Guidelines for the Implementation of the Green Agenda for the Western Balkans, promote increased investments in the region. The EIP is a blueprint for EU assistance aimed at bridging the socioeconomic gap between the region and the European Union and supports its green and digital transitions. At the heart of the plan is a substantial investment package articulated around 10 indicative flagship investments that support the development of connected, green, competitive and thriving economies in the Western Balkans through an increasingly dynamic private sector and stronger human capital development.

The digital transformation is also addressed through the accession process under the negotiation clusters (introduced to strengthen the accession process in 2020) on Fundamentals (e-government, public procurement (Chapter 5) and statistics (Chapter 18)), and Competitiveness and inclusive growth (Information society and media (Chapter 10)), and is supported through the Instrument for Pre-accession Assistance (IPA). Furthermore, support for institution-building may be provided through two dedicated Institution Building Instruments: TAIEX and Twinning. IPA III also promotes, when relevant, the participation of the beneficiaries in agencies, facilities and EU programmes, such as, but not

limited to, Erasmus+, Horizon Europe, the InvestEU Fund and Creative Europe. As with the previous pre-accession instruments, assistance is deployed to the benefit of the IPA III beneficiaries[22] through annual or multi-annual action plans at national or regional levels, or through horizontal initiatives targeting specific types of partners (e.g. civil society) or cross-cutting issues (e.g. EU integration facility).

Regarding EU neighbourhood countries, new investment initiatives have been launched based on the **"**new Eastern Partnership" and the "new Agenda for the Mediterranean". The European Union has defined its cooperation priority areas and specific objectives for 2021-2027 for most of the EU Neighbourhood partner countries and regions involved in multi-annual indicative programmes. These strategic documents are prepared based on inclusive dialogue and consultation with the partner countries, the EU Member States, civil society, women and youth organizations, local authorities, the private sector and other donors. The issue of support for connectivity and digitalization is addressed based on priority areas and the specific objectives of those programmes. For many years, funds have been available to support agriculture (ENPARD Georgia, the Republic of Moldova), most of which was allocated to efforts to strengthen capacities with regard to DCFTA agreements.

EU Neighbourhood multi-annual indicative programmes	
Eastern Partnership	Countries: Armenia, Azerbaijan, Belarus, Georgia, the Republic of Moldova and Ukraine
	MIP: Multi-annual 2021-2027
	Country Multiannual Indicative Programmes - 2021-2027: MIP Armenia, MIP Azerbaijan, MIP Georgia, MIP Ukraine, MIP the Republic of Moldova
	Indicative Budget 2021-2024: 632.24 million EUR for 2021-2024 An additional 929.88 million is foreseen to support the deployment of budgetary guarantees in the Eastern Neighbourhood
Indicators	Support for connectivity: Priority area 1/Specific objective 2 Supporting e-government and statistics: Priority area 2/Specific objective 2

[22] IPA beneficiaries are: Montenegro, Serbia, Albania, North Macedonia, Bosnia and Herzegovina, Kosovo* and Türkiye.

	Support of digitalization: Priority area 4: Resilient digital transformation Support to agriculture: Priority area 3/ Specific objective 2
Southern Partnership	Countries: Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine*[23], Syria and Tunisia
	MIP: Multi-annual indicative Programme Southern Neighbourhood 2021-2027
	Country Multiannual Indicative Programmes 2021-2027: Lebanon, Palestine, Migration, Algeria, Egypt and Jordan
	Indicative Budget 2021-2024: 474 million EUR for 2021-2024 Additional 1 248 million under the Neighbourhood Investment Platform (NIP) and the deployment of budgetary guarantees under the EFSD+ in the Neighbourhood South for 2021-2024
Indicators	Support for connectivity: Priority area 2/Specific objective 2 Support for digitalization: Priority area 2/Specific objective 1

Source: EU Commission

5.3 Delivery methods

Several delivery methods are available, such as grants, procurement contracts, programme estimates, budget support, trust funds, Technical Assistance, Information Exchange (TAIEX) and twinning, guarantees, loans and other financial instruments. DG-NEAR has, in 2017, prepared a guide to Addressing capacity development in planning/programming, monitoring and evaluation. The selection of delivery methods is addressed, agreed and formalized through dialogue between the beneficiary country and the EU Commission, and the selection of the delivery method depends mostly on the type of action supported (such as institutional building, agricultural interventions in the form of grants, investments in rural infrastructure) and the budget implementation type and method.

Twinning is an EU instrument for institutional cooperation between Public Administrations of EU Member States and of beneficiary or partner countries. "Twinning" programmes are also utilized as a

[23] State of Palestine

means of supporting the institutional development of public administrations in candidate countries or potential candidates for EU membership. Under such programmes, public sector experts from the EU member states are paired with their counterparts in the candidate countries, and they then work together on specific projects aimed at strengthening the administrative capacity and institutional frameworks of the beneficiary country. Twinning projects can cover a wide range of areas, including digitalization.

Twinning programmes are typically funded by the European Union and managed by the EC. Nevertheless, FAO is also piloting a twinning approach that encourages the exchange of knowledge, good practices and technology transfer between rural communities and institutions

Source: Twinning (europa.eu)

5.4 Methods of budget implementation

To ensure maximum efficiency in the implementation of funds, the **Financial regulation** detailed in Art. 62 allows for several budget implementation approaches, agreed upon in financial framework partnership agreements:

- **Direct management:** By EU commission departments, including Union delegation staff under the authority of their respective Heads of delegation, and in accordance with, or through executive agencies
- **Indirect management**: EU funds contracted through intermediaries (called entrusted entities), that follow either the European Union's rules or its own rules if identified as equivalent in an ex-ante check known as a pillar assessment. Indirect management can be used with the following entrusted entities to serve specific purposes:
    - With a partner country, or an entity designated by it, to strengthen ownership and alignment with national procedures in line with the principles of aid effectiveness. This is often used in the context of the Instrument for Pre-Accession;
    - IPA III Beneficiary (in accordance with the IPA implementing regulation)

- With an agency of a Member States or an EFTA country (Iceland, Liechtenstein, Norway or Switzerland) or, in exceptional cases, with an agency of a third donor country as a means of reinforcing donor coordination and harmonization.
- With an international organization, with a view to making the best use of the comparative advantage of dedicated international organizations, fostering long-term collaboration with key international partners, and increasing donor coordination and harmonization.
- The European Investment Bank (EIB) which lends and provides guarantees and financial instruments in support of EU policies, often in conjunction with other forms of EU support (blending, ELM guarantees, ACP Investment Facility, etc.)
- An EU-specialized (traditional/regulatory, hence not executive) agency.

- **Shared management**: With Member states

The Financial regulation also defines in detail the rules to be applied regarding the use of instruments for different budget implementation approaches (under Titles V-XII).

6 CONCLUSIONS

Though digitalization is considered by many to be the future, the transformation started decades ago with the conversion of analogue information into a digital format. Today, digital agriculture necessitates the development, use and maintenance of digital infrastructure, technologies and skills in many socio and physical domains. This compendium summarizes how the European Union has developed the necessary legal requirements for the digitalization of agriculture through such strategies and interventions as investments, farm advisory services and smart villages, as well as through the digitalization of its CAP and its information systems related to financing, management, monitoring and evaluation. This compendium should not be considered a comprehensive collection of the EU requirements related to digitalization in agricultural policies and agriculture in general, given especially that legislation is still subject to continuous development in the fields of digitalization and agricultural law, however, it can aid officers in the negotiations of pre-accession countries and support the harmonization of agricultural policies with the those of the EU Member States.

This document stresses the importance of a wide toolbox in support of digitalization in agriculture beyond what is considered a legal requirement, including:

Digital enablers:

- **Common agri-food data structures**, registers and datasets facilitate the easy access, administration and disbursement of support through e-government, although these MUST be integrated, interoperable and unified.
- **The necessary digital infrastructure** must be in place and operational to ensure everyone, everywhere, particularly in rural areas (where free Wi-Fi is not available), has equal access to services.
- **Basic digital skills** and equipment are needed if everyone is to be an equal member of the community.

Political enablers:

- The national **CAP Strategic Plans** are the ones which will propose the interventions and design the **strategy for their digital implementation,** together with their counterparts from sectoral producer organizations and local communities.
- Food producers will discuss new approaches to farming with the enhanced use of digital techniques, for which they need to be informed about new approaches.
- Local authorities will prepare digitized approaches to the establishment of smart villages in their **local development plans**, supported by LEADER, for which they will need to be skilled in the use of the LAG approach and the possible use of digitalization in rural services.

Careful investigations, analyses and preparations are needed for the preparation of a vision and **strategy for the digital transformation** of current operational policies into a CAP strategic plan, starting with:

- The development of CAP-specific information systems, supported by skilled officials.
- Opportunities related to the use of EU digital and spatial infrastructures and participation in the knowledge exchange platforms of the Union in the fields of remote sensing and spatial big data for agricultural and rural policies.
- The adjustment, simplification, and digitalization of national and pre-accession agricultural and rural development interventions to be re-used under the CAP.
- The provision of support to investments and services in support of better and more resilient food production and supply, enhanced through digitalization.
- The development of programmes and approaches for the efficient exchange and transfer of knowledge through digitalization.
- The fostering of investments and services in rural communities to increase the quality of life and the younger population, contributing to the development of a new business environment.
- Programs and approaches that ensure the population has equitable access to digital infrastructure, resources and services.

National programmes for adoption of Acquis (NPAA) and **supporting action plans** need to be developed or adjusted to address and ensure the coherent phasing of parallel processes - institutional building and legal adjustments, the development of CAP strategic plan interventions, adjustments to national and pre-accession interventions, and digitalization.

Funding is available through several dedicated instruments - Pre-accession (IPA) and Neighbourhood (NDCI) with supporting Guarantee facilities, and FAO (NVI), as well as opportunities linked to other EU funds on the basis of agreed programmes.

Under different conditions, the digitalization of agriculture and rural areas can bring new positive opportunities but can also raise new negative threats to food production and the inclusion of small farmers. The integrated approach of the CAP - with agriculture and rural development pillars - offers the wide range of interventions needed for the development of sustainable rural communities and the production of food, while also taking care of nature and the social fabric.

7 LIST OF ABBREVIATIONS

AKIS	Agricultural Knowledge and Innovation System
CAP	Common Agricultural Policy
CMO	Common Organization of Agricultural Markets
EAFRD	European Agricultural Fund for Rural Development
EAGF	European Agricultural Guarantee Fund
EC	European Commission
EIP	European Investments Programme
ENPARD	European Neighbourhood Programme for Agriculture and Rural Development
ERDF	European Regional Development Fund
ESF+	European Social Fund Plus - europa.eu
EU	European Union
FADN	Farm Accountancy Data Network
FAO	Food and Agriculture Organization of the United Nations
GAEC	Good agricultural and environmental conditions
IACS	Integrated Administration and Control System
ICT	Information and Communication Technology
IFI	International Financial Institutions
Interreg	Programmes to stimulate cooperation between regions inside and outside the

	European Union (EU), funded by the European Regional Development Fund
IPA	Instrument for Pre-accession Assistance
IPARD	EU pre-accession assistance for rural development
ITU	The International Telecommunication Union
LEADER/CLLD	Community-Led Local Development
NDICI	Neighbourhood, Development and International Cooperation Instrument
MS	Member State of the European Union
SMR	Statutory management requirements

8 GLOSSARY

The pre-accession countries and territories addressed in this compendium are the Western Balkans (Albania, Bosnia and Herzegovina; Kosovo*Error! Bookmark not defined.; Montenegro; North Macedonia; S erbia); Türkiye; and the Associated trio (Georgia, the Republic of Moldova, Ukraine), as well as the others that may apply for membership of the European Union

Electronic Information System

An information system is a combination of the necessary software, hardware and telecommunication networks for the collection, storage, processing and transfer of useful data and information in a digital or electronic format. In the EU Common Agricultural Policy, different electronic information systems exist for different purposes and actors.

Digital agriculture

E-agriculture, today commonly referred to as “digital agriculture”, is the application of Information and Communication Technologies (ICT) to enhance agricultural and rural development, improve productivity, facilitate access to markets, knowledge, and financial opportunities, and enable improvements in the agrifood supply chain.

In this context, ICT is used as an umbrella term encompassing all information and communication technologies including devices, networks, mobiles, services and applications; these range from innovative internet-era technologies and sensors to other pre-existing aids such as fixed telephones, televisions, radios and satellites. More specifically, digital agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use ICT in the rural domain, with a primary focus on agriculture. Provisions of standards, norms, methodologies, and tools as well as development of individual and institutional capacities, and policy support are all key components.

Source: Authors’ elaboration based on Sylvester, G. 2016. E-agriculture strategy guide – Piloted in Asia-Pacific countries. Bangkok, FAO and ITU

Digital technologies

Electronic tools, systems, devices and resources for the generation, storage or processing of data in a digital form. Digital technologies can be embedded in physical or mechanical equipment (e.g. GPS in tractors) or dis-embedded (e.g. marketplace). The mechanisms and functionalities of some technologies may overlap or be closely related. For example, artificial intelligence, machine learning and data analytics, or remote sensing and satellites, which can similarly be used complementarily for predictive or prescriptive functionalities.

Digital solutions

Digital products and services that utilize digital tools, digital channels or digitally-enabled data analytics (e.g. machine learning, AI) to resolve problems or address identified needs, such as the delivery of information, advice, farming inputs, market access, logistics support, financial services and decision-making tools directly to smallholder farmers or other actors in the agri-food value chains, including extension agents, agribusinesses, financial service providers and policymakers.

Digital Villages

Digital Villages are a concept embraced by FAO and promoted through its flagship Digital Villages Initiative (DVI). Digital Villages harness the power of technology, grassroot innovations, knowledge and partnerships to empower rural communities to engage in a digital rural transformation process as so to become people-centric, smart, green, digitally-connected and interconnected. They rely on participatory and inclusive approaches and benefit from cooperation and alliances with other rural communities and actors in rural and urban areas. More information at: Digital Villages Initiative in Europe and Central Asia (fao.org)

Internet of Things

A network of physical objects, or "things", embedded with the necessary electronics, software, sensors and network connectivity that allow them to collect and exchange data. The Internet of Things (IoT) allows objects to be sensed and controlled remotely within an existing network infrastructure, creating opportunities for the greater integration of the physical world and computer-

based systems, and resulting in improved efficiency, accuracy and economic benefit. Each "thing" is uniquely identifiable through its embedded computing system, but can interoperate within the existing Internet infrastructure.

Precision Agriculture

Precision agriculture is a farming management concept based on the observation, measurement and actions in response to variations in crops. These variations may contain many components that can be difficult to compute, and as so technologies have advanced to offset these difficulties. There are two types of technology applied in support of precision agriculture: those ensuring accuracy, and those that enhance farming operations. By combining these two technologies, farmers can create a decision support system for an entire operation, thereby maximizing profits and minimizing excessive resource use. This can include the management of crop production inputs (seed, fertilizer, lime, pesticides, etc.) on a site-specific basis to increase profits, reduce waste and maintain environmental quality.

Smart Villages

Smart Villages are defined by the European pilot project on Smart Eco-social Villages as "smart communities in rural areas that use innovative solutions to improve their resilience, building on local strengths and opportunities. They rely on a participatory approach to the development and implementation of a strategy to improve the economic, social and environmental conditions in the community, in particular, by mobilizing the solutions offered by digital technologies. Smart Villages benefit from cooperation and alliances with other communities and actors in both rural and urban areas. The initiation and implementation of Smart Village strategies may build on existing initiatives and can be funded through a variety of public and private sources".

Source: How to support Smart Villages strategies which effectively empower rural communities?

9 ANNEX: PROPOSED NATIONAL SELF-ASSESSMENT CHECK-LISTS

Based on the requirements outlined in Chapter 3 of this guide, FAO and ITU have developed a toolbox in the form of self-assessment checklists, that, through several steps and a series of questions, can aid pre-accession countries in carrying out an in-depth situation analysis, an identification of needs and the development of action plans supporting the digital transformation of food production and life in rural areas.

This self-assessment tool is organized around three clusters of checklists or questions concerning:

- The setting up of digital information systems for the management, monitoring and evaluation of the CAP.
- The efficiency of policy deliveries, opportunities to reduce administrative burdens and simplification through e-governance.
- The needs and opportunities for the development of strategies and interventions in support of digital agriculture (e.g. through pre-accession support or CAP Strategic Plans for after accession).

Though most of the questions posed in this checklist require binary or numerical replies (yes, no, number), the inclusion of a "description" column is an invitation to think critically also about the quality. This is quite relevant, for instance, when it comes to paying attention to the quality of services, rather than the mere number of proxy indicators such as the "number of medical services accessible through the Internet".

Part I: Checklists guiding the setting up of digital information systems for management, monitoring, and evaluation activities

1.1 Strategy for the development of digital technologies in agriculture and rural areas
• **Legal reference:** Article 114 (b) of the CAP strategic plan regulation requires Member States to establish "a description of the strategy for the development of digital technologies in agriculture and rural areas and for the use of those technologies to improve the effectiveness and efficiency of the CAP Strategic Plan interventions". The EC provides also Recommendations to the Member States regarding their strategic plans for the Common Agricultural Policy.

- **Scope:** The checklist supports the assessment of policy documents related to e-agriculture, which can support the development of CAP mandatory information systems, the design of digitally enhanced agri-policy policy interventions, and the enhancement of e-government for improved implementation

• **Checklist**	**Yes/No**	**Description**
○ Is there a national strategy containing elements that would support the compliance of the legal framework, institutional setup and policy actions with the *Acquis* in agriculture and rural areas, including also digitalization?		
○ Is there an existing policy document addressing the development of digital technologies in agriculture and rural areas considering the needs of the national agricultural and rural development strategies and detailing the systems that need to be established in the pre-accession period?		
○ Are there any existing policy documents or action plans for the enhancement of e-governance related to agriculture and rural development that envisage the re-use of previously collected agri-data collections, thus reducing the administrative burden on the administration and farmers?		
○ Are there any existing policy documents or action plans related to the digital enhancement of policy actions (supported investments in digitalization, digitally supported or virtual cooperation, digital services)?		

1.2 Agricultural Statistics and FADN

- **Legal reference: Statistics and Farm Accountancy Data Network (FADN):** Art. 143 of the CAP Strategic Plan Regulation states that Member States shall provide the Commission with the available information required for the monitoring and evaluation of the CAP in accordance with the multiannual evaluation plan referred to in Article 141. The data needed for the context and impact indicators shall come primarily from established data sources, such as the Farm Accountancy Data Network and Eurostat. Should such indicator data not be available or incomplete, the gaps shall be addressed in the context of the **European Statistical Programme** established under Regulation (EC) No 223/2009 of the European Parliament and of the Council (51), the **Farm Accountancy Data Network** (FADN) established by Council Regulation (EC) No 1217/2009 (52), or through formal agreements with other data providers such as the Joint Research Centre and the European Environment Agency. […] **Data from administrative registers, such as the integrated system** referred to in Article 65(2) of Regulation

(EU) 2021/2116, **the identification system for agricultural parcels** referred to in Article 68 of that Regulation, and **animal and vineyard registers**, shall also be used **for statistical purposes**, in cooperation with the statistical authorities in the Member States and with Eurostat.

The legal requirements related to agricultural statistics are summarized in the Requirements Compendium.

- **Scope:** The checklist is used to:
  - Assess any gaps in the coverage of agri-statistical records to be submitted to the EC, which will lead to the design of an action plan for their improvement
  - Assess the level of coherency of the data collected through administrative systems with those presented in statistical records so as to improve and align the coding across systems,
  - Increase the use of compilation of statistical, administrative and other agri-data collections for their use in the improvement of policy actions

• **Checklist**		
Submission of statistical data - official statistics	***Yes/No***	***Description***
○ Has an Agri-census been conducted since 2022 in line with Regulation (EU) 2018/1091		
○ Have Agricultural accounts and prices been compiled in line with Regulation (EU) 138/2004 and its amendments since 2022?		
○ Has statistical data been compiled for crops, animals, and milk and dairy products in line with EU regulations ?		
○ Has regular data collection been established for “organic production and farming” in line with Council Regulation 834/2007 and its amendments?		
Interoperability	***Yes/No***	***Description***
○ Are any agri-statistical data collected through the use of administrative systems (i.e., IACS and other administrative systems, FADN, Animal register, other registers)?		
○ Are any software-supported tools being used for the validation of administrative sources (such as cross-checking FADN, IACS, AMIS)?		
○ Are the statistical data in use for agricultural policy analysis supported by adequate analytical software packages, taking into account collected statistical data on agriculture, environmental and food safety, and other related data-such as those linked to water use, forestry, genetic resources and population		

FADN setup	*Yes/No*	*Description*
○ Has the information system for FADN been established in line with Regulation (EU) 1217/2009?		
○ Is the FADN software producing the resulting RICA1 report?		
○ Is the farm sample considered satisfactory by the EC?		
○ Is the advisory service provider collecting FADN data?		
○ Is the advisory service provider offering follow-up advice to farmers?		
○ Is there online access to FADN data entries and are the results accessible by farmers?		
Opportunities for FADN connectivity and data re-use	***Yes/No***	***Description***
○ Are the data to be included in the FADN returns available from the farm register and other official databases related to farms and upon the farmer's authorization?		
○ Are the data from FADN published and used for policy design?		
○ Can the individual FADN data be compared with the average data from farms of the same production type and category?		
○ Can individual FADN information be seen by the agricultural advisor upon being granted authorization by the farmer?		
○ Are the results of FADN analysed by the advisory service providers and academic institutions, and are follow-up measures proposed?		
○ Are there any electronic tools supporting the provision of feedback on farm performance making use of FADN data?		
○ Are any follow-up advisory activities proposed to farmers based on the analysis of FADN data which would result in improved agri-technical measures, improved seeding materials, and the application of improvement programmes?		
○ Are there any digital tools in place that make use of information from the advisory service providers and other farmers that could aid researchers in addressing problems and initiating improvement actions?		

○ Are the FADN results used to aid farmers in the preparation of business plans?		
○ Are the FADN data used to aid farmers in the design of business plans?		
○ Are the FADN data used for the calculation of simplified cost options?		
Digital skills assessment of FADN Liaison Agency, advisory services and researchers	**Yes/No**	**Description**
○ Are there staff with advanced digital skills involved in the validation of the collected data?		
○ Are there staff with advanced skills involved in the management of FADN?		
○ Are there advisory staff with specific skills in the collection of FADN data?		
○ Are there advisory staff with advanced skills providing follow-up advice based on FADN data?		
○ Are there research staff with advanced skills involved in the analysis of FADN data, and in the provision of follow-up actions based on FADN data?		
○ Are there advisory and research staff with advanced skills in the provision of information to farmers in the use of AI and innovative tools in agricultural production?		
Agricultural prices collection	**Yes/No**	**Description**
○ Are there staff with advanced skills in of validation of price collections?		
○ Are there staff with advanced digital skills involved in the management of the reporting of agricultural prices?		

1.3 Integrated Administration and Control System (IACS) and registers

- **Legal reference related to IACS:** In accordance with Article 65 of the CAP Horizontal Regulation, each Member State shall set up and operate an **integrated administration and control system** (the "integrated system"). The integrated system **shall apply to the area- and animal-based interventions** and […] to the extent necessary, also be used for the management and control of conditionality **and interventions in the wine sector**. In accordance with Article 66 of the same regulation, **the integrated system shall comprise the following elements**:
  a) an identification system for agricultural parcels;

b) a geo-spatial application system and, where applicable, an animal-based application system;
c) an area monitoring system;
d) a system for the identification of beneficiaries of the interventions and measures referred to in Article 65(2) of the CAP horizontal regulation.
e) a control and penalty system;
f) where applicable, a system for the identification and registration of payment entitlements;
g) where applicable, a system for the identification and registration of animals.

- **Legal reference related to IACS data exchange and integration between the electronic databases and the geographic information systems:** In accordance with the CAP Horizontal Regulation, Article 66 […], the **integrated system shall provide information relevant for reporting on the indicators** referred to in Article 7 of the CAP Strategic plan regulation (i.e. impact, context, result and output indicators in Annex I of that regulation), and […] shall operate on the basis of electronic databases and geographic information systems, and **shall allow the exchange and integration of data between the electronic databases and geographic information systems**.
- **Legal reference related to IACS data public sharing requirement:** In accordance with Article 67 of the CAP Horizontal Regulation, Member States shall ensure that data sets collected through the integrated system which are relevant for the purposes of Directive 2007/2/EC of the European Parliament (INSPIRE) and of the Council or for monitoring Union policies, and […] European statistics in accordance with Regulation (EC) No 223/2009 are shared free of charge between its public authorities and made publicly available at a national level. Member States shall also provide the institutions and bodies of the Union with access to the said data sets […]. Public access to data sets should be limited where such access would adversely affect the confidentiality of personal data. […] and the access to all relevant data related to beneficiaries regarding the land they use or intend to use, in order to enable them to submit accurate applications.
- **Legal references related to data exchanges and the data re-use requirement**: The Implementing Regulation on high-value data […] contains a list of the high-value datasets that belong to the thematic categories set out in Annex I to Open Data Directive and held by public sector bodies among the existing documents to which that Directive applies, and […] also lays down the arrangements related to the publication and reuse of high-value datasets, in particular the conditions related to re-use and the minimum requirements for the dissemination of data via application programming interfaces. The thematic categories of high-value datasets are: Geospatial, Earth observation and environment, Meteorological, Statistics, Companies and company ownership, and Mobility.
- **Legal reference:** Article 67 of the CAP Horizontal Regulation, Member States shall record and keep any data and documentation on the annual outputs reported in the context of the annual performance clearance referred to in Article 54, and the reported progress towards the targets set out in the CAP Strategic Plan and monitored in accordance with Article 128 of Regulation (EU) 2021/2115. The data and documentation relating to the current calendar or marketing year, and to the previous 10 calendar years or marketing years, shall be accessible for consultation through the digital databases of the competent authority of the Member State.
- **Legal reference related to vineyard registers.** Article 145 of the Regulation (EU) 1308/2013 requires

that the Member States maintain a vineyard register containing updated information on production potential. The updated information contained in the vineyard register shall include, at minimum, the details and specifications set out in Annexes III and IV to Regulation (EU) 2018/273 related to each winegrower.

- **Legal reference related to checks.** Administrative checks shall, where appropriate, include cross-checks with, inter alia, data from the integrated administration and control system, in accordance with Art. 37(2) of the Regulation (EU) 2018/273.
- **Legal reference related to geographical area.** Article 6 of the Regulation (EU) 34/2019 (Geographical area) requires that the demarcated geographical area used for the protection of designations of origin (PDO) and geographical indications (PGI) shall be defined in a precise way that presents no ambiguities, referring as far as possible to physical or administrative boundaries.
- **Legal reference relating to production and market information notifications:** Regulation (EU) 1185/2017, Annex III "Requirements relating to production and market information notifications as referred to in point (b) of Article 12 (1185/2017): 8. Wine sector products", requires sending the yearly declaration to the EC in an electronic form.

Legal reference related to declarations and inward and outward registers (not mandatory in digital form):

- **Legal requirements related to declarations.** In accordance with Chapter V of Regulation (EU) 2018/274, Wine producers are to submit their production, stock, harvest and marketing declarations (as per Article 34 of Regulation (EU) 2018/273).
- **Legal reference related to inward and outward registers. In accordance with Chapter IV of Regulation (EU) 2018/274**, operators are required to keep inward and outward registers recording the entry and withdrawal of each batch of wine products, with information on the category of product, and the operations specified in Article 29 of Delegated Regulation (EU) 2018/273 when carried out on their premises. The records can be paper-based or digital; or included as part of a declaration.
- **Legal reference related to the register of traders involved in the marketing of fruit and vegetables:** Under Article 10 of **Commission Implementing Regulation (EU) No 543/2011**, Member States are to establish a database of traders in fruit and vegetables listing, under the established conditions, the traders involved in the marketing of fruit and vegetables for which standards have been laid down pursuant to Article 113 of Regulation (EC) No 1234/2007.
- **Legal reference related to the collection of data concerning the availability on the market of organic and in-conversion plant reproductive materials, organic animals and organic aquaculture juveniles.** Each Member State shall (in accordance with Regulation (EU) **2018/848,** ensure that a regularly updated database is established for the listing of organic and in-conversion plant reproductive materials, excluding seedlings, but including the seed potatoes available on its territory.

- **Scope:** the checklist assists officials in
  - The assessment of gaps in currently established registers,

○ indicating gaps, highlighting possibilities and opportunities for their integration and interconnectivity, and ○ the assessment of the share of resources for food production covered by established registers		
• **Checklist**		
IACS setup	***Yes/No***	***Description***
○ Has the Integrated Administration and Control System (IACS) been established in line with the CAP Horizontal Regulation, Chapter II?		
○ Has the Land Parcel Identification System (LPIS) been established in line with Article 68 of the CAP Horizontal Regulation?		
○ Has the Beneficiary Identification System (SIB) been established in line with Article 71 of the CAP Horizontal Regulation?		
○ Has the Geospatial Aid Application System (GSA) been established in line with Article 69 of the CAP Horizontal Regulation?		
○ Has the control and penalty system been established in line with Article 72 of the CAP Horizontal Regulation?		
○ Has the area monitoring system been established in line with Article 70 of the CAP Horizontal Regulation?		
○ Has the animal identification and registration system (AIR) been established in line with Part IV, Title I, Chapter 2, Section 1 of Regulation (EU) 2016/429?		
○ Has the system for payment entitlements (SIRPE) been operated in line with Article 73 of the CAP Horizontal Regulation (if applicable)?		
○ Has Digital document and archives management been established as per Regulation (EU) 2116/2021 Art. 67)?		
○ Have systems been established under IACS been designed in such way that provide indicators to the CAP strategic plan management system in line with the IACS data exchange and integration between the electronic databases and the geographic information systems in accordance with the CAP Horizontal Regulation, Article 66		
○ Have systems been established for IACS data exchange that ensure the data sets collected through the integrated		

system are used for the purposes of the INSPIRE directive, Statistical exchange in line with CAP Horizontal Regulation, Article 67?		
○ Have systems been established for the re-use of IACS data falling under the thematic categories set out in Annex I to the Open Data Directive and held by public sector bodies among the existing documents to which that Directive applies: Geospatial, Earth observation and environment, Meteorological, Statistics, Companies and company ownership and Mobility - in line with Implementing Regulation on high-value data?		
Sector-specific registers	***Yes/No***	***Description***
○ Is there a Vineyard register in place (as per Regulation (EU) 1308/2013)?		
○ Has the Vineyard register been integrated with the Land parcel identification system?		
○ Is there an Organic production register in place (as per Regulation (EU) 834/2007 or Regulation (EU) 2018/848)?		
○ Is there a Register of traders of fruit and vegetables (as per Regulation (EU) 543/2011)?		
○ Is there a Register of traders of fruit and vegetables (as per Regulation (EU) 543/2011)?		

Resources registered in the agri-policy registers and IACS

	No of farms	Coverage of farms (%)	Coverage of land/animals (%)	Online accessible (Y/N)	Data are prefilled from the official databases (%)	Compliance with statistical data requirements (%)	Compliance with reporting requirements (%)	Compliance with EU common data space
Integrated administration and control system (IACS)								
Farm register								
LPIS			N/A					
GSA								
Control and penalty system								

Area monitoring system			N/A					
On-the-spot control								
Registers								
Vineyard register			N/A					
Fruit and vegetable traders								
Organic producers register								

1.4 Monitoring, reporting and accreditation

- **Legal reference:** Article 67 of the CAP Horizontal Regulation states that the Member States shall record and keep any data and documentation related to the annual outputs reported in the context of the annual performance clearance referred to in Article 54, and the reported progress towards the targets set out in the CAP Strategic Plan and monitored in accordance with Article 128 of Regulation (EU) 2021/2115. Data and documentation relating to the current calendar or marketing year, and to the previous 10 calendar or marketing years shall be accessible for consultation through the digital databases of the competent authority of the Member State.
- **Legal reference:** Annex I to the CAP Horizontal Regulation includes accreditation criteria for CAP-paying agencies:
  - **Accounting** is to record all payments made from the separate accounts of the paying agency for EAGF and EAFRD expenditures in the form of an information system, and prepare periodic summaries of expenditures, including monthly (for the EAGF), quarterly (for the EAFRD) and annual declarations to the Commission. The paying agency's accounts shall also include the assets financed by the EAGF and the EAFRD, in particular those concerning intervention stocks, uncleared advances, securities and debtors.
  - **Procedures for the reporting of the performance of interventions referred to in the CAP Strategic Plan Regulation** shall be supported by an information system for the collection, recording and storage, in a computerized form, of data relating to each claim and operation. In addition, the system shall provide a breakdown of all relevant output indicator data for each intervention to guarantee that the annual performance reporting shows that the expenditure was made in accordance with Article 37 of CAP Horizontal Regulation, as well as the result

indicator data, including targets and milestones. ○ **The security of information systems** shall be certified in accordance with the appropriate standards for the accreditation criteria.		
• **Scope:** The checklist aims to aid officials in the assessment of mandatory requirements with regards to the information systems to be established for financial and non-financial monitoring and for the reporting of policy implementations, and to ensure that the information systems have been developed and managed in accordance with best practices and standards.		
• **Checklist**		
Managing authority	***Yes/No***	***Description***
○ Has an information system for the management of the CAP strategic plans been established and interconnected with the Paying agency reporting system, in line with CAP strategic plan regulation 2115/2021 Article 130?		
Paying agency	***Yes/No***	***Description***
○ Has a Paying agency reporting system (as required by Article 63(5), point (a), of the Financial Regulation) been developed?		
○ Have accounting systems been established in line with the Accreditation criteria for CAP-paying agencies, Annex I?		
○ Have the performance reporting procedures for the interventions referred to in the Cap Strategic Plan Regulation been developed in line with the Accreditation criteria for CAP-paying agencies, Annex I?		
○ Has the Information systems security been certified as per the Accreditation criteria for CAP-paying agencies, Annex I?		
○ Has a single webpage been established for the publication of information relating to the beneficiaries (as per Article 98 of EU. Reg. 2116/2021?		
Digital skills need assessment for the management and implementation of agri-policies		
Policy design	***Yes/No***	***Description***
○ Has training or technical assistance been provided in the approaches to CAP programming with regard to digital transformation?		
○ Are there staff in place with skills in the use of advanced policy analysis and statistical tools?		
○ Are there staff in place with skills in the compilation of		

statistical data and data from the agricultural databases with advanced skills in agricultural statistics, CAP and national databases?		
Policy implementation - Paying Agency		
Organization and management of information systems	***Yes/No***	***Description***
○ Are there separate organizational units with adequate staffing within the Paying agency structure?		
○ Number of staff?		
○ Has certification been acquired, or IT audits conducted to check the compliance of EU requirements with the IT systems?		
○ Is there a written IT strategy for the Paying agency?		
○ Have information security policies been created, and are the staff aware of them?		
○ Is the segregation of duties respected within the organization of unit (s) responsible for the management of the information systems?		
○ Are the controls based on a risk assessment?		
○ Have manuals been developed and have work positions been defined?		
○ Have training programmes been developed for every working position?		
Technical support and administration	***Yes/No***	***Description***
Is the technical staff skilled in the management of:		
○ Assets?		
○ user support, IT capacity management, communications, incident management?		
○ data availability, backup and continuity management?		
Systems and database administration	***Yes/No***	***Description***
○ Are there any technical staff skilled in system and database administration?		
Software development	***Yes/No***	***Description***
○ Is there a software development methodology in place?		

○ Are there any software development staff, and are the users skilled in the software development lifecycle processes?		
○ Are there any software development staff skilled in programming?		
○ Are there software development staff skilled in the use of geospatial data and information systems?		
○ Are there any software development staff skilled in the use of document management information systems?		
Information security management	***Yes/No***	***Description***
○ Are there written procedures in place defining the tasks required for information security management?		
○ Are there written procedures in place defining the tasks related to operation and supervision reporting?		
Procurement, contracting and monitoring	***Yes/No***	***Description***
○ Are there staff specialized in the preparation of IT-related purchase and service contracts?		
○ Are there staff specialized in procurement procedures related to IT-related tenders?		
○ Are there staff with experience in the acquisition of IT equipment and services?		
○ Are there staff skilled in the preparation of memoranda of understanding and outsourcing contracts with external parties?		
Internal audit	***Yes/No***	***Description***
○ Are there staff skilled in the auditing of CAP information systems?		

Part II: Checklist on opportunities to reduce administrative burdens and increase simplification through e-governance.

2.1 Reduction of administrative burden and simplification		
• **Legal references related to the measures to reduce administrative burdens and to ensure simplification:** In accordance with Article 6 of the CAP Horizontal Regulation, Member States, with the support of the Commission, shall take appropriate measures to reduce administrative burdens and ensure simplification in the implementation of the CAP.		
• **Scope:** The aim of the checklist is to aid officials in the assessment of policy actions, leading to better implementations through digitalization: ○ Assessment of availability of data for pre-filled application forms; ○ Identification of opportunities to enhance e-governance in the field of agriculture so as to reduce the administrative burdens of public institutions and farmers through the use of digital technologies, and the re-use of already established data collections; ○ Assessment of efficiency in the implementation of policy interventions		
Applications - availability and submission	***Yes/No***	***Description***
○ Are the applications available online for download?		
○ Are the application forms available online for direct data entry, and to be printed and submitted on paper?		
○ Are the application forms available online for direct data entry, to be printed and submitted through the use of an ID certificate?		
○ Are there pre-filled applications containing data from the farm register?		
Availability of data for pre-filled application forms		
Are there existing agri collection available for the following data that could be used to pre-fill the application forms?	***Yes/No***	***Description***
○ Personal data on the farmer		
○ Data on the location of the farm		
○ Data on the bank account of the farmer		
○ Data on certifications		
○ Data on other farmers for joint applications		

Data on family members	***Yes/No***	***Description***
○ Personal data on family members		
○ Data on unpaid working hours by family members		
Data on land and animals on the farm	***Yes/No***	***Description***
○ Graphical and numerical land-use data		
○ Data on the type of land use		
○ Data on the animals on the farm		
○ Average value of animals unita " LU " on the farm		
Data on the equipment and buildings related to agricultural production and on-farm processing	***Yes/No***	***Description***
○ Data on mechanization and equipment on the farm		
○ Data on the supported mechanization and equipment on the farm		
○ Data on farm buildings, their locations, capacities and uses		
○ Data on farm building certificates - food production and animal welfare		
○ Data on supported investments related to buildings on the farm		
Data certificates and permits	***Yes/No***	***Description***
○ Are there any building permit data?		
○ Are data available on any other certificates required as proof of eligibility for investment?		
Data on business performance	***Yes/No***	***Description***
○ Are financial data available for assessment of viability of business plans from other registers (such as FADN)?		
○ Aare data provided on the environmental, spatial and social conditions required for the design of a business plan, available from other collections?		
Use of simplified cost options	***Yes/No***	***Description***
○ Have interventions been implemented that make use of		

simplified cost options?		
○ Have interventions been implemented that make use of standardized investment configurations based on simplified cost options?		
○ Have reference price databases been established that could support the application of simplified cost options for certain investments?		

Assessment of efficiency of interventions (IPARD programme) - processing efficiency

							Processing		
IPARD or IPARD-like or national measures	Number	Rejected (incomplete)	Refused (non-compliant)	Contracted	Use of simplified cost options	Updated reference price database	Average time for processing of applications	Of those time for on-the-spot control	Average time for processing of payment claims
	No	%	%	%	Yes/No	Yes/No	Days		
IPARD M1									
IPARD M3									
IPARD M7									
Small farmer's investments									
Rural infrastructure									

LEADER									
Technical assistance									
IPARD M4									
IPARD M11									

Part III: Checklist to aid the assessment of needs and opportunities for the inclusion of policy strategies and interventions in support of digital agriculture

3.1 Use of digital technologies supporting farm advisory services and AKIS		
• **Legal reference:** Article 15(4) of the CAP Strategic Plan Regulation states that "Farm advisory services shall be adapted to the various types of production and farms, and shall cover at least the following: [...] (f) digital technologies in agriculture and rural areas [...] (g) the sustainable management of nutrients, including, from 2024 at the latest, the use of a Farm Sustainability Tool for Nutrients."		
• **Scope:** the checklist aids officials in the identification of opportunities to make use of digitalization in advisory on several levels, and in the design of approaches and action plans for their application: ○ contributing to the availability of advisors (i.e. webpage containing a list of advisors, and their locations, specializations, contacts and the possibility of scheduling an advisory activity) ○ contributing to the dissemination of information (i.e. webpages containing advice and accepted practices related to food production) ○ contributing to the strengthening of the advisory service through regular knowledge exchanges with scientific and research institutions ○ contributing to the continuous learning of advisors and increasing their advisory capacity (through the inclusion also of private advisory services and intergenerational knowledge exchanges) using digital knowledge transfer and certification tools and ○ contributing to raising efficiency in food production through the use of FADN, with follow-up advisory and research actions		
• **Checklist**		
Availability and communication activities of advisory services	***Yes/No***	***Description***
○ Is there a webpage that supports searches for agricultural advisors that details their specializations?		

○ Is an electronic tool available for the scheduling of advisory services?		
○ Are there any webpages containing updated information on the best practices in agricultural production?		
○ Is digitalization used to provide advice to food producers regarding best production practices (such as technical data sheets and instructions for agricultural production)?		
○ Are there any electronic tools for the provision of yearly training to farmers?		
○ Are there any electronic tools for the provision of online advisory services?		
○ Are there tools in use by advisory service providers for the monitoring and recording of soil and other environmental conditions?		
Use of innovative approaches and AKIS		
○ Are there any policy activities that support the registration of Innovation partnerships?		
○ Are there electronic tools to aid searches for partners in Innovation partnerships?		
○ Are there any electronic tools available for the digital signing of cooperative Innovation partnership agreements?		
○ Are there any electronic tools supporting the preparation of projects under Innovation partnerships?		
○ Are there any actions in farm advisory in collaboration with scientific institutions established in fostering of short supply chains with the use of digital tools?		
Periodic training for farmers, advisory and information exchange		
○ Are there any digital tools available supporting the online training of farmers in agricultural practices, standards and regulatory requirements, and covering the yearly training requirements related to agricultural interventions?		
○ Are any digital tools available for the exchange of up-to-date knowledge between the advisory service providers and academic institutions?		
○ Are there any digital tools available for the acquisition d maintenance of advisory skills with periodical certification?		

Follow-up activities and research		
○ Is the advisory service provider using FADN or similar farm accounting digital data collection to provide advice to individual farmers		
○ Are there any follow-up activities based on the analysis of FADN and advisory exchange with farmers resulting in improved agri-technical measures, improved seeding materials and the launch of improvement programmes?		
○ Are there any digital tools in place that make use of information from the advisory service providers and farmers that could aid researchers in addressing problems and initiating actions for improvement?		

3.2 Opportunities for design of policy interventions for digital agriculture

- **Legal reference**: Article 114 (b) of the CAP strategic plan regulation requires Member States to provide "a description of their strategy for the development of digital technologies in agriculture and rural areas, and for the use of those technologies to improve the effectiveness and efficiency of the CAP Strategic Plan interventions".

- **Scope:** This checklist aims to assist the officials in:
  - the identification of opportunities to increase the efficiency of interventions related to food production and food availability through investments into digital and innovative technologies.
  - the identification of opportunities to increase the efficiency of interventions aimed at increasing the quality of life in rural areas through investments and services driven by digital and innovative technologies.

Efficiency of food production

Investments in digital and innovative technologies	***Yes/No***	***Description***
○ Have there been any investments in/are there any organizations offering a rental service for drones and other high-technology agri-tools that could contribute to rational use of non-organic substances in agricultural production and the reduction in food waste?		
○ Have any investments been made into technologies that could contribute to food production with lower losses and lower environmental impacts?		
○ Are services available for the scheduling of agricultural activities and		

inputs (labour, machinery, manure, seeds and seedlings, harvesters, transport)?		
○ Are there any updated agri-weather forecast services available providing early warning messages with supporting advice?		
○ Are there any electronic tools available that could support farmers in farm management and that are also connected with FADN?		
○ Is there a digital **Marketplace** that can support food producers in the purchase of inputs, trade and the organization of logistics (such as storage capacities), providing also support for invoicing and contracting?		
Cooperation	***Yes/No***	***Description***
○ Are there any digital tools available that can support the registration of cooperation of small producers for application for investments?		
○ Are there any digital tools available that could support the creation and administration of virtual producer organizations with the potential to grow into EU-recognized institutions?		
○ Are there any digital tools available that support digital clustering, including contracting?		
○ Are there any tools that could be used in support participation of local schools with local producers in school-food provision, including production planning and contracting?		
Food quality schemes	***Yes/No***	***Description***
○ Is there an integrated set of official numeric and spatial data (similar to the producers and growers file in the Vineyard register) detailing production, processing and sales capacities and locations that would support PDO/PGI schemes and other quality schemes in planning?		
○ Is there a tool that would support searches for partners within a designated area for participation in a quality scheme?		
○ Are there services available for the joint transportation of agricultural and food products from rural to urban areas?		
○ Is any support provided for the organization of “branded stands” of branded agricultural products in urban areas?		
○ Is any digital support provided for the management of the supply of		

“branded stands” with branded agricultural products in urban areas?		
School food schemes	***Yes/No***	***Description***
○ Is any digital support provided for the management of the supply of food to schools?		
Rural areas		
Establishment of Local Action Groups (LAGs)	***Yes/No***	***Description***
○ Is there any digital advisory support available contributing to the establishment of local action groups - such as for partner searches?		
○ Is any support provided in the form of agreement templates or other formal documents fostering public-private cooperation in rural areas that could contribute to the faster establishment of LAGs through the use of digital technologies?		
○ Is any support provided for the registration of LAG that makes use of electronic IDs?		
Design of local development strategies (LEADER or Smart Village)	***Yes/No***	***Description***
○ Are any electronic data available supporting the design of LEADER local development strategies, as envisaged by the resource?		
○ Are data available in an electronic medium supporting the design of Smart Village strategies, as envisaged by the compendium?		
○ Have any digital tools been developed that support the design of local development strategies?		
Local governmental services	***Yes/No***	***Description***
○ Are there any digital tools available for spatial planning support?		
○ Are there any digital tools available in support of PRAG-compliant procurements?		
○ Has a webpage been established listing the services provided by the local government?		
Rural services	***Number***	***Description***
○ What common services are accessible through the Internet (provision of food, home repairs, hairdressers, car repairs, and other		

services offered by local service providers)?		
Financial services (banking)		
○ What medical services are accessible through the Internet?		
○ What social services (kindergartens, elderly population support services, crisis centres) are accessible through the Internet?		
○ What on-demand transport services (transport scheduling/ sharing) are accessible through the Internet?		
○ What common local multiservice facilities exist offering free IT equipment and assistance in the use of digital tools, as well as spaces for different activities in support of the local common wellbeing?		
○ How many villages have the necessary infrastructures for the collection and storage of agricultural products for common use?		
Rural connectivity and skills	***Value (number, %)***	***Comment***
○ How many common local multiservice facilities are there offering free IT equipment and assistance in use of digital tools, as well as spaces for different activities in support of the local common wellbeing?		
○ % of inhabitants in rural areas with electronic IDs?		
○ % of households with computers in the home?		
○ % of households with fixed broadband Internet access?		
○ % of households with high-capacity broadband Internet access (> 100Mb/s)?		
○ % of schools/kindergartens with high-capacity broadband Internet access?		
○ Number of villages with common areas offering free IT equipment and digital access?		
○ Number of people in rural areas possessing basic digital skills?		
○ % of those aged over 55 years with basic digital skills?		
○ % of people in rural areas making use of e-banking?		
○ % of people in rural areas using e-mail?		

○ % of people in rural areas with advanced digital skills?		
○ % of staff in municipal offices skilled in use of spatial planning tools?		
○ % of staff in municipal offices skilled in use of PRAG rules?		

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