DIGITISATION: ECONOMIC AND SOCIAL IMPACTS IN RURAL AREAS

D4.1 POLICY ANALYSIS AND ROADMAP

TEN BUILDING BLOCKS TO SUPPORT POLICIES TOWARDS A MORE INCLUSIVE AND SUSTAINABLE RURAL DIGITALISATION IN EUROPE

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MARÍA ALONSO-ROLDÁN (UCO),
MARÍA MAR DELGADO-SERRANO (UCO),
GIANLUCA BRUNORI (UNIPI)

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Authors	María Alonso-Roldán (UCO), María Mar Delgado-Serrano (UCO), Gianluca Brunori (UNIPI)
Work Package Leader	UCO
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List of Acronyms

AI	Artificial Intelligence
AKIS	Agricultural Knowledge and Information System
BCO	Broadband Competence Office
CAP	Common Agricultural Policy
CEBF	Connecting Europe Broadband Fund
CEF	Connecting Europe Facility
CF	Cohesion Fund
COGECA	General Confederation of Agriculture Cooperatives
COPA	Committee of Professional Agricultural Organisations
DESI	Digital Economy and Society Index
DIH	Digital Innovation Hub
DII	Digital Intensity Index
DSS	Decision Support System
EAFRD	European Agricultural Fund for Rural Development
EC	European Commission
ECAT	European Centre for Algorithmic Transparency
EDIF	European Digital Innovation Hub
EFSI	European Fund for Strategic Investments
EIB	European Investment Bank
EIF	European Interoperability Framework
EIP	European Innovation Partnership
EIP-AGRI	European Innovation Partnership for Agricultural Productivity and Sustainability
EIT	European Institute of Innovation and Technology
EMFAF	European Maritime, Fisheries and Aquaculture Fund
ENRD	European Network for Rural Development
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Fund
ESF+	European Social Fund Plus
ESPON	European Observation Network for Territorial Development and Cohesion
EU	European Union
FAIR	Findable, Accessible, Interoperable and Re-usable

FISE	Forest Information System for Europe
GDPR	General Data Protection Regulation
GIS	Geographical Information System
H2020	Horizon 2020
I3	Interregional Innovation Investment
ICT	Information and Communication Technologies
IoT	Internet of Things
IRIS	Infrastructure for Resilience, Interconnectivity and Security by Satellite
JRC	Joint Research Centre
JTF	Just Transition Fund
LL	Living Lab
LTVRA	Long-Term Vision for Rural Areas
MIM	Minimal Interoperability Mechanism
NEI	Needs, Expectations and Impact
NGA	Next Generation Access
NGO	Non-Governmental Organisation
NIS	Network and Information Security
OECD	Organisation for Economic Cooperation and Development
R&I	Research and Innovation
REACT-EU	Recovery Assistance for Cohesion and the Territories of Europe
RIA	Research and Innovation Action
RIS3 (or s3)	Research and Innovation Strategies for Smart Specialisation
RRF	Recovery and Resilience Facility
RRI	Responsible Research and Innovation
SDGs	Sustainable Development Goals
SESI	Socio-Economic Sustainability Indicators
SMEs	Small and Medium-sized Enterprises
UN	United Nations

Executive summary

The DESIRA project aims to enhance the ability of society and political bodies to address the challenges arising from digitalisation in agriculture, forestry, and rural areas. Within the framework of Responsible Research and Innovation (RRI), the DESIRA Policy Roadmap has been developed using an integrated approach. It provides policymakers with insights and strategies to design an inclusive and sustainable rural digitalisation that aligns with the Sustainable Development Goals (SDGs).

The Policy Roadmap draws on data from various sources, including National Policy Reports analysing policies influencing rural digitalisation in the 15 participating countries, as well as a comprehensive review of the existing policy framework shaping rural digitalisation in Europe. Challenges in policy implementation and impact assessment, as well as disparities between urban and rural digitalisation, have been identified. These challenges include limited availability of rural data, difficulties in evaluating policy impact, struggles in following the rapid pace of changes in technology and policy development, and coordination issues among administrative departments.

European digitalisation policies and policies related to agriculture and rural areas (Common Agricultural Policy and Cohesion Policy) have had the most significant influence on rural digitalisation. The European Commission (EC) acknowledges the societal implications of digitalisation and has assumed a leading role in guiding the transformation with an individual-centric approach and emphasis on protecting rights. This approach is complemented with a "ruralisation" of European policies with the Long-Term Vision for Rural Areas and the proposed rural proofing mechanism.

To achieve effective rural digitalisation in Europe, it is recommended to prioritise it as a strategic objective. DESIRA would like to contribute to this with some guiding principles. This involves developing strategies that address societal issues, engaging rural stakeholders, ensuring coherence with other rural policies, and involving users in steering technology development, especially in the endorsement of ethical values (as proposed in DESIRA Ethical Code). In the rural digitalisation policymaking process, it is crucial to assess the current state of digitalisation in rural areas, adopt flexible approaches that accommodate rapid changes, consider diverse pathways based on contextual differences across rural areas, and extend the focus beyond agriculture and the timeframe of the Common Agricultural Policy (CAP). The EC should provide the necessary instruments to facilitate effective rural digitalisation, including mechanisms for alignment, monitoring, and accountability among Member States, and at the same time, flexible enough to allow upscaling or downscaling depending on each specific context.

Rural digitalisation strategies should not solely focus on technology innovations and market-driven approaches. Instead, strategies should guide technological pathways and integrate them with specific contexts. Digitalisation is part of a broader European "twin" transition aligned with the SDGs, needing transformative policies that address root causes and challenge the established routines, paradigms, and alliances.

Transformative policies should have clear directionality, reflexivity, and market integration. Following this approach, we propose ten building blocks which can support policies towards more inclusive and sustainable rural digitalisation:

1. **To ensure accessible, high-quality connectivity and digital infrastructures in rural areas.**
2. **To increase interoperability of digital technologies for rural areas, forestry and farming.**
3. **To improve rural, forest and agriculture data governance and data management following ethical principles.**
4. **To streamline digital education and competences adapted to different groups in rural areas**
5. **To promote innovation and digital ecosystems in rural areas.**
6. **To provide easy-to-use and affordable digital services to rural communities, farming and forestry.**
7. **To mainstream digital solutions to support service provision and administrative routines in rural areas.**
8. **To support data-driven decisions in farming, forestry and rural areas.**
9. **To monitor rural digitalisation policies progress, impacts and efficiency.**
10. **To raise awareness about the value of rural areas and to foster public engagement in rural issues**

These building blocks and their specific objectives are the result of the data gathered through the fifteen National Policy Analyses and the European policies review, which were then enriched through activities conducted both within DESIRA (fifteen National Policy Auditions, the Rural Digitalisation Forum and the General Assembly) and outside the consortium (the Rural Pact Conference, the SmartAgriHubs final event).

The main messages of this Policy Roadmap were shared in DESIRA Final Conference and have been included in the Declaration "Together for a more inclusive and sustainable rural digitalisation in Europe" (see **Annex 8.2**), endorsed by the conference participants. This Declaration will be shared to increase support from other rural stakeholders.

1 Introduction

The project DESIRA aims to improve the capacity of society and political bodies to respond to the challenges that digitalisation generates in agriculture, forestry, and rural areas. More specifically, it wishes to increase the uptake of societal concerns in policy and innovation related to information and communications technology (ICT) and to align digitalisation scenarios with societal needs and expectations.

As a result, the DESIRA Policy Roadmap has been produced within the framework of Responsible Research and Innovation (RRI), following an integrated work approach. This document presents the building blocks and the policy pathways to design an inclusive and sustainable rural digitalisation that can positively contribute to Sustainable Development Goals (SDG). The aim is to provide policymakers with an understanding of the issues that need attention and the potential strategies to address them.

The Policy Roadmap has sourced data from different activities organised in the DESIRA Living Labs, such as the policy recommendations proposed in workshops, the scenario reports and the policy briefs[2]. Moreover, the *Needs, expectations, and impacts of digitalisation in European agriculture, forestry and rural areas* (NEI report) from Work Package 2 has guided the formulation of the specific recommendations for policy making (see **3.1 Responsible Research and Innovation and SDGs**). Yet, the core of this document is constituted by the recommendations extracted from the *National policy reports*[3] which are detailed analyses of the policies influencing rural digitalisation in the 15 countries represented in the project. Feedback about the recommendations has been gathered from Consortium members through Policy Auditions as well as from stakeholders outside the consortium through various activities (Rural Digitalisation Forum, Rural Pact Conference, etc.). It should be mentioned the difficulties to align the timing of the research activities as proposed in DESIRA Grant Agreement with the political times (e.g., the National Policy analyses were done before the Common Agricultural Policy Strategic Plans were presented and before the Recovery and Resilience Facility was approved). The Roadmap also encompasses a comprehensive review of the robust policy framework that currently shapes rural digitalisation in Europe. We have made diligent efforts to incorporate this framework into the Roadmap, taking into account the most recent policies released, with the latest one mentioned in the text being issued on April 18, 2023.

This document starts with an introduction of the different activities deployed to produce the Roadmap. It also describes the approach followed to build the policy recommendations (RRI, alignment with SDGs and the Long-Term Vision for Rural Areas -LTVRA-, and transformative policies).

2 Documents available here: https://desira2020.eu/work-packages-and-deliverables/
3 Reports available here: https://desira2020.eu/resources/national-policy-analyses/

Then, an introduction to the European Union (EU) policy context is provided. Finally, the ten building blocks which can support policies towards more inclusive and sustainable rural digitalisation are presented, namely:

1. **To ensure accessible, high-quality connectivity and digital infrastructures in rural areas.**
2. **To increase interoperability of digital technologies for rural areas, forestry and farming.**
3. **To improve rural, forest and agriculture data governance and data management following ethical principles.**
4. **To streamline digital education and competences adapted to different groups in rural areas**
5. **To promote innovation and digital ecosystems in rural areas.**
6. **To provide easy-to-use and affordable digital services to rural communities, farming and forestry.**
7. **To mainstream digital solutions to support service provision and administrative routines in rural areas.**
8. **To support data-driven decisions in farming, forestry and rural areas.**
9. **To monitor rural digitalisation policies progress, impacts and efficiency.**
10. **To raise awareness about the value of rural areas and to foster public engagement in rural issues**

For each building block, we provide information about the most influencing EU policies, the challenges, and the strategies to overcome them. Additionally, we indicate specific objectives to operationalise the blocks. Where possible, we also share potential resources, best practices, and existing monitoring indicators. A final section reflects on the directionality of policies to achieve sustainable and inclusive rural digitalisation in Europe.

A shorter version of the DESIRA Policy Roadmap can be found in **Annex 8.3 DESIRA Policy Roadmap for dissemination** to maximise dissemination. The main messages of the Policy Roadmap were shared during DESIRA Final Conference (Brussels, 26th and 27th of April, 2023) and included in the DESIRA Declaration "Together for a more inclusive and sustainable rural digitalisation in Europe" (see **Annex 8.2**) endorsed by the conference participants and that will be circulated to increase support from other rural stakeholders.

2 Timeline

Several activities have contributed to create the DESIRA Policy Roadmap. During data collection, information from the Living Labs activities and other work packages (e.g., Socio-economic Sustainability Indicators and Needs, Expectations and Impact appraisal) was combined with the material from the National Policy Analyses to generate a first list of policy recommendations. Internal DESIRA events -such as the Rural Digitalisation Forum and the Policy Auditions- and external -Rural Pact Conference, SmartAgriHubs final event- have contributed to refine and to validate such recommendations -feedback-. The dissemination activities of the Policy Roadmap started with the DESIRA Final Conference and will continue in the following months. A summary of the most relevant activities contributing to build the Roadmap is provided in Table 1.

Tab. 1: Activities contributing to feed into the DESIRA Policy Roadmap.

	ACTIVITY	COORDINATOR	DATE
DATA COLLECTION	**Socio-economic Sustainability Indicators** Through an iterative, participatory process, a final set of 65 Socio-Economic Sustainability Indicators were chosen to assess the impact of digitalisation in agriculture, forestry, and rural areas. These indicators were then used to qualitatively measure the impact of digitalisation across 21 Living Labs (LLs) towards the DESIRA sustainability targets. The resulting policy recommendations were used as a basis for this work. Deliverable available here: https://desira2020.eu/wp-content/uploads/2022/06/D2.3-SESI.pdf.	DESIRA	Nov 2019 - May 2022
	Needs, Expectations and Impact appraisal The LLs applied the concept of Socio-Cyber-Physical System as an analytical lens through which to research and gain insights on its past and present impacts. To perform their Needs, Expectations and Impact (NEI) assessments, LLs used a mix of data collection tools (desk research, semi-structured interviews, a standardised online survey, and interactive workshops). The report can be downloaded here: https://data.d4science.net/T2PR.	DESIRA	May 2020 - Jul 2021
	Living Labs scenarios workshops Each LL conducted workshops to develop possible future scenarios for digitalisation in 2031. Topics ranged from digitalisation of public administration in rural areas or the use of robots for weed control in organic vegetable farming. Diverse scenarios were elaborated in each LL, including a rather positive scenario as well as a more negative scenario. These scenarios were turned into digital stories for dissemination. A report with the methodology to draft digital stories is available here: https://desira2020.eu/wp-content/uploads/2022/06/D3.6_Digital-stories-report.pdf.	DESIRA	Nov 2020 – Nov 2021
	Policy briefs The scenario development exercises were summarised in short documents illustrating the policy options to mitigate the negative impacts associated with digitalisation or to support digital trends associated with positive impacts. Documents available here: https://desira2020.eu/resources/policy-briefs/.	DESIRA	Nov - 2021

	ACTIVITY	COORDINATOR	DATE
DATA COLLECTION	**National Policy Analyses** DESIRA partners from 15 countries reviewed the policy mix at local, regional and national level associated to the digitalisation in rural areas. The revision included legal and regulatory frameworks, investments or programmes that fund initiatives boosting digitalisation. All the national policy reports can be read here: https://desira2020.eu/resources/national-policy-analyses/.	DESIRA	Dec 2020 - May 2022
FEEDBACK	**Rural Pact Conference** A first set of recommendations extracted from the previous activities was introduced in the Rural Pact Conference for validation and priority setting.	External, EC	15 and 16 June 2022
	Policy auditions The policy auditions were originally envisaged as sessions within the LLs targeted at policy makers to discuss, refine and validate the results of the Scenario report synthetised into Policy Briefs. Yet the 15 sessions organised by DESIRA partners were also valuable feedback activities for the Policy Roadmap.	DESIRA	Jun 2022 – Nov 2022
	SmartAgriHubs final event A dedicated workshop was organised to discuss and prioritise the building blocks of the DESIRA Policy Roadmap.	External	Sep 2022
	Rural Digitalisation Forum A specific session of the Rural Digitalisation Forum was devoted to discussing the draft Policy Roadmap.	DESIRA	Nov 2022
	DESIRA General Assembly A workshop was organised to gather feedback about the draft Policy Roadmap.	DESIRA	Jan 2023
DISSEMINATION	**DESIRA Final Conference** A session of the Conference was dedicated to present the Policy Roadmap.	DESIRA	April 2023

3 DESIRA Policy Roadmap approach

The DESIRA Policy Roadmap has been shaped by the approach of the Responsible Research and Innovation (RRI), the UN Sustainable Development Goals (SDGs), the EU Long¬-Term Vision for Rural Areas and transformative policies.

3.1 Responsible Research and Innovation and SDGs

Sustainable digital transformation can only be achieved with a good understanding of the intended and unintended benefits, challenges and obstacles that digital technologies can bring. Policies should avoid fostering only market-based digitalisation and should be able to provide directionality to the technological pathways and to integrate them with the specificity of the contexts where technology applies. This implies the adoption of the RRI principles into the digitalisation strategies at all levels, a) including users and stakeholders in the technology development; b) encouraging the anticipation of the consequences of technology adoption and the reflection on it; c) adapt to new information and to changing circumstances; d) open the processes of decisions of technology development.

In a RRI context, all involved actors adopt RRI principles: technology developers involve stakeholders and users from the beginning of the process of innovation and set up accountability schemes; business introduce RRI principles in their technology procurement, identifying the potential trade-offs between profit and public goods; and public administrations establish RRI-related criteria for funding, monitoring, and evaluating innovation projects.

Operationalising the RRI approach, DESIRA engaged agriculture, forestry and rural stakeholders in 21 Living Labs[4] (LLs) established in different European regions to understand the impact of digitalisation on sustainable development and the SDGs. The Socio-Economic Sustainability Indicators (SESI) report (DESIRA Deliverable 2.3[5]) presents the participatory process followed to define the indicators which were then used to qualitatively measure the impact of digitalisation in each LL against sustainability targets. Through scenario development, DESIRA LLs identified the potential consequences of the adoption of digital technologies in specific application scenarios and developed use cases based on the contribution of stakeholders. The policy recommendations derived from this process have been incorporated in this document with the view to contribute positively to the SDGs.

3.2 Transformative policies

Digitalisation is a component of a broader “twin” transition that the EU has pledged to pursue in accordance with SDGs. Transition implies transformative policies, that is, policies able to address the root causes of societal problems and that challenge existing routines, paradigms, and alliances. Transformative policies should be based on directionality, reflexivity, and market integration (see **Table 5**).

4 More information available here: https://desira2020.eu/living-labs/
5 Deliverable available here: https://desira2020.eu/wp-content/uploads/2022/06/D2.3-SESI.pdf

Directionality implies identifying -in a dialogue with stakeholders- clear objectives for digitalisation trajectories. It implies addressing horizontal (between sectors) and vertical (between administrative levels) policy incoherence. For this reason, besides clear objectives, clear roles and responsibilities in the implementation of the objectives should be assigned to actors endowed with sufficient authority, and incentives to the emergence of "institutional entrepreneurs" able to act as change-makers at local, national and EU levels should be provided.

Reflexivity is based on the assumption that transition is, by definition, uncertain, as it will deploy in the future. To reduce the uncertainty and the consequences of wrong pathways, transformative policies should be based on system approaches, participatory foresight, socio-technical experimentation, and organised learning from experiments. A good communication and collaboration between research, users and stakeholders, and policymaking are key here. Transdisciplinarity is the needed transformative approach to research.

Market integration implies managing the levers that will allow sustainable digital innovation to be economically viable: for example, with support to investments, cost compensations, changing administrative rules, and providing support services.

This roadmap proposes a policy framework for a "sustainable and inclusive digitalisation", a digitalisation pathway not only addressed to highly technological farms but one that also supports the agro-ecological transition of the farming sector by sustaining the competitiveness of low-input, circular, diversified, quality-oriented farms, and prevents the digital divide between rural and urban areas and between large and small farms. At the same time, the digitalisation pathway should support forestry sector in the materialisation of the EU Forestry Strategy 2030.

Transformative policies in this field require creating the basic (infrastructural and human capital) conditions for digitalisation, adapting digitalisation to different contexts, favouring digital inclusion, developing digital ecosystems, and designing specific policy tools and adaptive governance models.

3.3 Alignment with the EU Long-Term Vision for Rural Areas

The EU Long-Term Vision for Rural Areas (LTVRA) sees an active role in rural contributing to the EU's digital and green transitions. The EU recognises the opportunities and the importance of rural areas as providers of food, ecosystem services, etc., and, to preserve that, it has defined actions towards stronger, connected, resilient, and prosperous rural communities.

There are two elements that will support achieving the goals of the LTVRA. The first instrument is the *Rural Pact*, a place for stakeholders at all levels to share knowledge and experiences with the Commission acting as a facilitator. The second element is the *Rural Action Plan*, which drives the different EU policy areas and investment instruments to deliver the vision and its shared goals. The Plan will materialise through projects and initiatives, regrouped around flagships containing accompanying actions. For example, to foster the dynamism of rural areas, a *Rural Revitalisation Platform* will be set up as a one-stop shop for projects and funding for rural stakeholders to collaborate. Another example is the *Rural Digital Futures*, an integrated set of actions to boost sustainable digital transformation of rural areas. It

will address rural connectivity, digital technologies, digital skills, and a Rural Digital Index (rearranging existing Digital Economy and Society Index -DESI- indicators) to monitor the progress towards closing the urban-rural digital gap. To support and monitor the implementation of the Rural Action Plan, the Commission has deployed three instruments: (1) a *Rural Proofing* mechanism to monitor how rural areas are integrated into EU's policies, (2) an *EU Rural Observatory* built on an improve set of statistics to centralise the data on rural areas and to share relevant information, and (3) a *Toolkit on EU Funding opportunities for rural areas* to make this information accessible to local stakeholders.

The DESIRA Policy Roadmap is fully aligned with the LTVRA. On the one hand, DESIRA has contributed to develop the vision[6]. On the other hand, the recommendations proposed in this document incorporate LTVRA objectives (see **Table 2**) and the instruments, such as the Rural Pact or the Rural Observatory.

6 Some DESIRA partners (e.g., M Mar Delgado-Serrano) were among the team of experts coordinated by ENRD, who contributed to define the LTVRA. Also, DESIRA briefings were presented to the EC in one of the consultation activities of the LTVRA -a policy session organised on 9 February 2021 by the Research and Executive Agency-. Finally, the Communication considered some of the results coming from DESIRA D1.3 Synthesis Report on the Taxonomy and Inventory of Digital Game Changers

Tab. 2: Contribution of DESIRA Policy Roadmap recommendations to the EU LTVRA

DESIRA POLICY ROADMAP BUILDING BLOCKS	LTVRA (Source: https://rural-vision.europa.eu/action-plan_en)			
	STRONGER Empowered and vibrant local communities. Active part in policy and decision-making processes. Innovative solutions for the provisions of services, making the most of the possibilities offered by digital tools and encouraging strongly social innovation.	**CONNECTED** Being well connected between each other and to peri-urban and urban area. Maintaining or improving public transport services and connections, as well as deepening digital infrastructures.	**RESILIENT** **Preservation of natural** resources, the restoration of landscapes, including cultural ones, the greening of farming activities and shortening supply chain. Key role in the sustainable bio- and circular economy.	**PROSPEROUS** Diversifying economic activities to new sectors with positive effects on employment, and improving the value added of farming and agri-food activities. Sustainable local economic strategies including measures that make their environment attractive to companies and extend digital literacy.
To ensure accessible, high-quality connectivity and digital infrastructures in rural areas		X		
To increase interoperability of digital technologies for rural areas, forestry and farming	X	X		
To improve rural, forest and agriculture data governance and data management following ethical principles	X	X		
To streamline digital education and competences adapted to different groups in rural areas	X	X		X
To provide easy-to-use and affordable digital services to rural communities, farming and forestry		X		
To promote innovation and digital ecosystems in rural areas	X	X		
To support data-driven decisions in farming, forestry and rural areas			X	X

DESIRA POLICY ROADMAP BUILDING BLOCKS	LTVRA (Source: https://rural-vision.europa.eu/action-plan_en)			
	STRONGER Empowered and vibrant local communities. Active part in policy and decision-making processes. Innovative solutions for the provisions of services, making the most of the possibilities offered by digital tools and encouraging strongly social innovation.	**CONNECTED** Being well connected between each other and to peri-urban and urban area. Maintaining or improving public transport services and connections, as well as deepening digital infrastructures.	**RESILIENT** **Preservation of natural** resources, the restoration of landscapes, including cultural ones, the greening of farming activities and shortening supply chain. Key role in the sustainable bio- and circular economy.	**PROSPEROUS** Diversifying economic activities to new sectors with positive effects on employment, and improving the value added of farming and agri-food activities. Sustainable local economic strategies including measures that make their environment attractive to companies and extend digital literacy.
To mainstream digital solutions to support service provision and administrative routines in rural areas	X	X		
To raise awareness about the value of rural areas and to foster public engagement in rural issues	X	X	X	X
To monitor rural digitalisation policies progress, impacts and efficiency	X	X	X	X

4 EU Policy context

For decades, environmental policies (e.g., Habitats Directive, Water Directive) and digitalisation policies (e.g., Digital Single Market) in Europe have developed separately. The **European Green Deal** aims to transform the EU's growth strategy and to become the first climate-neutral continent by 2050, following a just and inclusive transition. The Green Deal incorporates research, innovation and technology as key elements to achieve its goals. Meanwhile, the current EU's digital strategy (**Europe fit for the Digital Decade**) seeks to achieve a suitable transformation for people and businesses while contributing to reaching the European climate-neutrality target. This means that the two main documents guiding the future of Europe are intertwined, merging the green and the digital strands in the so-called "**twin transition**". This framework presents a unique opportunity to develop more holistic policy approaches for rural digitalisation, which, until today, have been shaped independently by the Common Agricultural Policy (CAP), Cohesion Policy, the EU's digital strategy, the European Pillar of Social Rights and policies related to Sustainable Development Goals. How each of these policy strands has influenced rural digitalisation is presented next.

4.1 Digitalisation in rural policies

Rural policies have been hosted within other policy domains since the 1990s, notably agriculture and regional policies (Saraceno, 2013). Relegated to a secondary role, the initial policies influencing rural areas were not deliberative processes, but a result of different rationales introduced at different times to respond to immediate challenges (Delgado-Serrano, 2004). In 2000, rural development became the second pillar of the CAP, and it was included as part of the Agenda 2000 (Publications Office of the EU, 1997). Since then, the concept had increasingly gained relevance and independence until 2021, when President Von der Leyen materialised with the **LTVRA** a very much-needed process to define a future vision for European rural territories (read the dedicated subsection about the **Alignment with the EU Long-Term Vision for Rural Areas**).

The new **CAP** started in 2023. The new CAP is crucial to reach the objectives of the Green Deal[7] and its two core associated strategies: the **Farm to Fork Strategy** (to accelerate the transition towards a sustainable food system) and the **EU Biodiversity Strategy for 2030** (to restore biodiversity and to well-maintain ecosystems). In the new CAP, fostering knowledge, innovation and digitalisation in agriculture and rural areas is a cross-cutting objective. The European Agricultural Fund for Rural Development (EAFRD) shall help rural areas to achieve the goals of the twin transition with an allocation of over EUR 87 billion for the period 2021 to 2027 (EC, 2021g). The CAP Strategic Plans help to deal with the challenges identified in the LTVRA, including job opportunities, depopulation, access and improvement of basic services or connectivity (EC, 2022a).

The second major supporting source for rural areas is the **Cohesion Policy**, which is designed to promote harmonious development within the EU Member States, regions, and territories by strengthening economic, social and territorial cohesion. The 2021-2027 Cohesion Policy programme is more flexible,

7 Of the CAP overall budget, 40 percent should be climate-relevant, actions funded under the CAP should also contribute to the commitment of investing 10 percent of the total EU budget to biodiversity objectives (EC, 2021f).

so it can accommodate new challenges and emerging needs. It has also reduced the complexity by introducing one set of rules for all the funds within it. The new programme is defined in five objectives -which are aligned with the EU priorities- and the first one states: "a more competitive and smarter Europe by promoting innovative and smart economic transformation and regional ICT connectivity". In this sense, the *National/Regional Research and Innovation Strategies for Smart Specialisation* -RIS3 strategies[8]- (now called S3) is an "enabling condition", which means that the countries should have good governance of national or regional smart and specialisation strategies throughout the whole financial period.

Significant investments in people and infrastructure are mobilised in rural areas through the use of European Structural and Investment Funds (ESIF). The ESIF funds with the capacity to influence digitalisation in rural areas are summarised in **Table 3**.

The CAP and Cohesion Policy, together with the New and Reinforced Priorities, compose the EU's **Multiannual Financial Framework**. The 2021-2027 Long-Term Budget reduced the share for the CAP and Cohesion Policy, and it was topped up with the NextGenerationEU, the temporary recovery instrument which helps overcome the social and economic damage caused by the coronavirus pandemic. The NextGenerationEU reinforced other EU programmes, including Cohesion Policy Funds, EAFRD, or the JTF. The main piece within NextGenerationEU is the Recovery and Resilience Facility (RRF), which provides grants and loans to support reforms and investments in the EU Member States. It is worth mentioning that 20 percent of the RRF funds have been allocated to the EU's digital transformation.

Member States have got a great opportunity to foster sustainable and integrated rural development through the CAP Strategic Plans, the Cohesion Policy programme, and the RRF. As stated in the LTVRA, Member States should also capitalise on other EU programmes (e.g., Horizon Europe, InvestEU) and the European Investment Bank to cover existing investment gaps in rural areas.

Tab. 3: ESIF funds with capacity to influence rural digitalisation.

FUND	AIM	RESOURCES FOR RURAL DIGITALISATION
European Regional Development Fund (ERDF)	To correct the development imbalances between EU regions.	It provides funding for key policy areas, including innovation and research or the digital agenda (including investments for high-speed infrastructure). As stated in the Article 10 of the ERDF Regulation, funding should support disadvantaged areas, rural ones in particular.
Cohesion Fund (CF)	To provide financial support to projects relating to environment and transport infrastructure (only for Member States with a gross national income below 90 percent of the EU average).	It supports two specific objectives of the new Cohesion Policy: a greener, low-carbon and circular economy; and a more connected Europe. The Connecting Europe Facility facilitates investments in digital infrastructure.

8 RIS3 strategies are place-based agendas to prioritise research and innovation actions to respond to regional and national challenges, supporting also the less developed and rural regions.

FUND	AIM	RESOURCES FOR RURAL DIGITALISATION
The European Social Fund Plus (ESF+)	To support achieving the European Pillar for Social Rights[9] with investments for actions in employment, education and skills and social inclusion.	It supports the Learning and Skills Network which, at the same time, articulates the implementation of the Digital Skills and Jobs Coalition. The initiative ESF Social Innovation+ aims to facilitate the transfer and upscaling of innovative solutions to the current societal challenges. ESF+ will play a key role to recover from coronavirus pandemic and will be enhanced by resources from the Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU).
The Just Transition Fund (JTF)	It is one of the elements of the Just Transition Mechanism to support the economic diversification and reconversion of the territories most affected by transition towards climate neutrality.	It will facilitate the implementation of the European Green Deal. Investments in digitalisation, digital innovation and digital connectivity are activities supported by the Fund as stated in the Article 8 of the JTF regulation.
European Maritime, Fisheries and Aquaculture Fund (EMFAF)	To achieve sustainable fisheries and marine biological resources.	It shares the EU priorities, including the digital transition and supports investments in digital tools to enable transparent, efficient, and user-friendly fisheries control and monitoring.

4.2 Rural areas in digitalisation policies

The first **Digital Agenda for Europe** was published in 2010 and identified, for the first time, the key enabling role of ICTs in reaching Europe's goals. The document recognised seven key areas for which specific regulations and programmes were developed: Digital single market; interoperability and standards; trust and security; fast and ultra-fast internet access; research and innovation; enhancing digital literacy, skills, and inclusion; and ICT-enabled benefits for EU society. However, this agenda really pushed for the creation of a single digital market, fostered access to digital goods and services, and set up a regulation infrastructure to protect individuals and businesses, including those in rural regions.

9 The European Pillar of Social Rights in 20 principles (read here).

> **DIGITAL AGENDA FOR EUROPE 2010: BROADBAND TARGETS**
>
> Basic broadband for all by 2013: broadband coverage up to 30 Megabits per second (Mbps) for 100 percent of EU citizens.
>
> Fast broadband by 2020: broadband coverage at 30 Mbps or more for 100 percent of EU citizens.
>
> Ultra-fast broadband by 2020: 50 percent of European households should have subscriptions above 100Mbps.
>
> *(EC, 2010)*

The Digital Single Market Strategy, published in 2015, developed the first Digital Agenda further and assigned specific provisions (ESIF EUR 21.4 billion). Rural areas were mentioned concerning two aspects: "Particular efforts are needed to close the digital gap between urban and rural areas", and "The Commission will make specific proposals regarding the coordinated release of the 700 MHz band, which is particularly well-suited for ensuring the provision of broadband services in rural areas".

In April 2019, during the EU's Digital Day, 24 EU member states signed a Declaration of Cooperation: *A smart and sustainable digital future for European agriculture and rural areas*, where they recognised the potential of digitalisation and committed to establishing a Europe-wide innovation infrastructure, to facilitate the use of digital technologies in agriculture and rural areas, and to strength support for research.

The **Second Digital Agenda** (2020-2030) responds to the challenges that digital technologies introduce and set up actions to build safe and secure digital markets. The first strategic document within the Agenda is **Shaping Europe's digital future**, published on 19 February 2020; it establishes three key objectives to support the digital transition of Europe: (1) technology that works for people; (2) a fair and competitive economy and (3) an open, democratic and sustainable society. In this document, the EC committed to updating regulations concerning digital services based on the single market logic, such as the **Digital Services Act Package**, the Network and Information Security Directive containing "measures for a high common level of cybersecurity across the Union" known as ***NIS2***, or the **Artificial Intelligence Act**, among others.

The second strategic document of the Digital Agenda 2030 is the **2030 Digital Compass: the European way for the Digital Decade**, published on 9 March 2021. It presents a vision for 2030 in which citizens and businesses are empowered and enjoy new opportunities thanks to digitalisation, regardless of their location. The Digital Compass defines new connectivity objectives **"by 2030, all European households will be covered by a Gigabit network, with all populated areas covered by 5G"** as well as other objectives related to skills (at least 80 percent of all adults should have basic digital skills), businesses (more than 90 percent of EU small and medium-sized enterprises should reach at least a basic level of digital intensity) or public services (all key public services should be available online). Whereas new and existing digital divides are recognised in the strategy (including urban-rural), the vision seeks to leave no one behind and expects to contribute to improving the resilience of rural communities. The

Path to the Digital Decade policy programme was adopted in September 2021 to ensure reaching the objectives for 2030.

Funding for the Digital Agenda 2030 is mainly based on the **Digital Europe Programme** 2021-2027. It supports projects in five areas: supercomputing, artificial intelligence (AI), cybersecurity, advanced digital skills, and ensuring a wide use of digital technologies across the economy and society, including through **Digital Innovation Hubs** (DIH). These Hubs are one-stop shops for businesses to become more competitive using digital services. DIHs are established regionally to provide advice, support and capacity building, as well as opportunities for testing (EC, 2022f). Complementary funding mechanisms are provided through the RRF, the Structural Funds Facility, and **Horizon Europe**. Horizon Europe is the current funding programme for Research and Innovation to support achieving the UN's Sustainable Development Goals, climate change, and competitiveness. In this sense, Horizon Europe is the key instrument to steer and accelerate the EU's recovery, resilience and preparedness (DG for Research and Innovation, 2021). Within Horizon Europe, the cluster Food, Bioeconomy, Natural Resources, Agriculture and Environment includes rural areas, forestry and agriculture sectors as areas of intervention. Some topics overlap with Digital Agenda 2030, but the outputs and interventions are different and complementary.

The second generation of **Connecting Europe Facility** (CEF2) is the funding instrument to build modern transport, energy and telecommunications infrastructure across Europe. Within it, *CEF2 Digital* supports public and private investments in digital connectivity to comply with a Digital Single Market through grants and procurements. CEF2 Digital will contribute to developing Gigabit and 5G networks. The WiFi4EU[10] initiative (under *CEF Telecom* for the period 2014-2020) provided vouchers of EUR 15,000 to 5,500 municipalities to install free public Wi-Fi to offer connectivity for citizens and visitors. Given the success of the programme, it will continue for the period 2021-2027 and will evolve towards 5G Communities. The previous CEF had a key instrument for broadband, the Connecting Europe Broadband Fund (CEBF), which invested in seven very-high-capacity network projects in rural and semi-rural across Europe (EC, 2021a). For 2021-2027, broadband infrastructures can receive support from the ESIF and the Commission proposes to continue supporting the European Investment Bank lending activity for broadband networks through the InvestEU Programme.

To support improving the digital competences of European citizens, a renewed policy initiative, the **Digital Education Action Plan** will "tackle the connectivity divide between EU Member States regarding the uptake of very high-capacity broadband in all European schools". Along the same lines, the **European Digital Rights and Principles** signed by the European Commission (EC), the European Parliament and the Council of the EU on 14 November 2022 commits to a safe, secure and sustainable digital transformation putting people at the centre. The EU's "digital DNA" refers to rural areas in *Chapter II: Solidarity and Inclusion* (see **Figure 1**), both explicitly in the commitment to a digitalisation that leaves no one behind as well as implicitly in the connectivity and digital education and skills commitments.

10 https://wifi4eu.ec.europa.eu/

Fig. 1: Excerpt of European Declaration on Digital Rights and Principles.

Chapter II: Solidarity and inclusion

2. Technology should be used to unite, and not divide, people. The digital transformation should contribute to a fair and inclusive society and economy in the EU.

We commit to:

a. making sure that the design, development, deployment and use of technological solutions respect fundamental rights, enable their exercise and promote solidarity and inclusion;

b. a digital transformation that leaves nobody behind. It should benefit everyone, achieve gender balance, and include notably elderly people, people living in rural areas, persons with disabilities, or marginalised, vulnerable or disenfranchised people and those who act on their behalf. It should also promote cultural and linguistic diversity;

c. developing adequate frameworks so that all market actors benefiting from the digital transformation assume their social responsibilities and make a fair and proportionate contribution to the costs of public goods, services and infrastructures, for the benefit of all people living in the EU.

Connectivity

3. Everyone, everywhere in the EU, should have access to affordable and high-speed digital connectivity.

We commit to:

a. ensuring access to high-quality connectivity, with available Internet access, for everyone wherever in the EU, including for those with low income;

b. protecting and promoting a neutral and open Internet where content, services, and applications are not unjustifiably blocked or degraded.

Digital education, training and skills

4. Everyone has the right to education, training and lifelong learning and should be able to acquire all basic and advanced digital skills.

We commit to:

a. promoting high-quality digital education and training, including with a view to bridging the digital gender divide;

b. supporting efforts that allow all learners and teachers to acquire and share the necessary digital skills and competences, including media literacy, and critical thinking, to take an active part in the economy, society, and in democratic processes;

c. promoting and supporting efforts to equip all education and training institutions with digital connectivity, infrastructure and tools;

d. giving everyone the possibility to adjust to changes brought by the digitalisation of work through up-skilling and re-skilling.

4.3 Contributions from DESIRA national policy reports

The national policy analyses conducted by 15 European countries[11] within DESIRA project have contributed to understanding the impact of EU policies in rural digitalisation nationally, the adoption level, and the limiting factors (reports can be accessed through the links provided in **Annex 8.1 Reports on national policy analysis**). Those reports were finalised in autumn 2021, depicting the national, regional and local policy situation until then. Further research efforts have been made to provide as updated information as possible.

The implementation and impact assessment of the European policies influencing rural digitalisation in the study countries remains a challenge. The **lack of accessible national data** regarding rural areas in general, and more specifically, in relation to rural digitalisation, is the main limiting factor. Even at the European level, policy impact assessment can only be done ex-post and with limited outputs (e.g., total funding for rural digitalisation is not straightforward). Additionally, digitalisation is an **everchanging domain** requiring fast-speed and coordinated adaptations of the legal frameworks. Such adaptations usually require actions from several administrative bodies at different levels in a coherent way.

EU Rural Development and Cohesion Policies on one side, and the EU digital strategies on another, have notably influenced national policies supporting rural digitalisation. European countries have deployed relevant strategies which can be grouped into different policy areas, which will be introduced next. The links of the building blocks with these policy areas are presented in **Table 4**.

- **Infrastructure**. All study countries have deployed broadband strategies. In general, these strategies initially supported connectivity in the easy-to-access and more profitable areas (e.g., cities) and later included the rural and the less profitable locations. Many countries still have got dedicated broadband strategies with revised objectives according to their own needs and the European objectives (e.g., Gigabit society), whereas others have incorporated broadband goals into their digital agendas.
- **Digital competences, literacy**. Despite being a core part of European and national digital agendas, only recently has this aspect received a higher attention. To tackle the different dimensions of digital literacy, such as age, gender or education, the study countries have put in place strategies, initiatives, or both. France, Italy, Poland and Spain have launched standalone national strategies to promote digital skills in education, among the labour force and the general population, and to support ICT specialists training. However, none of those strategies target rural areas.
- **Rural digitalisation**. Whereas all study countries have got their own digital agendas -most of them published after the first digital agenda for Europe- as shown in **Figure 2**, the approach to rural digitalisation has been varied. Greece, Hungary and Spain have recently deployed dedicated strategies. Italy, Austria and Germany have included rural digitalisation objectives in wider rural development policies and Latvia has got a strategy that is specifically aimed at rural connectivity.

11 The study countries were EU Member States Austria, Croatia, Finland, Flanders (Belgium), France, Germany, Greece, Hungary, Italy, Latvia, Poland, Spain and The Netherlands, and non-EU countries Scotland (UK) and Switzerland.

- **Digital trust**. *Technology that works for the people* is one of the three pillars of the strategy *Shaping Europe's digital future*, which means generating a trustworthy and safe digital ecosystem for Europeans. In this sense, policies related to cybersecurity, interoperability of systems and data governance are necessary to complete the national digital ecosystems. All study countries have transposed the European NIS Directive[12] into their national legislation, but the level of maturity in relation to cybersecurity differs among them. Similarly, guidelines about interoperability exist in all study countries. Either through devoted policy frameworks (like in Spain, Latvia, Belgium, Austria, Greece and France) or embedded in wider strategies (e.g., UK Technology Code of Practice, Dutch DigitBeter, or Hungarian National Info communications Strategy), interoperability has been incorporated in the national policy landscape, especially linked to public systems. However, real interoperability of systems in the countries remains a challenge. In Italy, for example, interoperability has been reported to be significantly low.

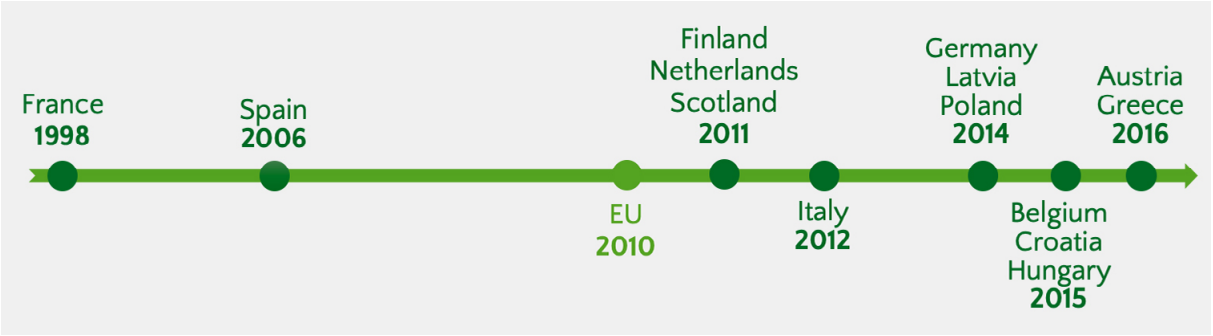
Tab. 4: Relation of DESIRA Policy Roadmap building blocks with policy areas

POLICY AREA	BUILDING BLOCK
 INFRASTRUCTURE	To ensure accessible, high-quality connectivity and digital infrastructures in rural areas.
 DIGITAL COMPETENCES, LITERACY	To streamline digital education and competences adapted to different groups in rural areas. To provide easy-to-use and affordable digital services to rural communities, farming and forestry. To promote innovation and digital ecosystems in rural areas.
 RURAL DIGITALISATION	To mainstream digital solutions to support service provision and administrative routines in rural areas. To raise awareness about the value of rural areas and to foster public engagement in rural issues. To monitor rural digitalisation policies progress, impacts and efficiency.
 DIGITAL TRUST	To increase interoperability of digital technologies for rural areas, forestry and farming. To improve rural, forest and agriculture data governance and data management following ethical principles. To support data-driven decisions in farming, forestry and rural areas.

12 National cybersecurity strategies are displayed on and interactive map available here: https://www.enisa.europa.eu/topics/national-cyber-security-strategies/ncss-map/national-cyber-security-strategies-interactive-map

Achievements derived from those strategies have been uneven. For instance, the connectivity targets of the first European Digital Agenda have been achieved in general terms, but not in rural areas, meaning that there are important gaps transposing EU policies in these locations.

Fig. 2: Timeline with first digital agendas or similar strategies published in the analysed countries (except Switzerland).



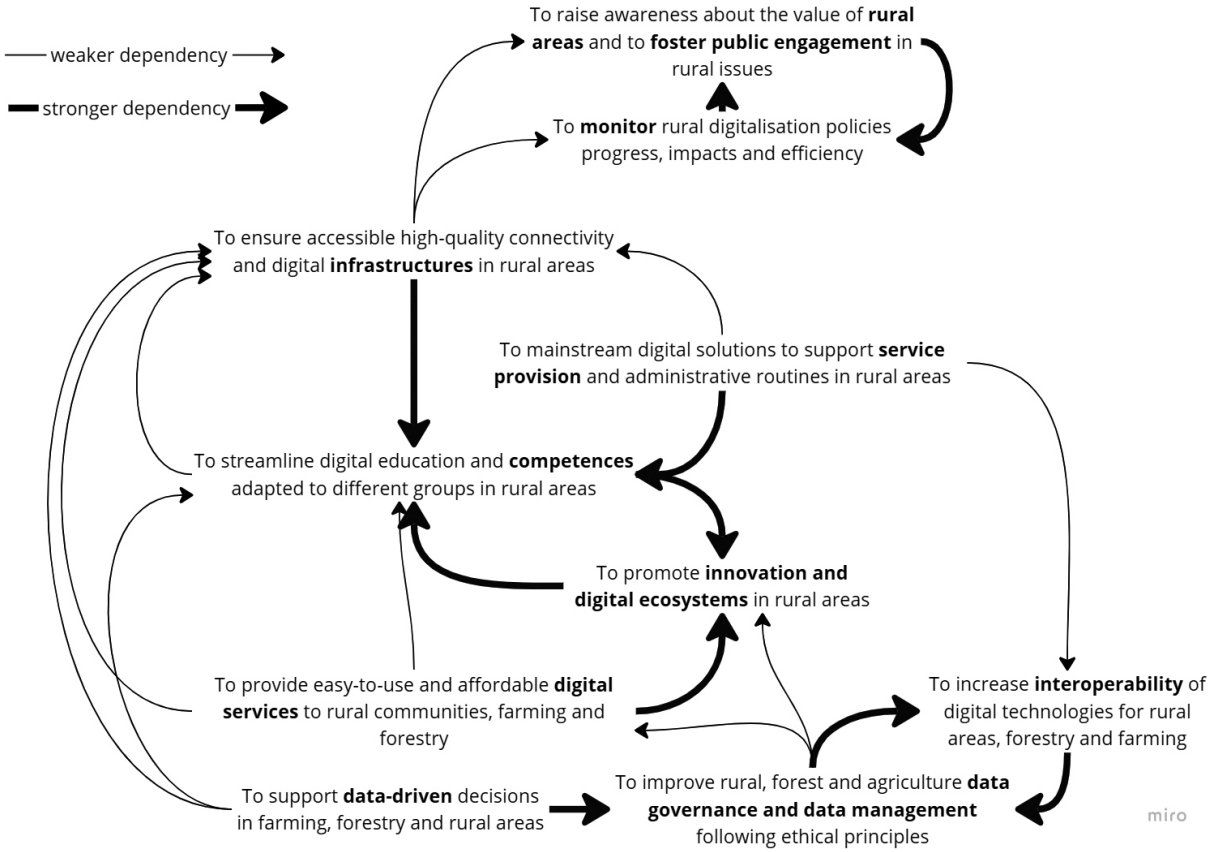
Several **issues affect EU policy adoption** across European countries. The first one is the capacity to integrate EU policies into the national policy spectrum as well as the capacity to implement such policies. Administrative complexity and the lack of experience or skills can limit the translation of policies, which are designed at higher levels. By the same token, pioneer countries might encounter more difficulties in adopting policies related to cutting-edge topics, such as digitalisation, whereas followers find a more paved way. Finally, there is an issue of timing, for some countries, the national contexts, priorities and starting points might not be aligned with the EU concerns. Yet some countries have gone one step ahead of the EU and have deployed rural digitalisation strategies (e.g., Spain, Greece, and Hungary).

5 Supporting a sustainable and inclusive rural digitalisation in Europe

The capacity to design effective policy relies on a good understanding on the socioeconomic realities and a solid knowledge base. The Rural People's Declaration of Kielce 15th September 2022 is a "call upon citizens and policymakers at all levels to mobilise resources and people, and ensure policies and programmes are coherent and rural-proofed". Along these lines, the DESIRA Roadmap supports **the need to set rural digitalisation as a strategic objective**, with priorities based around rural issues and set through community engagement. This requires **strengthening the policies** influencing rural digitalisation in a **coordinated** manner and identifying who is **responsible** for their implementation, which are the available **resources** and **how** should they be deployed. The EC should provide **instruments** to make rural digitalisation policies effective and therefore, to enable for **alignment, monitoring and accountability** of policies in the Member States. Moreover, strategies addressing rural digitalisation should **widen the scope**, looking beyond agriculture and further than the CAP current timeframe.

Based on these premises, we present next the **building blocks that can support policies towards more inclusive and sustainable rural digitalisation across Europe**. For each block, we provide specific objectives, challenges and coping mechanisms, and, whenever possible, we have also indicated resources, best practices and potential monitoring indicators. Considering the intricated EU policy framework which influences rural digitalisation, we have tried to focus on the **most relevant policies within each block**. The policy analyses done by DESIRA partners (see section **4.3 Contributions from DESIRA national policy reports**) revealed that policies and strategies influencing rural digitalisation nationally usually fall within four areas of policy (infrastructure; digital competences and literacy; rural digitalisation; and digital trust). These areas of policy have also been taken into account, as well as the relation among the different blocks (see **Figure 3**).

Fig. 3: Relation among the building blocks of the DESIRA Policy Roadmap.

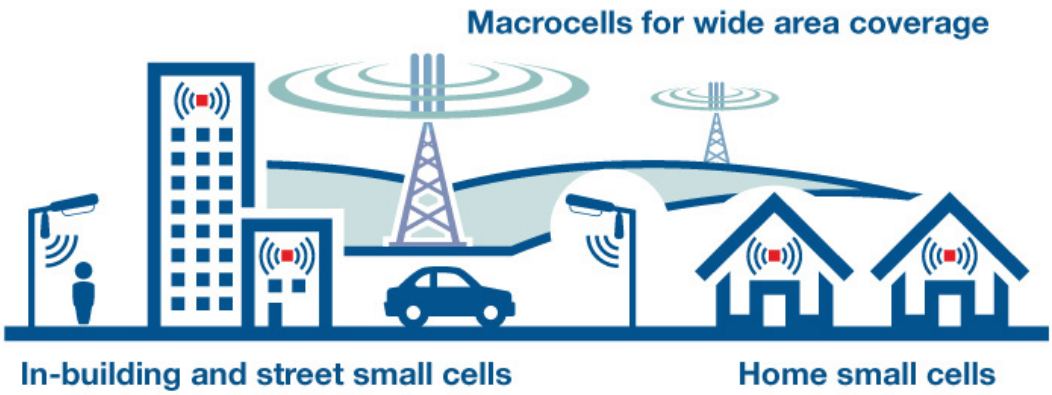


5.1 To ensure accessible, high-quality connectivity and digital infrastructures in rural areas

DESIRA	Policy area	Infrastructure
	Relation with other building block	To streamline digital education and competences adapted to different groups in rural areas
EU	Relation with other EU policies	• Path to the Digital Decade • Cohesion Policy • Common Agricultural Policy
	Contribution to LTVRA	Connected Rural Areas

The EU 2022 Digital Economy and Society Index (DESI) confirms **the need to further support and invest in closing the rural-urban digital gap**. In 2021, still 8.5 percent of rural households were not covered by any fixed network and 32.5 percent of rural households were not served by any Next Generation Access (NGA)[13] technology (EC, 2022b). Also in 2021, the urban-rural gap for 4G closed, covering 99.6 percent of rural areas in Europe, as stated in DESI 2022. However, the 5G Observatory Quarterly Report 17 -published in October 2022-, revealed that consumers in rural areas might not fully benefit from 5G unless coverage and capacity in lower bands are facilitated (VVA et al., 2022) (see Figure 4).

Fig. 4: Range of macrocells, small cells and dedicated in-building cells for 5G connectivity[14]. Source: https://www.emfexplained.info/?ID=25916



One of the main documents composing the current digital agenda for Europe -*2030 Digital Compass: The European way for the Digital Decade* (Digital Compass)- proposes **new connectivity objectives** "by 2030, all European households will be covered by a Gigabit network, with all populated areas covered by 5G".

13 Next Generation Access includes the following technologies: FTTH and FTTB (optical fibre cable), Cable Docsis 3.0 (coaxial cables), VDSL (copper wires) and other superfast broadband (at least 30 Mbps download).

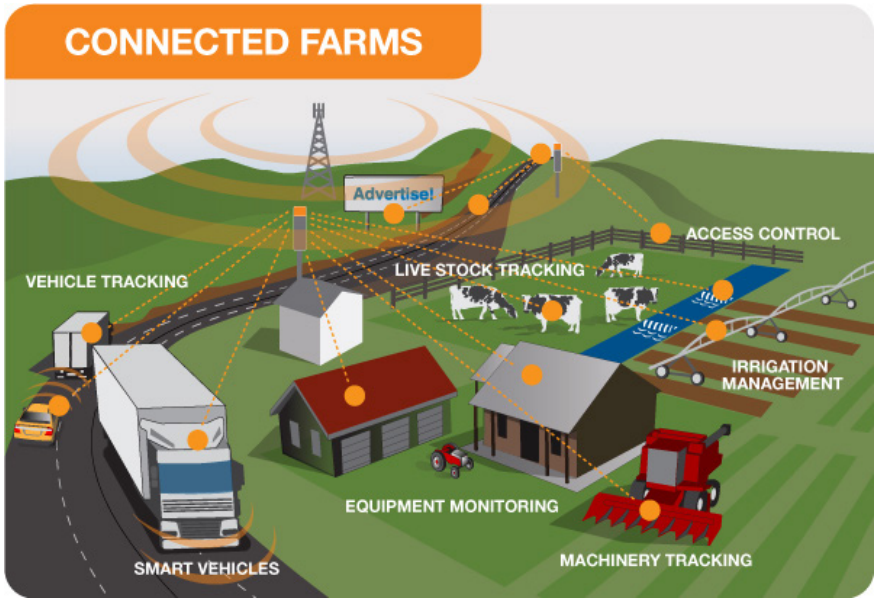
14 5G networks are designed to work in conjunction with 4G networks using a range of macro cells, small cells and dedicated in-building systems. Small cells are mini base stations designed for very localised coverage typically from 10 metres to a few hundred metres providing in-fill for a larger macro network. Small cells are essential for the 5G networks as the mmWave frequencies have a very short connection range. Source: https://www.emfexplained.info/?ID=25916

The Broadband Competence Offices (BCO) are the national and regional public authorities supporting the broadband rollout in the Member States. The **BCO Network Support Facility** supports the EU countries in reaching the connectivity ambitions and establishes annual workplans. It facilitates the BCOs (also present in Western Balkans and Norway) through various activities including: capacity building; support to improve the efficiency and effectiveness of broadband investments in addressing territorial disparities; connection with other networks (CAP Network, 5G Smart Communities, Rural Pact Support Office) and experts; and strengthening and empowering the regional BCOs through bespoke activities targeting their needs and regional contexts.

The *European Declaration on Digital Rights and Principles*, approved in December 2022, provides guidance to policymakers and companies dealing with new technologies. The text is built on the concept of "putting people at the centre of digital transformation in Europe" and specifies "affordable and high-speed digital connectivity everywhere and for everybody". Moreover, the *Annex of the Digital Compass* mentions **space-based assets** as an essential contributor to covering hard-to-reach areas, including remote or sparsely populated ones. In this sense, the EU has launched "IRIS²" (Infrastructure for Resilience, Interconnectivity and Security by Satellite[15]) an ambitious space-based Secure Connectivity system to be fully implemented by 2027.

A high-quality connectivity means to provide one that is affordable, reliable, stable, presents low latency, and redundancy (Council of Canadian Academies, 2021). It relies on **physical infrastructure** such as ground stations -in the case of satellite broadband-, cells, towers and masts -in the case of radio access network-. However, connectivity networks in rural areas need to be reinforced with **backbone infrastructure** such as data servers or data centres to fully benefit from agriculture 4.0 (see Figure 5) and to move towards digital sovereignty.

Fig. 5: Representation of a farm system based on Agriculture 4.0 in which digitalisation, automation and Artificial Intelligence (AI) play a major role. Source: https://www.emfexplained.info/?ID=25916



15 https://defence-industry-space.ec.europa.eu/eu-space-policy/eu-space-programme/iriss_en

Adopted in December 2022, the Digital Decade Policy Programme 2030 -**Path to the Digital Decade**- incorporates the ambitions proposed in the 2030 Digital Compass and set among the digital targets "secure, resilient, performant and sustainable digital infrastructures where at least 10.000 climate-neutral highly secure edge nodes are deployed in the Union, distributed in a way that guarantees access to data services with low latency (i.e. a few milliseconds) wherever businesses are located". In this regard, it is key to consider the geographical spread of rural, agricultural and forestry businesses, as they may occupy large pieces of land (also outside populated areas) and may require reliable data transmission for their activities (field sensors, etc.).

There are unprecedented **investments** in the EC that could bridge the digital divide in rural and remote areas including:

- EUR 16 billion in RRF reforms and investments approved to roll out digital connectivity networks in the next four years (EC, 2022b).
- EUR 151.3 million from the EC programme Connecting Europe Facility were granted in the first call for proposals[16], including projects deploying 5G network infrastructures in local and rural communities. From the list of selected projects[17], it is not easy to identify those influencing rural areas, but there is a EUR 4 million investment approved for "Flanders Smart Fields - 5G rural coverage for innovative healthcare services in the Westhoek".
- The new Cohesion Funds, the EAFRD (fostering knowledge, innovation and digitalisation in agriculture and rural areas, is a cross-cutting objective in the new CAP), InvestEU (additional fund for the period 2021-2017) and European Investment Bank loans which include in the priorities "infrastructure to connect Europe's citizens, internal markets and economies".

A screening of the CAP Strategic Plans confirms that most of the Member States envisage broadband investments under RRF to reach the 2030 connectivity objectives, as well as through the CEF Programme.

Despite regulation, funding and supporting instruments by the EC, **investments** in broadband roll-out remain a **challenge** for the less accessible areas due to social -low population density, ageing-, economic -brain drain, lower economic dynamism- and environmental -different terrain and "line of sight requirement" affected by dense forests- factors (Magnatti et al., 2020). To overcome this, local groups across Europe have played a key role in deploying high-speed broadband initiatives, including citizen-driven cooperatives (see **Figure 6**), public-private partnerships, self-funded projects and not-for-profit public wholesale network (see. **Figure 7**). More good practice examples can be found in the BCO Network website18. Despite progress, further efforts at European, national and regional level are needed to ensure connectivity in unpopulated areas.

16 https://digital-strategy.ec.europa.eu/en/news/eu-supports-deployment-digital-connectivity-infrastructures-1513-million-funding-under-connecting

17 https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/projects-results;programCode=CEF

18 https://digital-strategy.ec.europa.eu/en/library/broadband-handbook-facing-challenges-broadband-deployment-rural-and-remote-areas

Fig. 6: Broadband for Rural North "B4RN" project factsheet, UK.

European Commission

his project demonstrates that
ven the most self-sustaining
rivate initiative needs to
terface with the local public
odies.

ource
arry Forde, CEO Broadband for
e Rural North Ltd
44 1524 555 887
nfo@b4rn.org.uk
ttps://b4rn.org.uk

Broadband for the Rural North
UK

In rural Lancashire in 2007, local entrepreneurs and residents were very dissatisfied with the existing broadband provision. Telecommunications company, British Telecom, local authority broadband project, Superfast Lancashire and other providers were approached over several years, together with the local councils, but the prospect of any improvement to broadband access or speed was deemed at times unlikely or even impossible.

In December 2011, a local volunteer group launched Broadband for the Rural North Ltd, or B4RN, an innovative community-led project to bring high-speed broadband internet connectivity to domestic and business properties. B4RN is a professionally designed fibre optic broadband network registered as a non-profit community benefit society. It is run by a dedicated local team with the support of landowners and volunteers, and functions as an Internet service provider.

Because it is registered as a community benefit society with the Financial Services Authority, it can never be bought by a commercial operator and its profits can only be distributed to the community. The company's initial share offering raised hundreds of thousands of pounds from the local community and the first ground was broken in Quernmore in March 2012.

By 2015, B4RN had connected 1,000 properties. The network offers 1 Gbps (Gigabits per second) FTTH[1] broadband to every property in the coverage areas, costing households only €33.64 per month.

The project's funding relies almost entirely on local investors in shares and loans, with a further business development loan from the Esmeé Fairbairn Foundation, one of the largest independent grant-makers in the UK. More recently, B4RN has been successful at attracting funds through the BDUK connection voucher scheme.

Most of the work is done by volunteers and landowners, although there are now 21 paid staff on board as well. Volunteers:

- inform the community and encourage investment
- walk routes and agree wayleaves[2] (right of way permissions) with landowners
- coordinate site work between volunteers and landowners
- undertake the fieldwork of laying ducts and installing chambers
- advise property owners and help to install their house fittings
- prepare food for other volunteers.

The community's energy and interaction result in many volunteers choosing to continue working with the project, helping it expand into other areas long after they themselves are connected.

Routes of properly installed B4RN duct are eligible for a "shares for work" claim. Landowners, tenant farmers, contractors and people with professional groundwork skills and the capital investment in diggers, tractors and other types of machinery, can earn a fixed €1.68 per metre (including all expenses, such as fuel costs) for the distances they have installed.[3]

Because B4RN is non-profit, it extends its network into communities at their invitation only. Each new area that invites B4RN needs to raise the investment to cover the work and materials required for their area's installation.

Every community's core investment is made up of shares, the value of which can be ring-fenced for supporting the build-out in their area. The minimum shareholding is €112.16 and the maximum is €112,155.86. All shareholders are members of B4RN, and each member has

1 Fibre-to-the-home: where fibre is laid all the way to the home. Alternatives configurations include:
- FTTP – Fibre-to-the-Premises: fibre laid all the way to the premises.
- FTTB – Fibre-to-the-Building: fibre laid all the way to the building.
- FTTC – Fibre-to-the-Cabinet: fibre laid to the cabinet, with copper wires completing the connection
- FTTN – Fibre-to-the-Node: fibre laid to the node, with copper wires completing the connection

2 B4RN's wayleave agreement is a simple, single page, plain language document that gives permission to install B4RN ducts across a landowner's property.

Fig. 7: Digital Nièvre project factsheet, France.

European Commission

This project demonstrates how, while the use of existing infrastructure can dramatically reduce the network deployment costs, this approach is not without challenges: project leaders need to obtain permits from the infrastructure owners or public authorities. A high degree of preparation and coordination is necessary in order to succeed with this approach.

Source
Jean-Dimas Malot
+33 386618266
d.malot@niverlan.fr
www.nievrenumerique.fr

Digital Nièvre
France

Nièvre is a rural department in the region of Burgundy-Franche-Comté with approximately 33 inhabitants per square kilometre. Of its eight larger towns, only two reach the figure of 10,000 inhabitants.

In 2006, the General Council of Nièvre County and the Nevers Area created a joint association of local authorities in Bourgogne in charge of public high-speed networks: Nièvre Numérique. It is the delegating authority for public service broadband electronic communications for 2007-2027.

Nièvre Numérique sought to replace the existing wireless network communication technologies with a faster and more reliable fibre optic network. The association decided to make use of existing infrastructure, deploying an overhead fibre backbone using electricity pylons. The aim was to save up to 90% of the civil engineering cost and guarantee widespread broadband coverage. To achieve this, the association signed a contract with the French company in charge of the electric network (then ERDF, now ENEDIS) and fibre optic cables were wound around 172 km of high-tension electricity cables.

In addition, the association chose to deploy 50% of its network along other existing infrastructure, such as ducts belonging either to local authorities or to the French State. More than 60 km of existing infrastructure was used for the fibre network.

The association had to manage all the rights and access permits across private properties. It also had to manage the connection between the overhead and underground networks.

Good practice in project planning

- ✓ Making the facilities (passive infrastructures) owned by the public sector available at an attractive economic rate

DESIRA would like to propose the following specific objectives to improve connectivity and digital infrastructures in rural areas:

1. To set up a predictable regulatory environment, providing the conditions to incentivise investment and minimising deployment costs to achieve ubiquitous connectivity to support multifunctional and diverse rural areas, and the goals of the LTVRA through a combination of technologies.
2. To lay the foundations for the establishment of public-private partnerships to plan and co-fund digital connectivity and infrastructure interventions to benefit rural population.
3. To create a regulatory environment where verticals have a competitive range of options to access optimal 5G in rural areas.
4. To consider the nature of rural, agricultural and forestry businesses (which extension might reach wider than populated areas) in the provision of infrastructure for secure edge nodes.
5. To revise the role that platforms and internet service providers operating in rural areas could play in supporting the deployment of connectivity and digital infrastructures (co-financing, taxation).

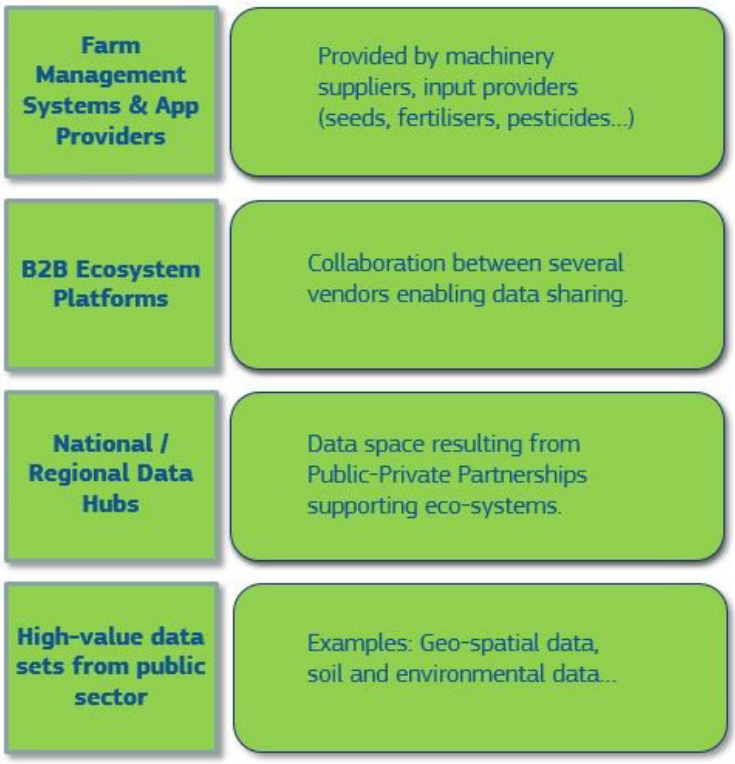
The progress could be monitored using DESI metrics regarding connectivity in rural areas (coverage, take-up, prices, etc.) as well as with the annual Study on Broadband coverage in Europe by Omdia.

5.2 To increase interoperability of digital technologies for rural areas, forestry and farming

DESIRA	Policy area	Digital trust
	Relation with other building block	To improve rural, forest and agriculture data governance and data management following ethical principles
EU	Relation with other EU policies	• Interoperable Europe Act
	Contribution to LTVRA	Stronger, Connected Rural Areas

Real **interoperability of digital systems remains a challenge** across Europe, both within and among Member States. Similarly, entities outside of Europe can provide applications and supporting digital infrastructures (data storage, servers, etc.), adding another level of complexity. This is particularly relevant for **digital applications for farm management and farm operations** (e.g., irrigation control systems, automated milking systems, tractors equipped with sensors transferring information to manufacturer companies), since many of them are tailor-made and/or provided by machinery suppliers or input providers (see Figure 8).

Fig. 8: Landscape of data sharing platforms in farming. Source: https://digital-strategy.ec.europa.eu/en/policies/digitisation-agriculture



Fragmentation of digital systems does not solely apply to farming 4.0, **digitalisation is affecting daily routines** and basic administrative procedures as well. For instance, livestock farmers are required to keep updated records of animal stock, which allows for transparency and traceability. Public administrations have enabled online platforms to gather this information quickly and safely, yet their usability remains a challenge. Following this example, a Spanish livestock farmer operating in two different adjacent regions -Andalucía and Extremadura, for instance-, must be registered and must use two different administrative platforms to update the animal stock records, each platform presenting different software requirements (see Figure 9 and Figure 10).

Fig. 9: Welcome page for the platform in Andalucía, Spain.

Fig. 10: Welcome page for the platform in Extremadura, Spain.

The numerous existing digital **applications for farming are not delivered in a bundled form**, and data does not flow between them (EC, 2022k). The **global trend is to establish a versatile, universal platform** to accommodate a diverse range of applications for farm management (Raj et al., 2021), however that is not a reality yet.

The same applies to the **forestry** sector. Transformation to Forestry 4.0 seems to be inevitable. The *Forest Sector Outlook Study 2020-2040* done by the United Nations Economic Commission for Europe indicates an increased complexity in value chains, which might change with grown automation of manufacture. The study recognises technology as a driver for production and consumption, but hard to project in the long-term. Network technologies and digital infrastructure supporting the forest supply chain (Internet of Things platforms, cloud computing, etc.) are expected to benefit the industry economically, socially and environmentally (Feng & Audy, 2021). Yet the **EU Forest Strategy acknowledges the lack of interoperability** between the use of remote sensing data with ground-based data, as well as issues with common definitions, which compromises the deployment of strategic forest planning at all levels.

For rural communities broadly, **local administration interoperability** presents several challenges, as stated in the deliverable *European Interoperability Framework Implementation: EIF and Smart Cities, towards a Smart Cities and Communities Interoperability Framework (EIF4SCC)*. Among others, interactions with higher administrative levels, cooperation with different actors, and increased amount of data collected through various technological solutions all create interoperability requirements (Flores et al., 2021). Recognising the lack of interoperability as the major obstacle to progress in the digital market, the **Interoperable Europe Act** for public administration[19] was adopted in November 2022. It will support strengthening cross-border interoperability and cooperation among public administrations and achieving the Europe's digital targets. The Act proposes a one-stop-shop for reusing and sharing interoperable solutions, the "Interoperable Europe Portal". It recognises that interoperability facilitates the successful implementation of policies, including agriculture.

Understanding where and who develops (e.g., local SMEs, big international providers, etc.) the digital applications that are currently used in rural areas, farming and forestry as well as their fragmentation (which application does what) can enable to define strategies towards interoperability.

There are different **EU strategies regarding interoperability** in place:

- The **European Strategy on data** (published on 19 Feb 2020). It defines the policies and investments to enable data economy for 2025, including the funding of common, **interoperable data spaces** in strategic sectors (see also section **5.3 To improve rural, forest and agriculture data governance and data management following ethical principles**). It was presented at the same time as the strategic document "Shaping Europe's digital future" and the White Paper on AI, setting the basis for the future of data-driven technologies.
- The EU **Standardisation Strategy**[20]. Updated in 2022 due to the rapid pace of innovation, the Strategy aims to enable the green and digital ambitions of the EU, ensuring the interoperability

19 https://commission.europa.eu/system/files/2022-11/com2022720_0.pdf
20 https://ec.europa.eu/commission/presscorner/detail/en/ip_22_661

of products and services in the digital Single Market. One of the key actions proposed is to improve the governance and integrity of the European standardisation systems and considers data standards as one of the urgent strategic areas. The Strategy was accompanied by a proposal for an amendment to the regulation on standardisation[21].

- The **2020 Industrial Strategy**[22]. Derived from the Standardisation Strategy and postponed due to COVID-19 pandemic, it proposes an update to the Policy Package and focuses on 14 industrial ecosystems, among which agrifood and digital can be found.

In terms of investments, the **Digital Europe Programme 2021-2027** will dedicate EUR 1 billion **funding** for deployment, best use of digital capacities, and interoperability.

The Living-in.eu[23] movement was launched in 2019 to boost sustainable digital transformation of cities and communities. In June 2021, one of its technical subgroups published "MIMs Plus" which was the result of a consensus among cities (including rural areas) and different European initiatives to achieve minimal interoperability of solutions, services and data. MIMs Plus consists of two parts: **Minimal Interoperability Mechanisms** (MIMs) and relevant European standardisation initiatives, such as EIF4SCC or CEF. The document provides recommendations for technical specifications and aims to build capacity to enable interoperability of data platforms for communities. MIMs will be key to develop the Data Space for Smart Communities across Europe.

The strong **coordination** among public and private entities required to tackle the different elements of interoperability (legal, organisational, data structure/semantic and technical) is and will continue to be a major **challenge**. Inspiration might be taken from the interoperability mechanisms developed by the EU Digital COVID Certificate (all EU countries and 49 non-EU countries joined the system, which was based on EU equivalence decisions).

DESIRA would like to propose the following specific objectives to increase interoperability of digital technologies for rural areas, forestry and farming:

1. To make compulsory the adaptation of the national regulations to comply with EU interoperability standards on rural contexts. If interoperability is achieved in rural contexts, it might as well work everywhere.
2. To prioritise research and innovation (R&I) projects that propose standardisation use cases and application scenarios in rural areas.
3. To encourage the development of new services addressed at rural areas and businesses (farming, forestry, tourism, etc.) that are interoperable as well as those that capitalise on existing standards, data, and digital applications.
4. To disseminate the Living-in.eu initiative among rural communities and rural villages, cities and municipalities and to support its adoption.
5. To support public-private coordination networks to boost interoperability in rural areas.

21 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022PC0032&qid=1683631320704
22 https://commission.europa.eu/system/files/2021-05/communication-industrial-strategy-update-2020_en.pdf
23 https://living-in.eu/

6. To monitor system fragmentation in farming/forestry sectors and the origin of applications used in rural areas (locally developed, global ones, etc.).
7. To make available the existing data regarding the uptake of Minimum Interoperability Mechanisms (MIMs) in rural areas, to encourage its collection.

To monitor the progress of interoperability across Europe, the previous EU interoperability programme -ISA2- used an Evaluation Framework based on evaluation criteria (relevance, effectiveness, efficiency, coherence, EU added value, utility and sustainability) and evaluation questions. Qualitative data was collected from 102 stakeholders who replied to a targeted or public consultation.

5.3 To improve rural, forest and agriculture data governance and data management following ethical principles

DESIRA	Policy area	Digital trust
	Relation with other building block	To increase interoperability of digital technologies for rural areas, forestry and farming
EU	Relation with other EU policies	Data Governance Act Data Act Directive on Security of Network and Information Systems (NIS2) General Data Protection Regulation
	Contribution to LTVRA	Stronger, Connected Rural Areas

The agrifood system can significantly benefit from the use of data, combining efficient and sustainable food production with well-informed consumers and fact-based policies (Wolfert et al., 2023). In the same way, the new EU Forest Strategy promotes a Strategic Forest Planning "based on reliable monitoring and data, transparent governance and coordinated exchange at the EU level". For rural areas in general, rural proofing mechanisms require data to assess policy impact and to achieve the Long-Term Vision for Rural Areas.

To fully capitalise on the potential of digitalisation in farming, forestry and rural areas there should be clarity about how data is collected, managed, processed, and owned. It is equally important to communicate such rules in a way that are easy to understand for all users. Finally, there are existing dataset which might be of interest for farmers, foresters and rural communities, of which they might not be aware.

Nowadays, c**oncerns regarding fragmented and unclear data governance** mechanisms and regulatory environments are affecting farmers willingness to adopt digital solutions (Jouanjean et al., 2020). At the same time, the increasing volume of non-personal data is an excellent source for innovation and growth to leverage. Yet the value of data is context-dependent, and it can be generated and used in different ways (*Data4Food2030, 2022*). Technology developers should capitalise on existing data (such as Land Parcel Identification Systems) when developing digital solutions for rural areas, farming and forestry and respect ethical values, such as those proposed in DESIRA Ethical Code.

Forest data is collected at national level, but this **information is often unavailable and seldom comparable among countries** (European Environment Agency, 2015) -which is also the case for some agricultural data sets-. At the same time, Eurostat collects annual data on traditional forest resources and the economic activity of the forestry and logging industry through the European Forest Accounts. While data collection is voluntary, not all Member States report their annual data (Eurostat, 2022a). Therefore, a monitoring framework is necessary at the European level (EEA, 2023) together with strategic forest planning. This requires harmonisation of information, capitalising on the national forest inventories and monitoring systems (European Environment Agency, 2015). Some steps were

taken in this direction with the creation in 2020 of the new Forest Information System for Europe (FISE)[24], a platform designed to provide comprehensive forest information at a European scale. FISE will be enhanced to become the basis for harmonised forest data in Europe, as stated in the new EU Forest Strategy. The EU Forest Strategy also demands a planning system based on "reliable monitoring and data, transparent governance and coordinated exchange at the EU level", initiating a legislative proposal for a Forest Observation, Reporting, and Data Collection framework.

Online since December 2022, the **Rural Observatory**[25] was built to increase knowledge production and to improve data collection and dissemination of rural data materialising the EU's Long-Term Vision for Rural Areas. The Rural Observatory gathers all the information available for rural areas across the EU from different datasets (data from the Joint Research Centre, ESPON, Eurostat, and some Horizon Europe projects), but it is still too early to assess its usability for rural proofing or progress towards achieving the LTVRA.

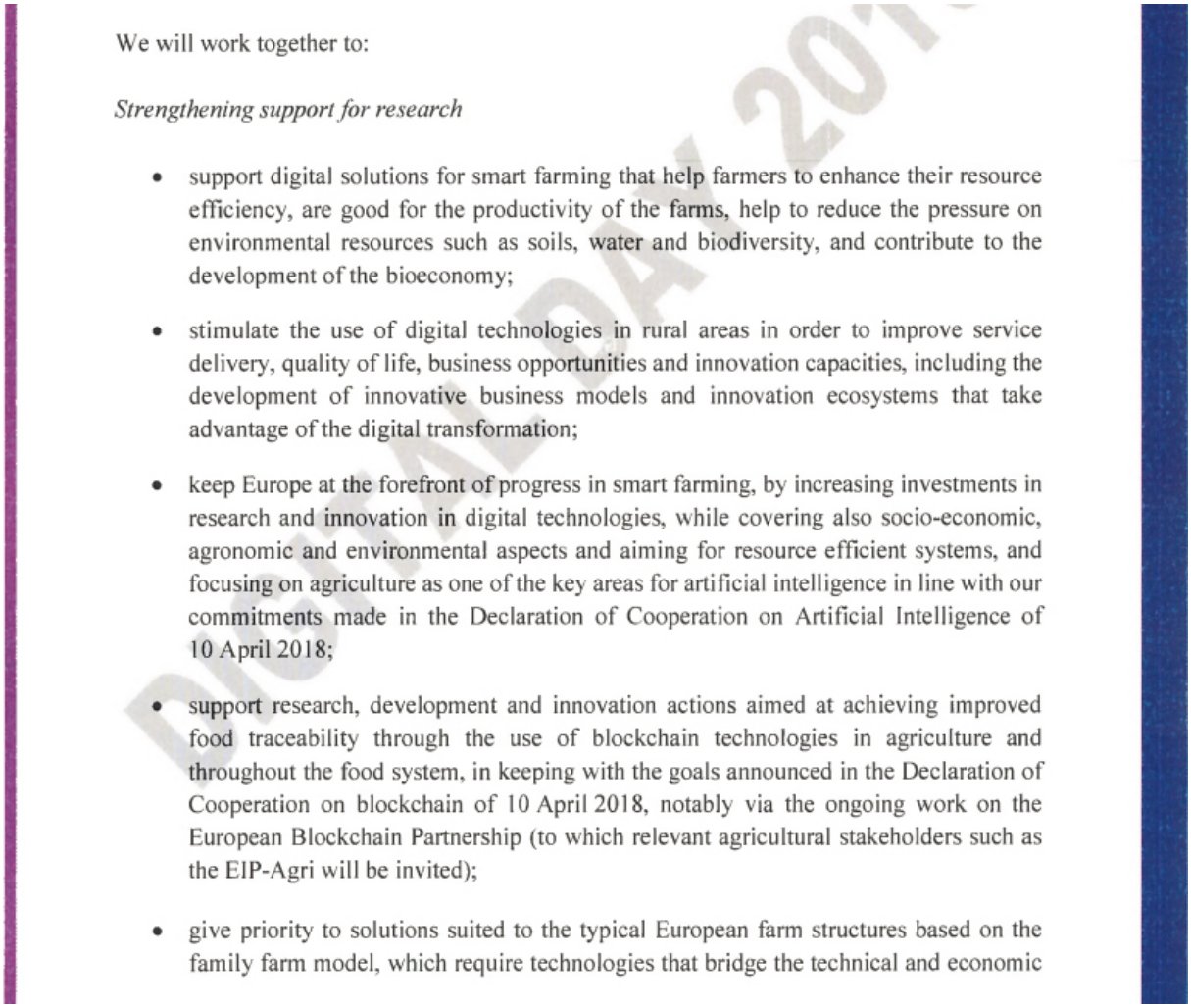
According to Jouanjean et al., (2020), a second major challenge is **data ownership**, for it touches several regulatory frameworks -such as contract and competition law, intellectual property rights, personal data protection and privacy-, although none of them fully respond to farmers' concerns in a clear way. Moreover, the **difficulties in data characterisation** -see Annex A of OECD report *Issues around data governance in the digital transformation of agriculture* report[26] - hinder the possibility of defining clear rules for each type. For instance, the report indicates that data can be classified in relation to "where data is generated and used," or it can be characterised "according to the objective of their use and their state". In this sense, **codes of conduct and farmer data cooperatives** could support raising awareness about their issues. In 2018, the Committee of Professional Agricultural Organisations and the General Confederation of Agricultural Cooperatives (COPA-COGECA) prepared, together with other organisations, the "EU Code of conduct on agricultural data sharing by contractual agreement" (see **Figure 11**). This non-binding document shares light on contractual relations and provides guidance on the use and access of data in the agri-food system.

24 https://forest.eea.europa.eu/
25 https://observatory.rural-vision.europa.eu/
26 https://www.oecd-ilibrary.org/docserver/53ecf2ab-en.pdf?expires=1673604303&id=id&accname=guest&checksum=961A324F88B2339DA7754BA7ABBCDCA2

Fig. 11: Code of conduct COPA-COCEGA, 2018. Source: https://www.cema-agri.org/images/publications/brochures/EU_Code_of_conduct_on_agricultural_data_sharing_by_contractual_agreement_2020_ENGLISH.pdf

The Declaration of Cooperation *A smart and sustainable digital future for European agriculture and rural areas* launched in April 2019 and today signed by 26 EU MMSS (see excerpt on **Figure 12**), recognised the **potential of digitalisation** for the agricultural sector and supported the setting up of a **European data space for smart agri-food application**. As stated in the Declaration "smart farming can help farmers to enhance their resource efficiency, farm productivity and help to reduce the pressure on environmental resources".

Fig. 12: Declaration excerpt. Full text available here: https://smartagrihubs.eu/latest/news/2019/August/DD3Declarationon agricultureandruralareas-signedpdf-%281%29.pdf



We will work together to:

Strengthening support for research

- support digital solutions for smart farming that help farmers to enhance their resource efficiency, are good for the productivity of the farms, help to reduce the pressure on environmental resources such as soils, water and biodiversity, and contribute to the development of the bioeconomy;
- stimulate the use of digital technologies in rural areas in order to improve service delivery, quality of life, business opportunities and innovation capacities, including the development of innovative business models and innovation ecosystems that take advantage of the digital transformation;
- keep Europe at the forefront of progress in smart farming, by increasing investments in research and innovation in digital technologies, while covering also socio-economic, agronomic and environmental aspects and aiming for resource efficient systems, and focusing on agriculture as one of the key areas for artificial intelligence in line with our commitments made in the Declaration of Cooperation on Artificial Intelligence of 10 April 2018;
- support research, development and innovation actions aimed at achieving improved food traceability through the use of blockchain technologies in agriculture and throughout the food system, in keeping with the goals announced in the Declaration of Cooperation on blockchain of 10 April 2018, notably via the ongoing work on the European Blockchain Partnership (to which relevant agricultural stakeholders such as the EIP-Agri will be invited);
- give priority to solutions suited to the typical European farm structures based on the family farm model, which require technologies that bridge the technical and economic

The ***European strategy for data*** (February 2020) focuses on putting the interests of the individual first when developing technology and supports the alignment of European values, fundamental rights, and rules in the digital world. Therefore, it shall contribute to enhance citizens' trust in data-driven innovations. The data strategy aims to build a real Single Market for data and established nine initial common European data spaces, including "A **Common European agriculture data space** to enhance the sustainability performance and competitiveness of the agricultural sector through the processing and analysis of production and other data, allowing for precise and tailored application of production approaches at farm level" and "**A Common European Green Deal data space**, to use the major potential of data in support of the Green Deal priority actions on climate change, circular economy, zero-pollution, biodiversity, deforestation and compliance assurance". Both data spaces are currently being developed through projects funded under the Digital Europe Programme: *AgriDataSpace*[27] for agriculture and *Great*[28] for Green Deal. In March 2021, additional data spaces followed, including the

27 https://agridataspace-csa.eu/
28 https://www.greatproject.eu/

Data space for smart communities (currently under deployment) which is strongly linked to the Green Deal data space. All data spaces will be supported by the Data Spaces Support Centre, which kicked-off in October 2022.

Recently, two main legislative initiatives have been brought forward in this regard:

- The **Data Governance Act** (presented on 25 November 2020 and approved in June 2022) to foster data-sharing mechanisms and availability of data across the EU, whilst facilitating the implementation of data spaces. As shown on the regulation text "Common European data spaces should make data findable, accessible, interoperable and re-usable (the FAIR data principles), while ensuring a high level of cybersecurity". This Act also ensures safeguarding for access requests from third countries in relation to non-personal data, a key point to increase trust and confidence in international data flows.
- The **Data Act**, proposed by the Commission on 23 February 2022, ruling on fair access to and use of data for all sectors, such as in the areas of smart machinery, and creating a governance framework on data access and use.

Both Acts contribute to materialise the vision set in the European Data Strategy, moving forward in the digital economy to benefit rural individuals, businesses, and public administrations by unlocking the potential of data. Moreover, the strategy vision for 2025 is that **80 percent of data processing is done at the edge**. To support this, the Annex of the *Digital Compass* defines a target to **guarantee the access to data services** with low latency **wherever businesses are located**. This is relevant for smart farming which uses data services both within and outside the farm. More specifically, the mentioned 10.000 climate neutral highly secure edge nodes should be deployed in the EU, requiring an edge node in every 100 kilometres. This node density can contribute to generate new digital services based on local data processing and to improve data control by users. The GAIA-X project -launched in 2019 to create a federated and secure digital infrastructure for Europe- aims to connect cloud service providers and users in a transparent and trustworthy environment where users retain sovereignty over their data, deciding where to store and what happens with their data. GAIA-X could prioritise supporting rural, farm and forest businesses in accessing and transferring their data.

The more digitalised a sector is, the more **vulnerable it is to cyberattacks**. A data breach in a digitalised agrifood sector can have unpredictable consequences. Therefore, the EC adopted a revised cybersecurity policy in November 2022, the **Network and Information Security Directive** -NIS2-, forcing national authorities to adopt their cybersecurity regulatory framework as well as reporting obligations for essential and important entities, including food production ones (see Annex of NIS2[29]).

These concerns find support in both the *European Declaration on Digital Rights and Principles for the Digital Decade* and *GDPR*. Moreover, blockchain technologies hold promise in enabling the development of more secure digital systems.

29 https://eur-lex.europa.eu/resource.html?uri=cellar:be0b5038-3fa8-11eb-b27b-01aa75ed71a1.0001.02/DOC_2&format=PDF

DESIRA would like to propose the following specific objectives to improve rural, forest and agriculture data governance and data management following ethical principles:

1. To engage and to include rural areas, farmers, foresters, and rural communities in the conversations defining data governance and data management.
2. To consider farm/forestry/rural enterprises and their associated land (e.g. farmland) in the count of businesses to be provided with edge nodes.
3. To align national policies for data with the Data Governance Act and the Data Act and to clarify how existing data regulations affect agriculture. To provide tailored regulation if needed.
4. To engage farmers, foresters, and rural communities in the data characterisation and to make relevant existing data (meteorological data, soil data…) accessible for farmers and rural communities.
5. To encourage reusing and integrating existing data (such as Land Parcel Identification Systems, Farm Sustainability Tool, etc.) in digital applications aimed at farmers, foresters, and rural areas.
6. To support developing and joining codes of conduct and farmer data cooperatives.
7. To encourage Member States to contribute to define and build the Forest Observation, Reporting and Data Collection framework.
8. To encourage Member States to add/to connect their data to the Rural Observatory and to the Forest Information System for Europe

Progress in relation to data governance and management can be measured using:

- DESI figures for Open Data.
- The Annual study on edge deployment under Connecting Europe Facility (as of 2022) for edge/cloud and data volume (530 percent increase), data professionals (10.9 million in the EU27), and value of data in the economy (EUR 829 billion in the EU27) -projected figures from European Data Strategy[30]-.

30 https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-data-strategy_en

5.4 To streamline digital education and competences adapted to different groups in rural areas

DESIRA	Policy area	Digital competences, literacy
	Relation with other building block	To promote innovation and digital ecosystems in rural areas
EU	Relation with other EU policies	• Path to the Digital Decade • Proposal for a Council Recommendation on the key enabling factors for successful digital education and training • Proposal for a Council Recommendation on improving the provision of digital skills in education and training • Common Agricultural Policy
	Contribution to LTVRA	Connected, Stronger and Prosperous Rural Areas

To benefit rural communities, **digital strategies should tackle all three components of the digital divide** -infrastructure, skills, and uptake- while considering the specific needs of each rural area, as well as the existing policy support (ENRD, 2019b). **Improving the digital skills** of European citizens has been a **priority** since the publication in 2010 of the first EU Digital Agenda, and it has been measured since 2011. For rural areas, however, a few indicators for digital skills were made available in 2015 DESI -e.g., skills in communication, information, problem-solving, and software-, and only in 2021 a higher level of detail started to be provided. The **latest data available presents a significant gap between urban and rural areas**: 46 percent of the rural population have basic digital skills as opposed to 61 percent in cities (EC, 2022c). On top of everything, the **gender gap** -especially in digital skills- adds up to well-known general demographic trends in rural areas: **ageing** -the average share of people over 65 in rural areas is 2 percentage points higher than in towns, and 3 percentage points higher than in cities (Aurambout et al., 2021)- and **depopulation** -in 1975, European rural population was 32 percent, whereas in 2015 this figure dropped to 29 percent (JRC, 2022b).

Farmers and foresters need increasing digital skills to perform their daily activities (farm and forestry machinery is becoming smarter and smarter), to fulfil their administrative duties and ultimately, to benefit from digitalisation (more sustainable and efficient practices). Rural communities and businesses are also required to improve their digital skills to access services which are increasingly moving online (e.g. rural bank branches are disappearing, while e-administration, e-health and e-education are increasingly common), to benefit from digital economy (new business opportunities), to improve social inclusion and their quality of life. In this sense, digital education should be provided following an integrative approach.

Digital skills constitute one of the four priority areas of the **Path to the Digital Decade** policy programme (see **Figure 13**), which sets a new objective: at least 80 percent of all adults should have basic digital skills by 2030. The EU has mobilised EUR 85 billion to support individuals and businesses in expanding their skills -including digital ones- through different mechanisms, highlighting the contribution from the European Social Fund Plus, as shown in **Figure 14**.

Fig. 13: Four priority areas of the Path to the Digital Decade. Source: https://digital-strategy.ec.europa.eu/en/library/introducing-path-digital-decade

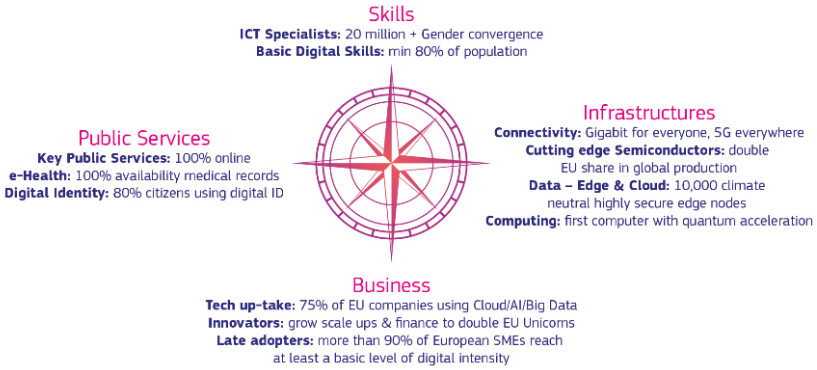


Fig. 14: Figure 14 EU investment in skills. Source: https://ec.europa.eu/social/main.jsp?catId=1223&langId=en

EU investment in skills

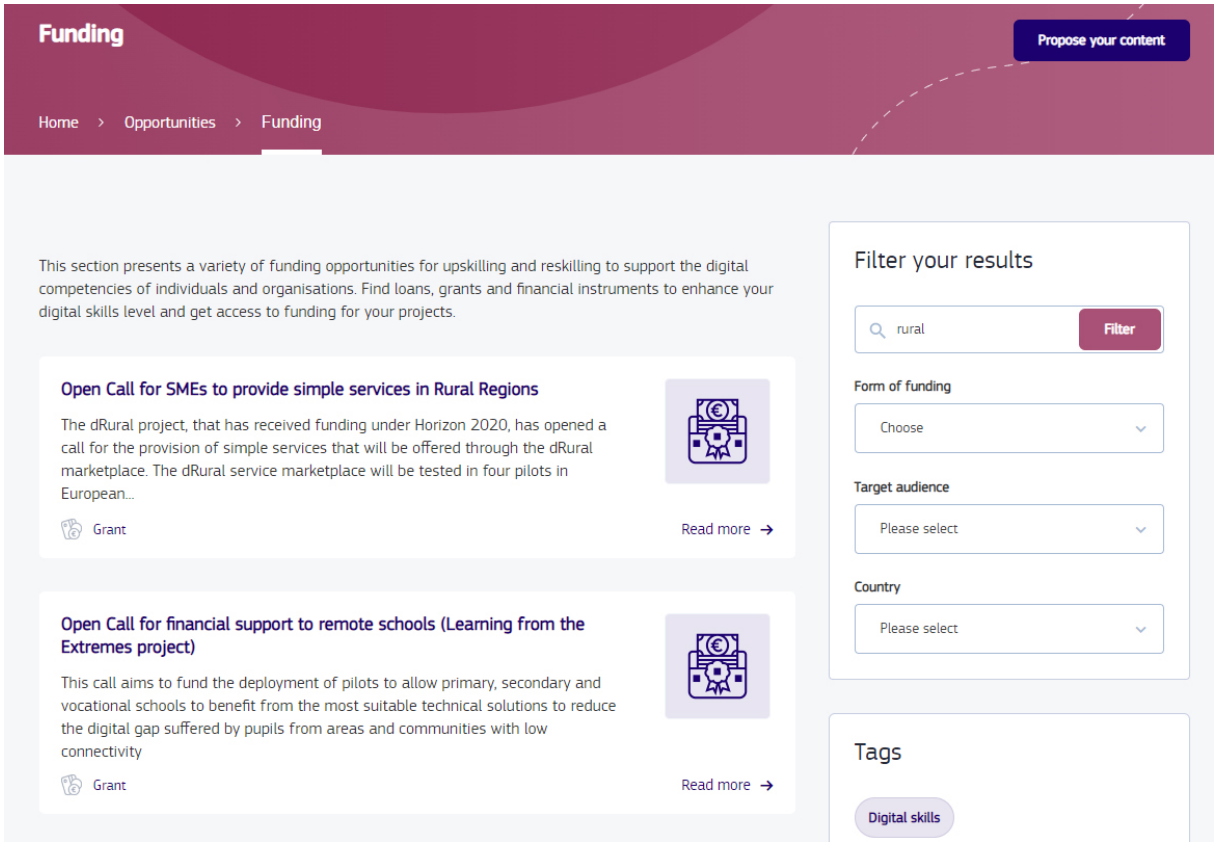
Programme	Investment (in billions of euros)*
European Social Fund Plus (ESF+)	61.5
Erasmus	16.2
InvestEU	4.9
European Globalisation Adjustment Fund	1.1
European Solidarity Corps	0.8
Digital Europe	0.5

**Resources from the Recovery and Resilience Facility specifically for skills investment cannot yet be estimated*

Whereas the Path to the Digital Decade seeks to leave no one behind and expects to contribute to improving the resilience of rural communities, there have not been **specific strategies or policies to support improving digital skills in rural areas** at the EU level. The **strategic framework for the European Education Area**[31] recognises the importance of equity and inclusion in education and training -especially after the COVID-19 pandemic- because "learners from disadvantaged backgrounds, including from rural and remote areas, are overrepresented among underachievers", but does not go beyond. Other programmes supporting digital skills are the European Skills Agenda -with no specific actions for rural areas- and the Digital Skills and Jobs Coalition, where only two funding opportunities supporting digital competences in rural areas can be found (see **Figure 15**).

31 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021G0226(01)&from=EN

Fig. 15: Figure 15 Funding opportunities within the Digital Skills and Jobs Platform specific for rural areas. Source: https://digital-skills-jobs.europa.eu/en/opportunities/funding.



The first EU Digital Education Action Plan 2018- 2020 did not propose any specific measure for rural areas, and nor does the current Plan for 2021-2027. However, recent proposals for a Council Recommendation were adopted on April 18th, 2023 following the two strategic priorities of the Digital Education Plan. The proposal for a "Council Recommendation on the key enabling factors for successful digital education and training" urges Member States to ensure access to high-quality and inclusive digital education to close the digital divided that widened due to COVID-19 crisis. The proposal for a "Council Recommendation on improving the provision of digital skills in education and training" addresses the need to adapt the programmes to the different groups and recommends Member States to "Identify 'priority or hard-to-reach groups' and set up appropriate measures to facilitate their participation, taking into account accessibility, territorial and socioeconomic gaps in digital skills". These two proposals open promising processes to improve digital skills in rural areas, especially if education and training activities are co-designed with rural stakeholders and delivered through networks that are familiar to them. Moreover, to identify motivations to start learning and to use easy-to-understand terms can facilitate the delivery of successful digital training initiatives. This is the approach followed by Cybervoluntarios[32], a Spanish NGO with 20 years of experience in supporting vulnerable groups acquiring digital skills (25% of their activities take place in rural areas).

32 https://www.cibervoluntarios.org/en

The new **CAP** presents an exceptional **opportunity** to support the development of digital skills in rural areas. More than 6 million people are expected to benefit from CAP-funded training, advice, and knowledge exchange (EC, 2022a), but these funds need to be carefully planned to not leave an important part of the rural population behind.

Member States have deployed some programmes promoting digital skills that are worth mentioning. For example, the Spanish "Digitalisation Strategy for the agri-food and forestry sector and rural areas" has among its three objectives to reduce the digital divide both for connectivity and skills. Over EUR 789 thousand have been invested in improving digital skills in rural areas, farming and forestry between 2019 and 2020 (Ministerio Agricultura Pesca y Alimentación, 2022). In 2021, a collaboration between the Ministry of Agriculture, Fisheries and Food, the University of Córdoba and the University Politécnica de Madrid led to establishing a centre for digital competences in the agrifood sector[33]. Free courses on topics like precision irrigation are provided by university teachers to increase the digital competences of workers in the agrifood sector. However, the approach is very focused in Agriculture 4.0 and do not cover other basic skills which might be needed in rural communities. Another interesting initiative is the Austrian Institute for further Education in Rural Areas. Known as LFI[34] (Ländliches Fortbildungsinstitut, in German), is an association founded in 1972 which offers vocational adult training in agriculture, forestry and rural home economics. Within the platform different activities regarding digitalisation can be found, ranging from a seminar about the benefits of digitalisation in farming to specialised online Geographic Information System (GIS) course applied to forestry. The Groen Kennisnet platform[35] is a knowledge platform for the Dutch agri-food and green sectors to facilitate knowledge dissemination and sharing. It is led by Wageningen University and Research Library and is a joint project with the Ministry of Agriculture, Nature and Food Quality.

DESIRA would like to propose the following specific objectives to improve digital skills in rural areas:

1. To support digital education and training programmes tailor-made for different target groups and embedded in rural areas' needs.
2. To take a holistic approach to communicate and educate about the benefits of rural digitalisation, including e-health, e-education, etc.
3. To involve local actors in the development of multi-stakeholder education platforms to identify the needs of the different target groups in rural areas and to co-create specific and adapted education strategies to address them.
4. To prioritise the use of existing networks and communication channels in rural areas to disseminate and conduct training.
5. To encourage the use and development of user-friendly tools/digital solutions for education and training activities.

33 https://centrocompetencias.mapa.es/
34 https://oe.lfi.at/
35 https://groenkennisnet.nl/

Progress in digital skills can be measured using:

- DESI indicators for rural areas: individuals with basic/above basic/at least basic overall basic digital skills; low/narrow/limited overall digital skills; etc.
- CAP indicator for "Enhancing performance through knowledge and innovation": Number of persons benefitting from advice, training, knowledge exchange or participating in European Innovation Partnership (EIP- operational groups supported by the CAP in order to enhance sustainable economic, social, environmental, climate-related and resource efficiency performance)[36].

36 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R2115&from=EN

5.5 To promote innovation and digital ecosystems in rural areas

DESIRA	Policy area	Digital competences, literacy
	Relation with other building block	To streamline digital education and competences adapted to different groups in rural areas
EU	Relation with other EU policies	• Cohesion Policy • Path to the Digital Decade • Common Agricultural Policy
	Contribution to LTVRA	Stronger and Connected Rural Areas

Knowledge and innovation can provide unlimited **opportunities to achieve the LTVRA** and the European **Green Deal**, especially if they are embedded in conducive digital ecosystems. The strategies fostering innovation and digital ecosystems in rural areas should contribute to thriving communities through the generation of alternatives adapted to the context and the demography. In this sense, new business opportunities can emerge in fields such as e-health, e-care, active ageing, or mobility. Similarly, well-designed, supported innovation niches can enhance the transition towards **sustainable agriculture** (Pigford et al., 2018) and **sustainable forestry** (EC, 2021d). In this context, Agricultural Knowledge and Innovation System (**AKIS**[37]) gains special relevance and it is within the new CAP that Member States have to assess its functioning and improvement. Whereas innovation processes can happen informally, they can emerge more easily where there are more opportunities -the most innovative companies are places in the most developed areas (García-Cortijo et al., 2019)-.

Emerging opportunities, such as the development of **bioeconomy and circular bioeconomy initiatives** have been driven by research and innovation and will continue to do so (EC, 2022d). Almost all the elements of the bioeconomy trace back to rural areas (ENRD, 2019a) with forestry, agriculture, and food production as its main contributors (De Schoenmakere et al., 2018). At the same time, bioeconomy policies boost sustainable innovation, generating solutions for sustainable food and bio-based products (EC, 2022d) as well as new value chains.

Fielke et al. (2020) conclude that (i) there will be an **increase of connectivity between humans and technology**, (ii) a growing connectivity will allow for more transparency regarding farming practices and information among stakeholders and (iii) digitalisation of agricultural innovation systems might present challenges in relation to balancing the priorities of stakeholders. The increased complexity reached in the evolution of IT systems calls for a **new approach** to analyse and design digital innovation ecosystems in agri-food (Wolfert et al., 2023). In this sense, the **socio-cyber-physical model** (Rijswijk et al., 2021) proposed and used within DESIRA offers a more suitable framework, as it includes the human interaction as well, integrating the research and innovation approach, and identifying responsibilities for the impacts generated in digitalisation.

37 AKIS is defined in the new CAP as "the combined organisation and knowledge flows between persons, organisations and institutions who use and produce knowledge for agriculture and interrelated fields".

Nevertheless, **innovation capacity in agriculture is underused** (EC, 2019) and many years separate the start of research from the mainstream application of its outcomes in agriculture (Alston et al., 2022). A **strong coordination is required** from all stakeholders to develop knowledge and innovative solutions to be mainstreamed at different levels and digital technologies can facilitate so.

Although not specifically designed for agriculture, forestry, and rural areas, the EC has put different mechanisms in place to support knowledge and innovation, which have also had an impact on them:

- In 2014, the *National/Regional Research and Innovation Strategies for Smart Specialisation* -RIS3 strategies- were established as an "ex-ante conditionality" to receive financial support from the **ERDF** for the period ending in 2020. **RIS3 strategies were place-based agendas** to prioritise research and innovation actions to respond to regional and national challenges, supporting also the less developed and rural regions. They were recognised as a favourable and supportive framework for innovation in rural areas (da Rosa Pires et al., 2014), although there was a limited number of RIS3 strategies prioritising rural areas for the period 2014-2020 (eight in total), according to the JRC monitoring RIS3 tool[38]. For the current Cohesion Policy programme 2021-2027, RIS3 (now called **S3**) is an "enabling condition", which means that the countries should have good governance of national or regional smart and specialisation strategies throughout the whole financial period. At the time of writing, there are 17 RIS3 documents (including final and drat) prioritising "food" across Europe and none referring to "rural", as taken from the JRC RIS3 monitoring tool. The **RRF** also has got the potential to contribute to deploy the S3 by fostering regional innovation ecosystems and innovation activities (Santos, 2021). However, the results will depend on the final implementation and governance models of this Facility (Santos, 2021), as S3 strategies require a multilevel, place-based, and multi-actor approach (Gañán de Molina et al., 2022). Additionally, S3 is still a challenging concept for most European regions and countries (Periáñez-Forte & Wilson, 2021), and rural areas have not been a priority in their design. Finally, the Interregional Innovation Investment (I3) is a new EU instrument within **ERDF** that supports interregional innovation investment projects belonging to shared S3 in the different thematic areas, including digital transition (EC, 2022i).
- **European Digital Innovation Hubs** (EDIH) are one-stop shops for businesses to become more competitive using digital services, funded through the **Digital Europe Programme** 2021-2027. EDIH relating to rural areas, agrifood or forestry sector can be found in the previous and the current funding period (e.g., *Smart Digital Farming* supports precision farming companies in Flanders; *DIH PANNONIA*, a digitalisation promotion centre in Croatia; or *Andalucía Agrotech DIH,* to support digitalisation of agrifood companies). Member States can allocate complementary funding for EDIH through the RRF, the Structural Funds Facility and Horizon Europe, among others.

38 https://s3platform.jrc.ec.europa.eu/map

The new **CAP** aims to foster knowledge, innovation and digitalisation in agriculture, forestry and rural areas. According to the Strategic Plans, the Member States aim to support 6,600 innovation projects (three times the amount for the previous period) carried out by Operational Groups under the European Innovation Partnership for Agricultural Productivity and Sustainability (**EIP-AGRI**) to develop innovative solutions allowing farmers, foresters and rural businesses to improve performance and sustainability (EC, 2022a). Additionally, over 200,000 independent advisors will receive support to transfer knowledge and to increase innovation among farmers (EC, 2022a). The **Smart Village** concept has gained relevance in the rural development agenda. Smart Villages are spaces to empower rural communities to take action to deal with the challenges they face through digital strategies and to build partnerships with cities and other rural communities. Smart villages can take a *Living Lab* approach to capitalise on the local knowledge and to co-create prototypes or innovations, or they can go a step further and be orchestrated as Fab labs, by including digital printing and production facilities (ENRD, 2019b). The CAP strategic plans aim to develop and implement more than 600 Smart Village strategies in Europe for the period 2021-2027 (EC, 2022a). To facilitate engagement, attention should be paid to the inclusiveness of spaces, prioritising locations where rural communities, farming and foresters are familiar and comfortable with.

The **New European Innovation Agenda** (adopted in July 2022) recognises innovation as indispensable to achieve the objectives of the twin transition. It presents supporting measures for innovators and technology development to address the most pressing societal issues. The Strategy expects to benefit sectors like agri-tech, mobility or health. *The Flagship 3: Accelerating and strengthening innovation in European Innovation Ecosystems across the EU and addressing the innovation divide* will focus on facilitating and connecting regional innovation valleys, with special support to regions with a lower innovation performance. Regional innovation valleys should tap into national and regional ERDF support. This action will connect with existing innovation ecosystems, such as Startup Villages. The roles of local stakeholders are of special relevance to identify gaps and needs in relation to digital innovation ecosystems.

Some examples of innovation in rural areas are the network platform for rural developers in Finland "Maaseutuverkosto[39]", the Irish remote working network supported by the Irish Rural Development Policy 2021-2025 "ConnectedHubs[40]", or the Greek rural Open Lab "Tzoumakers[41]" to create tools for small-scale agriculture.

DESIRA would like to propose the following specific objectives to promote innovation and digital ecosystems in rural areas:

1. To prioritise innovation strategies in rural areas that are aligned with the LTVRA.
2. To ensure that rural areas are present in funding programmes fostering innovation and digital ecosystems.
3. To couple digital innovation with social innovation in rural areas.

39 www.maaseutuverkosto.fi
40 https://connectedhubs.ie
41 https://www.tzoumakers.gr/english/

4. To enable inclusive spaces where rural communities, farmers and foresters can engage in digital innovation actions or to adapt existing ones (community centres, libraries, etc.).
5. To establish digital networks for all territories to connect and to share knowledge.
6. To promote the Living Lab approach in research projects working on rural digitalisation.
7. To support local stakeholders identifying the gaps and needs to reach competent rural digital innovation ecosystems.
8. To promote the use of the socio-cyber-physical approach to evaluate the impact of digital innovation in rural areas.

Indicators to monitor digital innovation:

- Number of S3 initiatives deployed in rural areas related to digital transformation.
- Number of EDIH relating to rural areas, forestry and farming. Number of digital knowledge clusters.
- Number of projects involving rural areas funded by innovation and digital programmes (e.g. *Social innovations for a fair green and digital transition* call under the Employment and Social Innovation (EaSI) strand of the European Social Fund+, or projects funded under Cluster 1 to 5 of Horizon Europe).
- Regional networks, such as LEADER groups, could support to identify innovation that is happening informally, which could indicate the innovation potential of an area.

5.6 To provide easy-to-use and affordable digital services to rural communities, farming and forestry

DESIRA	Policy area	Digital competences, literacy
	Relation with other building block	To promote innovation and digital ecosystems in rural areas
EU	Relation with other EU policies	• Path to the Digital Decade • Digital Services Act • Digital Markets Act • Common Agricultural Policy • Regulation to curb EU-driven deforestation and forest degradation
	Contribution to LTVRA	Connected Rural Areas

There are high hopes for digital transformation in agriculture and forestry. It is expected to contribute to achieving more sustainable, efficient, transparent, and fairer farming and forestry practices, as well as to enable the "twin transition". Therefore, creating a suitable environment to unleash the potential of digitalisation -based on trust and ethical values and governed by clear and accessible rules- in rural communities, farming and forestry should be a priority.

In 2020, there were 9.1 million agricultural holdings in Europe, of which two-thirds were smaller than five hectares (Eurostat, 2022b). It is **difficult to have a detailed picture of technology adoption across European farms**, given their variety and number, as many remain consistently unaccounted for. For example, the DESI indicator "digital technologies for businesses" monitors items like electronic information sharing, social media, AI, or e-invoices used by European enterprises. However, only enterprises with 10 or more persons employed are considered to calculate DESI, and there is not any distinction between urban and rural ones. It is known that **technological development is mostly favouring big corporations** rather than supporting small farmers in making informed decisions (Rotz et al., 2019). Still, there is a **gap between the technologies offered by research and market and the uptake** by farmers (Perpiña Castillo et al., 2021). One of the limitations to increasing adoption is that there is limited availability of cost-benefit analysis on the use of digital technologies in farming (EC, 2022k). Another main constraint is that not all technologies are adapted to the context in which they will be used. Other limitations include farmers' skills, reluctancy to share data, unclear information about how data will be used, connectivity issues or system interoperability (EC, 2022k).

Different strategies contribute to overcoming these. The high initial costs or investments to adopt new services can be reduced through cooperative or collaborative uptake. Connectivity issues affecting the correct use of technologies in rural areas could be improved if they are tested in real conditions -including discontinuous or faulty connectivity-. More transparent, user-friendly digital services could contribute to reducing the users' reluctance to share data and raise awareness about the benefits. Finally, adapting technologies that users are familiar with to new purposes (e.g., online extension services using instant messaging applications) can increase adoption in rural areas.

In the **forestry** sector, the story repeats. It is recognised, for many parts of the EU, as very "traditional" with slow technology and innovations uptake (A. Brunori et al., 2021). Even for Sweden, one of the digital frontrunners, there is a good way ahead in terms of digitalisation in this sector (Mistra Digital Forest, 2022). **Digital transformation is happening where it is more profitable**, such as monitoring forest health and forest resources (A. Brunori et al., 2021). Nevertheless, digitalisation will support the implementation of the new EU Forest Strategy for 2030 which relies on strategic monitoring and research and innovation to support the socio-economic functions of forests. Similarly, digitalisation can support implementing the Regulation to curb EU-driven deforestation and forest degradation[42] (repealing the European Union Timber Regulation), for instance, in the collection of the geographic coordinates of the plots of land where products are produced, or in the certification and traceability of wood.

Numerous digital services based on artificial intelligence, Internet of Things (IoT), robotics, blockchain, 5G, supercomputing, etc., **exist and are constantly evolving**. Only the knowledge base of potential digital game changers in rural areas built within DESIRA project - GNOMEE[43] contains over 600 services. However, digital transition is not happening at the same pace for all, **leaving behind remote disconnected and economically smaller** properties in rural areas, as well as people with lower digital skills. Therefore, supporting the creation of networks of end users, digital brokers/enablers and technology developers to enable technology co-design processes in rural areas could contribute to revert this trend.

Several EU policies aim to make the digital transition fairer and more transparent, namely:

- The **Path to the Digital Decade** prioritises the take-up of new technologies in small businesses establishing as a goal for 2030 that more than 90 percent of Small and Medium Enterprises (SMEs) reach at least a basic level of digital intensity. Unless rural businesses are given priority, it is likely that the remaining 10 percent of SMEs will be in rural or remote areas.
- The **Digital Services Act** entered into force in November 2022 providing new rules to protect consumers, and to establish transparency and accountability frameworks for online platforms, such as network infrastructure, hosting services or collaborative economy platforms.
- The **Digital Markets Act** will allow start-ups and small technological providers to be able to compete in the digital market, offering better services at better prices to consumers.

While these policies create a favourable environment to small technology developers and users, none of the policies above provide specific recommendations for rural areas, farming and forestry services and neither do they refer to improving usability. The **new CAP**, however, requires Member States to define in their Strategic Plans how the use of digital technologies will be demonstrated and boosted in rural areas, farming, forestry and advisory services. Whereas all farmers are expected to have access to advice on digital issues (EC, 2022a), little information is easily available regarding how accessibility to digital services will be encouraged[44] or how digital uptake, marketplaces, online services, etc. will affect rural inhabitants.

42 https://eur-lex.europa.eu/resource.html?uri=cellar:b42e6f40-4878-11ec-91ac-01aa75ed71a1.0001.02/DOC_1&format=PDF
43 https://www.gnomee.eu/kbt/
44 At the time of writing this Policy Roadmap, the Strategic Plans are not available in English, therefore unable to be analysed in depth.

DESIRA would like to propose the following specific objectives to provide easy-to-use and affordable digital services to rural communities, farming and forestry:

1. To support co-design processes for digital technologies used in rural areas to ensure that the needs of rural communities, farmers and foresters are addressed.
2. To encourage digital technologies to pass rural proofing (test in real contexts including small, remote farms and villages) before they go out in the market.
3. To support digital technologies that capitalise on existing services used by rural communities/ farmers/foresters or those which serve multiple purposes (cost reduction).
4. To establish a network of rural digital brokers/enablers who can connect and learn from other communities.
5. To consider the provision and funding of these services in rural development strategies.

Progress in relation to access to digital services can be measured using the Digital Intensity Index (DII) included in the Annex of the Digital Compass (or Digital Intensity Score in DESI). It can support monitoring the adoption of digital services, as it is a micro-based index that measures the availability at firm level of 12 different digital technologies. It is calculated using the results of surveys on the usage of information and communication technologies (ICT) in enterprises and households by Eurostat. An improvement to this index would be to differentiate the urban and rural enterprises. Another improvement could be to obtain information about the use of digital services in SMEs with less than 10 people employed (as are most businesses in rural areas).

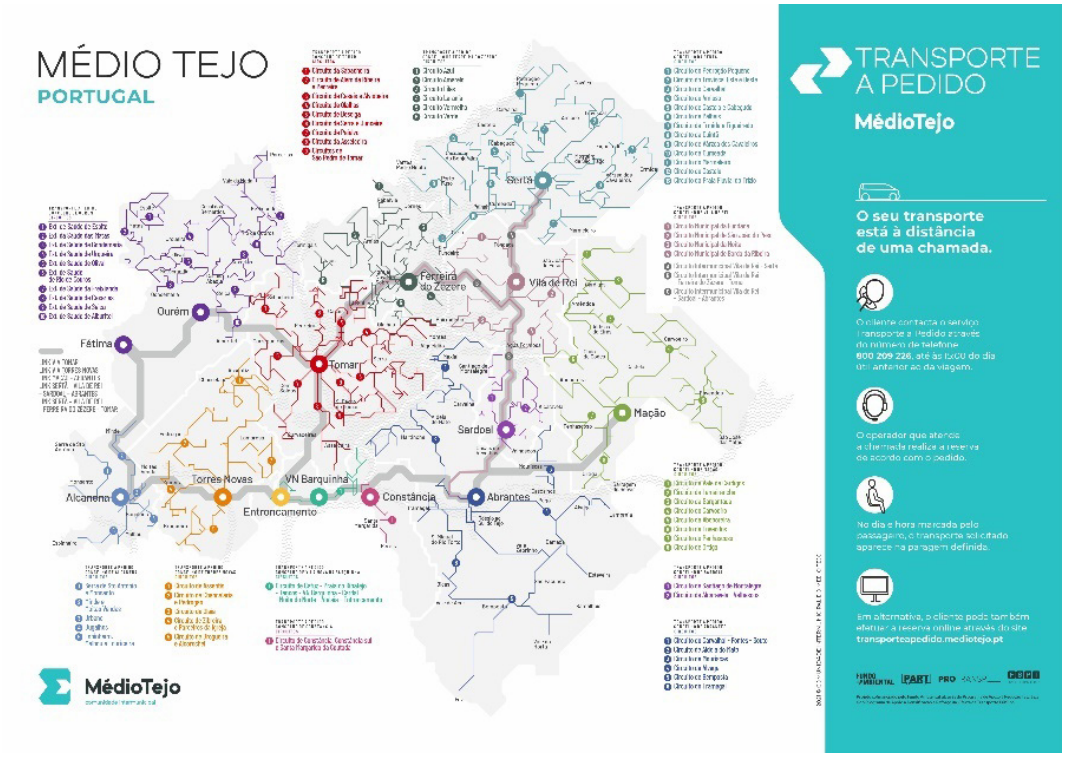
5.7 To mainstream digital solutions to support service provision and administrative routines in rural areas

DESIRA	Policy area	Rural digitalisation
	Relation with other building block	To streamline digital education and competences adapted to different groups in rural areas
EU	Relation with other EU policies	• Path to the Digital Decade • New Interoperable ActEuropean Digital Identity
	Contribution to LTVRA	Stronger and Connected Rural Areas

The LTVRA describes the concerns of many Europeans about "**the erosion of rural infrastructure and service provision**, including access to healthcare, social services and education as well as to postal and banking services" and recognises the **opportunities that the European digital ambitions** can bring to deal with such challenges. Undoubtedly, the digitalisation of **public and private services** and the use of new technologies can support improving and enhancing -not replacing- the quality of the service provision in rural areas. However, the advanced digital skills and high-quality connectivity that are required to fully benefit from digitalisation are not always present in European rural areas. Futhermore, only a quarter of Europeans living in sparsely populated areas have got above-basic overall digital skills, and less than half have got at least basic digital skills (EC, 2022c). Supporting networks of digital facilitators in rural areas (e.g., trained members of the public administration, such as librarians or advisors) could support individuals with lower digital skills making use of digital services. In terms of connectivity, if digital services are not designed or adapted to operate under faulty connection conditions, the urban-rural gap regarding access to services might increase. This applies to all types of services, for instance, there are streaming platforms that adapt the video quality to the bandwidth whereas others, are not able to reproduce the content unless there is minimum quality bandwidth.

A relevant initiative is the Portuguese "Transporte a pedido", which is an on-demand public transport service at fixed rates that connects localities within a region. Passengers can book their trips until 15h00 the day before their trip via phone call or online and a branded vehicle will pick them up at a determined stop (see **Figure 16**).

Fig. 16: "Transporte a pedido" services in Médio Tejo, Portugal. Source: https://transporteapedido.mediotejo.pt/Reservas/images/mediotejo/info/TaP_Mapa_Rede.jpg

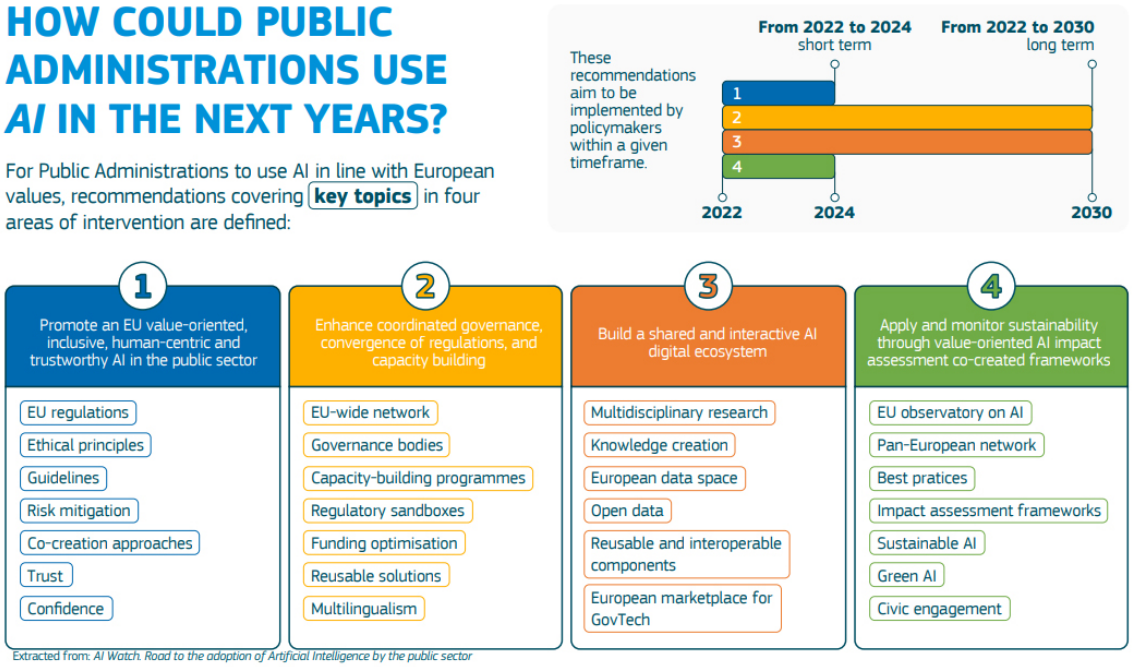


The general trend in digitalising both public and private services has had an impact on EU policies as well. The first Digital Agenda for Europe 2010-2020 focused on the creation of a single digital market to foster access to digital goods and services for citizens and businesses. One of the four cardinal points of the Path to the Digital Decade is the digitalisation of public services. More specifically it **aims to digitalise 100 percent of the key public services**, to facilitate **100 percent of European citizens with access to medical records online** and **80 percent of citizens to have access to digital identity by 2030.** To monitor progress in this regard, the eGovernment Benchmark included in DESI, evaluates the digital government services in 35 countries, including the 27 EU Member States. Citizens from participating countries assess four dimensions of the services, including user centricity, transparency, key enablers, and cross-border services. This evaluation, however, does not differentiate between rural and urban citizens.

The **Interoperable Europe Act** introduced earlier (see section **5.2 To increase interoperability of digital technologies for rural areas, forestry and farming**) is highly relevant as it is the cornerstone to reinforce interoperability among public administrations in the EU. It recognises interoperability as the key to mitigate cybersecurity risks, to increase efficiency and trust. Reliable and efficient digital public services are more resilient to replacement. The Act aims to generate an interoperability governance structure to enable public and private cooperation as well as to co-create interoperability solutions to be used by public administration at all levels. This could be relevant to enable "one-stop shops" for digital service provision.

To support the digitalisation of the public sector in line with European values (see Figure 17) the EC adopted the proposal for a **regulation establishing a framework for a European Digital Identity**[45] in June 2021. The proposal updates the 2014 regulation in relation to cross-border electronic identification, authentication and website certification. This document acknowledges the limited/lower access to services of citizens living in rural areas and expects to support the use of online and offline public and private services and to provide a more inclusive access to them.

Fig. 17: Recommendations for Public Administrations to use AI in line with European values. Source: AI in the public sector (JRC, 2022a).



To increase digitalisation of services, significant **investments** are being directed through the Digital Europe Programme (EC, 2022g), including:

- EUR 2.2 billion to increase accessibility and broaden the use of supercomputing in areas such as health, environment and security, and in industry, including small and medium-sized enterprises.
- EUR 2.1 billion for AI including, among other objectives, to open up the use of artificial intelligence by businesses and public administrations and to strengthen and support existing AI testing and experimentation facilities in areas such as health and mobility.
- And EU 1.1 billion for ensuring the wide use of digital technologies across the economy and society to support high impact deployments in areas of public interest (including health, Green Deal, smart communities), support public administrations and industry to deploy and access state of-the-art digital technologies and build trust in the digital transformation.

45 https://eur-lex.europa.eu/resource.html?uri=cellar:5d88943a-c458-11eb-a925-01aa75ed71a1.0001.02/DOC_1&format=PDF

Additional EUR 47 billion (36 percent of total digital expenditure in all Recovery and Resilience Plans) have been allocated by Member States through the RRF fund to contribute to digitalise public services (EC, 2021e).

The **COVID-19** crisis triggered an **intensification on the use of public and private digital services** and caused societal changes from which rural areas could benefit from. The report "Artificial Intelligence and Digital Transformation: early lessons from the COVID-19 crisis" by De Nigris et al. (2020) identifies three main types of outcomes. The first outcome is that COVID-19 has acted as a **booster** of the switch to online education, public administration, commerce and businesses; and the use of AI in medicine, among others. Second, COVID-19 has been an **amplifier** of teleworking and the better adaptation of digital companies to the lock down. Thirdly, COVID-19 has raised **concerns** about potential personal data misuse, misinformation, cybersecurity and high dependency on non-European platforms. Moreover, the report refers to an increased gap among the wealthier and poorer groups (among which, rural areas are included) in society due to COVID-19. In relation to that, the uneven pace of digitalisation processes created by COVID-19 can increase inequalities between urban and rural areas, as stated by the European Foundation for the Improvement of Living and Working Conditions EuroFound- (Rodríguez Contreras, 2021).

DESIRA would like to propose the following specific objectives to mainstream digital solutions to support service provision and administrative routines in rural areas:

1. To ensure access to services and administrative procedures in rural areas under similar conditions as urban ones.
2. To support "one-stop shop" for administrative routines and services in rural areas.
3. To promote public-private collaboration and new technologies to support the service provision in rural areas.
4. To ensure digital services and e-administration pass the "rural proofing" and "significant scenario" testing procedures.
5. To establish a network of digital brokers/intermediaries within the public administration for rural areas.
6. To gather rural data about Digital Public Services (e.g. eGovernment Benchmark) for the Digital Economy and Society Index (DESI) or to differentiate rural/urban data if already exists in the database.

5.8 To support data-driven decisions in farming, forestry and rural areas

DESIRA	Policy area	Digital trust
	Relation with other building block	To improve rural and agriculture data governance and data management
EU	Relation with other EU policies	• Artificial Intelligence Act • Product Liability Directive • Sectoral safety legislation
	Contribution to LTVRA	Resilient and Prosperous Rural Areas

There are **numerous technologies** available for Farming 4.0 and Forestry 4.0 that **support decision-making based on data**, including Artificial Intelligence (AI). AI algorithms can automatically process and analyse large amounts of data, identify patterns, and make predictions. Whereas algorithms can be a tool to generate positive impact, they can also lead to discriminatory decision-making, influencing people's lives (European Union Agency for Fundamental Rights, 2022).

Data analytics can be used in farming and forestry technology to support several operations, such resource use, pest management, crop selection and planting, harvest planning and logistics, etc. These technologies have got the capacity to contribute to a more sustainable resource utilisation and to enable environmental benefits. To unleash their potential, stakeholders need to **accept and to foster their use, as well as to get funding** to implement them (Ayoub Shaikh et al., 2022). More specifically, smallholders (a majority in Europe[46]) can benefit from data-driven agriculture only if the right farm data, at the right time in the right format to make better decisions is available and used (Maru et al., 2018). Along the same lines, the EU Forest Strategy introduced an EU-wide forest observation framework to provide open access information on the management and condition of EU forests with the views to increase data-driven decision-making on forests. The Strategy expects to increase public trust in forest management, reduce illegal logging and support sustainable forest management and adaptability to climate change.

However, promoting data-driven decisions applied to decision support systems (**DSS**) in agriculture[47], forestry and rural areas can be considered as the **last step of the digital transformation**, as it can only happen once the gap of the triple digital divide has been closed (good-quality infrastructure available, advanced digital skills and sufficient trust in the digital ecosystem). Therefore, it should come last in the list of rural digitalisation strategies priorities.

On the one hand, **advanced digital skills** should enable users to understand the solutions proposed by the technology as well as to identify potential faults. Acquiring advanced digital skills should not solely rely on users -and their supporting organisations- improving their digital capacities and becoming

46 Almost two-thirds of EU farms are smaller than five hectares (Eurostat, 2022b).

47 Following the definition provided by Zhai et al., (2020), "Agricultural Decision Support Systems (ADSS) is a human-computer system which utilizes data from various sources, aiming at providing farmers with a list of advice for supporting their decision-making under different circumstances".

"smart data users and managers" (Maru et al., 2018). Likewise, digital systems should become easier to use and to understand. On the other hand, improving **trust in digital ecosystems** depends, among others, on the suitability of the solutions provided by the technology -which also depends on the accuracy of the models, often calibrated with data from external contexts-, the quality of the data and the models, and a reduced bias of data-driven technologies.

The last point is closely related to **DSS architecture**, which is composed of three elements: the database, the model, and the user interface (Rinaldi & He, 2014). DSS systems face several challenges. First, data-driven technologies require reliable, abundant, varied, and meaningful data to generate useful deductions based on facts. **Context-specific data** is not often available for rural areas, farming, and forestry activities, so models need to use datasets provided by third parties. Consequently, the solutions proposed by technologies might not suit the local needs, and little control exist over the datasets. In the case of farming, the lack of data might be partially due to farmers' reluctancy to share their data. According to Bacco et al. (2019) digital solutions for smart farming are underutilised as users fear data misuse and losing control of their businesses. Secondly, there is the issue of **model design**, for digital applications are not always constructed and tested in the diversity of rural environments where they would then be used. Thirdly, graphical **user interfaces** can facilitate the usability and accessibility of digital applications. However, simplified graphical user interfaces are still a challenge in smart farming (Zhai et al., 2020).

To overcome these issues, tools, and applications should be **designed for specific situations and capacities**, and there should be measures in place to guarantee fair governance and management of data. This is particularly relevant in the case of smallholders, often the least powerful part of the value chain, who should take every possibility to be included in the collective flow of data in the agrifood sector (Maru et al., 2018). Moreover, there should be a system in place to assess and mitigate bias in algorithms, especially when these are used for decision-making that can have an impact on people (European Union Agency for Fundamental Rights, 2022). Finally, to fully exploit AI in farming, data processing should move from cloud platforms to computation platforms closer to the source to reduce delays (Bacco et al., 2019).

The European Commission launched on April 18th, 2023, the European Centre for Algorithmic Transparency[48] (ECAT) to support enforcement of the new rules to make a safer and more accountable online environment, as defined in the **Digital Services Act**. ECAT is managed by the Joint Research Centre (JRC). There, scientists and experts will work with quadruple helix stakeholders to understand how algorithms work, analysing their transparency and assessing their risks. Initially, it will focus on the algorithms used by the Very Large Online Platforms and Very Large Online Search Engines, which have an influence on all citizens -as they are of common use-. However, in the medium-term the specificities of rural areas should also be considered. The results might also impact on future algorithmic development.

The EC proposed three legal initiatives to create a **trustworthy AI**. (i) A first ever legal framework on AI, the **Artificial Intelligence Act**, which considers agriculture as one of the seven high-impact sectors in

48 https://algorithmic-transparency.ec.europa.eu/about_en

Europe to build strategic leadership regarding AI. (ii) **Product Liability Directive**, adapting liability rules to the digital age and AI, especially for products in the modern digital economy (e.g., smart devices and autonomous vehicles). (iii) A revision of the **sectoral safety legislation** including the Machinery Directive -to fill in the number of gaps in the current product safety legislation which were highlighted on the "Report on the safety and liability implications of Artificial Intelligence, the Internet of Things and robotics"- and the General Product Safety Directive -to "provide a safety net for products and risks to health and safety of consumers that do not enter into the scope of application of the AI proposal"-.

The EC has pulled **resources** from Horizon Europe programme and Digital Europe programme (EUR 1 billion per year) and RRF (EUR 134 billion available for digital transformation) to support developing AI in Europe (EC, 2022h). The pilot AI/Blockchain Investment Scheme and its Support Programme raised EUR 700 million to fund AI and blockchain start-ups and SMEs across Europe (EIF, 2020). The European Innovation Council provided over EUR 250 million during a pilot phase (2018-2020) to numerous AI innovations including some in the food and agriculture sectors (EC, 2021b). Despite the significant efforts of the EC to make Europe become "a world-class hub for AI", it is unclear how much funding is flowing for rural businesses, forestry and agriculture sectors to support AI concretely.

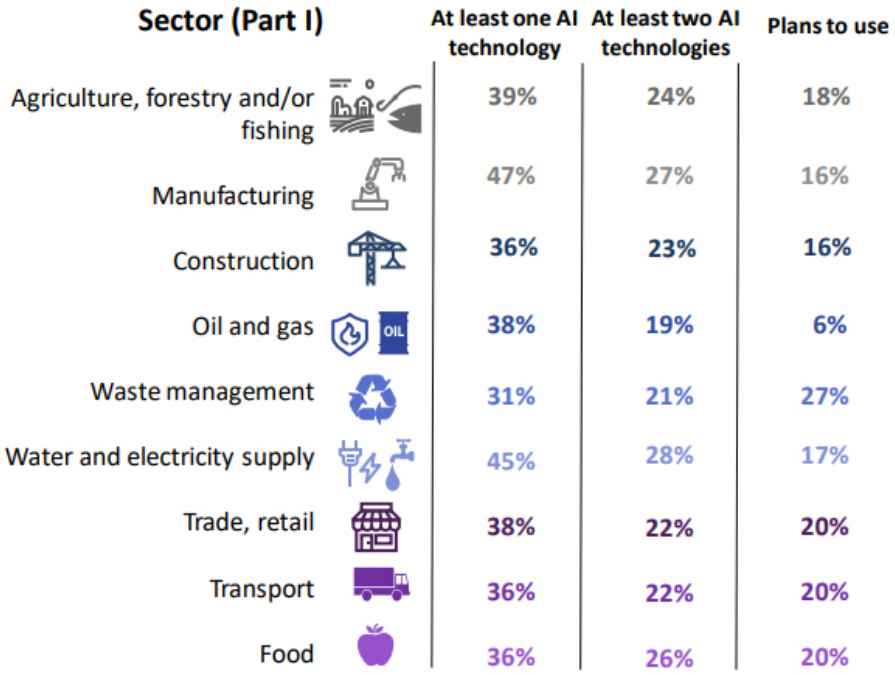
DESIRA would like to propose the following specific objectives to promote data-driven decisions in farming, forestry and rural areas:

1. To support data-driven and AI systems applied in/for rural areas, farming and forestry which are aligned with the LTVRA and multifunctional farming.
2. To prioritise data-driven and AI systems in rural areas that use contextualised data in their design processes.
3. To make information about data-driven applications accessible for farmers, foresters and rural communities so they can make informed decisions about their use.
4. To promote the use of data-driven applications once rural digital ecosystems are mature (users with advanced digital skills and sufficient degree of digital trust).
5. To protect the fundamental rights of farmers, foresters and rural communities in the applications using algorithms.
6. To conduct regular algorithmic risk assessments in the digital tools used in rural areas, farming and forestry.

The **progress** in the use of AI and data-driven in agriculture, forestry and rural business could use some metrics included in the survey on the uptake of AI technologies carried out by Ipsos for the EC[49]: level of adoption use of AI by sector (see **Figure 18**), challenges to the use of AI and planned use. The sectors include "agriculture, forestry and/or fishing" and "food" businesses with four or more workers. Other rural sectors could be added.

49 https://www.ipsos.com/sites/default/files/ct/publication/documents/2020-09/european-enterprise-survey-and-ai-report.pdf

Fig. 18: Levels of adoption of AI by sector. Source: survey on the uptake of artificial intelligence (AI) technologies carried out by Ipsos for the EC.



Other metrics can be taken from EUROSTAT statistics on Information and Communication Technologies and e-commerce for businesses, households and by individuals - which are also part of DESI-, such as big data analysis, use of robotics or Internet of Things, although not all metrics are provided for rural areas, what should be considered a priority.

5.9 To monitor rural digitalisation policies progress, impacts and efficiency

DESIRA	Policy area	Rural digitalisation
	Relation with other building block	To raise awareness about the value of rural areas and to foster public engagement in rural issues
EU	Relation with other EU policies	• Common Agricultural Policy • Path to the Digital Decade
	Contribution to LTVRA	Connected, Resilient, Strong and Prosperous Rural Areas

Several policies influence digitalisation in European rural areas and mobilise resources. However, they are many factors concerning the policy assessment in rural digitalisation. The first one is the **absence of a comprehensive strategy for rural digitalisation at EU level**. The massive number of initiatives dealing with digitalisation in the EU, as displayed in this report, hardly mention or have specific approaches for rural areas. At national and regional levels, rural digitalisation strategies are scarce and recent. The strong coordination required among all the public administrations with responsibilities in rural digitalisation (e.g., infrastructure, education, rural development, agriculture, economy, etc.) does not always exist. Moreover, there are **no binding mechanisms to push Member States to fulfil the objectives proposed** in the Path to the Digital Decade for rural areas (e.g., all populated areas covered by 5G network; 100 percent of the key public services digitised by 2030). Another key issue is the **rapid pace of digital transformation**, which requires a constant review of policies and the creation of new ones. Finally, the **lack of data regarding rural digitalisation** at all levels limits the capacity to define targets monitor progress. In this sense, the Rural Observatory and the data spaces set up by the EC (e.g., data space for agriculture, Green Deal, or smart communities) could serve as a repository to present the data gathered at different levels, both public and private. Guidelines for data gathering in compliance with the Data Governance Act and the Data Act, would be helpful.

Being digitalisation a cross-cutting objective in the **new CAP** and supporting the European twin transition, it is a great opportunity to strengthen objectives for rural digitalisation and their influencing policies.

The European Commission started to monitor the digital progress of Member States in 2011 through the Digital Agenda Scoreboard and then with the Digital Economy and Society Index (DESI) in 2015. The index includes four dimensions: human capital (digital skills of individuals and the number of ICT specialists, etc.), digital infrastructures, integration of digital technology and digital public services. Annually, it offers a score and ranking for all the EU Member States. An important limitation of DESI is that it only provides information for rural areas in very few of its variables since 2021, therefore it would be helpful to disaggregate or to identify with data relates to rural areas in existing datasets when possible.

DESIRA would like to propose the following specific objectives to monitor rural digitalisation policies progress, impacts and efficiency:

1. To encourage the use of policy impact assessments in strategies related to rural digitalisation at European, national, regional and local level.
2. To set up quantifiable indicators to monitor rural digitalisation progress, impacts and efficiency of policies, and to keep them updated.
3. To make data about rural digitalisation accessible through the Rural Observatory and the European data spaces.
4. To disaggregate rural data regarding digitalisation.

5.10 To raise awareness about the value of rural areas and to foster public engagement in rural issues

DESIRA	Policy area	Rural digitalisation
	Relation with other building block	To monitor rural digitalisation policies progress, impacts and efficiency
EU	Relation with other EU policies	• Common Agricultural Policy • Cohesion Policy
	Contribution to LTVRA	Connected, Resilient, Strong and Prosperous Rural Areas

Rural areas play a **key role in the expected transformation proposed by the European Green Deal** which aims for "No net emissions of greenhouse gases in 2050 and to decouple economic growth from resource use". More specifically, the Farm to Fork strategy -at the heart of the Green Deal- aims to drive the European food systems towards sustainability, considering that all citizens and operators across the value chain benefit from a just transition. Also, the Biodiversity Strategy for 2030 -another core part of the Green Deal- wishes to put European biodiversity on the path to recovery, which should benefit rural areas as their reservoirs. Likewise, the Green Deal is expected to contribute to the resilience of rural areas with the creation of new opportunities, for instance, creating new business in bioeconomy.

To achieve the EU's ambitions, **society at large should recognise the inter-dependency** between all territories, as well as the role of rural areas as providers of essential goods and services, such as food, water, ecosystem services, energy, etc.; and mitigators of climate change. In this sense, the last Special Eurobarometer about Agriculture and the CAP shows that 95 percent of Europeans consider that agriculture and rural areas are important for "our future", a share of respondents which has risen in 22 Member States since 2009 (EC, 2022e). Despite the **general positive consideration of rural areas**, their development is not even to the urban ones. The attractiveness of rural areas is often associated with an urban vision of natural landscapes, quietness, and high environmental quality (low noise and air pollution) (EC, 2022j), yet the issues and needs of rural communities are often ignored. Moreover, the existing diversity of rural areas across Europe requires contextualised analyses and bottom-up methods to tackle their specific concerns.

> The countryside, farms, villages and small towns, the coastal margins and islands, mountains and forests with their local cultures, people and communities, wildlife, landscapes, healthy environments, cultural heritage, and the social strength, self-government and mutual support found in rural communities, form the basis of a **good quality of life in rural areas that should be valued and cherished for future generations**. We express our concern that these rural features and values are challenged by exodus, decline and migration of skilled people.
>
> *The European Rural Parliament Manifesto 2022*

Rural areas have also **gained relevance in the EC policy framework** through the LTVRA and the new CAP, both striving for vibrant and economically viable rural Europe. The Rural Pact (one of the instruments to achieve the LTVRA) has been created to amplify the rural voices, to structure and enable networking and to encourage voluntary commitments to act for the vision. In this endeavour, digitalisation is a key instrument to improve communication and networking. Since the Rural Pact was created after the new CAP, there is no visible funding allocated. The Commission will take stock of the actions planned for rural areas in support schemes funded by the EU and Member States through Cohesion Policy Funds and the CAP by mid-2023 (as indicated in the "Next steps" of the LTVRA Communication).

Digital tools can support rural voices to be heard. In this sense, the LTVRA used an online public consultation to identify key aspects for rural prosperity. Of the 2,326 total responses, 62 percent of the stakeholders were citizens, of which 61 percent identified as living in rural areas (including 9 percent living in remote rural areas) (EC, 2021c). At the same time, the European Rural Parliament Manifesto from 2022 showed concerns about the under-representation of civil society in policy making, where only the stronger rural voices have got power. Again, digitalisation can enable a more **balanced engagement**. It can facilitate marginalised communities to have a voice through more accessible processes, combining online mechanisms with existing offline ones. One of the tools to promote the digital engagement of communities and businesses are the Rural Digital Hubs, defined as "spaces with access to superfast broadband, often alongside community and business focused services" (Price et al., 2022).

The Manifesto also recognises a domination of "urban and growth thinking" in the political discourses, both at European and national levels. It refers to the existing distance between the policy level and the rural actors which "is visible in politics, policies actions and communications", leaving the development potential and added value of rural areas under recognised. Along the same lines, a recent study about narratives on second-home practices and related politics during the COVID-19 crisis in Estonia and Finland, concludes that there is a **need to rethink the central city-based model** of regional development (Pikner et al., 2023).

The social movement "España Vaciada" ("Emptied Spain", in English) initiated to raise awareness about the massive depopulation and inequalities that Spanish rural areas suffer in relation to other territories. In September 2021, over 160 local and regional groups gathered to run jointly as a political platform in the next regional and national elections after "Teruel Existe[50]" ("Teruel exists" in English) -one of the constituent members- became the leading party in the province. They obtained one seat in the Spanish Congress and that vote was decisive to confirm the Spanish prime minister.

Not only can digitalisation contribute to the "ruralisation" of public discourses, but it also supports the **consolidation and creation of urban-rural networks**. In food systems, for instance, numerous digital platforms, messaging applications and social networks allow for a closer -or direct- relationship between consumers and producers, increasing transparency and trust, and obviously business opportunities.

Networking, cooperation and knowledge sharing among different rural areas is already being well supported by digitalisation. An example is the EU CAP Network[51], which facilitates communication and

50 Teruel is one of the most depopulated provinces in Spain, that has often been neglected in the policy and budget transferring strategies.
51 https://eu-cap-network.ec.europa.eu/eu-cap-network/about-european-cap-network_en

cooperation of innovation and knowledge for sustainable agriculture, forestry and rural areas across Europe. Many of their activities, such as seminars, experts' meetings, etc., happen online and are complemented with face-to-face activities, such as site visits. Its actions are funded through technical assistance from the **European Agricultural Fund for Rural Development** (EAFRD). EAFRD supports farmers and rural communities increasing sustainability and competitiveness. The fund is aimed at actions to foster digitalisation and to improve attractiveness of rural areas as places to live and work, among others. The current budget available is EUR 87.44 billion for the period 2021 to 2027 with an extra support from the Next Generation EU of EUR 8.07 billion for the years 2021 and 2022 (EC, 2021g).

In addition, the CAP Strategic Plans envisage investments to increase attractiveness of rural areas, aiming to create at least 400,000 jobs (EC, 2022a).

DESIRA would like to propose the following specific objectives to raise awareness the value of rural areas and to foster public engagement in rural issues:

1. To align the national and regional strategies influencing rural digitalisation with the EU's LTVRA (to use rural proofing mechanisms).
2. To support digital innovations that help overcome existing constraints in rural areas (such as participation in decision making, access to services, etc.), enhancing local knowledge and public engagement.
3. To disseminate/to consolidate platforms supporting connections among rural-urban areas and among rural-rural.
4. To increase awareness about the specificities of rural areas to challenge the predominant urban-centric approach to societal issues.

Some indicators to monitor the relevance of rural areas in Europe could be to analyse how often are rural areas mentioned in policies, online or in public discourses. The monitoring of the application of the rural proofing mechanism included in the LTVRA should also be a source of information.

6 Transformative policies for rural digitalisation

The analysis of the current rural digitalisation context highlights the complexity of the policy mix and the variety of approaches and entry points to boost it. Despite progress and collaborative efforts between the EU and national/regional governments, rural areas still face challenges in bridging the digital divide.

The analysis emphasises that rural digitalisation needs to be governed to be inclusive and sustainable. While the European Commission has been proactive in proposing recommendations and targets, regulating digitalisation aspects and providing support for implementation, it is crucial for Member States to make decisions and establish incremental objectives and targeted interventions adapted to their starting points. Explicit responsibilities, implementation mechanisms and adequate funding should be defined to ensure effective policy implementation, while addressing the unique needs of rural areas. In addition to clear objectives, it is important to assign clear roles and responsibilities to actors with sufficient authority in implementing these objectives. Furthermore, incentives should be provided to encourage the emergence of change-makers at local, national and EU levels.

DESIRA has put forward a Policy Roadmap that consists of ten building blocks, providing a clear direction for achieving inclusive and sustainable digitalisation in rural Europe. These building blocks and their associated objectives offer guidance and actionable steps to adopt a comprehensive and multi-stakeholder approach that addresses the factors contributing to the digital divide in rural areas. The building blocks are designed to be adaptable based on the context and can be tailored to different decision-making levels and scales. They provide flexibility to be scaled up or down according to the specific situation of each rural area. Additionally, while some building blocks should be implemented through compulsory measures, others can be voluntary or mixed decisions, following Howlett & Ramesh, (1995)[52].

Four building blocks, namely 1 – infrastructure and connectivity, 2 -interoperability of systems, 3 -data governance, and 9 – policy monitoring, should be initiated at the EU level and serve as a foundation for policies at national, regional, or even local scales. These building blocks should be enforced through compulsory instruments such as regulations and direct provision of funds, supported by public enterprises. In the case of **interoperability** of systems and **data governance**, establishing rules to regulate the activities of global players in Europe is key. A high-level framework that regulates the operations of non-EU actors within EU territory already exists and should be supported by mandatory instruments at the national level.

Achieving full **connectivity** for Europe has been a priority since the First Digital Agenda, but further efforts are required, especially in remote and sparsely populated areas to provide a high-quality infrastructure. While there have been some advancements in **monitoring** rural digitalisation, both building blocks require additional commitments at the national level.

The second group consists of two building blocks, 4 -digital education and 7 -service provision and administrative routines, where key policy decisions should be made at the national level. The European

52 Based on the classification of policy instruments by Howlett & Ramesh, (1995), compulsory instruments include regulation, public enterprise, or direct provision; mixed instruments refer to education, information and exhortation, subsidies, tax and user charges; and voluntary instruments consider family and community, voluntary organisation, private markets.

Commission can propose recommendations and set targets, but due to variations in rural digital **infrastructure** and **skills** among Member States, as well as the readiness to implement digital solutions to support **service provision and administrative routines** in rural areas, it is advisable to delegate these decisions to the national level. Transformation to e-administration requires strong commitment and coordination among national public entities, supported by compulsory instruments at the national level. However, a combination of compulsory and voluntary instruments may be more suitable for implementing tailored solutions to enhance digital skills and infrastructure in rural areas.

Three other building blocks are highly dependent on the context and require greater involvement at the regional and local levels. These include 5 -providing easy-to-use and affordable digital services, 6 promoting innovation and digital ecosystems, and 8 supporting data-driven decisions in farming, forestry, and rural areas. While policy instruments and funding can be designed at the EU and national levels, the final decisions and adoption should be voluntary, based on the willingness and capabilities of each region and locality.

Finally, **increasing awareness of the value of rural areas and fostering public engagement in rural issues** is a broad and comprehensive building block, not exclusively tied to rural digitalisation. This calls for the implementation of rural proofing mechanisms at all levels, from the EU to the local level, to shape policies influencing rural digitalisation.

The specific objectives provided within each building block have been shaped by the transformative policy approach proposed by Brunori, G. (2022), as described in section **3.2 Transformative policies**. **Table 5** demonstrates how these objectives can contribute to directionality, market integration, and reflexivity concerning access, complexity, and design.

In short, stakeholders can use the recommendations provided in this Roadmap to inform their own strategies. At the same time, national and European policy frameworks should enable and incentivise the emergence of mixed and voluntary instruments. For instance, subsidies could be used to support the customisation of an existing digital service to align with the specific needs of local farm management.

Tab. 5: Specific objectives guided by transformative policies using the framework for sustainable digitalisation strategies from Brunori, G. (2022).

Translation to transformative policies of specific objectives		01. To ensure accessible high-quality connectivity and digital infrastructures in rural areas	02. To increase interoperability of digital technologies for rural areas, forestry and farming
Directionality of design	To encourage pathways for digitalisation fit to multifunctionality, agro-ecology, small and diverse farming, and adaptation of digital technologies to different contexts.	To set up a predictable regulatory environment, providing the conditions to incentivise investment and minimising deployment costs to achieve ubiquitous connectivity to support multifunctional and diverse rural areas, and the goals of the LTVRA through a combination of technologies. To lay the foundations for the establishment of public-private partnership to plan and co-fund digital connectivity and infrastructure interventions to benefit rural population. To create a regulatory environment where verticals have a competitive range of options to access optimal 5G in rural areas.	To make compulsory the adaptation of the national regulations to comply with EU interoperability standards on rural contexts. If interoperability is achieved in rural contexts, it might as well work everywhere. To disseminate the Living-in.eu initiative among rural communities and rural villages, cities and municipalities and to support its adoption.
Directionality of access	To focus on combating the multiple dimensions of the digital divide.	To consider the nature of rural, agricultural and forestry businesses (which extension might reach wider than populated areas) in the provision of infrastructure for secure edge nodes.	
Directionality of complexity	To develop conducive digital ecosystems wherein all actors have the possibility to benefit from the use of data and to establish fruitful interactions with other actors		To support public-private coordination networks to boost interoperability in rural areas.
Market integration – design	Research fundings to specify required standards and prioritise application scenarios such as those of small size and marginal areas and focused on agro-ecological practices.		To prioritise research and innovation (R&I) projects that propose standardisation use cases and application scenarios in rural areas.

Translation to transformative policies of specific objectives		01. To ensure accessible high-quality connectivity and digital infrastructures in rural areas	02. To increase interoperability of digital technologies for rural areas, forestry and farming
Market integration – access	Strategies should guarantee the basic conditions of digitalisation. […] To keep rural areas within a level playing field, there is the need to be proactive, by constantly monitoring the digital divide, identifying the vulnerabilities, and addressing them with adequate tools.		To monitor system fragmentation in farming/ forestry sectors and the origin of applications used in rural areas (locally developed, global ones, etc.). To make available the existing data regarding the uptake of Minimum Interoperability Mechanisms (MIMs) in rural areas, to encourage its collection.
Market integration – complexity	Policies can encourage the consolidation of data-related infrastructures and services, such as advisory service platforms based on specific quality standards.		To encourage the development of new services addressed at rural areas and businesses (farming, forestry, tourism, etc.) that are interoperable as well as those that capitalise on existing standards, data, and digital applications.
Reflexivity in design	Design-related strategies could shape the characteristics of the design process. […] Considering the anticipation of the impacts as an evaluation parameter could encourage researchers to link innovation to its outcomes. Policy tools should be designed to activate dynamics of transformation through networking and market integration.	To revise the role that platforms and internet service providers could have in deploying connectivity and digital infrastructures (co-financing, taxation).	
Reflexivity in access	Given that the digital divide is a dynamic process, there should be systematic monitoring and adaptation of the strategies to its evolution.		
Reflexivity in complexity	To foster policy evaluation approaches aimed at improving the learning processes of all actors in the system, rather than just measuring outcomes, and building adaptive governance.		

Translation to transformative policies of specific objectives		03. To improve rural, forest and agriculture data governance and data management following ethical principles	04. To streamline digital education and competences adapted to different groups in rural areas
Directionality of design	To encourage pathways for digitalisation fit to multifunctionality, agro-ecology, small and diverse farming, and adaptation of digital technologies to different contexts.	To align national policies for data with the Data Governance Act and the Data Act and to clarify how existing data regulations affect agriculture. To provide tailored regulation if needed.	To take a holistic approach to communicate and educate about the benefits of rural digitalisation, including e-health, e-education, etc.
Directionality of access	To focus on combating the multiple dimensions of the digital divide.	To consider farm/forestry/rural enterprises and their associated land (e.g., farmland) in the count of businesses to be provided with edge nodes.	To support digital education and training programmes which are tailor-made for different target groups and embedded in rural areas' needs. To prioritise the use of existing networks and communication channels in rural areas to disseminate and conduct training. To encourage the use and development of user-friendly tools/digital solutions for education and training activities.
Directionality of complexity	To develop conducive digital ecosystems wherein all actors have the possibility to benefit from the use of data and to establish fruitful interactions with other actors	To engage and include rural areas, farmers, foresters, and rural communities in the conversations defining data governance and data management. To engage farmers, foresters, and rural communities in the data characterisation and to make relevant existing data (meteorological data, soil data…) accessible for farmers and rural communities.	To involve local actors in the development of multi-stakeholder education platforms to identify the needs of the different target groups in rural areas and to co-create specific and adapted education strategies to address them.
Market integration – design	Research fundings to specify required standards and prioritise application scenarios such as those of small size and marginal areas and focused on agro-ecological practices.		

Translation to transformative policies of specific objectives		03. To improve rural, forest and agriculture data governance and data management following ethical principles	04. To streamline digital education and competences adapted to different groups in rural areas
Market integration – access	Strategies should guarantee the basic conditions of digitalisation. […] To keep rural areas within a level playing field, there is the need to be proactive, by constantly monitoring the digital divide, identifying the vulnerabilities, and addressing them with adequate tools.	To encourage Member States to contribute to define and build the Forest Observation, Reporting and Data Collection framework. To encourage Member States to add/to connect their data to the Rural Observatory and to the Forest Information System for Europe.	
Market integration – complexity	Policies can encourage the consolidation of data-related infrastructures and services, such as advisory service platforms based on specific quality standards.	To encourage reusing and integrating existing data (such as Land Parcel Identification Systems, Farm Sustainability Tool, etc.) in digital applications aimed at farmers, foresters, and rural areas. To support developing and joining codes of conduct and farmer data cooperatives.	
Reflexivity in design	Design-related strategies could shape the characteristics of the design process. […] Considering the anticipation of the impacts as an evaluation parameter could encourage researchers to link innovation to its outcomes. Policy tools should be designed to activate dynamics of transformation through networking and market integration.		
Reflexivity in access	Given that the digital divide is a dynamic process, there should be systematic monitoring and adaptation of the strategies to its evolution.		
Reflexivity in complexity	To foster policy evaluation approaches aimed at improving the learning processes of all actors in the system, rather than just measuring outcomes, and building adaptive governance.		

Translation to transformative policies of specific objectives		05. To promote innovation and digital ecosystems in rural areas	06. To provide easy-to-use and affordable digital services to rural communities, farming and forestry
Directionality of design	To encourage pathways for digitalisation fit to multifunctionality, agro-ecology, small and diverse farming, and adaptation of digital technologies to different contexts.	To prioritise innovation strategies in rural areas that are aligned with the LTVRA. To couple digital innovation with social innovation in rural areas.	
Directionality of access	To focus on combating the multiple dimensions of the digital divide.	To enable inclusive spaces where rural communities, farmers and foresters can engage in digital innovation actions or to adapt existing ones (community centres, local libraries, etc.).	To support co-design processes for digital technologies used in rural areas to ensure that the needs of rural communities, farmers and foresters are addressed. To support digital technologies that capitalise on existing services used by rural communities/ farmers/foresters or those which serve multiple purposes (cost reduction)
Directionality of complexity	To develop conducive digital ecosystems wherein all actors have the possibility to benefit from the use of data and to establish fruitful interactions with other actors	To establish digital networks for all territories to connect and to share knowledge.	To consider the provision and funding of these services in local development strategies.
Market integration – design	Research fundings to specify required standards and prioritise application scenarios such as those of small size and marginal areas and focused on agro-ecological practices.	To promote the Living Lab approach in research projects working on rural digitalisation. To ensure that rural areas are present in funding programmes fostering innovation and digital ecosystems.	To encourage digital technologies to pass rural proofing (test in real contexts including small, remote farms and villages) before they go out in the market.
Market integration – access	Strategies should guarantee the basic conditions of digitalisation. […] To keep rural areas within a level playing field, there is the need to be proactive, by constantly monitoring the digital divide, identifying the vulnerabilities, and addressing them with adequate tools.	To support local stakeholders identifying the gaps and needs to reach competent rural digital innovation ecosystems.	To establish a network digital brokers/enablers who can connect and learn from other communities.
Market integration – complexity	Policies can encourage the consolidation of data-related infrastructures and services, such as advisory service platforms based on specific quality standards.		

Translation to transformative policies of specific objectives		05. To promote innovation and digital ecosystems in rural areas	06. To provide easy-to-use and affordable digital services to rural communities, farming and forestry
Reflexivity in design	Design-related strategies could shape the characteristics of the design process. […] Considering the anticipation of the impacts as an evaluation parameter could encourage researchers to link innovation to its outcomes. Policy tools should be designed to activate dynamics of transformation through networking and market integration.	To promote the use of the socio-cyber-physical approach to evaluate the impact of digital innovations in rural areas.	
Reflexivity in access	Given that the digital divide is a dynamic process, there should be systematic monitoring and adaptation of the strategies to its evolution.		
Reflexivity in complexity	To foster policy evaluation approaches aimed at improving the learning processes of all actors in the system, rather than just measuring outcomes, and building adaptive governance.		

Translation to transformative policies of specific objectives		07. To mainstream digital solutions to support service provision and administrative routines in rural areas	08. To support data-driven decisions in farming, forestry and rural areas
Directionality of design	To encourage pathways for digitalisation fit to multifunctionality, agro-ecology, small and diverse farming, and adaptation of digital technologies to different contexts.		To support the data-driven and AI systems applied in/for rural areas, farming and forestry which are aligned with the LTVRA and multifunctional farming.
Directionality of access	To focus on combating the multiple dimensions of the digital divide.	To ensure access to services and administrative procedures in rural areas under similar conditions as urban ones. To support "one-stop shop" for administrative routines and services in rural areas. To promote public-private collaboration and new technologies to support the service provision in rural areas. To establish a network of digital brokers/ intermediaries within the public administration for rural areas.	To make information about data-driven applications accessible for farmers, foresters and rural communities so they can make informed decisions about their use.
Directionality of complexity	To develop conducive digital ecosystems wherein all actors have the possibility to benefit from the use of data and to establish fruitful interactions with other actors		
Market integration – design	Research fundings to specify required standards and prioritise application scenarios such as those of small size and marginal areas and focused on agro-ecological practices.		
Market integration – access	Strategies should guarantee the basic conditions of digitalisation. […] To keep rural areas within a level playing field, there is the need to be proactive, by constantly monitoring the digital divide, identifying the vulnerabilities, and addressing them with adequate tools.	To gather rural data about Digital Public Services (e.g., eGovernment Benchmark) for the Digital Economy and Society Index (DESI) or to differentiate rural/urban data if already exists in the database.	

Translation to transformative policies of specific objectives		07. To mainstream digital solutions to support service provision and administrative routines in rural areas	08. To support data-driven decisions in farming, forestry and rural areas
Market integration – complexity	Policies can encourage the consolidation of data-related infrastructures and services, such as advisory service platforms based on specific quality standards.	To ensure digital services and e-administration pass the "rural proofing" and "significant scenario" testing procedures.	To protect the fundamental rights of farmers, foresters and rural communities in the applications using algorithms. To conduct regular algorithmic risk assessments in the digital tools used in rural areas, farming and forestry. To prioritise data-driven and AI systems in rural areas that use contextualised data in their design process. To promote the use of data-driven applications once rural digital ecosystems are mature (users with advanced digital skills and sufficient degree of digital trust).
Reflexivity in design	Design-related strategies could shape the characteristics of the design process. […] Considering the anticipation of the impacts as an evaluation parameter could encourage researchers to link innovation to its outcomes. Policy tools should be designed to activate dynamics of transformation through networking and market integration.		
Reflexivity in access	Given that the digital divide is a dynamic process, there should be systematic monitoring and adaptation of the strategies to its evolution.		
Reflexivity in complexity	To foster policy evaluation approaches aimed at improving the learning processes of all actors in the system, rather than just measuring outcomes, and building adaptive governance.		

Translation to transformative policies of specific objectives		09. To monitor rural digitalisation policies progress, impacts and efficiency	10. To raise awareness about rural issues and values, to foster public engagement
Directionality of design	To encourage pathways for digitalisation fit to multifunctionality, agro-ecology, small and diverse farming, and adaptation of digital technologies to different contexts.		To align the national and regional strategies influencing rural digitalisation with the EU's LTVRA (to use rural proofing mechanisms). To increase awareness about the specificities of rural areas to challenge the predominant urban-centric approach to societal issues.*
Directionality of access	To focus on combating the multiple dimensions of the digital divide.		To support digital innovations that help overcome existing constraints in rural areas (such as participation in decision making, access to services, etc.), enhancing local knowledge and public engagement.
Directionality of complexity	To develop conducive digital ecosystems wherein all actors have the possibility to benefit from the use of data and to establish fruitful interactions with other actors		
Market integration – design	Research fundings to specify required standards and prioritise application scenarios such as those of small size and marginal areas and focused on agro-ecological practices.		
Market integration – access	Strategies should guarantee the basic conditions of digitalisation. […] To keep rural areas within a level playing field, there is the need to be proactive, by constantly monitoring the digital divide, identifying the vulnerabilities, and addressing them with adequate tools.	To set up quantifiable indicators to monitor rural digitalisation progress, impacts and efficiency of policies, and to keep them updated. To make data about rural digitalisation accessible through the Rural Observatory and the European data spaces. To disaggregate rural data regarding digitalisation.	To disseminate/to consolidate platforms supporting connections among rural-urban areas and among rural-rural.

Translation to transformative policies of specific objectives		09. To monitor rural digitalisation policies progress, impacts and efficiency	10. To raise awareness about rural issues and values, to foster public engagement
Reflexivity in design	Design-related strategies could shape the characteristics of the design process. […] Considering the anticipation of the impacts as an evaluation parameter could encourage researchers to link innovation to its outcomes. Policy tools should be designed to activate dynamics of transformation through networking and market integration.		
Reflexivity in access	Given that the digital divide is a dynamic process, there should be systematic monitoring and adaptation of the strategies to its evolution.		
Reflexivity in complexity	To foster policy evaluation approaches aimed at improving the learning processes of all actors in the system, rather than just measuring outcomes, and building adaptive governance.		

*It applies to policies in general, not necessarily to rural digitalisation policies.

7 Conclusions

The 15 countries participating in DESIRA project performed National Policy Analyses on rural digitalisation. These analyses revealed challenges in implementing and assessing the impact of policies influencing rural digitalisation, as well as an ongoing urban-rural digitalisation gap. The difficulties identified include limited data availability for rural areas, particularly concerning rural digitalisation; the fact that the policy impact assessment can only be done ex-post and with limited outputs (e.g., measuring country-level funding for rural digitalisation is difficult); rapid changes in technologies and digitalisation policies; and coordination challenges among the different administrative departments involved in national and regional digitalisation initiatives.

Our research indicates that European digitalisation policies and policies related to agriculture and rural areas, mainly the Common Agricultural Policy and Cohesion Policy, have had the greatest influence on rural digitalisation in Europe.

The EC recognises the current and potential impacts of digitalisation on European society, such as improved communication and trade, but also imbalanced power relationships. Therefore, the EC has taken a leading role in guiding this digital transformation based on European values, prioritising individual-centric approaches and rights protection. Despite the difficulties of regulating a constantly evolving global activity with powerful stakeholders outside Europe, this position sets a precedent in the online world. For instance, the Digital Services Act holds technology companies accountable for the content on their platforms when operating in Europe.

In parallel, rural areas have also gained significance on the EU agenda through the Long-Term Vision for Rural Areas and the proposed rural proofing mechanism for European policies.

The EC's policy approach can pave the way for inclusive and sustainable digitalisation in rural areas and should be adopted at national and regional levels. To enable that, the EC should provide instruments to make rural digitalisation objectives effective, facilitating alignment, monitoring, and accountability within Member States.

While providing uniform indications to Member States is challenging, we recommend that rural digitalisation be established as a strategic objective for Europe. DESIRA proposes some guiding principles for that:

- Organise digitalisation strategies around societal issues instead of focusing solely on technological development.
- Involve users in shaping technological development.
- Endorse the principles of the Ethical Code by technology developers
- Ensure coherence with other policies influencing rural areas.
- Engage rural stakeholders in the process.

By developing the building blocks and specific objectives for different aspects of rural digitalisation (see **Section 5 Supporting a sustainable and inclusive rural digitalisation in Europe**), we have become aware of the need to assess the status of rural digitalisation at national and regional levels to inform

policy formulation, rather than simply following urban digitalisation strategies. Also, that digitalisation policies and strategies should adopt flexible approaches that accommodate the dynamic pace of digitalisation. We recognise that pathways for rural digitalisation are diverse depending on the context and starting situation of the various rural areas across Europe. Finally, we agree that strategies and policies addressing rural digitalisation should broaden their scope beyond agriculture and extend beyond the current timeframe of the CAP.

The main ideas of this Policy Roadmap are included in the DESIRA Declaration *"Together for a more inclusive and sustainable rural digitalisation in Europe"* (see **Annex 8.2 DESIRA Declaration "Together for a more inclusive and sustainable rural digitalisation in Europe"**), which was presented and endorsed by participants of DESIRA Final Conference. The Declaration will be disseminated to increase support from rural stakeholders.

8 Annex

8.1 Reports on national policy analysis

Click on each country's name to access the National Policy Analysis report:

Austria

Flanders, Belgium

Croatia

Greece

Finland

France

Hungary

Germany

Italy

Latvia

The Netherlands

Poland

Switzerland

Spain

Scotland

8.2 DESIRA Declaration "Together for a more inclusive and sustainable rural digitalisation in Europe"

DESIRA Declaration

Together for a more inclusive and sustainable rural digitalisation in Europe

We, 120 participants from 20 countries, met for DESIRA Final Conference in Brussels from 26th to 27th of April 2023, gathering citizens, researchers, policy makers, European Union institutions, representatives of civil society organisations and private companies.

We understand that **digitalisation generates socio-economic impacts** in rural areas, agriculture and forestry and we pursue to improve the capacity of rural stakeholders, farmers and foresters to **respond to the challenges that digitalisation entails**.

We recognise that digitalisation is an integral part of a broader "twin" transition that the European Union has committed to pursuing in line with the United Nations' Sustainable Development Goals. We recognise that achieving a **sustainable and inclusive digital transformation** requires a comprehensive understanding of the intended and unintended benefits, challenges and obstacles associated with digital technologies.

We emphasise the importance of establishing sustainable **rural digitalisation as a strategic objective**, with priorities based around **rural issues** and set through **community engagement**. This requires a **coordinated strengthening** of policies related to rural digitalisation, identifying responsible parties for implementation, assessing available resources, and determining how they should be allocated. Furthermore, it is necessary to expand the scope of digitalisation **beyond agriculture** and extend it beyond the timeframe of the Common Agricultural Policy.

Additionally, policymaking for rural digitalisation requires an **evaluation of the current status of digitalisation** in rural areas and to consider **adopting flexible policy approaches** that can accommodate rapid changes as well as diverse policy pathways that account for contextual differences across rural areas.

The **European Commission should provide instruments** to make rural digitalisation policies effective and therefore, to enable for alignment, monitoring and accountability of policies in the Member States.

We endorse **future policies to provide directionality** to the technological pathways and to integrate them with the specificity of the contexts where technology applies, rather than fostering only market-based digitalisation. This implies the adoption of the **Responsible and Research Innovation principles** into the digitalisation strategies. As a result, we propose ten pathways to support policies towards more inclusive and sustainable rural digitalisation in Europe that are fully aligned with the EU's Long-Term Vision for Rural Areas:

1. TO ENSURE ACCESSIBLE, HIGH-QUALITY CONNECTIVITY AND DIGITAL INFRASTRUCTURES IN RURAL AREAS.

It means an affordable, reliable, stable connectivity that presents low latency and redundancy. Physical and backbone infrastructure are required to fully benefit from agriculture/forestry 4.0 and to move towards digital sovereignty.

2. TO INCREASE INTEROPERABILITY OF DIGITAL TECHNOLOGIES FOR RURAL AREAS, FORESTRY AND FARMING.

Achieving real interoperability of digital systems needs to tackle legal, organisational, data structure/ semantic and technical elements.

3. TO IMPROVE RURAL, FOREST AND AGRICULTURE DATA GOVERNANCE AND DATA MANAGEMENT FOLLOWING ETHICAL PRINCIPLES.

There should be clarity about how data is collected, managed, processed, and owned to fully benefit from the use of data.

4. TO STREAMLINE DIGITAL EDUCATION AND COMPETENCES ADAPTED TO DIFFERENT GROUPS IN RURAL AREAS.

Digital strategies should tackle all three components of the digital divide: infrastructure, skills, and uptake.

5. TO PROMOTE INNOVATION AND DIGITAL ECOSYSTEMS IN RURAL AREAS.

Knowledge and innovation can contribute to achieving the goals of the LTVRA and the European Green Deal -capitalising on localised Agricultural Knowledge and Innovation Systems- and generate new business opportunities.

6. TO PROVIDE EASY-TO-USE AND AFFORDABLE DIGITAL SERVICES TO RURAL COMMUNITIES, FARMING AND FORESTRY.

Digital services should be more transparent and user-friendly to increase their adoption. Digital services should be co-designed with rural users and pass rural proofing.

7. TO MAINSTREAM DIGITAL SOLUTIONS TO SUPPORT SERVICE PROVISION AND ADMINISTRATIVE ROUTINES IN RURAL AREAS.

Digital technologies can support improving and enhancing -not replacing- the quality of the service provision in rural areas.

8. TO SUPPORT DATA-DRIVEN DECISIONS IN FARMING, FORESTRY AND RURAL AREAS.

This should be the last step of the digital transformation, as it can only happen when there are advanced digital skills, high-quality connectivity and full trust in the digital ecosystem.

9. TO MONITOR RURAL DIGITALISATION POLICIES PROGRESS, IMPACTS AND EFFICIENCY.

Making disaggregated rural digitalisation data available and establishing mechanisms to push Member States to fulfil the objectives related to rural digitalisation.

10. TO RAISE AWARENESS ABOUT THE VALUE OF RURAL AREAS AND TO FOSTER PUBLIC ENGAGEMENT IN RURAL ISSUES.

Society at large should recognise the goods and services provided by rural areas, the inter-dependency of all territories and the role of rural areas in the EU's green and digital transitions.

Signatories commit:

- To generate research-based evidence about rural digitalisation and to make it accessible.
- To share available resources to improve rural digitalisation, including funding and supporting instruments, at regional and local levels.
- To work on reducing the rural digital divide (enhancing interoperability of digital systems; generating and sharing accessible and safe data and tools; contributing with resources to improve digital education; supporting ethical development of technologies; etc.).
- To strengthen collaboration and knowledge exchange among researchers and rural stakeholders.
- To engage in transdisciplinary and collaborative projects regarding rural digitalisation.
- To support and disseminate rural digitalisation projects that follow Responsible Research and Innovation approach.

And to support rural areas in their transition to sustainable and inclusive digitalisation.

In Brussels, 27th of April 2023

8.3 DESIRA Policy Roadmap for dissemination

DIGITISATION: ECONOMIC AND SOCIAL IMPACTS IN RURAL AREAS

DESIRA Policy Roadmap: Ten pathways to support policies towards a more inclusive and sustainable rural digitalisation in Europe

DESIRA project[1] aims to **enhance the ability** of society and political bodies to **address the challenges arising from digitalisation** in agriculture, forestry, and rural areas.

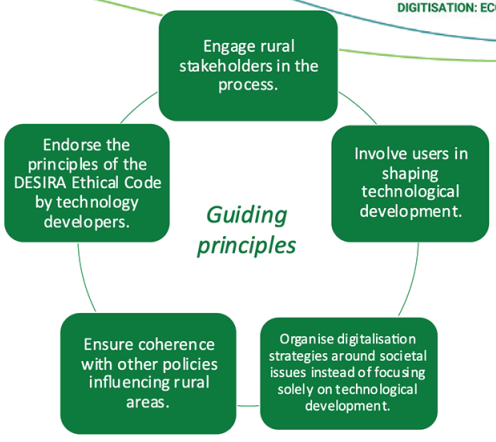
Within the framework of **Responsible Research and Innovation**, the DESIRA Policy Roadmap has been developed using an integrated approach. It provides policymakers with **insights and strategies** to design an inclusive and sustainable rural digitalisation that aligns with the **Sustainable Development Goals**.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

The Roadmap draws on **data from National Policy Reports**[2] analysing policies influencing rural digitalisation in the fifteen participating countries, and a comprehensive review of the existing policy framework shaping rural digitalisation in Europe. These analyses revealed **challenges in implementing and assessing** the impact of policies influencing rural digitalisation, as well as an ongoing **urban-rural digitalisation gap**. Challenges include **limited availability of rural data**, difficulties in evaluating policy impact, struggles in following the **rapid pace of changes in technology** and policy development, and **coordination issues among administrative departments**.

[1] https://desira2020.eu
[2] https://desira2020.eu/resources/nationalpolicyanalyses/

DIGITISATION: ECONOMIC AND SOCIAL IMPACTS IN RURAL AREAS



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

In the rural digitalisation policymaking process, it is key to **assess the current state of digitalisation** in rural areas, **adopt flexible approaches** that accommodate rapid changes, **consider diverse pathways** based on contextual differences across rural areas, and **extend the focus beyond agriculture**

At the same time, the European Commission should provide the **necessary instruments to facilitate effective rural digitalisation**, including mechanisms for **policy alignment**, **monitoring**, and **accountability among Member States**.

The following **ten pathways** are based on **transformative policies**, that is, policies able to address the root causes of societal issues. Transformative policies consider **directionality** (clear policy objectives), **reflexivity** (through engagement and experimentation) and **market integration** (economic viability of digital innovation levers), which are incorporated in DESIRA proposals for a sustainable and inclusive rural digitalisation in Europe.

PATHWAY 1. TO ENSURE ACCESSIBLE HIGH-QUALITY CONNECTIVITY AND DIGITAL INFRASTRUCTURES IN RURAL AREAS

- To set up a predictable **regulatory environment**, providing the conditions to **incentivise investment** and minimising deployment costs to achieve **ubiquitous connectivity** to support multifunctional and diverse rural areas, and the goals of the Long-Term vision for Rural Areas through a combination of technologies.
- To lay the foundations for the establishment of **public-private partnership** to plan and co-fund digital connectivity and infrastructure interventions to benefit rural population
- To create a regulatory environment where verticals have a competitive range of options to access **optimal 5G in rural areas**.
- To **consider** the nature of **rural, agricultural and forestry businesses** (which extension might reach wider than populated areas) in the provision of infrastructure for secure edge nodes.
- To revise the role that **platforms and internet service providers** operating in rural areas could play in supporting the deployment of connectivity and digital infrastructures (co-financing, taxation).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

Contribution to the Long-term Vision for Rural Areas: **CONNECTED rural areas**

BACKGROUND
- Current rural-urban digital connectivity gap.
- New connectivity objectives to reach.
- Physical and backbone infrastructures needed.
- Lower investments in less accessible areas.

SUPPORTING INVESTMENTS
- European Agricultural Fund for Rural Development.
- Cohesion Funds.
- Connecting Europe Facility.
- Digital Europe Programme.
- Horizon Europe.
- Next Generation EU.
- Recovery and Resilience Facility Fund.
- InvestEU.
- European Investment Bank.

MONITORING
- Digital Economy and Society Index metrics regarding connectivity in rural areas.
- Annual Study on Broadband coverage in Europe by Omdia.

SUPPORTING POLICIES
- Path to the Digital Decade.
- Cohesion Policy.
- Common Agricultural Policy.

PATHWAY 2. TO INCREASE INTEROPERABILITY OF DIGITAL TECHNOLOGIES FOR RURAL AREAS, FORESTRY AND FARMING

- To make **compulsory the adaptation of the national regulations to comply with EU interoperability standards** on rural contexts. If interoperability is achieved in rural contexts, it might as well work everywhere.
- To prioritise research and innovation (R&I) projects that propose standardisation use cases and **application scenarios in rural areas.**
- To encourage the development of **new services** addressed at rural areas and businesses (farming, forestry, tourism, etc.) that are **interoperable** as well as those that capitalise on existing standards, data and digital applications.
- To **disseminate the Living-in.eu** initiative among rural communities and rural villages, cities and municipalities and to support its adoption.
- To **support public-private coordination networks** to boost interoperability in rural areas.
- To **monitor system fragmentation in farming/forestry sectors** and the origin of applications used in rural areas (locally developed, global ones, etc.).
- To make available the existing **data regarding the uptake of Minimum Interoperability Mechanisms** (MIMs) in rural areas, to encourage its collection.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

Contribution to the Long-term Vision for Rural Areas: **STRONGER, CONNECTED rural areas**

BACKGROUND
- Interoperability challenges affect daily routines and administrative procedures in rural communities, farming and forestry.
- Global trend to unify platforms.
- New interoperability standards to comply with.

SUPPORTING INVESTMENTS
- Digital Europe Programme

MONITORING
- ISA² Evaluation Framework

SUPPORTING POLICIES
- Interoperable Europe Act.
- Data Act.
- Data Governance Act.

PATHWAY 3. TO IMPROVE RURAL, FOREST AND AGRICULTURE DATA GOVERNANCE AND DATA MANAGEMENT FOLLOWING ETHICAL PRINCIPLES

- To **engage and include rural areas**, farmers, foresters, and rural communities in the **conversations defining data** governance and data management
- To consider **farm/forest/rural enterprises** and their associated land (e.g., farmland) in the count of businesses to be provided with **edge nodes.**
- To **align national policies** for data with **the Data Governance Act and the Data Act** and to clarify how existing data regulations affect agriculture. To provide tailored regulation if needed.
- To **engage farmers, foresters, and rural communities** in the data characterisation and to make relevant existing data (meteorological data, soil data..) **accessible** for farmers and rural communities.
- To encourage **reusing and integrating existing data** (such as Land Parcel Identification Systems, Farm Sustainability Tool, etc.) in digital applications aimed at farmers, foresters, and rural areas.
- To support developing and joining **codes of conduct** and farmer data cooperatives.
- To encourage **Member States to contribute** to define and build the **Forest Observation, Reporting and Data** Collection framework
- To encourage **Member States** to add/to **connect their data** to the **Rural Observatory** and to the **Forest Information System for Europe.**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

Contribution to the Long-term Vision for Rural Areas: **STRONGER, CONNECTED rural areas**

BACKGROUND
- Potential benefits of data in agrifood systems, forestry and rural areas underused.
- Concerns regarding data ownership and unclear data governance mechanisms in agriculture, forestry and rural areas.
- Harmonisation, agreements and codes of conduct regarding data are required.

SUPPORTING INVESTMENTS
- Digital Europe Programme

MONITORING
- DESI figures regarding Open Data.
- Annual study on edge deployment (Connecting Europe Facility).

SUPPORTING POLICIES
- Data Governance Act.
- Data Act.
- Directive on Security of Network and Information Systems (NIS2).
- General Data Protection Regulation.

PATHWAY 4. TO STREAMLINE DIGITAL EDUCATION AND COMPETENCES ADAPTED TO DIFFERENT GROUPS IN RURAL AREAS

- To support **digital education and training programmes tailor-made** for different target groups and embedded in rural areas' needs.
- To take a **holistic approach to communicate and educate** about the benefits of rural digitalisation, including e-health, e-education, etc.
- To involve local actors in the development of **multi-stakeholder education platforms** to identify the needs of the different target groups in rural areas and to co-create specific and adapted education strategies to address them.
- To prioritise the **use of existing networks and communication channels** in rural areas to disseminate and conduct training.
- To encourage the use and development of **user-friendly tools**/digital solutions for education and training activities.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

Contribution to the Long-term Vision for Rural Areas: **STRONGER, CONNECTED and PROSPEROUS rural areas**

BACKGROUND
- Digital skills gap in rural areas.
- Limited digital education and training programmes addressing/tailored for rural areas.
- New targets for digital skills, leaving no one behind

SUPPORTING INVESTMENTS
- European Agricultural Fund for Rural Development.
- European Social Fund Plus.
- Digital Europe Programme.

MONITORING
- DESI indicators regarding skills in rural areas.
- CAP indicator for "Enhancing performance through knowledge and innovation" (people involved in advice, training, etc.).

SUPPORTING POLICIES
- Common Agricultural Policy.
- Path to Digital Decade.
- Proposal for a Council Recommendation on improving the provision of digital skills in education and training.
- Proposal for a Council Recommendation on the key enabling factors for successful digital education and training.

PATHWAY 5. TO PROMOTE INNOVATION AND DIGITAL ECOSYSTEMS IN RURAL AREAS

- To prioritise **innovation strategies** in rural areas that are **aligned with the LTVRA.**
- To ensure that **rural areas are present in funding programmes** fostering innovation and digital ecosystems.
- To **couple digital innovation with social innovation** in rural areas.
- To enable **inclusive spaces** where rural communities, farmers and foresters can engage in digital innovation actions or to adapt existing ones (community centres, libraries, etc.).
- To **establish digital networks** for all territories to connect and to share knowledge.
- To **promote the Living Lab approach in research projects** working on rural digitalisation.
- To support **local stakeholders identifying the gaps and needs** to reach competent rural digital innovation ecosystems.
- To promote the **use of the socio-cyber-physical approach to evaluate the impact** of digital innovation in rural areas.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

Contribution to the Long-term Vision for Rural Areas: **STRONGER, CONNECTED rural areas**

BACKGROUND

- Knowledge and innovation can contribute to achieving the goals of the LTVRA and the European Green Deal.
- Potential to generate new business opportunities in rural areas.
- Increased complexity in human-technology relations.

SUPPORTING INVESTMENTS

- Recovery and Resilience Facility Fund.
- European Regional Development Fund.
- Digital Europe Programme.
- European Agricultural Fund for Rural Development.

MONITORING

- S3 initiatives related to rural digital transformation.
- EDIH in rural areas, forestry and farming.
- Number of digital knowledge clusters.
- Projects in rural areas funded by innovation and digital programmes.

SUPPORTING POLICIES

- Cohesion Policy.
- Common Agricultural Policy.
- Path to the Digital Decade

PATHWAY 6. TO PROVIDE EASY-TO-USE AND AFFORDABLE DIGITAL SERVICES TO RURAL COMMUNITIES, FARMING AND FORESTRY

- To support **co-design processes for digital technologies used in rural areas** to ensure that the needs of rural communities, farmers and foresters are addressed.
- To encourage **digital technologies to pass rural proofing** (test in real contexts including small, remote farms and villages) before they go out in the market.
- To support **digital technologies that capitalise on existing services** used by rural communities/farmers/foresters or those which serve multiple purposes (cost reduction).
- To establish a **network of rural digital brokers/enablers** who can connect and learn from other communities.
- To consider the **provision and funding of these services** in rural development strategies.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

Contribution to the Long-term Vision for Rural Areas: **CONNECTED rural areas**

BACKGROUND

- Big corporations benefit more from technological development than small farmers, foresters.
- Existing gap between available technologies and their adoption (cost-benefit analysis is limited, technologies not well adapted to rural contexts).

SUPPORTING INVESTMENTS

- European Agricultural Fund for Rural Development.
- Digital Europe Programme.

MONITORING

- Digital Intensity Index (DII) included in the Annex of the Digital Compass (similar to Digital Intensity Score in DESI).

SUPPORTING POLICIES

- Path to the Digital Decade.
- Digital Markets Act.
- Digital Services Act.
- Common Agricultural Policy.
- Regulation to curb EU-driven deforestation and forest degradation.

PATHWAY 7. TO MAINSTREAM DIGITAL SOLUTIONS TO SUPPORT SERVICE PROVISION AND ADMINISTRATIVE ROUTINES IN RURAL AREAS

- To **ensure access to services and administrative procedures** in rural areas under similar conditions as urban ones.
- To support **"one-stop shop" for administrative routines and services** in rural areas.
- To promote **public-private collaboration and new technologies** to support the service provision in rural areas.
- To ensure digital services and e-administration **pass the "rural proofing" and "significant scenario" testing** procedures.
- To establish a **network of digital brokers/intermediaries within the public administration** for rural areas.
- To gather **rural data about Digital Public Services** (e.g. eGovernment Benchmark) for the Digital Economy and Society Index (DESI) or **to differentiate rural**/urban data if already exists in the database).

Contribution to the Long-term Vision for Rural Areas: **STRONGER** and **CONNECTED rural areas**

BACKGROUND
- Concerns about erosion of service provision in rural areas.
- EU policies prioritise the digitalisation of public services.
- Advanced digital skills and highquality connectivity required.

SUPPORTING INVESTMENTS
- Digital Europe Programme.
- Recovery and Resilience Facility

MONITORING
- Data currently unavailable

SUPPORTING POLICIES
- Path to the Digital Decade.
- New Interoperable Act for public administration.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

PATHWAY 8. TO SUPPORT DATA-DRIVEN DECISIONS IN FARMING, FORESTRY AND RURAL AREAS

- To support **data-driven and AI systems** applied in/for rural areas, farming and forestry which are **aligned with the LTVRA and multifunctional farming.**
- To prioritise data-driven and AI systems in rural areas that **use contextualised data** in their design processes.
- To make **information** about data-driven applications **accessible** for farmers, foresters and rural communities so they can make informed decisions about their use.
- To promote the use of **data-driven applications once rural digital ecosystems are mature** (users with advanced digital skills and sufficient degree of digital trust).
- To **protect the fundamental rights** of farmers, foresters and rural communities in the applications using algorithms.
- To conduct **regular algorithmic risk assessments** in the digital tools used in rural areas, farming and forestry.

Contribution to the Long-term Vision for Rural Areas: **RESILIENT** and **CONNECTED rural areas**

BACKGROUND
- Artificial Intelligence and data analytics have got the potential to improve decision-making in farming, forestry, and rural areas.
- Challenges related to data availability, model design, and user interfaces.
- Last step of digital transformation once triple digital divide (skills, infrastructure, trust) is closed.

SUPPORTING INVESTMENTS
- Horizon Europe.
- Digital Europe Programme.
- Recovery and Resilience Facility Fund.
- European Innovation Council.

MONITORING
- Metrics included in the survey on the uptake of AI technologies carried out by Ipsos for the EC.
- Statistics on Information and Communication Technologies and e-commerce for businesses, households and by individuals.

SUPPORTING POLICIES
- Digital Services Act.
- Artificial Intelligence Act.
- Product Liability Directive.
- Sectoral safety legislation.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

PATHWAY 9. TO MONITOR RURAL DIGITALISATION POLICIES PROGRESS, IMPACTS AND EFFICIENCY

- To encourage the **use of policy impact assessments** in strategies related to rural digitalisation at European, national, regional and local level.
- To set up **quantifiable indicators to monitor rural digitalisation progress**, impacts and efficiency of policies, and to keep them updated.
- To make **data about rural digitalisation accessible** through the Rural Observatory and the European data spaces.
- To disaggregate rural data regarding digitalisation

Contribution to the Long-term Vision for Rural Areas: **CONNECTED, RESILIENT, STRONG and PROSPEROUS rural areas**

BACKGROUND
- Absence of comprehensive rural digitalisation strategies and data at EU level.
- Strong coordination amongpublic administrations with responsibilities in rural digitalisationrequired.
- Rapid pace of digital transformation.

SUPPORTING INVESTMENTS
- Funding currently unavailable.

MONITORING
- Data currently unavailable.
- To disaggregate or to identify with data relates to rural areas in existing datasets would be helpful.

SUPPORTING POLICIES
- Common Agricultural Policy.
- Path to the Digital Decade..

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

PATHWAY 10. TO RAISE AWARENESS ABOUT THE VALUE OF RURAL AREAS AND TO FOSTER PUBLIC ENGAGEMENT IN RURAL ISSUES

- To **align the national and regional strategies** influencing rural digitalisation with the EU's LTVRA (to use rural proofing mechanisms).
- To support **digital innovations that help overcome existing constraints** in rural areas (such as participation in decision making, access to services, etc.), enhancing local knowledge and public engagement.
- To **disseminate/to consolidate platforms supporting connections** among rural-urban areas and among rural-rural.
- To increase awareness about the specificities of rural areas to **challenge the predominant urban-centric approach to societal issues**.

Contribution to the Long-term Vision for Rural Areas: **CONNECTED, RESILIENT, STRONG and PROSPEROUS rural areas**

BACKGROUND
- Rural areas are essential providers of essential goods and services, and they play a crucial role in mitigating climate change.
- General positive consideration of rural areas.
- Digitalisation can amplify rural voices and improve communication, engagement and networking

SUPPORTING INVESTMENTS
- European Agricultural Fund for Rural Development.
- Cohesion Funds.

MONITORING
- Data currently unavailable.
- An improvement could be to analyse how often are rural areas mentioned in policies, online or in public discourses.
- Monitoring the application of rural proofing across Europe

SUPPORTING POLICIES
- Common Agricultural Policy.
- Cohesion Policy..

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818194.

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