Deliverable No. 3.1

Learning needs and gaps of rural communities

WP3

RURACTIVE

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- **PU:** Public, fully open, e.g. web
- **SEN:** Sensitive, limited under conditions of the Grant Agreement

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List of Acronyms and Abbreviations

AI: Artificial Intelligence
AR: Augmented Reality
BFH: Bern University of Applied Sciences
CNC: Computer Numeral Control
CRM: Customer Relationship Management
DRT: Demand Responsive Transport
DSS: Decision Support System
Dynamo: Rural pilot area in RURACTIVE
ESG: Environmental, Social, Governance
IAAC: Institute for Advanced Architecture of Catalonia
IoT: Internet of Things
ITS: Intelligent Transport Systems
JHI: The James Hutton Institute
GIS: Geographic Information System
LCT: Local Community Trainer
M: Month
MaaS: Mobility as a Service
ML: Machine Learning
MOOC: Massive Open Online Course
PP: Project Partner
RDD: Rural Development Driver
RIE: Rural Innovation Ecosystem
RTAP: Rural Transit Assistance Program
SECAP: Sustainable Energy and Climate Action Plan
SPSS: Smart Product Service System
SUMP: Sustainable Urban Mobility Planning
ToT: Train-of-Trainers (ToT) program
UCD: University College Dublin, National University of Ireland
UNIBO: Alma Mater Studiorum – Università di Bologna
UX: User Experience
VR: Virtual Reality
WP: Work Package

RURACTIVE Glossary

Cross-cutting priorities: a set of overarching priorities that should be integrated into the implementation of RURACTIVE solutions and referred to climate change adaptation and mitigation, biodiversity, and social justice and inclusion.

Dynamo (D): a rural pilot area. In RURACTIVE there are 12 pilot areas in 7 EU Member States, 2 Associated Countries and Switzerland in which the RIEs will be established. The RURACTIVE Dynamos are: D1-Northern Ostrobothnia, FI, PP: UOULU; D2-Südburgenland, AT, PPs: BAB, WAB; D3-Diputación Zamora, ES, PPs: DZ, CARTIF; D4-North-East Scotland, UK PPs: GBIZ, JHI; D5-Andalucia, ES, PP: BALAM; D6-Zagori, GR, PP: EMZ; D7-Zakarpattya, UA, PP: FORZA; D8-Fiastra Valley, IT, PP: BF; D9-Zadar, HR, PPs: URB, CZAD; D10-Abruzzo, IT, PP: BORGHI; D11-Gotland, SE, PPs: RG, UU; D12-Törbel, CH, PP: BFH.

DSS: Decision Support System - is an integrated set of tools and processes designed to help professionals make informed and intelligent decisions.

Groups at risk of social exclusion and underrepresentation: stakeholders at risk of exclusion due to factors such as physical disabilities, age, ethnic origins, religious believes and other intersecting aspects. Historically, these groups have been underrepresented and largely excluded from decision-making processes, especially in rural areas. These groups encompass, but are not limited to: 1) Young People (aged 18 to 29 years); 2) Older people over the ages of 65 to 75 (varying based on national or local retirement age criteria); 3) People with long-term physical, mental, intellectual disabilities, or sensory impairments; 4) Migrants, and individuals belonging to linguistic, ethnic, and religious minorities; 5) Long-term unemployed: individuals who have been jobless and actively seeking employment for at least a year; 6) LGBTQIA+ community (lesbian, gay, bisexual, transgender, queer or questioning, intersex, asexual and more based on sexual orientation or gender identity).

Innovation: the process of developing new solutions or applying them in a new context, that has a significant positive impact in transforming established practices, products, processes, actions, models of governance, decision making practices, and initiatives, while generating added value for rural communities and better responding to their needs. Forms of innovations considered in RURACTIVE are digital and technological, technical, social, organisational and governance, financial and business models.

Rural Development Drivers (RDDs): set of drivers that guide rural development. They include Sustainable multimodal mobility, Energy transition and climate neutrality, Sustainable agrifood systems and ecosystem management, Nature-based and cultural tourism, Culture and cultural innovation, Local services, health and wellbeing.

Rural Innovation Ecosystem (RIE): communities of people, places and practices that share interests in one or more specific RDDs to be established in Dynamos' areas.

Solutions: place based established practices, processes, initiatives, models of governance, actions and products comprising one or a combination of various forms of innovations (digital and technological, technical, social, organisational and governance, financial and business models) that drive rural communities towards a sustainability transformation.

Stakeholder: an institution, organisation, group or individual that has some interest or impact in one or more of the RDDs of the project, either as possible contributors to the co-development and implementation of solutions, or as a beneficiary of such solutions.

Local Community Trainer (LCT): individuals or groups (organisations or informal collectives) who possess digital competences and the attitude of changemakers, that will be trained during the co-development phase, to be then able to train local communities around digital skills.

Summary

This report D3.1 is the outcome of RURACTIVE Task 3.1 on *Understanding learning needs and gaps for enhancing rural community-led innovation*. D3.1 outlines learning needs and gaps in Europe's rural areas, essential to be addressed via capacity-building opportunities for local rural actors to support the development of community-led innovative solutions for a sustainable, just and green transition in rural societies. This report presents an inventory of learning needs and gaps within six RURACTIVE's Rural Development Drivers (RDDs). The RURACTIVE RDDs are: sustainable multimodal mobility, energy transition and climate neutrality, sustainable agrifood systems and ecosystem management, nature-based and cultural tourism, culture and cultural innovation, and local services, health, and wellbeing. Additionally, according to the conceptual framework developed in D2.1, cross-cutting priorities such as climate change mitigation and adaptation, biodiversity, and social justice and inclusion were considered.

The report D3.1. is built on the evidence collected from three types of knowledge sources: 1) scientific literature review; 2) evidence of the community of practice through a review of EU projects integrating insights from experts on the ground including local policymakers, researchers, and the communities; 3) evidence from RURACTIVE Dynamos, based on their past experiences in implementing innovative solutions in their territories (identified and assessed via RURACTIVE Catalogue of Solutions).

In RURACTIVE, learning needs and gaps refer to the missing competences within rural communities, crucial to actively engage in the development, implementation, and sustainable management of place-based solutions within local Multi-Actor Rural Innovation Ecosystems (RIEs). Competences in RURACTIVE are defined as a combination of knowledge, skills, abilities, attitudes, and behaviour needed to support the development and implementation of innovative solutions – the combination of various forms of innovations (digital and technological, technical, social, organisational and governance, financial and business models) – that drive rural communities towards a sustainability transformation.

The following categories and subcategories of competences have been identified in RURACTIVE as important for rural communities to foster innovation processes:

- **digital and technological competences**: information and data literacy; digital communication and collaboration; digital content creation; digital safety and cybersecurity; digital technologies for problem solving; and digital technologies for rapid prototyping.
- **social competences**: communication and dissemination; community-building, collaboration and engagement; adaptability and resilience, and environmental and social justice advocacy.
- **organisational competences:** leadership and strategic management; operational management; sustainable viability.
- **governance competences:** institutional frameworks and new governance practices; conflict mitigation and mediation; participatory decision-making and policy engagement.

- **financial and business competences:** entrepreneurial skills and funding acquisition; financial accounting and controlling; new / innovative business models; and business strategy, planning, positioning and performance.
- **technical competences** – in RURACTIVE technical competences are distinguished according to the main rural development drivers (RDDs) considering cross-cutting priorities.

This report highlights that combination of different competences is needed to support the development and implementation of innovative solutions in rural areas across the six RURACTIVE Rural Development Drivers, while considering cross-cutting priorities such as climate change mitigation and adaptation, biodiversity, and social justice and inclusion. Outcomes of D3.1 suggest that learning needs and gaps associated with developing these competences include both "hard" skills, such as technical, technological, and digital expertise in specific areas or sectors, and "soft" skills, which are equally important. These soft skills include competences in communication and dissemination, community-building, collaboration and engagement, adaptability to change established practices and openness to innovation, as well as advocacy skills for environmental and social justice. Leadership and skills to ensure sustainable viability of implemented solutions are important, along with good governance competences. These include understanding institutional frameworks, knowledge of how to mitigate conflicts, and the ability to negotiate and find compromises within communities regarding different preferences of community actors. Additionally, participatory decision-making and policy engagement are important for development of sustainable solutions in rural areas. Financial and business competences also appear to be important, including the ability to develop entrepreneurship and acquire funding, as well as innovative business models (e.g., public-private partnerships) and innovative business strategies, planning, positioning, and performance. Digital competences appear to be especially important for rural actors for their integration into the digital economy and for fostering their innovation potential. Findings suggests that digital skills and digital literacy competences are essential for enabling rural communities to bridge the digital divide, participate fully in the digital economy, and leverage technological advancements to foster innovative solutions to the challenges they face.

The outcomes of Deliverable 3.1 will inform Task 3.2 on multilevel knowledge and competence transfer among RURACTIVE Technical Partners and Dynamos. By outlining learning needs in digital skills and digital literacy, D3.1 guides Task 3.3 on supporting Dynamos in overcoming the digital divide. This will lead to the development of training materials (Task 3.4), which will also be translated into materials for e-learning courses and open educational resources. These materials will be integrated into Massive Open Online Courses (MOOCs) and other eLearning and gamified capacity-building resources developed in RURACTIVE (Task 3.5). Additionally, the outcomes of D3.1 will inform RURACTIVE masterclasses for scientists and policymakers (Task 3.6).

The Deliverable is structured into five main sections: i) An introduction to the scope of the document (Section 1); ii) A definition of key terminologies (Section 2); iii) Methodological approach of the Deliverable 3.1 (Section 3); iv) Presentation of the results and findings on learning gaps and needs of rural communities in Europe (Section 4); v) Concluding remarks (Section 5).

1. Introduction

RURACTIVE aims to empower rural communities to act for societal change by making available knowledge regarding the development and implementation of place-based community-led solutions that integrate various forms of innovation (digital and technological, technical, organisational, governance and social, financial and business models).

To unlock the innovation potential of rural communities to implement such solutions addressing six RURACTIVE Rural Development Drivers (RDDs), it is crucial to understand the learning needs and gaps of local communities to facilitate this process. The RDDs being considered by RURACTIVE are:

- sustainable multimodal mobility,
- energy transition and climate neutrality,
- sustainable agrifood systems and ecosystem management,
- nature-based and cultural tourism,
- culture and cultural innovation,
- local services, health and wellbeing.

Alongside these RDDs three cross-cutting priorities are considered:

- climate change mitigation and adaptation,
- biodiversity,
- social justice and inclusion.

In RURACTIVE, learning needs and gaps refers a set of missing competences amongst rural communities, essential to be addressed to support, enhance, and implement innovative solutions.

The report D3.1 on Learning needs and gaps of rural communities aims to analyse scientific literature, evidence of the community of practice across Europe (via review of EU funded projects and evidence from RURACTIVE Dynamos), to identify missing competences needed by rural actors to implement innovative, smart and community-led solutions. Missing competences are also examined by analysing relevant EU strategic and competence frameworks. Since the EU Long Term Rural Vision considers digital connectivity and digital literacy to be key enablers for diversifying economic activities in rural areas, while EU Digital Agenda "Shaping Europe's Digital Future" indicates that *"technology must work for people to enable an open, democratic, and sustainable society, and help in fighting climate change and achieving the green transition",* in Deliverable 3.1 a particular focus has been made to explore digital competences required by rural actors to foster transformation.

Deliverable 3.1 aims to:

- define learning needs and gaps, competences, capacities and capabilities in RURACTIVE;
- present the outcomes of literature review, EU projects review and evidence from RURACTIVE Dynamos on missing competences (c.f. learning needs and gaps) in rural Europe that are crucial for fostering innovations within six RURACTIVE RDDs;
- outline digital competences needed in rural Europe to foster innovative solutions focusing on enhancing digital skills and digital literacy.

The Deliverable is structured into five main sections:

i) an introduction to the scope of the document (Section 1);
ii) definition of learning needs, competences, capacities, capabilities (Section 2);
iii) methodological approach of the Deliverable 3.1 (Section 3);
iv) presentation of the results and findings on learning gaps and needs of rural communities in Europe (Section 4);
v) concluding remarks (Section 5).

2. Understanding learning needs and gaps in RURACTIVE

This section outlines the understanding of learning needs and gaps in the framework of RURACTIVE project and explains the role of knowledge, skills, and abilities (i.e., competences) required to build human capital in rural areas to support smart and community-led innovative solutions (as indicated in the RURACTIVE conceptual framework - Task 2.1).

Learning needs and gaps in the context of human capital

The RURACTIVE conceptual framework outlines different forms of capitals (built, natural, social, human, financial and cultural) which are essential to develop and implement innovative solutions in rural areas (c.f. RURACTIVE Deliverable 2.1). *"Growth of all forms of capital […] in a community can create virtuous spirals of development"* (Egusquiza *et al.*, 2021). Improvements in one capital can lead to positive effects in other capitals, creating a synergistic effect that fosters community development, as outlined in the Community Capital Framework (Emery and Flora, 2006). In RURACTIVE, *human capital is understood to be a set of knowledge, skills and abilities (c.f. competences) of people to develop and enhance their resources and to access outside resources and bodies of knowledge to*

increase their understanding, identify promising practices, and to access data for community development (c.f. De Luca *et al.,* 2024; RURACTIVE Deliverable 2.1). Human capital is identified as a crucial element in fostering innovative solutions (Górriz-Mifsud *et al.*, 2020; Scalabrino, 2022). Dedicating resources to the development of human capital can yield extensive benefits across multiple aspects of community wellbeing (Emery and Flora, 2006; SIMRA, 2020). Investing in knowledge and skills development of rural actors and creating an access to learning opportunities and supportive environments that enable them to be effective in leveraging their ***competences,*** is an integral part of building human capital.

Competences to support innovative solutions in RURACTIVE

Competences are often defined in literature as a combination of knowledge, skills, attitudes, abilities, and behaviours (e.g., Vincent, 2008; Corres *et al.*, 2020). Frameworks published by the European Commission define competences as a combination of knowledge, skills, and attitudes. Examples include GreenComp – The European Sustainability Competence Framework by Bianchi *et al*. (2022), and DigComp 2.2: The Digital Competence Framework for Citizens by Vuorikari *et al*. (2022). These frameworks draw their definitions from the European Council's recommendations, which outline competences as a combination of the following:

- *Knowledge*: facts, figures, concepts, ideas, and theories that are well-established and refer to the understanding of a particular area or subject.
- *Skills*: practical abilities to perform processes and utilize existing knowledge to achieve desired results.
- *Attitudes:* dispositions and mindsets that influence how individuals act or react to ideas, people, or situations (Council of the European Union, 2018, p.7).

To ensure a comprehensive approach, RURACTIVE also incorporates the terms *abilities* and *behaviour* in its definition of competence. Competences encompass various aspects of an individual's or a group's ability to perform tasks or activities effectively (Vincent, 2008). Competence is more than just knowledge, skills, abilities, attitudes, and behaviours; it is the combination of these elements in practice that enables individuals or communities to achieve their goals or to accomplish specific tasks (Council of the European Union, 2018).

In RURACTIVE, competences are defined as a *combination of knowledge, skills, abilities, attitudes, and behaviour* needed to support the development and implementation of solutions – the combination of various forms of innovations (digital and technological, technical, social, organisational and governance, financial and business models) – that drive rural communities towards a sustainability transformation.

Table 1 illustrates the dimensions of competences and how each of them can be addressed.

Table *1*. Competences dimensions

COMPETENCE DIMENSIONS	GUIDING QUESTION	CAN BE ADDRESSED THROUGH
KNOWLEDGE	*Aware of…/knows about…/understands that…*	*Learning (online/offline), information sharing, knowledge transfer events*
SKILL	*Can…/knows how to do…*	*Training, coaching, mentorship, learning-by-doing*
ABILITY	*Is able to…/is capable of…*	*Coaching, mentor support*
ATTITUDE	*Is willing to.../care about.../ acknowledges…*	*Raising awareness via knowledge sharing and trainings*
BEHAVIOUR	*Is doing…/is using…*	*Encouraging, coaching*

Source: based on Bianchi et al. (2022), Vuorikari et al. (2022).

To build competences through targeted learning courses and training, it is essential to combine all dimensions of competence: knowledge, skills (such as technical – programming or accounting or soft skills such as communication or leadership); abilities; attitudes; and behavioural models (e.g., adaptability, problem-solving, resilience). The combination of these dimensions of competences in learning programmes are crucial for individuals or communities to be effective in developing and implementing innovative solutions to tackle the challenges they face. Literature suggests that competences are crucial to support the development and implementation of innovative solutions (OECD, 2009).

Learning needs and gaps

Learning needs and gaps in RURACTIVE are understood as the missing competences of rural communities that hinder their ability to implement innovative solutions. Learning needs and gaps can be explained as the learning deficit between the current and desired level of competences.

In RURACTIVE, learning needs and gaps in the context of rural communities refer to the *missing competences*, encompassing a combination of knowledge, skills, ability, attitude, and behaviour, crucial for rural actors to actively engage in the design, implementation, and sustainable management of smart, place-based innovative solutions within their local Multi-Actor Rural Innovation Ecosystems (RIEs).

Learning needs typically reflect deficiencies in knowledge, skills, abilities, attitudes, and behaviour that individuals or communities *perceive as necessary* to achieve a specific objective

or goal. Hence, learning needs are identified *subjectively*; the request to learn arises from the understanding that acquiring these competences is essential to support implementation of an innovative solution.

Learning gaps are often identified by conducting a comprehensive literature review or detailed analyses by external experts. These methods help to reveal the competences – knowledge, skills, abilities, attitude, and behaviours – that community members might lack but which they are not aware they are "missing". These 'unperceived' learning needs are essential competences for rural areas, essential for development, yet often unrecognized by the community members ("learners") themselves.

Addressing learning needs and gaps

Learning needs and gaps in rural areas can be addressed via tailored trainings. Addressing learning needs and gaps is essential for bridging the gap in knowledge and know-how to implement innovative solutions in rural contexts. In RURACTIVE bridging such gaps will be via tailored training programmes for Dynamos and will entail train-the-trainers (e.g., Local Community Trainers) in RURACTIVE Dynamos for building digital competences, especially digital skills and digital literacy, and through the uptake of MOOCs, with related masterclasses oriented towards policy teams. In the context of rural development, competences are essential for empowering rural actors to actively participate in the development and implementation of smart, community-led solutions. By enhancing the ***competences*** of rural communities and addressing their learning needs and gaps, RURACTIVE can build their ***capacities*** and ***capabilities*** to foster innovative, community-led solutions as illustrated in Figure 1.

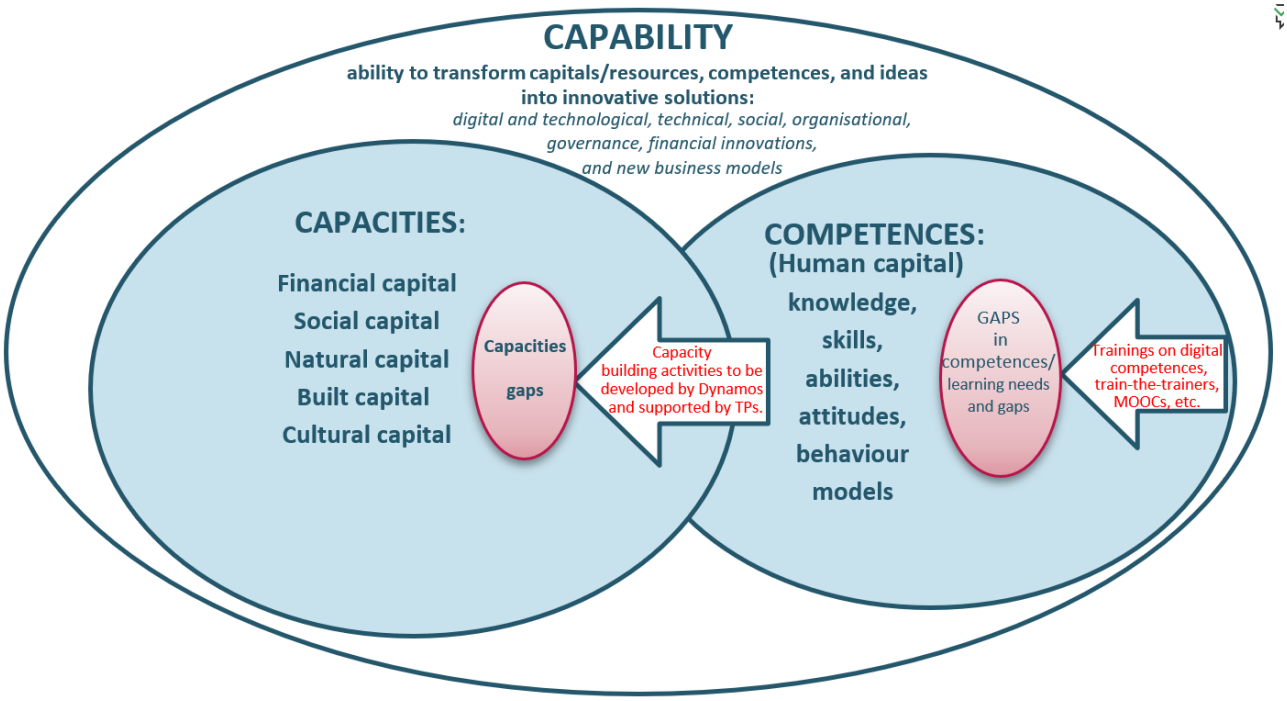

Figure 1. RURACTIVE approach to addressing learning needs and gaps: building competences and capacities to make rural actors capable to act for change.

In RURACTIVE, capacity building refers to enhancing the abilities and strengths of rural actors through the transfer of essential competences to ensure that capital and resources available in Dynamos are successfully engaged in developing new solutions.

Capacity in RURACTIVE, refers to the available resources – built, financial, cultural, natural and social capital[3] – that individuals, groups, communities, or societies have or can leverage or acquire by utilizing available human capital (competences) to meet their needs, achieve their goals and implement smart solutions.

Access to learning opportunities plays a profound role in this process. Having both essential capitals (capacities) and developed skills or knowledge (competences), creates capability.

Capabilities, according to Sen (1993) refers to the real freedoms and opportunities people have to pursue lives they value, beyond just access to resources. It emphasizes well-being through individuals' ability to achieve valuable life within their personal and social contexts, highlighting empowerment and choice. In RURACTIVE capability refers to ability to transform capitals / resources and competences into new ideas to implement innovative solutions to increase wellbeing of people. Capability is the ability to respond to change (adaptation) and to drive change (innovation) to transform capitals/ resources, competences, and ideas into new solutions that depart fundamentally from existing ones (Damanpour 1991; Lawson and Samson 2001; Robeyns and Fibieger Byskov, 2023.).

This report focuses on understanding **competences** required by rural communities to empower them to act for change. The approach to understanding those missing competences is outlined in the Methodology section.

[3] Capitals are defined in the RURACTIVE conceptual framework (c.f. Del 2.1).

3. Methodological approach

The RURACTIVE approach to identifying and understanding learning needs and gaps (i.e. missing competences) to foster innovations in rural areas, and to unlock the "know-how" potential of rural communities to implement smart and community-led innovative solutions, consists of five steps (Figure 2). The process integrates top-down and bottom-up approaches and evidence from multiple stakeholders (science, policy, practitioners).

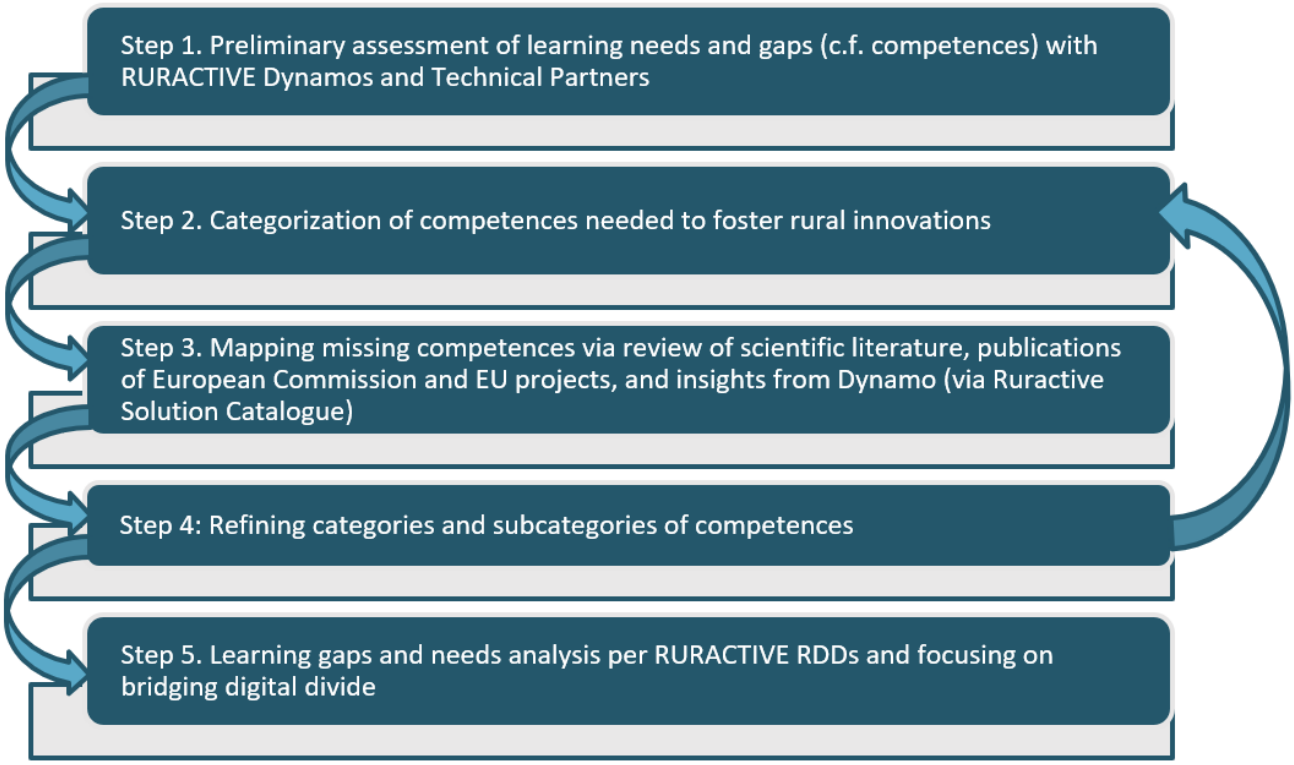

Figure 2. RURACTIVE approach to identifying and understanding *learning needs and gaps* with five-step process.

Step 1: Preliminary assessment of learning needs and gaps

Based on the preliminary mapping of learning needs and gaps conducted amongst RURACTIVE Dynamos during the project proposal stage, and further informed by insights gained from a workshop with RURACTIVE Technical Partners and Dynamos held during the kick-off meeting in Bologna, Italy in September 2024 (see Figure 3). The workshop was organized in a World Café format and aimed to involve all Dynamos to reflect on the learning needs and gaps of rural communities based on their

experiences. Main categories of competences which were identified, corresponded to types of innovations[4] targeted by RURACTIVE.

Figure 3. RURACTIVE Dynamos and Technical Partners identifying learning needs and gaps for rural areas during a workshop at the kick-off meeting in Bologna, Italy, September 2024.

Step 2: Categorisation of competences needed to foster rural innovations

An initial set of categories and sub-categories of competences, and their definitions, has been developed based on Step 1 and enhanced by the results of review of EU competence frameworks such as *GreenComp: The European Sustainability Competence Framework* (Bianchi *et al.,* 2022) and *DigComp 2.2: The Digital Competence Framework for Citizens* (Vuorikari *et al.,* 2022), *EntreComp: The Entrepreneurship Competence Framework* (Bacigalupo *et al.*, 2016), *LifeComp: The European Framework for Personal, Social and Learning to Learn Key Competence* (Sala *et al.* 2020).

[4] In RURACTIVE, **innovation** is understood by a process of developing new solutions or applying them in a new context, that has a significant positive impact in transforming established practices, products, processes, actions, models of governance, decision making practices, and initiatives, while generating added value for rural communities and better responding to their needs (c.f. D2.1). The types of innovations targeted by RURACTIVE: digital and technological, technical, social, organizational and governance, financial innovations, and new business models.

A systematic literature review (see Step 3) confirmed or challenged each subcategory. Definitions of competences categories and subcategories underwent validation by both RURACTIVE Technical Partners and the Dynamos to ensure their applicability and relevance to rural context (see Step 4).

Step 3: Review of scientific literature and EU projects

A systematic review of literature has been conducted to collect science-based evidence on missing competences in rural Europe as per defined categories (in Step 2). This systematic review was essential to ensure a comprehensive and evidence-based identification of the competences needed, drawing on established frameworks, science-based evidence and evidence of the community of practice.

Science-based evidence: Findings and insights from peer-reviewed publications were collected from Web of Science. The review process used the following keywords that considered rural context, RURACTIVE rural development drivers (RDDs), innovation types and needs/gaps context (Table 2).

Table *2*. Keywords considered to identify learning needs and gaps in literature review

RURAL CONTEXT	RDDs CONTEXT	INNOVATION CONTEXT	NEEDS/GAPS CONTEXT
rural, community, local	mobility	"digital innovation"	"learning need*"
community-led	energy	"technological innovation"	"learning gap*"
community-based	agrifood, agri-food, agro-ecology, agroecology culture, cultural innovation health, wellbeing, tourism	"technical innovation" “cultural innovation” "social innovation" "organizational innovation" "governance innovation" "financial innovation" "business model" "innovation ecosystem" Innovation, transition, transformation, development	"capacity need*" "capacities need*" "capacity gap*" "capacities gap*" skills, knowledge, competency, competences

The following search string was applied:

TOPIC = (rural OR local OR community or “community-based” OR “community-led”)
AND
TITLE = (mobility OR energy OR (agrifood OR “agri-food” OR “agro-ecology” OR agroecology) OR (culture OR “cultural innovation”) OR (health OR wellbeing OR “health and wellbeing”) OR tourism)
AND
TOPIC = ("digital innovation*" OR "technological innovation*" OR "technical innovation*" OR "social innovation*" OR "organizational innovation*" OR "governance innovation*" OR "financial innovation*" OR "business model*" OR innovation* OR transition OR transformation OR development OR “innovation ecosystem*”)
AND
ALL FIELDS = ("learning need*" OR "learning gap*" OR "capacity need*" OR "capacities need*" OR "capacities gap*" OR "capacity gap*" OR “skill*” OR competences OR competency OR knowledge OR literacy)

Use of the search string led to the identification of:

- peer-reviewed publications from Web of Science, covering keywords from Table 2, totalling n=9.662;
- screened publications after the application of filters `relevance to European countries` and `publication year 2010-2023` totalling n=2.468.

Evidence from EU projects and EU policy documents: The results of EU projects and reports, together with relevant recent publications (policies, regulations, frameworks, etc.) published by the EC have been reviewed using keywords indicated in Table 2. Findings from reviewed EU projects (see Table 3) provided empirical evidence and reflections on practical and bottom-up-oriented requests of rural stakeholders and valuable insights to the experiences, challenges, and successes of rural practitioners working on the ground regarding competences needed in rural Europe. The chosen projects are dealing with topics of RURACTIVE RDDs and involve bottom-up collaborative innovative solutions in rural areas.

Table *3*. List of reviewed EU project

PROJECT	TITLE/DESCRIPTION	STATUS	LINK
RURITAGE	Rural regeneration through systemic heritage-led strategies	complete	www.ruritage.eu
SIMRA	Social Innovation in Marginalised Rural Areas	complete	http://www.simra-h2020.eu/
DESIRA	Digitisation: Economic and Social Impacts in Rural Areas	complete	https://desira2020.agr.unipi.it/
FUTURAL	Empowering the future through innovative smart solutions for rural areas	in progress	https://futural-project.eu/
SMARTA	Smart rural transport areas	complete	https://ruralsharedmobility.eu/
SMARTA2	Sustainable rural mobility	complete	https://ruralsharedmobility.eu/smarta-2/
REACT	Renewable Energy for self-sustAinable island CommuniTies	complete	https://react2020.eu/
TEXTOUR	Social Innovation and TEchnologies for sustainable growth through participative cultural TOURism	in progress	https://textour-project.eu/
MATILDE	Migration Impact Assessment to Enhance Integration and Local Development in European Rural and Mountain Areas	complete	https://matilde-migration.eu/
WELLCO	Wellbeing and Health Virtual Coach	complete	http://www.wellco-project.eu/
RURALCARE	Employment and Social Innovation (EaSI)		https://ruralcare.eu/
UNISECO	Understanding and improving the sustainability of agro-ecological farming systems in the EU	complete	https://uniseco-project.eu/
SHELTER	Sustainable Historic Environments hoListic reconstruction through Technological Enhancement and community-based Resilience	complete	https://shelter-project.com/
FIREURISK	Developing a holistic, risk-wise strategy for European wildfire management	in progress	https://fireurisk.eu/
LIVERUR	Living Lab research concept in Rural Areas	complete	https://liverur.eu/
AI4EU	A European AI On Demand Platform and Ecosystem	complete	https://arquivo.pt/
AGRILINK	Agricultural Knowledge: Linking	complete	http://www.agrilink2020.eu/

	farmers, advisors and researchers to boost innovation.		
INNOFOREST	Smart information, governance and business innovations for sustainable supply and payment mechanisms for forest ecosystem services	complete	http://www.innoforest.eu/
DRURAL	The service marketplace for European rural areas	in progress	https://drural.eu/
SHERPA	Sustainable Hub to Engage into Rural Policies with Actors	complete	https://rural-interfaces.eu/
ROBUST	Rural-Urban Outlooks: Unlocking Synergies	complete	http://www.rural-urban.eu/
SHEMAKES.EU	Opportunity Ecosystems Bridging the Gender Gap	complete	https://shemakes.eu/
GRANULAR	Giving Rural Actors Novel data and re-Useable tools to Lead public Action in Rural areas	complete	Cordis
POLIRURAL	Future Oriented Collaborative Policy Development for Rural Areas and People	complete	https://polirural.eu
NEMOS PROJECT	A New Educational Model for acquisition Of Sustainability competences through Service-learning	complete	https://www.nemosproject.com/
POROTUULI	Trust-based and conflict-avoiding wind power construction in reindeer husbandry area	in progress	https://www.luke.fi/en/projects/porotuuli
MAMBA	Maximised Mobility and Accessibility of Services in Regions Affected by Demographic Change	complete	https://interreg-baltic.eu/project/mamba/
INCLUSION	Towards more accessIble and iNCLUSIve mObility solutions for EuropeaN prioritised areas	complete	http://www.h2020-inclusion.eu/index.html
MARA	Mobility and Accessibility in Rural Areas	complete	https://www.mara-mobility.eu/
MELINDA	Mobility Ecosystem for Low-carbon and INnovative moDal shift in the Alps	complete	https://www.alpine-space.eu/project/melinda/
HIREACH	High reach innovative mobility solutions to cope with transport poverty	complete	https://cordis.europa.eu/project/id/769819
FLIARA	Female-Led Innovation in Agriculture and Rural Areas	in progress	https://fliara.eu/
LAST MILE	Sustainable mobility for the last mile in tourism regions	complete	https://projects2014-2020.interregeurope.eu/lastmile/
COEVOLVERS	Coevolutionary approach to unlock the transformative potential of nature-based solutions for more inclusive and resilient communities	in progress	https://co-evolvers.eu/
MOVING	Mountain Valorisation through Interconnectedness and Green Growth	in progress	https://www.moving-h2020.eu/
MARGISTAR	Transforming marginalised mountainous areas towards their green, digital, and healthy futures	in progress	https://margistar.eu/
SMARTERA	SMART community-led transition for Europe's Rural Areas	in progress	https://smartera-project.eu/
CODECS	Maximising the CO-benefits of agricultural Digitalisation through conducive digital ECoSystems	in progress	https://www.horizoncodecs.eu/

Insights from RURACTIVE Dynamos: RURACTIVE Dynamos reported, in the RURACTIVE Solutions Catalogue, solutions which have been implemented previously in their territories (Task 2.2 in RURACTIVE). Questions regarding competences that are needed to implement a solution, have been integrated into the RURACTIVE Solution Catalogue: **link** (Figure 4). This evidence provides a practical perspective on the competences required in a specific rural context/ in real-life situations.

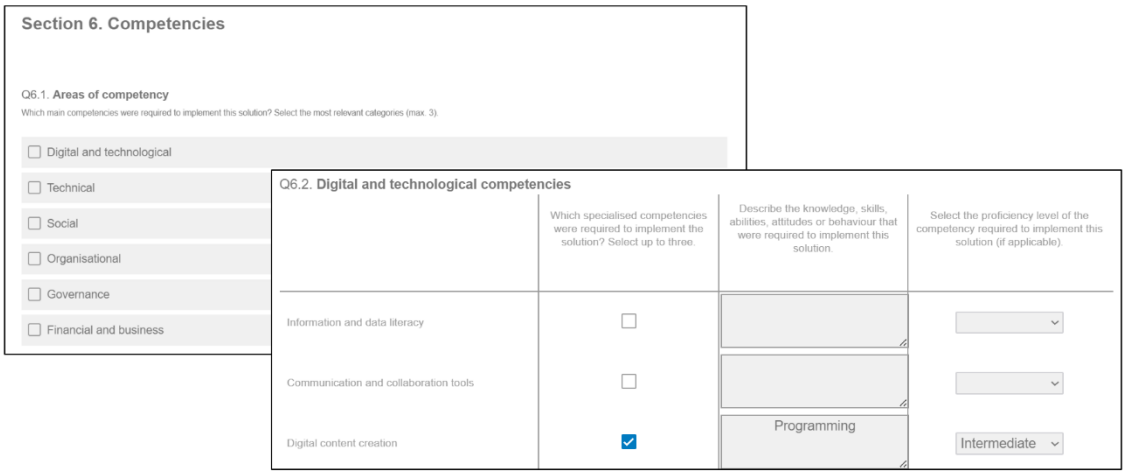

Figure 4. Questions regarding competences in RURACTIVE Solution Catalogue

Step 4: Refining categories and subcategories of competences

The RURACTIVE approach to defining categories and subcategories of missing competences to foster rural innovations (Step 2) relied on a feedback loop process aimed at refining the subcategories at every step, ensuring their relevance and accuracy. Reviews of scientific literature and of EU projects and reports, and insights from Dynamos on solutions they reported as having been implemented (Step 3), provided examples of competences needed, validating the relevance and applicability of subcategories of RURACTIVE competences, and enabled their refinements. RURACTIVE partners supported the validation process of competences categories while testing Solution Catalogue during a workshop in Gotland, Sweden, 11-13.04.2024 (Figure 5).

Figure 5. RURACTIVE Dynamos and Technical Partners validating the categorisation of competences and reflecting on those needed to implement innovative solutions in rural areas.

This process identified that the adaptability and resilience is a competence which should be highlighted as a separate subcategory, and for skills to be included regarding how to transform established practices in new way, and know-how for adapting to changing situations by bringing new ideas and thinking 'out of the box'.

Step 5: Learning gaps and needs analysis

A learning gaps and needs analysis (Section 4) based on the outcome of literature review, EU project and evidence from Dynamos was performed for each RURACTIVE RDD. The analysis also considered learning needs for climate change mitigation and adaptation, biodiversity protection and social justice and inclusion. A particular focus of the *Learning gaps and needs analysis* was on understanding the competences needed to bridge the gap in rural digital divide (Section 4.4).

4. Results: Learning needs and gaps in rural communities

This section outlines the RURACTIVE competence categories and subcategories, provides the findings from the inventory of missing competences, and analyses the corresponding learning needs and gaps for each RURACTIVE RDD.

4.1 RURACTIVE competences categories and subcategories

Informed by a systematic literature review and enriched by the feedback and expertise of RURACTIVE partners, categories, and subcategories of competences (Figure 6) needed to develop and implement innovative rural solutions (which consist of different types of innovation) have been developed. The main competence categories align with the types of innovations (as defined in RURACTIVE conceptual framework developed by De Luca et al. 2024 in WP2 (c.f. Del 2.1) - digital and technological, technical, social, organisational, governance, financial innovations, and new business models.

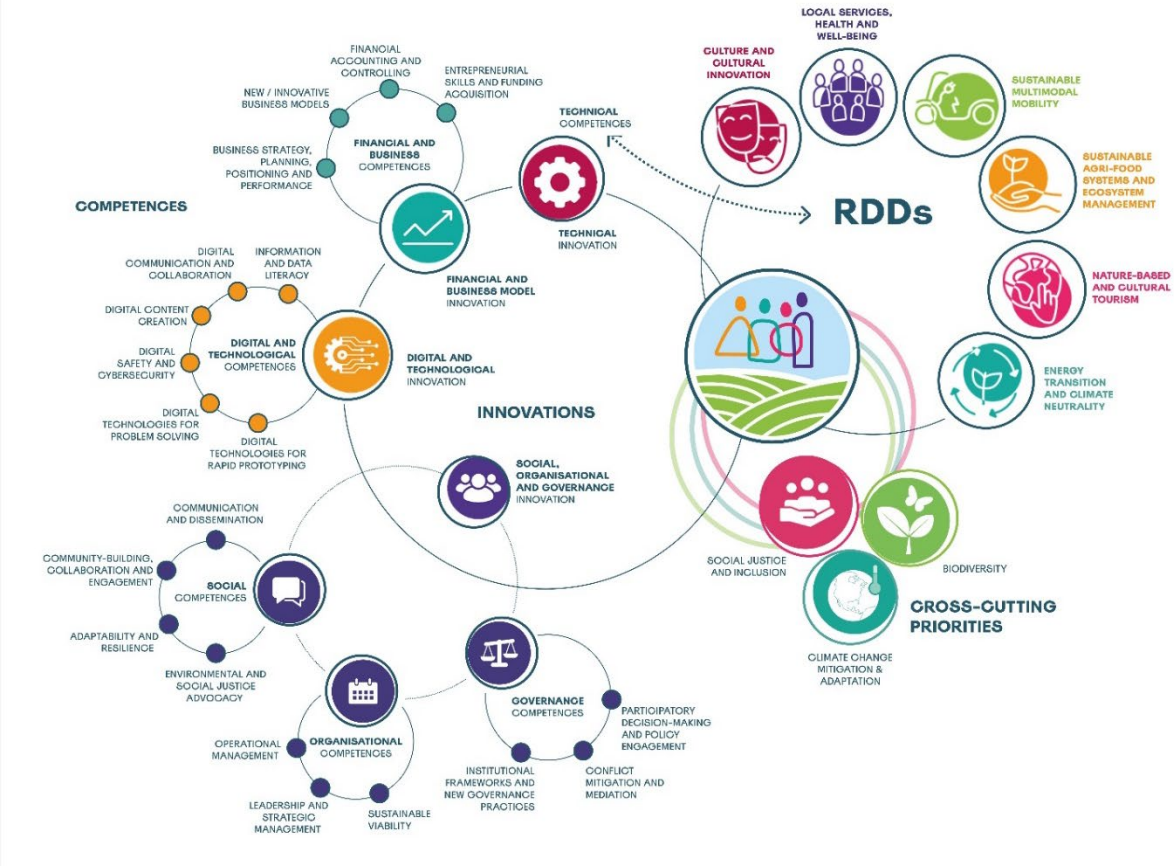

Figure 6. RURACTIVE competences categories and subcategories

This categorisation aids in capacity-building and the development of tailored training programmes relevant to specific types of innovation, with a view to offering specific skills, knowledge and abilities for their successful design, implementation and maintenance. Explanations of each competence category and subcategory are provided in Sections 4.1.1-4.1.6.

4.1.1. Digital and technological competences

Digital and technological competences encompass knowledge, skills, abilities, attitude, and behaviours required to utilize digital tools effectively, including artificial intelligence (AI), as well as emerging technologies to develop or improve digital or non-digital products, services, practices, or processes.

The subcategories in digital and technological competences are adopted from EU Digital Competence Framework developed by Vuorikari *et al.* (2022) and extended with a subcategory on digital technologies for rapid prototyping. Explanations of subcategories and examples of corresponding competences are shown in Table 4.

Table 4. Digital and technological competences

Subcategories	Definition	Examples
Information and data literacy	Competences needed for effectively searching and utilizing digital information. These competences involve filtering information (e.g., official information/ policies, evidence from grey sources), locating and retrieving digital data, assessing source relevance (credibility, recognise fake news and disinformation), as well as managing, organising, and storing digital data, information, and content. This also involves utilizing Artificial Intelligence technologies for data analysis and information retrieval.	• Browsing, searching, and filtering data, information, and digital content • Evaluating and structuring data, information and digital content • Managing data, information and digital content
Digital communication and collaboration	Competences encompass interacting, communicating, and collaborating using digital technologies. This involves engaging in different community activities or businesses through digital platforms. Additionally, managing one's digital presence, identity, and reputation is a crucial aspect of these competences.	• Interacting through digital technologies • Sharing data and information through digital technologies • Engaging citizenship through digital technologies • Collaborating through digital technologies • Awareness of netiquette (behavioural norms and know-how, as well as cultural and general diversity in digital environments) • Managing digital identity (including in social media)
Digital content creation	Competences involve creating and editing digital content (including webpages), enhancing and incorporating information into existing knowledge bases, and ensuring compliance with copyright, licensing, and AI regulations	• Developing digital content in various file formats for websites • Integrating and re-elaborating digital content • Understanding and applying copyright and

		licenses • Programming skills and knowledge of web development languages (e.g., HTML, CSS, JavaScript)
Digital safety and cybersecurity	Competences that involve protecting devices, content, personal data, and privacy in digital environments, protecting physical and psychological health while using digital tools, and understanding impacts of digital technologies and their use, as well as understanding (the importance of) common cybersecurity threats (and maintaining security hygiene).	• Protecting devices • Protecting personal data and privacy • Protecting health and wellbeing • Protecting the environment • Considering ethical aspects
Digital technologies for problem solving	Competences essential for utilizing technologies and tools/-apps/-software to address challenges and find possible solutions, e.g., using decision-support systems, cloud computing and internet of things.	• Knowing the main functions of the most common digital devices (e.g., computer, tablet, smartphone) to identify and troubleshoot problems related to these devices and their services • Adjusting and customizing digital environments to personal needs (e.g., accessibility) • Know how to use digital technologies to help turn one's idea into action (e.g., making a video to create a channel to share recipes and nutrition tips for a specific dietary style or preference) • Using data analytics tools to analyse data, identify trends, and make data-driven decisions to improve the efficiency and effectiveness of transportation systems • Cloud computing and internet of things
Digital technologies for rapid prototyping	Competences in utilizing digital software, coding environments and digital fabrication technologies for rapidly prototyping ideas and products to promote innovation and accelerate the digital transition in rural areas.	• Recognize basic programming concepts and develop digital coding for the creation of applications and machines • Understanding the principles of rapid prototyping techniques such as 3D printing, CNC machining, and laser cutting. This includes knowledge of digital design, materials, processes, and the limitations and strengths of each technique • Knowing electronic circuits design and digital tools for prototyping products • Being able to find and interact with open-source repositories to share, reuse, and accelerate prototyping processes

Having digital and technological competences is essential for rural actors to be effective in navigating the requirements of a digital economy and during times of crisis (e.g., Covid or war, climate extremes – forest fires, floods; biodiversity loss). These enable utilization of digital technologies for personal, professional, societal and economic development (EC, 2021), flexible approaches to business and work arrangements, facilitates remote working, and supports the rapid development of different types of innovations in rural context (e.g., as seen in the post-COVID period; DNV, 2021; Bendrik, 2024). Digital educational tools and online platforms have proven to be efficient in fostering social inclusiveness, with specialist tools such as augmented and virtual reality (AR/VR) (e.g., during the COVID-19 crisis) shown to have considerable potential for enhancing online education and training (OECD, 2020; Rosset, 2021). Digitalization is contributing to achieving goals of climate neutrality, with remote collaboration between different regions, sectors, professionals, and fostering the development of innovations, notably in rural areas and of groups at risk of exclusion (as described to in RURACTIVE). However, the widespread deployment of digital tools may pose risks associated with service quality, digital divide and data security / cybersecurity (Newlands *et al.*, 2020; World Bank, 2020). Those who cannot address their learning needs to bridge knowledge gaps risk being left behind (e.g., elderly people, those with low levels of digital literacy).

4.1.2. Technical competences

Technical competences encompass hard skills and abilities required to perform specific tasks, operations, or functions within a particular sector and/or industry with a specific reference to rural context.

While digital and technological competences focus on skills related to digital tools and technologies to develop or improve digital or non-digital products, services, practices or processes, technical competences include a broader range of specialized hard skills and knowledge specific to a particular field or industry (e.g., know-how to install solar panels; skills on implementing precision agriculture; skills in designing and engineering transportation infrastructure, etc.). These competences are associated with skills and practical know-how to develop or improve products, services, practices, or processes in a particular sector and /or industry.

In RURACTIVE, digital and technological competences refer to skills related to the use and understanding of digital tools, platforms, and technologies. This includes proficiency in using computers, software applications, internet resources, social media platforms, and other digital tools to perform tasks efficiently and effectively. Digital competences also encompass skills in navigating digital information, evaluating online resources, and adapting to new digital technologies as they emerge. Technical competences generally refer to a broader range of hard skills and knowledge specific to a particular field or industry. These skills may include specialized knowledge of tools, equipment, procedures, or techniques relevant to a specific job or profession in a specific sector. Technical competences can vary widely depending on the field, covering engineering and installation through to measurement, monitoring and reporting.

They often require formal training, education, or experience in a specific technical area and may involve hands-on application of specialized knowledge to solve complex problems or perform tasks within a particular sector.

In RURACTIVE, technical competences to promote innovations in rural areas have been analysed according to the rural development drivers (RDDs) and the cross-cutting priorities (climate change mitigation and adaptation, biodiversity and social justice and inclusion) (Table 5).

Table 5. Technical competences to promote innovations in rural areas within six rural development drivers (RDDs) and cross-cutting priorities

RURACTIVE RDDs	Definition	Examples
Sustainable multimodal mobility	Technical competences in sustainable multimodal mobility are the practical know-how required to develop or enhance products, services, practices, or processes for designing, implementing, and managing transportation systems, ensuring sustainable, smart, and resilient mobility solutions that address the diverse mobility needs of rural communities.	• Analysing transportation needs and developing plans for sustainable mobility solutions considering population density and age, geographical features, transportation infrastructure and integrated electronic ticketing systems • Designing and implementing demand-responsive transportation systems that optimize route planning and scheduling to efficiently serve rural areas • Establishing and managing shared rural mobility services and voluntary citizen initiatives, such ridesharing and asset-sharing programs to reduce vehicle emissions and promote cost-effective transportation • Implementing strategies to promote active travel modes such as walking and cycling with engineering suitable infrastructure improvements, educational campaigns, and community engagement initiatives • Applying Intelligent Transport Systems (ITS), apps, data management, business models, service integration, MaaS, marketing, etc.
Energy transition and climate neutrality	Technical competences in energy transition and climate neutrality, involve practical know-how required to develop or enhance products, services, practices, or processes within energy production, distribution, and supply chain management ensuring the transition towards climate neutrality, energy efficiency, and energy resilience. This includes assessing energy consumption patterns, promoting prosumership, and establishing rural energy communities using appropriate technologies tailored to local characteristics/ resources of the territory.	• Planning and developing community-led renewable energy initiatives • Conducting techno-economic analyses to evaluate the feasibility and cost-effectiveness of various energy transition solutions • Integrating renewable energy sources into existing energy grids, including understanding grid stability, storage technologies, and grid management • Applying low-carbon and renewable energy sources to improve energy efficiency (including in buildings) • Utilizing the voluntary carbon market to promote energy resilience, leveraging carbon credits to incentivise investments in renewable energy projects and energy-efficient technologies

Sustainable agrifood systems and ecosystem management	Technical competences in sustainable agrifood systems and ecosystem management – encompass practical know-how required to develop or enhance products, services, practices, or processes in agriculture and ecosystem management. They are essential for implementing innovations in the agrifood sector whilst ensuring the sustainable management of natural ecosystems in response to climate change, biodiversity loss, and concerns for social justice and inclusion.	• Planning and implementing agrifood management (precision agriculture, agroecology, pest management, and irrigation management, agricultural productivity while preserving ecosystem health and biodiversity) • Using precision agriculture technologies such as GPS-guided tractors, sensor-based monitoring systems to optimize crop yields and resource efficiency • Planning and implementing sustainable ecosystem management and governance (skills in forest, river, and watershed management in the context of biodiversity loss and climate change), ecosystem services management, biodiversity/ forest restoration, efficiency in resource use (bioeconomy, circular economy, etc.) • Optimising land-use planning • Planning and implementing zero-waste food supply (farm-to-fork logistics) • Implementing farm sustainability (e.g. CO_2 measurement) • Planning and implementing quality check of raw and processed food • Running bio and organic farming, and carbon farming
Nature-based and cultural tourism	Technical competences in nature-based and cultural tourism encompass practical know-how required to develop or enhance products, services, practices, or processes in rural tourism. Note: These competences relate to know-how in branding and destination management, creation of user-friendly platforms for hospitality and marketing, methods and technology in monitoring and managing the carrying capacity of rural tourism destinations (through IT solutions such as big data analysis), application of spatial data for nature and cultural discovery and catering/ gastronomy services (e.g. using drones for delivery), creation of cultural and nature-based routes and paths with elements on awareness building e.g. on climate and biodiversity.	• Branding and destination management • Creating user-friendly platforms for hospitality and marketing • Utilizing spatial data for nature and cultural discovery • Providing hospitality and catering/gastronomy services • Creating cultural and nature-based routes and paths with awareness building on climate change and biodiversity loss • Monitoring and managing the carrying capacity of rural tourism destinations • Managing, preventing and mitigating overtourism
Culture and cultural innovation	Technical competences in culture and cultural innovation encompass practical know-how required to develop or enhance products, services, practices, or processes to promote local culture and cultural innovations in rural areas / effectively manage, preserve, and promote both tangible and intangible cultural heritage in rural areas.	• Competences for utilizing 3D Modelling and Virtual Reality • Accessibility management for diverse groups, such as people with disabilities (e.g., Web Content Accessibility Guidelines [WCAG] for designing websites accessible to users with disabilities, including screen readers and keyboard navigation) • Competences, tools and techniques for enabling cultural accessibility and heritage management • Competences in platforms management /dissemination

		both tangible and intangible cultural heritage • Creating and coordinating short-term and long-term cultural events considering local expectations and preferences
Local services, health and wellbeing	Technical competences in local services, health and wellbeing encompass practical know-how required to develop or enhance products, services, practices, or processes care and wellbeing.	• Designing and managing tools for emergency preparedness and response (forest fires, floods, extreme weather events, etc.) • Health monitoring of rural people at risk of exclusion • Promoting healthy diet and lifestyles for people at risk of social exclusion • Preparing guidelines for sustainable housing and circular economy, responses to climate change vulnerability of rural and remote areas • E-Governance Platforms for government services and information access, emergencies and hospital /care access

4.1.3. Social competences

Social competences (Table 6) encompass knowledge, skills, abilities, attitudes, and behaviours required to effectively engage, communicate, and collaborate with rural actors and communities. They are often referred to as '*soft skills*'. These skills provide rural actors with the competences to mobilize and involve a diverse range of stakeholders, including policymakers and groups at risk of exclusion, in developing innovative solutions that meet social needs and address challenges such as climate change adaptation and mitigation, biodiversity loss, as well as social justice and inclusion (Bianchi *et al.,* 2022). Effective communication, empathy towards customers and colleagues, resilience in the face of failure, openness to diverse perspectives, and collaboration are essential social competences for driving innovation in rural communities (Sala *et al.*, 2020).

Table 6. Social competences

Subcategories	Definition	Examples
Communication and dissemination	Competences essential to interact, communicate, and exchange information effectively through various channels (verbal, storytelling, presentations, project pitching to different audiences, language skills for preparation of written materials for e.g., digital platforms, face-to-face interactions, discussion /focus group moderation, facilitation, etc.). Notes: Effective communication and dissemination skills are essential for engaging rural actors and communities in collaborative efforts, mobilizing support for social and environmental initiatives, and promoting inclusive decision-making	• Verbal communication skills e.g., storytelling techniques and ideas pitching, clear and articulate expression of ideas and information • Presentation tools and approaches for delivering engaging / elaborating key informative messages to diverse audiences, structure presentations for clarity and impact • Language skills - writing clear and compelling content (in native language and in English) for project acquisition, dissemination at different platforms, social media, preparation reports, etc • Using active listening techniques to understand the challenges and co-create solutions • Adapting communication style to accommodate diverse cultural backgrounds via mentoring and

	processes. This includes the ability to tailor communication strategies to the needs and preferences of audiences (from a diverse set), leverage appropriate channels and technologies for reaching target groups, and convey complex concepts in accessible and culturally sensitive ways. Dissemination involves sharing knowledge and best practices, building networks and partnerships, and empowering stakeholders to take actions towards addressing societal challenges and promoting wellbeing in rural areas.	coaching
Community-building, collaboration, and engagement	Competences required to build trust, mobilise support, build networks, engage rural actors in collaborative efforts for social and environmental initiatives and promoting inclusive decision-making processes.	• Engaging, moderating, facilitating group activities and dialogues • Teamwork and leadership skills (ability to build and nurture interdisciplinary teams, leverage individual strengths, and facilitate productive teamwork) • Competences in facilitation and co-creation of projects • Facilitating participatory decision-making processes and fostering a sense of ownership and empowerment within the community • Cultural competence and diversity management (sensitivity to cultural norms, values, and traditions) • Skills in promoting inclusivity, fostering cross-cultural dialogue, and addressing barriers to participation • Conflict resolution and mediation - skills in identifying and addressing conflicts within the community, including interpersonal conflicts and disagreements (constructive dialogue, mediate disputes, and find mutually acceptable solutions to conflicts) • Networking and partnership building • Know-how to leverage networks and resources to support innovation, access funding opportunities, and scale up successful initiatives. • Skills in building and maintaining strategic partnerships with diverse stakeholders, including government agencies, non-profit organisations, businesses, and academic institutions
Adaptability and resilience	Competences needed to adapt to changing circumstances (e.g., COVID, war/conflicts) and overcome challenges by bringing new approaches. It involves being flexible, innovative, thinking out of the box, and proactive in responding to unexpected events or disruptions. These competences include know-how to transform established practices in new ways, abilities to take a window of creating new opportunities, bringing traditional habits to create space for new habits	• Know-how to transform established practices in new way • Know-how to adapt to changing situations by bringing new ideas • Thinking out of the box or laterally

Environmental and social justice advocacy	Competences needed to comprehend and address environmental and social issues in rural contexts. In RURACTIVE, this includes understanding and acknowledging the cross-cutting priorities climate change mitigation and adaptation, biodiversity, as well as social justice and inclusion, while also possessing the competences to effectively tackle these (challenges)	• Advocating for environmental policies and regulations that promote sustainability and social equity • Organising community-led initiatives to address environmental degradation/ biodiversity loss and social injustices • Collaborating with local stakeholders to develop sustainable tourism strategies that respect and protect natural and cultural heritage • Educating and raising awareness among rural communities about the importance of environmental conservation and social justice issues • Mobilizing public support and engagement for initiatives that promote environmental and social justice in rural areas

4.1.4. Organisational competences

Organisational competences (Table 7) are knowledge, skills, abilities, attitude, and behaviour required to effectively organise, coordinate, and manage projects, products, services, processes or people. Leadership, strategic thinking, and a people-centric culture are vital for aligning innovative activities with goals for environmental sustainability and achievement of UN Sustainable Development Goals; financial sustainability; Environmental, Social, Governance (ESG); and adherence to the "green agendas" along with development of Inner Development Goals[5] (Bacigalupo *et al.*, 2016; Council of the European Union, 2018; OECD, 2018; Ankrah *et al.*, 2023; Shtaltovna *et al.* 2024).

Table 7. Organisational competences

Subcategories	Definition	Examples
Leadership and strategic management	Competences essential for effectively managing and overseeing a project or community initiative, including establishing strategic direction, partnerships, scale-up projects and ideas, fostering innovations	• Leadership skills • Strategic direction-setting • Willingness and know-how to take on risks
Operational management	Competences essential to efficiently manage daily operations within an organisation, project or initiative. This includes coordinating activities, allocating and optimizing processes to achieve operational objectives and deliverables. Operational management focuses on the	• Project management applying modern tools • Customer Relationship Management (CRM) • Marketing strategies and digital marketing • Sales techniques and strategies • Human resources management • Product and service development

[5] Inner Development Goals (IDG) are a set of skills and qualities that help us to live purposeful, sustainable, and productive lives to support implementation of the UN Sustainable Development Goals (SDGs): ***Inner Development Goals – Inner Growth for Outer Change.***

	practical implementation of plans and strategies, monitoring performance metrics, and making necessary adjustments to be resilience and adaptable to changes.	
Sustainable viability	Competences required to plan and implement projects, products, services, and processes in a way that ensures long-term viability and benefits for the community; environmental sustainability and achievement of UN Sustainable Development Goals (SDGs); financial sustainability; Environmental, Social, Governance (ESG) reporting, and adherence to the "green agenda," etc.	• Know-how to ensure financial sustainability • Know-how to ensure environmental sustainability (integrate UN SDGs, "green agenda", ESG, etc.) • Know-how to ensure long-term viability and engagement

4.1.5. Governance competences

Governance competences (Table 8) encompass knowledge, skills, abilities, attitudes, and behaviour required to ensure effective governance, policymaking and implementation of initiatives.

Table 8. Governance competences

Subcategories	Definition	Examples
Institutional frameworks and new governance practices	Competences essential for understanding and assessing institutional frameworks and ensuring ethical, legal, and other regulatory compliance. They also involve skills to evaluate and assess policies (local, regional, national) aimed at addressing rural challenges, promoting "green agendas". This also includes knowledge of new governance practices.	• Understanding of organisational structures, policies, and procedures that govern decision-making processes, roles, and responsibilities within an institution or community • Familiarity with ethical principles, legal requirements, and regulatory standards • Ensuring labour law compliance and ethical guidelines • Adhering to environmental regulations • Ensuring transparency and accountability • Knowledge of new governance practices
Conflict mitigation and mediation	Competences required for conflict mitigation through dialogue, negotiation, mediation, and consensus-building.	• Mediating land use conflicts • Resolving disputes in a community project • Facilitating dialogue between stakeholders
Participatory decision-making and policy engagement	Competences required for gathering and analysing information, assessing risks, and making informed decisions, as well as setting strategic priorities for rural development, participating in decision-making and policy formulation.	• Organising inclusive decision-making forums • Developing a participatory process for establishing rural energy community • Co-creation of carbon farming • Developing a participatory process for forest landscape restoration

4.1.6. Financial and business competences

Financial and business competences encompass knowledge, skills, abilities, attitude, and behaviour required to implement products, services, practices or business processes that affect economic, financial, societal, environmental and cultural dimensions of the market and organisational ecosystem (Table 9).

Table 9. Financial and business competences

Subcategories	Definition	Examples
Entrepreneurial skills and funding acquisition	Competences needed to successfully secure financial resources for initiatives, projects, or organisations. In the context of rural areas, where funding opportunities may be limited and competition for resources is high, these competences play a crucial role in supporting innovation, sustainable development, and community wellbeing.	• Grant writing • Financial forecasting to anticipate future performance • Risk management and mitigation risks
Financial accounting and controlling	Competences required for analysing financial data, preparing, and interpreting financial statements, and reporting to ensure sound financial controlling and sustainability	• Financial analysis and reporting • Budget preparation and variance analysis • Budgeting (budgeting principles and financial management practices to develop realistic project budgets, track expenses, and ensure compliance with funding requirements. This involves accurately estimating costs, allocating resources efficiently, and maintaining financial records)
New / innovative business models	Competences required to rethink traditional business practices and adopting innovative strategies and smart business models to address evolving market needs, capitalize on emerging trends by leveraging creativity, technology, collaboration, and partnerships (e.g., private-public partnership, sharing economy, etc.)	• Know-how to develop innovative business plans • Know-how to develop new business models e.g., private-public partnership, social enterprises, local carbon markets, business models that prioritize resource efficiency (e.g., payment for ecosystem services), or reuse or recycling to create a closed-loop system (c.f. circular economy business models)
Business strategy, planning, positioning and performance	Competences needed to effectively conduct market research to understand and analyse needs and market dynamics, develop market entry strategies, identify target markets, and establish competitive positioning; develop, implement, and manage strategic plans, position businesses for success within rural environments, and assess and improve performance outcomes	• Business environment analysis • Business risk management • Setting goals with SMART (Specific, Measurable, Achievable, Relevant, Time-bound) objectives • Developing branding and positioning strategies • Conducting market profiling • Analysing product performance and adapt to changing markets

4.2. Inventory of learning needs and gaps to foster innovations within RURACTIVE RDDs

The inventory of learning needs and gaps and missing competences required to foster innovations in rural Europe within RDDs of RURACTIVE, is presented in the matrix below (Table 10). This inventory is based on the evidence collected from three types of knowledge sources:

1) scientific literature review;
2) evidence of the community of practice via review of EU projects to integrate evidence from experts on the ground including local policymakers, researchers, and the communities;

3) evidence from RURACTIVE Dynamo Partners, based on their past experiences in implementing innovative solutions in their territories (collected via the Catalogue of Solutions).

The inventory of learning needs and gaps to foster innovations shows that digital and technological competences, emphasizing digital skills for all, including a basic one – for elderly, and proficiency in artificial intelligence and emerging technologies for young people – are essential to be addressed to allow equal opportunities to participate in digital era. Information and data literacy, crucial for navigating web applications and digital learning tools, supports innovation, community empowerment especially enabling young people to be active actors of the transformation process. Technical competences that are missing in rural areas focus on technical aspects of the implementation of sustainable practices with e.g. carbon reduction and circular economy principles, enabling the development of environmentally sound products. This needs special educational strategies and opportunities for rural actors. Social competences enabling to foster social innovations include effective communication, and advocacy e.g. for environmental and social justice, promoting collaboration and resilience. Organizational competences, including leadership, strategic management, and advanced marketing techniques, enhance operational effectiveness and community outreach. Governance competences advocate for multi-level governance, conflict mediation, and participatory decision-making to address land use conflicts and ensure inclusive policy engagement. In financial and business competences, learning needs are associated with entrepreneurial skills, funding acquisition, and innovative business models, crucial for economic resilience and environmental stewardship, and inclusive development.

Sections from 4.2.1 to 4.2.6 explains the results of the inventory.

Table 10. Summary Matrix with results of an inventory on missing competences in rural Europe

RDD Competence category	General (not RDD-specific)	Sustainable multi-modal mobility	Energy transition and climate neutrality	Sustainable agrifood systems and ecosystem management	Nature-based and cultural tourism	Culture and cultural innovation	Local services, health and wellbeing
Digital and technological competences							
General digital and technological competences	• Digital skills (incl. of elderly people) • Able to utilize artificial intelligence and new technologies • Understand and use digital tools and technologies	• Digital skills	• Digital skills and AI literacy	• Digital skills (incl. elderly farmers and forest owners' digital skills) • Basic IT skills	• Technological expertise of tour operators • Technology skills in augmented reality		• Digital skills (incl. of elderly people) • Able to develop infrastructure aimed at improving internet access and connectivity in rural areas
Information and data literacy	• Know-how to use web applications • Know-how to use web services • Competences in digital learning methods and tools	• Know-how to use car-sharing apps	• Awareness and knowledge about disruptive renewable energy technologies (e.g. new solar technology) • Have a holistic understanding of energy systems and energy technologies, incl. the knowledge of their advantages • Know-how to utilize tools (e.g. solar maps/atlases) and planning software to optimize the exploitation of solar energy	• Awareness of technological advancements and the ability to integrate technology into agrifood businesses for more efficient and sustainable practices • Know-how to use technologies to optimize quality and consistency in organic agriculture, livestock farming, and aquaculture • Able to facilitate the integration, accessibility, and compatibility of dietary health information through technology	• Know-how to use professional literature as knowledge and information (K&I) source, including the use of websites • Know-how to use apps guiding tourists to local attraction • Able to effectively utilize apps designed for cultural assets, particularly those involving local or indigenous residents	• Know-how to use tools for GIS mapping and planning • Awareness among migrants regarding the potential benefits of new technologies and innovation in rural and mountainous areas, despite their traditional perspective on countryside and agriculture	• Understand how to effectively search the internet (incl. websites for finding public health information and search relevant electronic databases) • Able to conduct digital transactions
Digital communication		• Awareness about various blended		• Know-how to manage knowledge	• Able to use dissemination channels for knowledge	• Know-how to use participatory co-	• Able to provide, as well as know

and collaboration		learning methods and possessing the digital competences to interact where required		from previous projects using digital platforms • Utilizing digital technologies for preserving and sharing knowledge, local heritage, and specialized know-how across generations	and information (K&I), encompassing understanding both the content (knowledge and information) and the methods (channels) through which they are disseminated	planning tools • Live-streaming skills	how to access and use, telemedicine services for local health services
Digital content creation	• Knowhow to develop and implement digital innovations • Know-how to develop new web applications and web services • Able to create content by using artificial intelligence and new technologies	• Know-how to develop and implement digital parking systems and mobility services • Know-how to develop and implement car sharing apps	• Expertise in renewable energy technologies, as well as technological innovations in energy efficiency • Know-how to implement solar technology	• Know-how to develop decision support systems • Know-how to develop and implement Industry 4.0 solutions	• Know-how to develop apps guiding tourists to local attractions • Able to develop apps designed for cultural assets, particularly those involving local or indigenous residents	• Know-how to develop participatory co-planning tools • Know-how to create a data base for the promotion of cultural and natural heritage	
Digital safety and cybersecurity			• Understand how technology aligns with existing social norms and practices				• Ensure data content privacy and security (including beyond project duration)
Digital technologies for problem solving			• (Data) Analytical and research skills	• Data management and data analysis skills • Know-how to use decision support systems • Information and communications technology (ICT)-related knowledge in development of satellites, artificial vision, sensors, remote controls, remote detection		• Know-how to digitalize administrative processes	

				systems, management and decision-making support systems applicable to the agrifood and forestry sectors			
Digital technologies for rapid prototyping						• Know-how to develop tools for GIS mapping and planning	
Technical competences							
	• Competences in effective carbon reduction measures, as well as in sustainable resource management and circular economy • Competences to develop and implement innovative products • Competences to apply innovative education methods and tools, e.g. for environmental education • Awareness and knowledge about climate change	• Competences to develop and provide multimodal mobility systems and public transport services to connect rural areas (e.g. for tourists in limited-access areas such as mountains) • Competences to provide sustainable transport services (for elderly people or impaired pedestrians, incl. free of charge options) • Awareness and knowledge to use alternative and green transport services	• Development of design concepts for photovoltaic systems, incl. knowledge about visual impacts of photovoltaic systems • Expertise in renewable energy technologies, incl. energy efficiency, green engineering, green construction and renewable resources (e.g. material flow analyses; data analyses of buildings, logistics, and renewable energy potential in local environments), as well as practical skills to improve the efficiency and reliability of renewable energy	• Competences in food production (e.g. small-scale product processing) and supply chain management (e.g. developing micro-logistic innovation techniques), incl. ensuring food quality (esp. animal-based food products), and efficient techniques in food preservation, processing and in the distribution process • Awareness of sustainable agricultural production practices/techniques (e.g. organic cultivation) and knowledge in agroecological practices incl. understanding	• Knowledge and skills in tourism management and in developing products and services for rural areas, such as providing innovative, sustainable and high quality tourism products and services tailored to specific demands and trends (e.g. touristic farm activities/agro-tourism services, alternative tourism concepts such as snow-independent winter activities, nature-based and community-based tourism services, cultural offers and sports activities • Knowledge and understanding of sustainable tourism principles, its potential, as well as awareness of the positive and negative economic, environmental and socio-cultural effects of tourism, incl. knowledge and education in reducing	• Knowledge on cultural innovation and understanding its impact on socio-economic areas • Competences to provide training for (unemployed) career-changers (e.g. in service professions) • Expertise to overcome infrastructural obstacles, including knowledge in providing education and financial support to empower women in innovations, which are essential for fostering gender equality	• Competences in personal and community health care practices (incl. health literacy), as well as in rural health care services • Competences to provide adequate social and elderly care, incl. supporting caregivers in healthcare • Systematic and evidence-based knowledge to meet the needs of clients with mental illness

			technologies • Technical expertise and skills in installation, operation and maintenance of energy infrastructure (e.g. solar/photovoltaic technology, Smart Local Energy Systems, bioenergy systems), including knowledge about material procurement and solar energy transition • Expertise in overcoming challenges such as low energy density, discontinuity and uncertainty of sources	ecological principles, environmental considerations, biodiversity conservation (e.g. sensor-detecting GHG emissions in soil and water monitoring), as well as green entrepreneurship • Knowledge to improve dairy farming operations, such as implementing mechanisation (e.g. milking, feed distribution) and infrastructure (e.g. animal housing, manure storage and manure spreading) to enhance productivity, animal welfare, and environmental sustainability in dairy farming • Competences in implementing innovative agricultural practices that address environmental concerns while ensuring economic viability, together with understanding the value of diverse genetic resources and biodiversity in	negative impacts and promoting sustainable tourism practices • Competences in promoting cooperation, knowledge transfer, and participatory learning for sustainable tourism development in rural areas through facilitating entrepreneurship and integrating community development with tourism practices		

				farming systems • Knowledge of precision agriculture, modern pomology, as well as skills in participatory local food production models and educational tools application			
Social competences							
General social competences	• Know-how to develop and implement social innovations			• Ability to think holistically and interdisciplinarity, essential for understanding complex relationships in agroecology (e.g. ecological functioning, human wellbeing, socio-technical innovations, governance models, and land-use policies) and adapting to paradigm shifts in training			
Communication and dissemination	• Able to engage in dialogue and in social interaction • Interpersonal skills • Communication skills • Language skills		• Socio-analytical skills (quick analysis of situations and reactions, interpersonal) • Negotiation skills • Able to apply conversation techniques such as attentive listening skills and patience,		• Knowledge of experts, and confidence to contact them, as a source of knowledge and information (K&I) • Facilitating the transition of academic knowledge to local communities by creating, distributing, and advocating for practical tools aimed at		

			speaking their actor-languages		strengthening local innovation ecosystems in rural and remote areas		
Community-building, collaboration and engagement			• Networking and support skills • Able to collaborate with experts and subcontractors • Willingness to volunteer in community energy projects (e.g. interest to participate in a collective bioenergy action)	• Collaboration competences (e.g. to connect with local communities and enterprises, as well as to collaborate effectively within a network and to empower actors in value chains) • Willingness of farmers to engage or collaborate in an innovative policy regarding biodiversity conservation payments • Know-how to coordinate actions among institutions, farms and the civil society to improve agro-biodiversity • Building trust and confidence in agricultural cooperatives	• Ability to act for change with local people to realise rural tourism potential • Active participation and cooperation of informed stakeholders, as well as involvement of local residents in tourism planning to implement sustainable tourism development • Ability to collaborate effectively	• Competences in methods for the intergenerational transfer of traditional knowledge • Need for further involvement and dialogues on social innovation in marginalized rural areas • Collaboration competences for the product development with Regional Tourism Organisations	• Developing skills related to community engagement, empowerment, and collaborative problem-solving • Willingness to accept guidance and help
Adaptability and resilience			• Able to adapt to changes in established processes (regarding organisation inertia) • Cognitive skills (for developing new value propositions)				

Environmental and social justice advocacy	• Environmental awareness and literacy		• Public/civil society's acceptance, awareness and interest of renewable energies • Social visibility and awareness of energy technologies • Public acceptance concerning the visual impact of photovoltaic installations	• Raising awareness regarding the benefits of organic products and healthy food • Recognizing the social importance of rural communities to attract young farmers while ensuring continuous access to local markets or direct marketing opportunities to aim for sustainability		• Awareness of gender issues in technology and finances, as well as cultural barriers	
Organisational competences							
Leadership and strategic management			• Leadership and direction-setting skills (e.g. willingness to take risks, sense of responsibility), incl. transformative leadership capabilities				• Competences in leadership and collective learning methods
Operational management	• Competences in advanced marketing techniques		• Project management skills (e.g. capability to effectively manage decentralised energy projects) • Marketing and sales management skills for solar photovoltaic technology • Managing complex projects about integrated and shared energy	• Competences to use marketing platforms • Product sales skills • Capabilities to establish short marketing chains and the use of ICTs for marketing local and seasonal products	• Skills in organisational management and optimization of companies • Product development skills (of tourism providers and policymakers): understanding how to effectively tailor rural tourism products/services and policy efforts to customer's needs and expectations, according to current trends • Knowledge in tourism management, especially in	• Event organisation skills • Competences to promote sports activities and community-bonding activities • Competences to attract artisans and young people to build local makers community and innovate in relation to local heritage	

			systems (from development to recycling of waste materials)		rural tourist groups and segments • Professional marketing skills to prepare and promote sustainable tourism products in order to attract visitors		
Sustainable viability	• Environmental Sustainability: Minimizing negative impacts on the environment and conserving natural resources. • Economic Sustainability: ensuring financial stability and growth without depleting resources or causing long-term harm. • Social Sustainability: Promoting social equity, wellbeing, and quality of life for all community members.						
Governance competences							
General governance competences	• Competences in multi-level governance		• Able to design and implement effective public support schemes and mechanisms for internalizing the external costs of fossil fuel generation to reduce the economic gap between the different				

			technologies for using energy sources				
Institutional frameworks and new governance practices			• Competences in legal requirements such as regulations, acts and legislative procedures, public tender procedures (e.g. understanding legal matters regarding solar photovoltaic technology) • Knowledge about ethical concerns regarding effects on environment, climate change, land use (land-for-fuel vs. land-for-food) and on social impacts of pursuing higher investment returns, incl. corresponding legal frameworks	• Regulatory compliance in small-scale product processing	• Awareness and knowledge of rural tourism enterprises of legal standards regarding attractive accommodation facilities suitable for rural tourism services		
Conflict mitigation and mediation	• Able to mediate, mitigate and resolve land use and resource conflicts • Negotiation skills • Trust building				• Knowledge in conflict resolution, critical reflection and cultural communication associated with the tourist experience in the community • Competences to develop and use conflict management tools in tourism and to promote trust building	• Competences to counteract socio-cultural problems • Competences to develop concepts in overcoming old role models addressing tradition resilience and gender values	
Participatory decision-making and policy engagement			• Decision-making skills • Capable of effectively	• Able to establish small farmers associations that collaborate	• Creating action-oriented training mechanisms that empower learners to actively participate,	• Able to formulate and implement cultural policies effectively,	

			coordinating across policy and implementation levels, alongside the ability to learn and adapt within a complex governance structure, including interdisciplinary skills to navigate complexity • Coordinating municipality decision-making processes and municipality strategies	effectively to adapt to changes in policies and strategies, involving skills in collective processing, selling, and managing land at landscape level, as well as fostering cooperation and mutual support among neighbouring farmers • Able to facilitate stakeholder engagement and collaboration in jointly defining goals and benefits of platform building by reflecting innovation ideas, identifying leaders, and designing a roadmap for the future • Securing provision and financing of Front-End Services (FES) in emerging policy strategies	enabling them to co-create methods and tailor them to their local context	incorporating ideas from various sources and addressing principles of accessibility, social justice, participation, and learning	
Financial and business competences							
General financial and business competences			• Financial skills, incl. problem-solving skills (to overcome financial limits)				
Entrepreneurial skills and funding acquisition			• Knowledge of bioenergy funding schemes • Financial competences for		• Able to enhance women's financial capital, incl. financial literacy (beyond that of non-paid positions/ underpaid/		

			planning energy refurbishment investment, drafting financing plans and financing a project scheme • Able to overcome risk aversion and to address high perceived risks (of new business models) as a barrier for investments		temporary jobs in rural tourism)		
Financial accounting and controlling	• Competences in financial management		• Competences in managing internal costs of electricity generation, which often exceed those of traditional fuels		• Business experience (e.g. accounting)		
New / innovative business models	• Competences regarding business model innovation		• Competences regarding business model innovation (e.g. awareness for renewable energy business innovation)	• Capable of developing new business models tailored to rural contexts		• Competences to develop and implement market innovation (from research to industry)	
Business strategy, planning, positioning and performance	• Entrepreneurship skills			• Competences in sustainable business models • Able to identify targeted market incentives and implement effective economic support measures as well as access comprehensive information on market conditions	• Know-how to prepare business plans • Knowledge about how to found an organisation • Implementing an entrepreneurial culture		

4.2.1. Sustainable Multimodal Mobility

The review of literature and EU projects reveals numerous competences needed to foster innovative solutions for sustainable multimodal mobility. Learning needs and gaps associated with developing these competences include a deeper understanding of how to design, implement, and manage mobility solutions that are sustainable, smart, greener, and resilient, while simultaneously meeting the diverse needs of rural communities. This is in line with *A Long-Term Vision for Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040.*

Scientific and grey literature provide examples primarily related to the skills gap requiring to be bridged to incentivize active mobility through **digital** means, such as apps for car or bike sharing and exemplify awareness-raising and cooperation to promote sustainable multimodal mobility and mitigation-relevant adaptation measures (e.g., European Mobility Week; encourage cooperation with the European Covenant of Mayors on alignment of SUMP (Sustainable Urban Mobility Planning) and Sustainable Energy and Climate Action Plans (SECAPs) instruments). New technological developments in the field of digitalization have led to a significant upgrade in shared mobility options but which need to be addressed in rural areas.

The literature underscores the importance of *integrating digitalization, community engagement, and environmental considerations* to create sustainable and inclusive new mobility services in rural areas such as car-sharing, on-demand ridesharing, bike-sharing, and similar options, which are becoming increasingly important (c.f. HE SmartERA project). Participatory processes are key for these developments.

To promote sustainable multimodal mobility, the following **technical competences** have been highlighted as being needed most: know-how on innovative approaches for planning sustainable transportation (app incentivizing active mobility, car/bike sharing, etc), and skills to develop and implement zero-emission mobility solutions (including active, collective, and shared mobility applications). Technical skills are also required to implement connected and automated multimodal mobility systems, e.g., integrated electronic ticketing systems (as implemented e.g. in Switzerland). Furthermore, competences to promote *Flexible Transport Services* that function like public transport, such as route-based and *door-to-door Demand Responsive Transport* (DRT) are necessary. Additionally, skills in developing *Ride Sharing Services,* such as shared car-pooling, volunteer lift-giving and e-hitchhiking, will be beneficial. Equally important is expertise in Asset Sharing, allowing access to vehicles without ownership, such as car-sharing or bike-sharing (as suggested in HE SmartERA project).

Insights from the RURACTIVE Dynamos identified the need for competences which will enable the development and implementation of multimodal mobility services and public transport services

tailored to attract tourists in rural areas. Additionally, literature notes there is a need for competences in developing mobility services that will link remote rural areas (both with urban or accessible areas, and between remote rural areas), especially in implementing smart mobility systems for limited-access areas such as mountains or islands. Skills in using Geographic Information Systems (GIS) can enable planners and policymakers with responsibilities for rural areas to visualize spatial data more effectively, analyse transportation networks, and identify high-demand areas for sustainable mobility solutions. GIS skills enable the creation of interactive maps, spatial analysis tools, and decision-support systems for use in optimizing infrastructure investment and enhancing accessibility and connection between rural and urban areas (Rybarczyk and Wu, 2010; Şişman and Aydinoglu, 2020; Kaya *et al.*, 2022).

Digital and technological skills needed to promote sustainable multimodal mobility in rural areas include competences for utilizing data for developing and using apps to promote less energy-intensive transportation modes (e.g. car or ride-sharing apps). Designing personalized multimodal travel services, based on Smart Product Service System (SPSS), which can provide multimodal route recommendations tailored to individual preferences, is also of considerable importance (Xu *et al.*, 2021). Digital technologies for problem solving (e.g. DSS tools) and digital technologies for rapid prototyping, as well as tools for communication and collaboration play a key role in promoting sustainable multimodal mobility (c.f. SMARTA, SmartERA[6]).

Skills in the application of artificial intelligence (AI) are vital aspects in sustainable multimodal mobility (Nahar, 2024). Understanding data privacy regulations and implementing robust security measures is essential for building trust and ensuring the confidentiality of sensitive transportation data. Competences in data protection enable the development of secure data-sharing protocols, anonymization techniques, and compliance with privacy laws (Hahn *et al.*, 2019). Machine learning (ML) and predictive analytics are valuable tools for developing algorithms with which to forecast travel demand, optimize transit schedules, and personalize route recommendations, improving the accuracy and efficiency of multimodal transportation systems (Basak *et al*., 2019; Nabizadeh *et al*., 2020; Müller-Hannemann *et al*., 2022; Zhang and Zhao, 2022). The integration of tools within an Internet of Things (IoT) can enable real-time data collection on traffic conditions and user behaviour, enhancing infrastructure management and safety (Fantin Irudaya Raj and Appadurai, 2022). User experience (UX) design is crucial for engaging users with digital solutions in sustainable multimodal mobility, emphasizing intuitive interfaces and user satisfaction to encourage the adoption of sustainable transportation options (Zulfiandri *et al*., 2021).

[6] *https://ruralsharedmobility.eu/wp-content/uploads/2021/03/Smarta-Policy-Recommendations_Final-Version_web.pdf and Trainings in mobility - https://www.nationalrtap.org/Training/National-RTAP-Training-Overview*

Social, organisational and governance competences needed to promote sustainable multimodal mobility are often associated with a lack of effective communication skills essential for conveying information ("convince and bring on board") and coordinating efforts with good leadership and strategic management. These competences help foster collaboration amongst rural stakeholders in the complex landscape of rural transportation systems, such as ensuring buy-in of implemented solutions (as referred to in the EU SMARTA project and indicated by RURACTIVE Dynamos).

According to Dynamo insights, there is a need for greater awareness and knowledge regarding the use of alternative and green transport services crucial for reducing environmental impacts. Müller *et al*. (2024) highlight the importance of understanding the strengths and weaknesses of existing mobility systems to recognize their potential for improvement. Access to platforms for learning best practices and know-how also appear to be very important (as referred to in the EU projects SMARTA, SMARTA2, LAST MILE and INCLUSION). Networking skills are also important for engaging with communities and rural stakeholders, as well as ensuring inclusivity in planning and implementing sustainable mobility solutions (as referred to in the EU projects SMARTA, SMARTA2, LAST MILE, MAMBA, INCLUSION, MARA, MELINDA and Hi-Reach).

Social competences involve understanding behavioural change strategies to promote sustainable travel behaviours. Effective interventions, such as social marketing campaigns, incentives, and nudges, can encourage individuals to choose more eco-friendly transportation options (Anagnostopoulou *et al*., 2020). For example, the BikeLibrary project engages with families, schools, and local communities to promote active travel and sustainable transportation by providing free access to bicycles (Bleeperbike Ireland Opco Limited, 2024). This initiative encourages families to participate in cycling, enabling them to experience its benefits directly. Consequently, it fosters community engagement by creating opportunities for families to connect with each other and with local authorities (National Transport Authority, 2023).

In sustainable multimodal mobility, learning gaps have been identified regarding building **financial and business competences,** particularly in areas such as business strategy development, planning, positioning and performance of sustainable and smart mobility solutions. Entrepreneurship skills (e.g. social entrepreneurship) are associated with identifying opportunities (e.g. launch of hackathons amongst youth or local startups to develop mobility solutions) for offering new and sustainable business models in the complex landscape of rural multimodal transportation (e.g. with a public-private partnership approach). According to RURACTIVE Dynamos, skills and know-how are needed to develop business models for sustainable and free-of-charge transport services e.g. for elderly people, ensuring inclusivity in transportation.

Expertise in business model innovation is essential for developing new and sustainable revenue streams in the public sector. This includes exploring subscription-based services, mobility-as-a-service (MaaS) platforms, and shared ownership models to meet the evolving needs of users while

promoting environment sustainability (Butler *et al*., 2020). Negotiating and managing public-private partnership (PPP) strategies are also important for leveraging resources and expertise from both sectors to implement sustainable transportation projects including understanding legal frameworks, risk-sharing mechanisms, and stakeholder engagement to facilitate effective collaboration (Willoughby, 2013).

Addressing these learning needs and gaps is critical for unlocking the potential of sustainable multimodal mobility and accelerating the transition towards more sustainable and resilient transportation systems as well as to create positive societal and environmental impacts.

BOX 1. Capacity building needs to support the effective implementation of smart and community-led solutions for sustainable rural multimodal mobility

To effectively promote sustainable rural multi-mobility, a focus on enhancing capacity through structured training programmes and mechanisms for developing competences is recommended. Comprehensive training to develop capacity should be provided to local implementers (e.g., practical training for skill-building). Capacity-building, training, and knowledge transfer programmes need to be developed, covering a wide range of topics including needs assessments, planning, operations, resource optimization, and regulatory compliance. In addition, emerging needs are likely to include training in areas such as Artificial Intelligence for use in developing sustainable rural multimodal mobility e.g., Intelligent Transportation Systems (ITS), app development, data management, and innovative business models. Means are needed to share best practices and knowledge about innovations in topics of new and emerging areas, such as ITS, app development, data management, business models, service integration, Mobility as a Service (MaaS), and marketing.

To empower rural communities to embrace sustainable multi-mobility solutions and create smarter rural transportation for the future, training programmes should leverage synergies with social, health, and tourism initiatives to maximize the impact of capacity-building efforts. A special focus of such training should be on ensuring buy-in and developing strategies for dissemination and outreach with **digital tools**. To create the desired impacts, these capacity-building efforts should be integrated into existing rural development frameworks, such as e.g., initiatives like Smart Villages. Europe could draw inspiration from successful models like the US Rural Transit Assistance Program (RTAP) to provide guidance, capacity building and support to rural communities in implementing sustainable multi-mobility solutions.

Source: based on EU SMARTA project, SMARTA2, LAST MILE, MAMBA, INCLUSION, MARA, MELINDA, and Hi-Reach

4.2.2. Energy Transition and Climate Neutrality

Decarbonising the power system is one key requirement for achieving targets of climate neutrality by 2050. The development of renewable energy is a key element in tackling climate change and ensuring energy security (Miller *et al.*, 2023). Rural areas in Europe are at the forefront of the development of renewable energy systems at micro- and small-scale up to large scale. Electricity and energy

companies more generally have been transitioning to large- and medium scale renewable energy developments, primarily of wind and hydro energy, and in southern Europe, solar energy (e.g. PS10 Solar Power Plant, Spain). The demands of such businesses have led universities and technical colleges to develop courses on relevant areas of engineering, planning, finance, and increasing on recycling and re-use, in some cases as MOOCs (e.g. *Engineering Design for a Circular Economy, TU Delft*).

A significant obstacle to the adoption of resource-efficient renewable energy solutions reported by several authors is the limitations of the human capital (c.f. competences) available within rural communities for the design and establishment of operational renewable energy projects (e.g., Scotti and Minervini, 2017; Virtič and Kovačič-Lukman, 2018; Slee, 2020). Important elements of that human capital are leadership, in developing and advocating ideas for Energy Transition and Climate Neutrality, and champions or ambassadors, who can have significant impacts on the development of community-led solutions (Herbes *et al*., 2017; see also under **social competences**). Good institutional frameworks, policies and new governance practices, along with conflict mitigation skills e.g., to facilitate trust-based and conflict-avoiding renewable energy constructions in rural areas, seems to be of value while implementing sustainable Energy Transition and Climate Neutrality solutions.

The deployment of renewable energy in rural areas under the EU's legal framework for energy can significantly contribute to the Rural Action Plan outlined in the Long-term Vision for the EU's Rural Areas. In supporting the 'resilient rural areas' pillar of this vision, the plan highlights that EU funds can finance the renovation of buildings in rural areas and help achieve the European Green Deal's objectives by increasing energy efficiency and local renewable energy production.

The Clean Energy for All Europeans Package of the European Commission (2019) aims to accelerate the clean energy transition, providing all citizens with access to secure, competitive and sustainable energy. It includes measures to support renewable energy deployment, improve energy efficiency, and promote innovation in clean energy technologies across member states. In this package, the EU identifies skills gaps in the renewable energy sector, noting the need for capacity building through retraining and upskilling as part of energy transitions (c.f. European Commission's Green Deal), and facilitation of knowledge exchange.

The European Commission's Green Deal (European Union, 2019) aims to transform the EU into a climate-neutral continent by 2050, with specific targets for reducing greenhouse gas emissions and the uptake of renewable energy, with strong support for knowledge transfer (EC-Directorate-General for Communication, 2021). As part of the Green Deal, the European Commission proposed initiatives, such as the European Climate Law and the Renovation Wave strategy, to accelerate the transition to renewable energy and improve energy efficiency across Member States. These initiatives emphasize knowledge and know-how dissemination, stakeholder engagement, fostering horizontal and vertical

collaboration efforts among rural stakeholders, and normative shifts towards sustainable practices (adaptability, resilience, environmental and social justice advocacy) (EC-Directorate-General for Climate Action, 2024; EC-Directorate-General for Energy, 2024).

The Renewable Energy Directive EU/2023/2413 increased the target for renewable energy generated in the European Union by 2030 to a minimum of 42.5%, up from the previous 32% target, with the aspiration to reach 45% (European Union, 2023). To achieve the target requires an increased rate of development and operationalisation, and support for addressing concerns of communities of associated environmental and social impacts, trade-offs between those, and the benefits accrued society-wide and at local levels. In realising those benefits, Miller *et al*. (2023) identify the need to match the availability of skills with the types of energy systems best suited to the resources of an area (e.g. wind, solar, hydro, biomass) with a view to building local capacity in the right competences over current and future stages in the lifecycle of the systems of relevance (e.g. site preparation and management, maintenance, decommissioning, re-use of materials). Such local capacity building is also recognised by the IPCC (2023), alongside needs for competences in various aspects of governance, finance, technology transfer, investments, local development, and "context specific gender-based and other social equity considerations with meaningful participation of Indigenous Peoples, local communities and vulnerable populations."

The literature review highlights that **competences in good governance** are beneficial for rural actors in the transformation and transition of energy systems to ensure compliance with regulations, and the adoption and development of frameworks capable of effective decision-making, handling conflicts, and engagement with a diverse range of stakeholders (Komendantova *et al.*, 2018). Specific governance competences identified as lacking at community level are:

i) effective coordination across different levels of policy and implementation, with the capacity to learn and adapt within a complex governance structure (Irshaid *et al.*, 2021);

ii) processes of decision-making and respect of issues of ethics and social justice (Ruppert-Winkel, 2018; Virtič and Kovačič-Lukman, 2018);

iii) regulatory and legal requirements relating to renewable energy technologies (e.g. solar photovoltaic, Havlíček *et al.*, 2012; Neij *et al.*, 2017);

iv) tendering and procurement procedures (Herbes *et al.*, 2017; Virtič and Kovačič-Lukman, 2018);

v) management and coordination of networking, stakeholder engagement and public relations, and the ability to collaborate with experts and subcontractors (Lutz *et al.*, 2017; Ruppert-Winkel, 2018; Virtič and Kovačič-Lukman, 2018).

A characteristic of community-led renewable energy development is a reconfiguration of institutional arrangements consistent with social innovations (Hewitt *et al.*, 2019). Often such reconfigurations are driven by innovators and leaders that emerge from communities, acting on a voluntary basis and

building collective efforts (Voytenko and Peck, 2011; Virtič and Kovačič-Lukman, 2018; Ravazzoli *et al.*, 2019). Such individuals require key **social competences** for driving forward the energy transition and achieving their local goals. These include problem solving skills for developing new value propositions, and for use in communications with stakeholders (e.g. investors, community; Herbes *et al.*, 2017). Social competences also include interpersonal skills for the effective management of relationships and developing social capital, socio-analytical skills for quick situational analysis, negotiation skills, and effective communication techniques such as attentive listening (Ruppert-Winkel 2018; Virtič and Kovačič-Lukman, 2018).

Effective communication with civil society and the participation of local stakeholders are essential to address public perception and acceptance of renewable energy (Lutz *et al.*, 2017; Komendantova *et al.*, 2018). Skills in stakeholder identification and engagement should provide means of approaching and including citizens who may be underrepresented in decision-making and in benefiting from local renewable energy developments (e.g., elderly, migrants, indigenous peoples) (Komendantova *et al.*, 2018; IPCC, 2023), and gaining from end-user and local knowledge (Virtič and Kovačič-Lukman, 2018).

Jager (2006) argues that environmental awareness among citizens plays a crucial role in improving local involvement, acceptance, and support for climate neutrality, often influencing the decision to invest in renewable energy technologies (Warren and McFadyen, 2010; Boon and Dieperink, 2014). Effective strategies for raising awareness of issues relating to renewable energy include climate schools for young people, public information events, media reports, and excursions and exhibitions that can be used to familiarize local people with renewable energy and energy efficiency technologies (Komendantova *et al.*, 2018). Across all ages, gamification of energy transition measures is another approach which is being implemented, with associated needs for design and computing competences (Komendantova *et al.*, 2018).

Peer-to-peer learning and sharing of lessons of success between rural energy communities is a valuable means of inspiration and filling knowledge gaps (e.g.,), an example of the funding of which is the UK Government . Leveraging tools and knowledge enables communities to harness the potential of renewable energy and the creation of sustainable futures. Know-how and information on benefits to be gained from developing community-led renewable energy includes: understanding its scope to mitigate climate change by reducing greenhouse gas emissions; the potential for new income streams for communities; the legal requirements to be satisfied (e.g. governance structures for managing energy system and income generated); opportunities for locally prioritised investment in community development schemes; regulatory requirements and processes for selling energy to the national grid; mechanisms for increasing energy independence and resilience; and how to tackle issues of planning, land use and environmental impacts of renewable energy developments (Miller *et al.*, 2023).

Herbes *et al.* (2017) identify a potentially significant impediment to community energy or energy cooperatives which they refer to as "normative or ethical concerns". They report three main obstacles:

I) risk aversion, both by those involved in the cooperative and its management;
II) concerns about certain business models that, while legal, do not match what lawmakers intended in terms of environmental impact or ethical standards;
III) lack of skills and time amongst the unpaid managers of renewable energy cooperatives.

In addition, in large, small and micro-businesses, a lack of adaptability or resistance to change can pose a significant obstacle, particularly regarding organisational inertia and the reluctance to modify established processes (Herbes *et al*., 2017; Ravazzoli *et al*., 2019). Such resistance may arise from different perspectives or values (e.g., regarding purposes of development, benefits and disbenefits, impacts on individuals and communities).

Rural entrepreneurs require the capability to acquire and utilize new competences and practices (Havlíček *et al.*, 2012). Foremost of those competences is expertise in project management, particularly in the operational planning and management of projects which may be decentralized in nature (Havlíček *et al.*, 2012; Herbes *et al.*, 2017; Virtič and Kovačič-Lukman, 2018; Hewitt *et al.*, 2019; see also under **governance competences**). Skills are also required in the institutions with responsibilities for rural areas, such as local authorities (e.g. planners), and businesses providing advisory and professional services (e.g. architects, building developers) for the use of contemporary tools to enable them to better exploit the potential of renewable energy in their local contexts (Havlíček *et al.*, 2012; Herbes *et al.,* 2017; Neij *et al.*, 2017).

An increasingly significant competence required to stimulate investments of communities and businesses of renewable energy generation is adaptability, leadership skills and capabilities for adopting collaborative approaches (Gailing and Rohring, 2016). Alongside the characteristics of their personalities, the human capital of those individuals includes competences in strategic direction-setting and the management of risk, requiring access to **organisational** competences (Lutz *et al.*, 2017; Ruppert-Winkel, 2018). Combined within leadership skills, such competences enable the launch of community-led renewable energy projects (notably in wind, solar, hydropower and biomass) and decentralised, low-carbon and resilient energy (Miller *et al.*, 2023; Evans *et al.*, 2015). Other leaders may be those who are operating behind the scenes (informal leaders), who possess strong skills in communication and networking and who can foster change (Ruppert-Winkel, 2018).

Several regions have mature mechanisms for enabling communities to take steps in the generation of energy including supporting them in building competences and know-how, albeit this is still a significant undertaking in time and effort. Models of community **leadership** in renewable energy development (e.g., ownership, rental, shareholding) and operation are increasingly understood and

deployed (Slee, 2020). Characteristically, such developments are social innovations, contributing to rural development through place-based or issue-based groups in community energy, particularly in communities with the technical and human capacity to deliver renewable energy projects. From such developments, energy communities are emerging as a framework to foster a just green transition for rural communities, ensuring that the values and benefits are retained locally while promoting democratic participation and citizen engagement (Soloviy *et al.*, 2019). These communities enable collective ownership and operation of energy systems, transforming citizens from consumers to "prosumers" who engage in self-generation and self-consumption of energy. Competences needed to support this transition include *community engagement, participatory governance, and the ability to innovate business models that prioritize local value retention* and sustainable development.

Engagement with members of communities and interactions between actors with different roles and responsibilities are requirements at large, small and micro scales of renewable energy development. To achieve successful outcomes (e.g. an equitable distribution of investment, returns, and impacts) requires competence in a range of soft skills.

Financial and business competences are essential for effective green energy investment. Specific competences identified as lacking are in planning energy refurbishments, drafting financing plans, and implementing project financing schemes (Virtič and Kovačič-Lukman, 2018). Voytenko and Peck (2011) highlight a critical deficiency in knowledge on green energy and energy efficiency funding schemes. In a broader sense, there is a need for financial problem-solving skills to overcome financial constraints and challenges in energy transitions in rural regions (Sareen *et al.*, 2018). Moreover, competences related to innovation in business models, including awareness of renewable energy business innovation, public-private mechanisms and energy cooperatives are valuable assets for driving energy transitions (Herbes *et al.*, 2017).

Digital content creation and developing innovative applications and services that meet contemporary energy needs and leverage cutting-edge technology are increasingly important competences for realising the energy transition (c.f. RURACTIVE Dynamos). The Digital Europe Programme (DIGITAL) focuses on enhancing digital skills and infrastructure to drive innovation in the energy sector. This includes funding for projects that promote digitalization in renewable energy, support research and development in digital technologies for energy efficiency, and initiatives to address cybersecurity challenges in the energy domain. It has a particular focus on small and medium-sized enterprises, citizens, and public administrations. By developing these digital competences, rural communities can harness the potential of renewable energy technologies for sustainable development and economic growth (EC-Directorate-General for Communications Networks, Content and Technology, 2024).

To solve problems, local communities require to be able to draw upon analytical and research skills, enabling local actors to research and implement solutions, and analyse and report data on their

development (e.g. monitoring energy output and income generated) (Virtič and Kovačič-Lukman, 2018). In turn this can inform processes of decision-making, including community visioning exercises, scenario planning, and choices about future land use (e.g. participatory planning tools such as the Virtual Landscape Theatre; Craglia *et al.*, 2012; Wang *et al.*, 2016). Possessing analytical skills for rapid prototyping empowers local stakeholders to test, reject, modify and adopt climate neutrality solutions (Virtič and Kovačič-Lukman, 2018).

Technical competences required for the energy transition and climate neutrality are often found to be lacking in rural areas (Neij *et al.*, 2017). Examples of skill gaps are in the procurement and installation of components of renewable energy systems (Sareen *et al.*, 2018), the technical operation and maintenance of infrastructure and in domains such as bioenergy, green engineering, and the construction of green energy infrastructure (Voytenko and Peck, 2011; Havlíček *et al.*, 2012; Herbes *et al.*, 2017; Busse *et al.,* 2019; Haf *et al.*, 2019; Bray *et al.*, 2022). Technical competences within community-led developments also require knowledge of how to link renewable energy facilities to electricity grid systems, and an understanding of contractual arrangements with transmission companies. This requires broad knowledge and professional support for small-scale developers in rural communities (Energy Networks Association, 2020).

The delivery of these competences can be enhanced through tailored training programmes for acquiring technical expertise in renewable energies and energy efficiency, and by programmes of mentoring. Such mentoring arrangements can be used to improve the capabilities of staff in public and private sector organisations, (e.g. in planning and handling processes of applications for measures of support), as well as the recipients of those measures (Miller *et al*., 2023).

BOX 2. Capacity-building needs to support the effective implementation of smart and community-led solutions for sustainable energy transition for climate neutrality

Effective implementation of smart and community-led solutions for a sustainable energy transition toward climate neutrality in rural areas necessitates a multifaceted set of competences. These include enhancing digital skills to leverage advanced technologies such as IoT and AI for optimizing energy management and distribution. Social skills are essential, including the ability to navigate relationships effectively, build trust, conduct socio-analytical assessments of situations and interpersonal dynamics, negotiate, and communicate effectively through attentive listening, and speaking in terms that resonate with different types of stakeholders. These skills are particularly valuable for building rural energy community projects or energy cooperatives. Organisational skills are beneficial in fostering community engagement, collaboration, and the co-creation of locally adapted solutions. Robust governance frameworks must also be established, emphasizing participatory decision-making and transparent processes to ensure accountability and inclusivity. Training and education programmes tailored to these diverse competences will empower rural communities, enabling them to manage effectively and sustain innovative energy systems, ultimately

contributing to a greener, more resilient future. Addressing the lack of adaptability or resistance to change requires specific competences to overcome organisational inertia and the reluctance to modify established processes. Key skills include change management expertise to guide rural communities through transitions smoothly, conflict resolution abilities to help reconcile different perspectives and values, and strategic thinking to align development goals with stakeholder interests. Additionally, skills in stakeholder engagement and communication are crucial for understanding and addressing concerns related to the benefits and impacts of change on individuals and communities in large, small and micro-businesses.

4.2.3. Sustainable Agrifood Systems and Ecosystem Management

Sustainable agrifood systems and ecosystem management have demands for high levels of human capital (Miller *et al*., 2022; Ravazzoli *et al*., 2021; Kerr *et al*., 2022). In its review on agroecology and innovation in approaches to sustainable agriculture the HLPE (2019) identified a need for strengthening knowledge systems and better use of learning outcomes. The US Aid supported *Food Security and Nutrition (FSN)* Network Agriculture and Natural Resource Management report five core competences of agroecological resilience, market development, improved nutrition, gender equity, and social and behavioural change. Vanni *et al*. (2021) identify needs for advice, research, innovation and training throughout social networks of farming systems as significant requirements for successful transitions to agroecology. Such training and learning should be life-long, with a view to developing the knowledge and skills of younger generations of land managers and other actors in value chains, throughout their careers (Miller *et al*., 2022)**.** However, it cannot be assumed that training alone will lead to changes in behaviour. Such an outcome also requires appropriate incentives (e.g. culture, personal preferences, attitudes and transaction costs) and capacities (e.g. financial, human, physical, social, informational) (FAO, 2014). FAO (2014) also note that adaptability is a core competence for achieving an effective value chain in sustainable agriculture and agrifood systems.

Taking a long-term view, the evolution and mainstreaming of **digital** tools in developing sustainable agrifood systems is an example of the importance of ongoing programmes of re- and upskilling for actors in policy, business and communities. This is consistent with the European Union strategy of a *Europe fit for the digital age* and its aim of increasing training in digital skills for the workforce and for consumers (European Union, 2020). Digitalization and new technologies have important roles in supporting the stewardship of natural resources and ecosystems under the management of land systems (agriculture, forestry, semi-natural habitats). The rapid rate of change in digital technologies (data, hardware, software) leads to the development and application of new tools, in different environments, over a significant range in costs and infrastructure requirements. This is evident in agroecology and sustainable agrifood systems (e.g. *Horizon Europe D4AgEcol project*).

Bellon-Marel *et al.* (2022) identify three roles for digitalization in relation to agroecology and therefore the need to build competences in these areas: i) to accelerate agroecological transition at

farm and territory scales; ii) to place agriculture at the centre of fair management of territorial commons (natural and environmental risks, global warming); iii) to empower consumers and farmers in supply chain. Each is benefiting from increased availability and accessibility of data of suitable spatial resolutions (e.g. field level drone surveys), software (e.g. decision support tools) and hardware (e.g. mobile devices). Bellon-Marel *et al.* (2022) also note debates in scientific literature about the consistency of the principles of agroecology with trends towards increased digitalization, with potential incompatibilities between agroecology as a social movement and the providers of tools by global businesses. Amongst the gaps in knowledge are those relating to the utilization of technologies to optimize quality and consistency in organic agriculture, livestock farming, and aquaculture (García *et al*., 2018).

New means and opportunities for managing natural resources are arising through the increased accessibility of data from remotely sensed sources (satellite, airborne and ground based) (e.g. Rosset *et al*., 2019; Rosset, 2021). The evolution of low-cost digital sensors is enabling in-field, near-real time monitoring of environmental variables of relevance to sustainable agriculture such as soil carbon, soil moisture, and GHG emissions. System design, installation (sensors, low power wireless networks), scheduled maintenance, and connections to data reporting portals, can be expected to be by businesses or organisations (e.g. research) with suitably trained employees. However, land managers (farm employees, foresters, natural resource managers, communities) require training to enable day-to-day operational use and maintenance of the equipment, and interpretation of the data produced (Hassan *et al*., 2023). Such systems are also providing opportunities for new SME and micro-businesses to set-up and provide specialist services to land managers such as applications confirming land management practices are reducing carbon emissions or increasing carbon stocks in soils; and field level imagery for interpretation of crop stress due to water scarcity, and the effectiveness of nature-based solutions to (e.g. peatland restoration) (Miller *et al*., 2023; RURACTIVE Dynamos). Those businesses are developing the **competences** required of a **technical** nature (e.g. installation of sensors, maintenance of drones), organisational (e.g. equipment supplies), financial (e.g. accounting), and social (e.g. marketing and building client relationships).

Increasingly, technologies such as augmented and virtual reality, are emerging as tools for interpreting results in relation to other data (e.g. maps of soil, drone captured imagery of fields, modelled yields of agricultural and forest crops), offering potential for new businesses as well as requirements for building competences in the use of the tools emerging. User groups can be expected to be from citizens, land and resource managers, businesses, and policy officers at various levels of governance. Each user group will have different types of use case for such tools such as strategic planning and visioning for land, tactical resource management, site level problem solving, and raising awareness of issues associated with sustainable systems of farming or forestry, ecosystem processes (e.g. peatland restoration), and threats to ecosystems (e.g. plant health, wildfire, flooding).

Virtual platforms for the exchange of experience and knowledge make it possible to share the many and diverse lessons learnt from practice which, in turn, supports sharing of knowledge and information albeit place specific (e.g. in agroforestry, that may include the dynamics of the local ecosystems, the silvicultural techniques used, and their effects; see virtual tour of agroforestry at Glensaugh farm, UK). However, as Anderson *et al.* (2019) report, place-based approaches provide valuable means of learning, with people sharing knowledge of taking different actions within the same region, with skills aligned to local circumstances and experiences, or doing the same actions in different regions. This provides context-specific factors for digitalisation, one of the categories of questions for assessing impacts of digital agriculture presented by Benegiamo *et al*. (2023). Such knowledge sharing can form part of peer-to-peer learning, a highly effective means of building capacities in land management (e.g. agroecological farming systems, Zawalińska *et al*., 2022).

Digital tools are also providing new means of reviewing and interpreting pressures on natural ecosystems (e.g. soil erosion), and the monitoring of natural disasters such as wildfire (e.g. Lino *et al*., 2021) and flooding (e.g. Chen *et al*., 2019). Where such disasters are of regional or national significance (e.g. plant or animal disease outbreaks), the skillbase will reside with public agencies (e.g. modelling, data processing, publication by various means). However, in response to these challenges, small and micro-businesses are also providing innovative services, and communities are developing social innovations, all with their own requirements for **technical, organisational** and **social competences** (e.g. social innovation in forestry, Ludvig *et al*., 2020), and means of support (e.g. mentoring, EU CAP Network, 2023; Miller *et al*., 2023).

New capabilities emerging from research is the coupling of visualisation tools with digital twins. This configuration is facilitating the modelling of implications of changes in management practices or external interventions (e.g. agricultural or forest yields, hydrological and ecological status of natural resources) linked to representation of the implications (e.g. Tzachor *et al*., 2022). The development of digital twins, and thus the hosting of the competences required, is predominantly within research environments. However, expectations are of such tools being used operationally at various levels of governance such as strategic planning by regional authorities, entities with territorial responsibilities for the management of catchments or protected areas, and land management organisations (e.g. businesses, communities). The nature of the **technical competences** required for such user groups would vary by application but are likely to be in relation to handling digital data (as inputs or outputs), interpretation of graphical information (e.g. visualisations, charts), and extracting materials for use in presentations to relevant stakeholders (e.g. local communities, investors).

Ongoing challenges for rural actors are on how to maintain knowledge of technological advances and learn new **digital** skills (Petrolo *et al.*, 2022), which is equally applicably irrespective of age, gender and background. Fundamental skills include digital literacy, online searching, interpretation and use of data, derivation of data for their own areas of business, web site development, use of software

and hardware tools, and more advanced skills associated with the development of new tools (e.g. web services, cloud computing, decision support systems) (Bellon-Maurel and Huyghe, 2017; Ylipulli *et al*., 2023; RURACTIVE Dynamos).

Decision Support Systems are used extensively in agrifood, forestry and natural resource management. For example, in many sectors of agrifood production they are used in farm planning and land management, with applications designed for particular aspects of farm businesses (e.g. sustainability assessments; Landert *et al*., 2020). The design and implementation of such systems requires suitable skills in modelling, software engineering and human computer interfaces (Zhai *et al.,* 2020). An extension of such systems is their incorporation into the development of alternative scenarios of land management with which managers can explore ideas over different strategies and practices. These have also been built into serious games, such as SEGAE (Jouan *et al*., 2021), which is described as "providing a modelling framework that gamifies the implementation of agroecological practices in an integrated crop-livestock farm and assesses their impacts on sustainability". From the perspective of the customer, the competences required to use such tools include general digital literacy (e.g. Ylipulli *et al*., 2023) and means of learning product specific knowledge (c.f. RURACTIVE Dynamos).

As products and services become established, the potential to gain relevant underlying knowledge forms part of formal teaching curricula, such as in agriculture, forestry and land management courses. An example is the use of tools for precision measurement, recording and mapping (e.g. precision agriculture and forestry). Such tools have become mainstream in large-scale agriculture and forestry and are becoming common place in small-scale land management. An example is an app for use on a mobile device, produced from the AGRENIO project, which provides an easy-to-use software solution using precision agriculture tools to support efficient irrigation and fertilization for farmers in an easy and cheap way. However, differences are apparent in competence sets of different types of actors in sustainable agriculture and ecosystem management (e.g. those with and without formal training in concepts and tools, stage of career development, age) (e.g. Ceccarelli *et al*., 2022). Similar circumstances can be expected to arise with newer digital tools as they become available to small-scale farming enterprises (e.g. autonomous vehicles, robotics; UK-RAS, 2023).

In sustainable agrifood systems and ecosystem management, several **technical** competences are often lacking. García *et al*. (2018) identified a need for knowledge about small-scale processing of products, including compliance with regulations and the development of quality certifications. There is a need for expertise in techniques for developing and maintaining the quality of animal-based food products, incorporating management practices for animal feed, transportation, and processing. Associated competences required are in the development and application of efficient techniques for food preservation, processing, and transportation to ensure food quality.

Understanding is needed of the value of diverse genetic resources and the ecological benefits associated with biodiversity in farming systems (Rossi, 2020) and also in forestry (Rosset *et al*., 2019; Rosset, 2021) through social learning. Traditionally, small scale agriculture used techniques that were in line with the preservation of land and its biodiversity, however in many places such traditional knowledge, practices, and crop varieties, have been forgotten or dropped in favour of new techniques that prioritise higher yields and increases in production (Spacek *et al.*, 2022; S4C Research Agenda 2030).

The future of sustainable agrifood systems relies upon ensuring they can operate economically. In most cases, the production theme of sustainable agriculture and food systems will be guided by site characteristics (e.g. biophysical capability for agriculture), markets, roles within supply chains, and motivations and capabilities of the actors involved. These characteristics all provide a context for the types of **technical competences** required for the different types of agricultural production (e.g. horticulture, arable cropping, livestock, agroforestry). Each type of production requires its own specialist knowledge and support services which are not relevant to others (e.g. glasshouses or polytunnels for horticulture; intercropping techniques for agroecological farming systems for arable crops; infrastructure and professional support for animal welfare for livestock farming; silviculture and tree management mixed with arable or livestock in an agroforestry system). **Technical competences** linked to land systems which are predominantly for agricultural production include the operation of equipment (e.g. sowing, fertilising and harvesting machinery), product storage and transport requirements which will be transferable across agricultural sectors.

The distribution of skills across an enterprise will vary depending upon the diversity of the business and the number of employees, noting that for many smallholdings there is only one practicing farmer, or a farming family, with a consequence that one or two people need to have almost all of the necessary **technical competences** between them. **Technical competences** are also required in all aspects of health and safety when working in a farming environment.

Forestry systems have different **technical competences** to those of agriculture, whilst overlapping in the case of agroforestry systems. The competency requirements will vary across Europe and the socio-economic and geographic environments. In some areas, forest planning, planting and harvesting are likely to be contracted out (e.g. reducing needs for financing and qualifying to operate specialist machinery). However, **technical competences** will be expected in the certified use of tree cutting tools (e.g. chain saws), tree removals and use of appropriate equipment, contributing to fighting wildfires, the establishment and maintenance of new woodlands in their local context, forest surveying (e.g. LANTRA, 2023; SRUC, 2024), and will vary between types of forest management (e.g. forestry, arboriculture). **Technical competences** are also required in all aspects of health and safety when working in a forestry and woodland environment.

As noted, agroecological farming is knowledge intensive, requiring the **technical competences** associated with conventional farming systems, but expanded to implement objectives of lower inputs, less intensive production, and increased benefits for natural ecosystems. These systems may include using minor crops, increasing agrobiodiversity, and introducing aspects of other systems (e.g. production of on-farm manure to a predominantly crop oriented enterprise). Consequently, a wide range of relevant knowledge is required, encompassing land management practices, business, and social and human rights (Marchetti *et al*., 2020). Several digital tools have been developed for use by individual farmers or networks (e.g., Cool Farm Alliance) to identify strengths and weaknesses regarding the sustainability of production, products, and businesses more generally. Examples include the Cool Farm Tool and SMART (Landert *et al*., 2020), each providing information upon which farmers and land managers can take measures for improving the sustainability of the processes and businesses (Grenz, 2017; Berbeć *et al*., 2018).

Increasingly, policy interests in sustainable systems, for agrifood and ecosystem management, point to *nature-based solutions*, delivering on tackling climate change and reversing the loss of biodiversity. The European Union supports an extensive set of *research and innovation projects* on biophysical, social and economic aspects of such approaches. On the ground, these require a broad range of **technical, social, digital and business competences** (e.g. Petrolo *et al.*, 2022; European Commission, 2023). These competences need to be complimented by those that enable the preparation and operation of the systems into which they fit, or modify, including knowledge about sustainable production practices, multi-functional systems (e.g. carbon forestry), factors influencing local food production, monitoring of resources (e.g. soil and water quality), and forms of governance (e.g. community-based agriculture, community forestry) (Sarkki *et al*., 2022; Brnkalakova *et al*., 2022; Nijnik *et al*., 2022; Barlagne *et al*., 2021; Govigli *et al*., 2020; Sarkki *et al*., 2019; Nijnik *et al*., 2019).

A challenge for sustainable nature resource governance in a time of climate crisis and degraded landscapes (c.f. UN Decade on Ecosystem Restoration) can be addressed by building capacity of multiple local actors in sustainable governance models via role-playing strategy games by engaging stakeholders in dialogue, facilitating informed decision-making, and fostering innovative sustainability strategies (Garcia *et al.*, 2022; Waeber *et al*., 2023). These adaptable and digitalizable games stimulate diverse insights and innovations among stakeholders, aiding conflict resolution and policy development for local communities, resource managers, policymakers, environmental NGOs, businesses, civil society, researchers, and educational institutions.

A challenge for sustainable agrifood systems and ecosystem management is the development of **governance models** which enable transitions to sustainable systems (García *et al*., 2018; Melnykovych *et al*., 2018; Brnkalakova *et al*., 2022). These models need to cover the length of the supply and value chains from producer to consumer to ensure equitable sharing of risk and benefits, direction, responsibility and accountability. For the exploration and development of governance

models, **organisational competences** are also needed throughout the value chains of sustainable agricultural systems (EU CAP Network, 2023). These include developing logistics processes that support flexible, sometimes shorter, supply chains (García *et al.*, 2018); technologies to enhance agro-ecological resilience (e.g. soil and water management, agroforestry); agriculture for improved nutrition; market development; extension services; and means of measuring impact and the use of data (Cranston *et al*., 2016).

The operationalising of a systems approach requires competences in **social** skills, which is a characteristic of sustainable agrifood systems and ecosystem management (Kerr *et al*., 2022). Those competences include managing and navigating social networks, which are vital for building effective relationships within teams and with stakeholders, communication and language skills, (e.g. socio-ecological costs from agriculture, conveying concepts related to ecological restoration, natural variability of products equalities and human rights) (Bexner Kerr, 2021). The importance of collaboration for fostering partnerships and working effectively within networks, both locally and beyond, is reflected in comments from the RURACTIVE Dynamos. Such networks include producers, local businesses, local communities and consumers, all of whom are key components in systems of sustainable agriculture and its associated actions (e.g. ecosystem management, social justice).

A characteristic of agroecology is its transdisciplinary nature (Schwarz *et al*., 2022). The ability to think holistically as well as having **skills to adapt to changing conditions**, are essential for understanding complex relationships in agroecology and adapting to paradigm shifts, especially in the realms of climate change (Oteros-Rozas *et al*., 2019). Systems thinking is necessary for identifying problems, and the development of innovative approaches to finding effective solutions and broad-based partnerships to implement approaches that will have appreciable impacts at scale (FAO, 2014). Currently, national and regional education and training providers provide courses which include systems thinking, including in agriculture and ecosystem management, equipping actors to be flexible, adaptable, efficient and agile. The curricula of such courses have a challenge to remain contemporary in a rapidly evolving technical and digital environment (e.g. GEDI online course on gender and forest governance).

Notable requirements in sustainable agrifood systems and ecosystem management are knowledge and skills in **business** management and **finance** amongst actors throughout value chains, entrepreneurs, and communities. The EU CAP Network (2023) notes that “It is vital for farmers to possess business acumen, communication and marketing skills, and an understanding of evolving consumer demands.” These skills are essential for actors involved in designing and managing social, process, product and business innovations, and ensuring their sustainability.

They are also significant in exploring new markets and value chains, recognising that changing their system may change qualities of their products. A characteristic of food from organic and agroecological farming systems is the heterogeneity of their products. Such heterogeneity is a

consequence of transitions away from intensification of farming, and thus divergence from standards set for supply chains for high value products (e.g. whisky) and supermarkets (consistency of size, shape, characteristics of grains) which provide the highest financial returns. Developing markets that will accept, or value, different standards is a challenge for this sector, which focuses actors to consider new business models (Donner and de Vries, 2023).

Competences in **business and finance** enables the development of strategies that balance economic profitability with environmental and social sustainability. For application in rural areas, some new business models need to be tailored to enable them to address the unique challenges and opportunities of agrifood systems and ecosystem management (García *et al*., 2018). When linked with social skills, these competences enable actors to design and implement business models that promote resilience and achieve environmental and social justice objectives in their farming approach, fostering social inclusivity within rural contexts (e.g. by integrating refugees in this process or other representatives of groups at risk of social exclusion and underrepresentation) (Hutcheson *et al*., 2023). Such skills are required in different mixes by land managers, producers and businesses along supply chains, and new (often micro-) businesses set-up to offer new services (e.g. monitoring the effectiveness of land management practices). The identification of opportunities, innovating new approaches and business models, and tackling challenges faced by actors engaged in transitioning to sustainable agriculture and ecosystem management is often associated with individual entrepreneurs (c.f. RURACTIVE Dynamos; Lianu *et al.*, 2023).

New business models are often associated with transitions to agroecological farming systems such as private-public partnerships, social enterprises, involvement in local carbon markets, prioritization of resource efficiency (e.g., payment for ecosystem services), reuse or recycling to create a closed-loop system (c.f. to circular economy business models), and marketing channels to consumers (e.g. direct, public procurement, retail, wholesale) (Linau *et al*., 2023; Hutcheson *et al*., 2023). Marketing channels take different forms including the use of conventional media (e.g. broadcasting, press) and digital means (e.g. websites, social media). In each case, businesses or community-led enterprises require the competences to plan media campaigns, writing messages in language appropriate for press releases or social media outputs, and linking between different media platforms and accounts (e.g. website, Facebook, X, Instagram), and the businesses' sales platforms.

Engaging with consumers and producers via a dedicated **digital** platform is a mechanism which is increasingly popular as part of an innovative marketing strategy (Peón and Martínez-Filgueira, 2020). Such platforms can enhance market diversification, promote knowledge exchange and awareness raising of agroecological principles and products, and be a means through which producers can collaborate within the agrifood sector. Numerous marketing channels of produce from agroecological or sustainable farming systems are operating around Europe, including through conventional retail outlets with dedicated aisles, direct marketing, community supported agriculture, farmers' markets (van der Ploeg *et al*., 2019).

Direct marketing is being facilitated by platforms offered by large scale retail or online sales websites (e.g. ebay, Etsy), for which the technical competences are limited to those of proficiency with computer operation, human computer interfaces, and platform specific tools. Bespoke platforms, designed for use in the agrifood sector, have emerged with the potential to offer short marketing chains and leverage information and communication technologies (ICTs) for marketing local and seasonal products (García *et al*., 2018). Examples are: i) Agrimarketplaces is a digital B2B market solutions that brings together farmers and industrial buyers; ii) *IShopRural*, a social innovation which created an online marketing platform which provides a means of selling natural products, authentically sourced from the local producers, an output from the H2020 SIMRA project (Marini Govigli *et al*., 2020).

Generally, online marketing platforms have been commissioned from businesses which have developed with the relevant skills. However, designing, planning and managing products for sale through dedicated platforms requires a broad range of competences including:

i) Organisational, such as managing information about product availability, ordering, and any particular requirements for shipping (e.g. temperature controlled, biosecurity and product import/export rules); personnel and facilities for collecting and distributing products;
ii) Business and accounting, such as managing accounts, handling funds, and making secure transactions;
iii) Social, such as engagement with producers, contractors (e.g. website or social media maintenance);
iv) Digital, such as software and interfaces used for the presentation and information about products, ordering, and online security systems.

Skills in each of these areas of competence may be limited in any given rural area, such as the utilisation of marketing platforms, which then limits the reach and accessibility of sustainable agrifood offerings; or sales techniques, which hinders the conversion of marketing efforts into sales (Garcia *et al*., 2018; c.f. RURACTIVE Dynamos).

BOX 3. Capacity building needs to support the effective implementation of smart and community-led solutions for sustainable agrifood systems and ecosystem management

Development of capacity-building, training, and knowledge transfer programmes covering a wide range of topics include emerging areas of skills such as digital tools, precision agriculture technologies, ICT-related knowledge, and innovative business models. Tailored training programmes are required to bridge competence gaps in sustainable agrifood systems and ecosystem management. Decision support tools require to be accessible and usable for their effective implementation. For local implementers of smart solutions, structured capacity development programmes need to be the designed and delivered. These programmes should encompass a range of social competences such as good governance practices and community-led approaches, empowering stakeholders to actively engage in decision-making processes. Tools are also required to facilitate good quality collaboration between diverse groups, including farmers,

NGOs, communities and researchers with an aim of co-constructing sustainable practices. Capacity building programmes should be designed and tailored to suit the capabilities of target audiences, and their aspirations for personal development, creating opportunities for life-long learning and taking account of people's characteristics of age, gender, physical and mental capabilities, and peer influences. The curriculum of education and training should cover fundamental skills (e.g., digital literacy), concepts (e.g., internet of things), through to advanced tools (e.g., app development, coding, data management), and more general skills such as marketing. Capacity-building initiatives should reinforce climate-smart practices and foster a mentality of adaptability. Underlying the digital skills, there is a need to ensure contemporary technical competences such as the effective management of water and soils, cultivation of drought-resistant crops, carbon forestry, and nature-based solutions more generally (e.g., peatland and habitat restoration). These competences enable actions on the ground which also requires engagement within existing structures of governance, thus a need to understand, respect and work through issues of land ownership, tenure and formal and informal responsibilities for its management (e.g., legal land management agreements, citizen and community volunteering), which benefits from social skills (e.g., conflict management). Approaches to such engagement can be informed by the co-construction of scenarios for alternative futures of land management, informed by decision support tools, and made engaging using tools such as serious games and virtual reality representations. Alongside technical, organisational, digital and social skills, financial literacy and entrepreneurship skills are required to translate innovative ideas into sustainable reality. These competences can empower citizens to manage budgets effectively and cultivate resilient business models capable of withstanding social and environmental challenges.

Source: based on H2020 SIMRA, UNISECO, LIFT, SHERPA, CODECS, MOVING, FIREres and Horizon Europe GRANULAR projects.

4.2.4. Nature-based and Cultural Tourism

Nature-based innovations and eco-tourism initiatives promote eco-friendly practices such as biodiversity conservation (partnering /collaborating with local conservation organisations to protect natural habitats and biodiversity), landscape restoration, responsible trekking, and waste management, while highlighting the unique natural features of the area. Agro-tourism encourages farm visits, organic food experiences, and agricultural activities, educating tourists about sustainable farming practices. Community-based tourism involves local communities in designing tourism experiences, offering authentic cultural performances, handicraft workshops, and storytelling sessions. Homestays and guesthouses encourage locals to host tourists, providing an immersive experience that supports community livelihoods. Cultural events, festivals, and markets that celebrate local traditions can all attract tourists and creating economic opportunities, for which community engagement skills are crucial.

Digital skills and very important for fostering innovations in rural nature-based tourism, in an era of digitalization. Enhancing **digital skills and digital literacy** is crucial for utilizing web applications and services to promote tourism effectively. This includes digital skills tailored to individuals with specific needs (elderly, disabled, etc.) and skills in utilizing web applications and web services (Hadad, 2019), competences in developing and using applications for cultural tourism involving local actors, as well as guiding tourists to local attractions. Additionally, it involves the ability to effectively utilize professional literature as knowledge and information sources and to promote local tourism, which may include accessing and navigating relevant websites (Loiodice, 2015; Cikic *et al.*, 2018; Hadad *et al.,* 2019).

Tourism firms need to innovate continuously to remain competitive, adapt to an ever-changing world, and continue to offer attractive services to their customers via branding and destination management (e.g. Destination Management Plans, marketing and distribution platforms, hospitality and gastronomy services, open services based on spatial data, Virtual/Augmented Reality tools) (Hall, *et al*., 2008; RURACTIVE Dynamos). This is especially true for rural areas. Knowledge on how to innovate and adapt to be resilient can be delivered by applying digital skills which will drive innovation processes e.g. 3D mapping of indoor and outdoor environments using Apple smart devices (Nonaka and Takeuchi, 1995; Cavusgil *et al.*, 2003; Newell *et al.*, 2009; Díaz Vilariño *et al.,* 2020). Knowledge on how to promote nature-based and cultural tourism plays a key role – the use of skills and experience to add intelligence to information, enabling better decision-making and providing a reliable basis for action (Cooper, 2006; Hoarau, 2014).

Stakeholder engagement skills are essential for informed participation and cooperation which, in turn, are needed for the sustainable development of tourism (Mihalič, 2015). **Social** skills, including communication and conflict resolution, are necessary to address both positive and negative perceptions of tourism impacts on the economy, environment, and socio-cultural aspects (Šegota *et al*., 2017). Residents who are well informed and involved compared to "*unaware residents, passive observers, and uninformed activists"* (Šegota *et al.,* 2017) tend to have better perceptions of tourism. This highlights the importance of educating and involving local communities in tourism planning and development. This involvement can improve public services, preserve local culture, boost local businesses, and support sustainable practices. Training programmes tailored to these competences will empower rural communities, ensuring that tourism contributes positively to their development and sustainability.

Communication and collaboration competences encompass understanding channels in the diffusion of knowledge and information, this includes knowledge of the content itself and of the methods and channels utilized for dissemination (Darwish and Kamaljit, 2011; Cikic *et al.*, 2018). Digital content creation extends to needs in acquiring skills in the development of new applications and services. Problem-solving involves leveraging professional skills, particularly technological, among tour operators (Loiodice, 2015). This includes abilities to apply digital skills for the development of

augmented reality technology for use in innovative solutions and enhanced experiences within the tourism sector (Gonçalves *et al.*, 2022).

The missing **technical** competences in nature-based and cultural tourism encompass a broad spectrum of skills necessary for developing and enhancing products, services, and processes and include expertise in developing specific / niche tourism and its management (e.g. wine tourism, food and beverage tourism, wildlife tourism, natural science tourism), guest animation, and the creation of innovative tourism offering (Nicolosi *et al.*, 2016; Cikic *et al.*, 2018). Additionally, there is a need for knowledge in delivering high-quality services and the capability for proactive change (Idziak *et al.*, 2015).

Entrepreneurial and managerial skills are needed for creating innovative, customized tourism products that align with demand and trends (Loiodice, 2015). Furthermore, there is a requirement for tourism skills and understanding among residents, although support for community-based tourism may be limited (Matilainen *et al.*, 2018). Therefore, competence in enhancing rural tourism infrastructure and fostering awareness of sustainable practices is needed (Akin *et al.*, 2015; Farmaki *et al.*, 2015). This includes recognizing the potential of sustainable tourism and promoting environmental consciousness (Farmaki *et al.*, 2015). Understanding the nuanced impacts of tourism is also critical as well as knowledge of how to engage local stakeholders and widen cooperation (Šegota *et al.*, 2017), e.g. by promoting tourism offers on different platforms knowledge of innovative entrepreneurship is necessary. **Knowledge relating to innovative entrepreneurship** aids the fostering of cooperation for the development of entrepreneurship, promotion of competitive ability, knowledge transfer and the sustainable development of rural areas (e.g. through workshops for small entrepreneurs; Milohnic, 2015; Dala Torre, *et al.*, 2020).

Technical competences are needed for developing and implementing innovative products, e.g. agro-tourism, and nature-based tourism, as well as in designing biking routes (Wilkes-Allemann and Ludvig, 2019; Nijnik *et al.*, 2019) with cultural elements and alternative tourism concepts. Reducing negative tourism impacts through understanding and integrating community members in the design of tourism practices can help to foster sustainable tourism growth and ensure public acceptance. Accessibility is one key limiting factor in rural settings, thus competences on how to develop tourism while facing challenges of accessibility to the area is crucial. Concerning climate change and potential biodiversity issues, technical competences are needed to understand how to mitigate the impact of tourism regarding CO_2 emissions and other environmental dimensions (water, waste, etc.). Moreover, climate change will affect tourism in different ways (e.g. change in peak season, the number of arrivals, impacts on the main local attractions) requiring technical competences to develop adaptive solutions to climate change impacts (RURACTIVE Dynamos).

In the domain of nature-based and cultural tourism, there are several notable **social competences** that are often found to be lacking. There is a need for individuals to possess the ability to personally

contact experts for knowledge and information, a skill crucial for staying informed and offering quality experiences to tourists (Cikic *et al.*, 2018). Communication skills are vital (Bertella, 2011). Amongst those, language is a key competence both in terms of the quality in the native language and skills in other languages, enabling interaction with diverse tourists (RURACTIVE Dynamos). Collaboration skills are necessary for fostering partnerships and working with stakeholders from different backgrounds (Akin *et al.*, 2015; Špaček *et al*., 2022). Additionally, there is a need for know-how and individuals capable of catalysing change within local communities to renew rural tourism potential, highlighting the importance of proactive engagement and advocacy (Akin *et al.*, 2015).

Active participation and cooperation of informed stakeholders is essential for implementing sustainable tourism development practices, recognising the significance of collective action (Šegota *et al.*, 2017). Environmental literacy is also critical for understanding and promoting eco-friendly, nature-based tourism practices (Rakitovac, 2016).

As in other sectors, the gender gap in tourism has to be addressed. Women have the potential to drive more sustainable, inclusive, and nature-based cultural tourism initiatives (Cikic *et al.,* 2018). Reeves and Baden (2000), in their Gender and Development approach, highlight rural women as agents of change rather than passive recipients of development efforts (Taşli, 2007; Cikic *et al.,* 2018). However, despite this potential, rural women often face challenges such as a lack of financial, educational, and social capital, which limits their access to paid or leadership positions in the tourism sector (Cikic *et al.,* 2018). Studies suggest that women in tourism are more innovative than men (Brandão et al., 2015), however there are disparities in representation and opportunities. Women in rural tourism tend to be older, with limited work experience, and are underrepresented among owners (Cikic *et al.,* 2018; Babović and Vuković, 2008). The prevailing rural gender regime, which emphasizes traditional gender roles, further constrains young rural women's ability to engage in the workforce beyond caregiving roles (Cikic et al., 2018). To address these challenges, there is a need to offer training opportunities for rural women to become social entrepreneurs (Sarkki *et al.*, 2021; Sfeir *et al.*, 2021; Gramm *et al.,* 2020; Dalla Torre *et al.,* 2019). Additionally, addressing the lack of financial capital and fostering better cooperation with local institutions, especially in the service sector, are crucial for empowering women in rural tourism (Gorizz -Mifsud *et al.,* 2019; Cikic *et al.,* 2018). Moreover, efforts to enhance women's social capital through professional organisations can further support their participation and leadership in rural initiatives (Cikic *et al.,* 2018).

In the sector of nature-based and cultural tourism, there is a noticeable absence of certain **governance competences.** Firstly, in conflict mitigation and mediation, there is a lack of knowledge in conflict resolution, critical reflection, and cultural communication associated with the tourist experience within communities (Prince and Ioannides, 2017; Melnykovych *et al.*, 2019; Špaček *et al*., 2022). RURACTIVE Dynamos highlighted the lack of that competences to develop and utilize conflict management tools in tourism and to promote trust-building. Secondly, in ethical, legal, and

regulatory compliance, there is a need for rural tourism enterprises and associations to have awareness and knowledge of legal standards regarding attractive accommodation facilities suitable for rural tourism services, as well as playing role in promoting local tourism (Beresecká and Hudáková, 2018).

Informed **stakeholders' participation and cooperation** are crucial requirements for the successful implementation of sustainable rural tourism development (Mihalič, 2015), constituting a vital aspect in the study of sustainability. Residents' perceptions of tourism impacts, both positive and negative, are closely linked to their level of informedness about tourism in a destination and their involvement in tourism planning and development processes (Šegota *et al.*, 2017). The findings in a study by Šegota *et al.* (2017) indicate that residents who are well informed and involved in a tourism initiative tend to hold more positive perceptions of tourism, whereas those with low levels of information and involvement tend to harbour more negative perceptions (Šegota *et al.*, 2017). Furthermore, residents with low levels of such engagement often express doubts about the initiative's contribution to environmental protection, reflecting concerns similar to those observed by Harrill (2004) of residents' fears regarding the environmental impact of tourism growth (Šegota *et al.*, 2017). Additionally, residents with low levels of awareness and engagement tend to hold significantly worse perceptions of tourism in terms of its effects on public services and education quality, preservation of local culture, economic benefits for local people, promotion of local products, and property values (Šegota *et al.*, 2017; Melnykovych *et al.*, 2019; Špaček *et al.*, 2022).

Operational management suffers from a lack of expertise in **organisational** management and optimization of companies (Loiodice, 2015), hindering efficient and effective operations within tourism enterprises. In terms of marketing and sales, there is a wide range of deficiencies. There is a lack of marketing skills and tourism management knowledge (Nicolosi *et al.*, 2016), with a need for knowledge in marketing tourist products and preparing promotional materials to attract visitors effectively (Idziak *et al.*, 2015). Substantial professional marketing knowledge is required to develop suitable and sustainable tourism products (Idziak *et al.*, 2015). Gender disparity was identified in the sector, indicating a need for women's knowledge in developing and advertising tourism (Cikic *et al.*, 2018). Rural tourism enterprises and policymakers may need more knowledge to understand rural tourism groups and segments, effectively tailor products to customer needs, and capitalize on emerging trends (Hjalager *et al.*, 2018). Small- and very small tourism enterprises face resource and skill shortages, particularly in marketing activities (Selby *et al.*, 2011). Moreover, there is a need for competences to modernize and attract visitors and a general deficiency in organisational skills across the sector (Idziak *et al.*, 2015).

Significant challenges in rural areas include a general lack of skilled labour, an uneven balance of power regarding decision-making and access to financial resources, and the presence of many small business that are traditionally resistant to change and often focus on short-term marketing goals

(Müller and Jansson, 2007; Ruhanen, 2008; Tremblay *et al.*, 2008; Jamal and Stronza, 2009; Bertella, 2011).

The initial lack of **business skills** and experience has been identified as a potential problem from the start, leading some services, such as accounting, to be outsourced to local offices. Other services, particularly those related to marketing, have been partly acquired externally and partly developed (Bertella, 2011). Many small rural tourism businesses face difficulties related to human capital, this issue is especially critical for small firms located in rural remote areas and operating in tourism (Bertella, 2011).

Rural tourism **businesses** face an innovation gap due to several factors. Their asset composition, which includes land, landscape, material facilities, climate advantages, manpower, and capital, often competes with other economic avenues of exploitation (Hjalager *et al.*, 2018). Additionally, a knowledge gap exists when these businesses fail to tap into knowledge resources and do not access wider markets and network associations to enhance their chosen trajectories (Hjalager *et al.*, 2018). Furthermore, there is a knowledge gap when these businesses fail to leverage available knowledge resources and access broader markets and network associations to enrich their strategies (Hjalager *et al.*, 2018). Moreover, there is a risk that rural tourism businesses lack a comprehensive understanding of the potential inherent in rural tourism, necessitating the diversification of products and services to align with current trends (Hjalager *et al.*, 2018). Notably, rural tourism businesses catering to low-budget guests may be late movers in innovation and digitalisation, often postponing new initiatives and investments, thereby maintaining the innovation gaps (Hjalager *et al.*, 2018). This insufficient awareness and attention to needed adjustments contribute to a "change motivation" innovation gap, potentially tarnishing the reputation of rural tourism. To promote the development of local tourism, local community decision-makers (e.g. mayors, elected councillors, local authority staff, advisory personnel, and local action groups) need to be aware of i) the opportunities created by tourism and ii) the operational limitations of very small tourism businesses (Selby *et al.*, 2011).

The challenges faced by rural small tourism businesses e.g. guesthouses are due to limited collaboration with tourism agencies. Larger agencies favour accommodations with greater capacity, and uncertainties in local festival schedules hinder effective promotion of rural tourism (Matei, 2018). Additionally, rural guesthouses struggle with an untrained workforce and inadequate promotion on specialized websites, stemming from a lack of digital skills among employees. This skills gap restricts online visibility and impedes the sector's potential growth in Romania (Hadad, 2019).

In the sector of nature-based and cultural tourism, there are notable gaps in **financial and business competences** across various domains. Firstly, in financial accounting and controlling, there is a clear need for business experience, particularly in accounting practices, to ensure sound financial management within tourism enterprises (Bertella, 2011). Regarding business strategy, planning, and performance, there is a demand for competences in preparing business plans and founding

organisations (Akin *et al.*, 2015; Idziak *et al.*, 2015). Additionally, fostering an entrepreneurial culture is essential for promoting innovation and sustainability within the nature-based and cultural tourism sector (Loiodice, 2015). By providing training and support in financial management, investment strategies, and business planning, stakeholders can empower rural communities to harness the economic potential of tourism while preserving and promoting their natural and cultural heritage.

BOX 4. Capacity building needs to support the effective implementation of smart and community-led solutions for sustainable Nature-based and Cultural Tourism

By integrating culture, nature, and innovation, rural areas can thrive as attractive destinations for tourists while preserving their authenticity. Capacity building needs to support the effective implementation of smart and community-led solutions for sustainable Nature-based and Cultural Tourism includes understanding local culture and involves actively engaging with local rural actors to comprehend their culture, traditions, and heritage, encompassing historical heritage, artwork, cultural landscapes, customs, food, and language.

Barriers to implementing innovative business models include internal factors such as a lack of awareness, perceptions of disruptive technologies, organisational inertia, cultural issues, conflicts with existing business models and assets, and cognitive challenges in understanding these factors.

Skills in inclusive participation tools are crucial and entails involving local people, groups of underrepresentation and other stakeholders in branding and destination management recognizing their essential perspectives and voices. Good negotiation, adaptation and resilience skills requires knowledge on how to find a harmony between preserving local culture and attracting tourists, avoiding situations where cultural integration compromises the original natural landscape and local traditions. Training and capacity building might involve investing in programs for local guides, artisans, and service providers to enhance their skills in hospitality, storytelling, Destination Management Plans, marketing and distribution platforms, gastronomy services, open services based on spatial data, Virtual/Augmented Reality tools, and sustainable tourism practices, while integrating local cultural processes. There is a need to enhance rural women's financial literacy and knowledge on new types of businesses in rural tourism using digital tools.

Digital literacy play an important role in this process and can equip rural communities with skills to promote their offerings online, including managing websites, social media, and online booking platforms. Digital skills are also necessary for developing maps with needed basic infrastructure like roads, sanitation facilities, and clean water supply stations, crucial for attracting tourists. Nature-based and Cultural Tourism Marketing requires digital marketing knowledge and skills, designing platforms and digital communication items for different consumer groups (youth, migrants, disable, etc), and travel agencies to promote rural tourism, highlighting the unique cultural and natural aspects of the area. Collaboration and conflict mediation skills are crucial for addressing and resolving conflicts that may arise from differing interests, ensuring that tourism development respects and benefits local culture.

4.2.5. Culture and Cultural Innovation

Cultural innovation interlocks with integrating traditional knowledge and creative thinking and community engagement to align economic development with societal values and preferences (c.f. Crevoisier, 2015). This underscores the importance of competences spanning various domains to shaping and leveraging knowledge (e.g., traditional local knowledge).

The advancement of cultural innovation within rural European settings necessitates a nuanced integration of cultural insight, creative acumen, and community engagement. The requisite competences span a spectrum, ranging from a comprehensive grasp of local heritage and diversity — aimed at enhancing accessibility and preserving cultural and natural assets — to the cultivation of imaginative and design-thinking capabilities. This includes the appreciation of intangible cultural heritage and the orchestration of both short and long-term cultural events, such as creative centers, festivals, and traditional celebrations involving diverse rural actors and groups.

Digital and technological skills may be highly relevant to the enhancement of the cultural sector. More specifically the integration of AI, virtual and augment reality in this sector is increasing which may make culture more accessible to all and enhance the visitor experience (Hadad, 2019). To do so, digital, and technological competences such as programming, and digital content development may be needed to innovate this sector driving inclusivity. Moreover, digital content could be accessible to a wider number of people and specific content developed so that people with disabilities may support making culture and art more accessible. Innovative approaches for orchestrating community activities, e.g., virtual theatres and collaborative games for community strategy development, underscore the importance of stakeholder collaboration in both instigating and perpetuating cultural initiatives. Concurrently, proficiency in digital tools for multimedia production, and adapt storytelling techniques emerge as central to effectively disseminating and fostering the uptake of cultural innovations. Educational skills in delivering cultural programmes and workshops should be coupled with a steadfast commitment to sustainability and eco-conscious practices (RURACTIVE Dynamos).

Soft skills appear to be of utmost importance to establish solutions towards cultural innovation. Learning needs are often related to lacking effective communication skills for conveying ideas, fostering collaboration, and engaging with diverse stakeholders (rural and urban as potential consumers of these innovations). Additionally, there is a need for competences in developing and implementing social innovations, which can drive positive change within communities and cultural practices. Furthermore, competences in methods for the intergenerational transfer of traditional knowledge are crucial for preserving and passing down elements of cultural heritage. Strengthening these competences can enhance the capacity for cultural adaptation, innovation, and sustainability, ultimately contributing to the preservation and evolution of cultural practices in contemporary contexts. There appears to be a need to provide training tailored for the needs of unemployed

career-changers, particularly in service professions, to equip them with the skills necessary for employment in the cultural sector (RURACTIVE Dynamos).

Collaboration competences are essential for product development in partnership with e.g. Regional Tourism Organisations, associations or cooperatives enabling the creation of culturally enriching experiences and offerings yet benefit from cooperation. Moreover, knowledge of cultural innovation is crucial, emphasizing the ability to identify, foster, and implement innovative approaches within cultural contexts. Understanding the impact of innovation on socioeconomic areas is another vital competence required, recognizing how innovation can influence and shape various aspects of society and the economy (RURACTIVE Dynamos).

There are notable gaps in **organisational** competences, particularly in operational management and marketing and sales. Operational management is hindered by a lack of skills in event organisation, which are crucial for the successful planning and execution of cultural events and activities. On the marketing and sales front, deficiencies are apparent in attracting artisans and young people to foster a local makers community and innovate local heritage. Additionally, there is a need for competences to promote sports activities and community-bonding activities, which play a vital role in enhancing community engagement and cultural participation (RURACTIVE Dynamos).

Certain **governance** competences are frequently absent in rural communities. Firstly, in policy development and analysis, there is a lack of ability to formulate and implement cultural policies effectively, incorporating ideas from various sources and addressing principles of accessibility, social justice and inclusion, participation, environmental aspects, and learning (Lysgård, 2019). Secondly, in conflict mitigation and mediation, there is a need for competences to counteract socio-cultural problems (e.g. integrate migrants into local culture). Additionally, there is a lack of competences to develop concepts aimed at overcoming “old”/ traditional role models, addressing new perspectives, and promoting gender values (RURACTIVE Dynamos).

There is evidence of gaps in **financial and business** competences, particularly concerning business strategy, planning, and performance. Social entrepreneurship skills are vital for fostering these types of innovation, identifying opportunities, and navigating the dynamic landscape of cultural industries. Furthermore, there is a need for competences to develop and implement market innovations, applying recent research findings in an industrial context, and the involvement of young people. These competences are essential for translating creative ideas into tangible products, services, or experiences that resonate with audiences and contribute to the cultural and economic vitality of communities.

Leadership and systemic thinking are important requirements for guiding cultural innovations. Leaders must excel in risk management, negotiation, and mediation to navigate dynamic cultural landscapes and foster collaboration among diverse stakeholders. Such leaders should have the capacity to envisage what constitutes a sustainable future and anticipating opportunities and

challenges. Addressing competence gaps and adopting a systemic approach to cultural innovation is essential for achieving sustainable cultural development and ensuring the cultural and economic vitality of communities.

Cultural innovation and digital skills have blossomed in the aftermath of the COVID-19 pandemic, with virtual reality (VR) emerging as a key tool. As traditional avenues for cultural exploration and engagement were disrupted by lockdowns and restrictions, VR offered a unique solution which allowed individuals to immerse themselves in virtual environments and experiences from the comfort of their own homes. Examples of cultural innovations facilitated by VR include virtual park visits, interactive museum tours, and immersive historical reenactments. These applications of VR technology have provided avenues for cultural exploration during times of physical distancing and opened new possibilities for enhancing cultural experiences in the digital era. This has the potential to be further enhanced and developed.

To promote cultural innovations in the era of digitalization, a range of competences is essential. Technical competences include skills in VR technologies, including software development, 3D modelling, and VR content creation. Creativity and artistry are equally important, as cultural innovation requires imaginative thinking and artistic abilities to design captivating virtual environments and develop engaging storytelling experiences that resonate with audiences. Cultural awareness is essential to ensure that virtual experiences are culturally sensitive and authentic, respecting the nuances of different cultures and historical contexts. Competences in User experience (UX) design, digital marketing, collaboration, and adaptability are essential for creating intuitive, accessible, and impactful cultural experiences that resonate with diverse audiences.

BOX 5. Capacity building needs to support the effective implementation of smart and community-led solutions for sustainable culture and cultural innovation

To support the effective implementation of smart and community-led solutions for sustainable culture and cultural innovation skills, such as preserving local heritage and fostering stakeholder collaboration are key competences for effective cultural initiatives. Technological integration and digital literacy play a pivotal role in enhancing cultural accessibility and engagement, with competences such as programming and digital content development, AI and augmented reality, driving innovation and inclusivity.

Social and intergenerational competences are crucial, encompassing effective communication, social innovation development, and methods for transferring traditional knowledge. These skills facilitate community engagement, foster positive change, and ensure the sustainability of cultural heritage. Governance and policy competences are essential for formulating and implementing inclusive cultural policies, as well as mitigating conflicts and fostering integration in diverse communities.

Leadership and systemic thinking are needed to guide cultural innovation efforts. Leaders must excel in risk management, negotiation, and mediation to navigate dynamic cultural landscapes and foster collaboration among diverse stakeholders. Those leaders require capacities for envisioning a sustainable future and

anticipating opportunities and challenges. Addressing competence gaps and adopting a systemic approach to cultural innovation is essential for achieving sustainable cultural development and ensuring the cultural and economic vitality of communities.

Promoting cultural innovation in European rural areas requires a blend of cultural awareness, creative skills, and community engagement. Key competences needed to promote culture and cultural innovation include understanding local heritage and diversity (e.g. improving accessibility, protecting assets at risk of deterioration) creative thinking, and design thinking (e.g. valuing intangible cultural heritage, short/long-term cultural events (e.g. creative centres or hubs, festivals, traditional celebrations involving different groups of rural actors). Innovative ways for organising community activities (virtual theatres, board games for community strategy development, etc.) and stakeholder collaboration are essential to mobilize and sustain cultural projects. Additionally, proficiency in digital tools, multimedia production, and storytelling is crucial for promoting and sharing cultural innovations. Educational skills for delivering cultural programmes and workshops, along with a focus on sustainability and eco-conscious practices, further support these initiatives.

Digital marketing and communication, and advocacy skills are needed to attract audiences and secure funding, while research and analytical abilities help in understanding cultural trends and evaluating project impacts. Implementing these competences involves capacity-building programmes, networking platforms, pilot projects, and securing support from a diverse range of funding sources. By developing these skills, rural areas can effectively foster cultural innovation, enhancing local identity and promoting economic and social development, as well as environmental justice and social inclusion.

4.2.6. Local services, health and wellbeing

Rural areas often characterized by higher unemployment rates, lower wages, limited educational attainment, a growing elderly population, and disparities in accessing healthcare services, exacerbating health inequalities (Jones *et al.*, 2011; Zamfir *et al.*, 2015). The loss of traditional inherited knowledge in land-use governance and management becomes increasingly significant amidst rising rates of rural depopulation (Smaliychuk *et al.*, 2016; Molnar and Berkes, 2018). For instance, agricultural land abandonment is becoming more prevalent due to factors such as the continuous decline of rural population, increasing urbanization, outmigration, marginalization, and dependency on the external economy (S4C Research Agenda 2030). This scenario underscores the critical linkages between local services, health, and overall wellbeing in rural communities.

In local services, health, and wellbeing, **digital and technological competences** play a pivotal role in fostering resilience and inclusivity. These were of high importance in time of COVID crisis, and appear to be of importance in circumstances that prevail under other crisis such as war or conflicts, climate extremes, enabling the use of web applications, official information and government services, as well as conducting digital transactions. Skills in IT and effective internet search techniques ae vital for accessing information and navigating electronic databases, ensuring that individuals can harness digital resources for their local service and health and well-being needs. This entails crafting

applications and services specifically designed to address the unique challenges faced in healthcare delivery, especially in rural and remote areas (as seen during COVID crisis).

The war in Ukraine illustrates a critical need for the **digitalization of public services to ensure that no one is left behind**. This is especially true for rural and remote localities where access to information and public services has not been possible, with digital platforms serving the needs of people. Ukraine during the war has emerged as one of most advanced EU country implementing digital transformations across governance, education, healthcare, social services, aiming at empowering all citizens, irrespective of their location or background. Ukraine has introduced the world's first fully legal digital ID system with a focus on inclusivity and accessibility, even in remote rural areas. Complementing this, Ukraine's swift business registration processes have facilitated entrepreneurial ventures, fostering economic growth and opportunity in both urban centres and rural communities. Anchoring these efforts is an open source *govtech* solution that leverages mobile and web technologies to ensure that essential government services function across the country, fostering a sense of unity and cohesion. The Diia app and Diia web portal, which are used by over 20 million users, provide a user-friendly interface for accessing critical services and information, regardless of geographical location. To nurture culture of entrepreneurship and digital literacy, Diia.Business offers free courses on basic digital skills and professional upskilling. The Diia.Centers and Diia.City initiatives aim to revolutionize administrative service delivery, ensuring that citizens in rural and urban areas alike have equal access to essential government services (register for a doctor’s appointment, marriage, etc). Embracing transparency and inclusivity,

Ukraine's Diia.Engine platform is facilitating the rapid creation of secure registers, laying the groundwork for efficient online services that prioritize the needs of all citizens, including those living in conflict-affected regions and forced migrants or refugees. The Diia.OpenData app provides access to crucial information, empowering communities to participate in decision-making processes and hold government agencies accountable, fostering trust and resilience in times of crisis. A new application, the *Ukraine WinWin* initiative, offers a visionary roadmap for sustainable development that prioritizes inclusivity and bridges the rural-urban divide, ensuring that no citizen is left behind in the journey towards peace and prosperity. To effectively implement these initiatives, competences in digital governance, community engagement, conflict resolution, and strategic planning are proving essential. Schooling systems are also aimed being digitalised and implemented, such as the Diia.Mria which is ensuring smooth schooling process for children. Diia.Education proposes training modules, including to learn soft and digital skills as well as language courses.

RURACTIVE Dynamos exemplify the importance of developing solutions that cater to the distinct needs of specific groups within communities (e.g. elderly, migrants, etc.), fostering resilience and promoting wellbeing amidst adversity. The ability to create digital content tailored to local service, health, and wellbeing contexts is essential to ensure inclusivity and tackle rural-urban divide. Examples in waste management show how digital skills combined with good governance an be used

in door-to-door collection services and recycling initiatives which significantly improve rural well-being.

Social competences to promote innovations in local services, health, and wellbeing are often lacking in rural areas. Interpersonal competences are crucial for building relationships and fostering trust within outside communities (especially among traditional habitants and newcomers to support integration). Effective communication skills are essential for conveying information, addressing concerns, and promoting health and wellbeing initiatives. There is also a need for developing specific skills related to community engagement, empowerment, and collaborative problem-solving (Albuquerque and Farias, 2021; Ravazzoli *et al*., 2021) for effectively addressing challenges of local health and wellbeing. Attitudes towards accepting guidance and help, amongst rural migrants, is crucial to effectively support and advocate for the wellbeing of communities. The study by Eriksson *et al*. (2010) highlights that children in rural areas perceive a lack of social capital due to environmental and social constraints in their daily lives. However, they experience enhanced wellbeing due to strong cohesion within their neighbourhoods. Settings such as schools, natural environments, and sporting associations support their wellbeing. Spatial isolation in rural areas creates contexts for developing unique social network structures and trust, but also fosters feelings of exclusion and social control. Children express paradoxical feelings of living in a good and safe area while feeling isolated and restricted.

In addressing challenges related to services that improve well-being e.g. better housing, waste management, or bottom-up (community-led) care initiatives, a diverse skill set remains paramount. E-governance expertise ensures efficient waste management practices through digitalization and community engagement. Public health competences enable the promotion of sustainable solutions and enhancing community wellbeing. Meanwhile, education initiatives cultivate awareness and knowledge exchange, while employment and employability programmes stimulate economic growth and social resilience within rural communities.

The missing **technical competences** in the sector of local services, health and wellbeing encompass a range of skills necessary for developing and enhancing products, services, practices, and processes: needs for carer support among healthcare professionals (Røen *et al.*, 2019) to ensure better adaptation to changing conditions; competences in personal and community health care practices, including health literacy for effectively addressing the diverse health needs of individuals and communities; adequate social and elderly care requires specific competences to provide comprehensive support and assistance tailored to the unique needs of these populations. Systematic and evidence-based knowledge is necessary to effectively meet the needs of clients with serious mental illness, ensuring appropriate care and support tailored to their specific circumstances (Bergmark *et al.*, 2021).

Overall, any activity related to local services, health and wellbeing will require specific **technical competences** related to working with vulnerable groups and their special needs, such as when working with people with disabilities. This is vital to achieve services that are inclusive with people from any background, for example connected devices for care and wellbeing services demand competences in e-governance for streamlined digital processes, alongside expertise in public health and a one-health approach to ensure the integration of human and environmental perspectives. Digital nomadism and remote working competences can also facilitate good outputs.

In local services, health, and wellbeing, literature suggest that missing **organisational competences**, particularly relates to a lack of skills in leadership, adaptive changes and collective learning. Such learning is needed in practices of new forms of governance, participatory decision-making and policy engagement. RURACTIVE Dynamos encompass creative thinking, problem-solving skills, collaboration, adaptability, risk-taking, strategic alignment, leadership, customer-centricity, effective communication, and technical expertise, tailored to specific fields. Importantly, embedding these competences within organisational cultures, supported by appropriate structures and processes, is crucial for sustaining an innovation ecosystem.

The absence of **good governance and effective leadership** hinders the development and implementation of innovative solutions to address community health and wellbeing needs (Van Vooren *et al.*, 2023). There is a deficiency in fostering collective learning (Van Vooren *et al.*, 2023), which is crucial for sharing knowledge, best practices, and resources among stakeholders to improve service delivery and enhance overall community wellbeing. Addressing these competence gaps is essential for promoting sustainable development and ensuring the provision of quality local services in the health and wellbeing sector.

BOX 6. Capacity building needs to support the effective implementation of smart and community-led solutions for sustainable local services, health, and wellbeing

To effectively implement smart and community-led solutions for sustainable local services, health, and wellbeing, capacity building is essential, particularly in leveraging digital technologies. Connected devices play a crucial role in care and wellbeing services, such as remote patient monitoring and ingestible sensors. To support their implementation, capacity building should focus on e-governance for streamlining processes, public health initiatives for comprehensive monitoring, education for skill enhancement, and employment programmes to ensure a skilled workforce capable of utilizing these technologies.

The following competences require to be addressed:
-Technical competences: expertise for the successful implementation of smart solutions in local service delivery and healthcare, ability to use emerging technologies such as Internet of Things (IoT), artificial intelligence (AI), and data analytics, as well as the ability to integrate these technologies into existing systems effectively.

-Social competences / soft skills for community engagement taking into account the needs, priorities, and aspirations of local residents; competences in community outreach, stakeholder collaboration, and participatory decision-making.
-Organisational competences/ project management in local services, health, and wellbeing - skills in strategic planning, budgeting, risk management, and performance monitoring to ensure that projects are delivered on time, within budget, and achieving the desired outcomes.
- Good governance competences - understanding the policy and governance, fostering collaboration between government agencies, community organisations, and other stakeholders; skills in policy advocacy, and negotiation.
- Cross-cultural communication – competences to enable solutions in the diverse cultural contexts in which local services, health, and wellbeing initiatives operate, competences in cross-cultural communication, sensitivity, building trust, fostering collaboration, and promoting social cohesion within communities.
-Sustainability and adaptability and resilience - competences in environmental stewardship and sustainable resource management.

4.3. Insights into learning needs and gaps from RURACTIVE Dynamos

This section summarizes insights from RURACTIVE Dynamos on the competences needed to implement innovative solutions in their territories. Based on these insights, collected through the RURACTIVE Solution Catalogue, this section outlines learning needs based on the experience of specific solutions already implemented and established in RURACTIVE Dynamos.

RURACTIVE Dynamos emphasized the importance of competences in fostering innovation in rural areas, regardless of whether these competences belong to local communities' actors or external actors (as explained in Kluvankova *et al.,* 2021). This means that local residents either possess the necessary skills themselves or have strong connections to external experts who can assist in implementing solutions by applying their competences. Thus, not all competences need to be present locally, however, the rural community must have the capacity to acquire any additional or missing competences or resources as needed. Core competences needed in rural communities include problem-solving skills, project management skills, design thinking, adaptability and resilience, financial and business models, and knowledge in digitalization. Key competences required for the solutions implemented by Dynamo Partners are summarised in Table 11.

RURACTIVE Dynamos suggested that alongside technical competences (e.g. “hard” skills), “soft skills” play a beneficial role in nurturing a culture of innovation in rural areas for '*individuals to feel empowered to express ideas and explore new practices*' and '*take actions to change established practices, be adaptive and resilient*.' Effective communication, understanding behavioural models in

rural settings, and perspectives of different rural actors were identified as being important. Dynamo Partners suggests that openness of rural actors to explore new opportunities and change "business as usual approaches" are important for fostering creative collaboration and good outcomes. These competences enable individuals and teams to generate, develop, and implement new ideas, leading to improved processes, products, or services. They are crucial for fostering a culture of innovation, "thinking out of the box" and ensuring that rural areas are competitive in a rapidly changing environment.

Table 11. Key competences required for the solutions implemented by Dynamos

RURACTIVE RDD	Implemented Solutions by Dynamos	Location	Key competences needed
Sustainable Multimodal Mobility	REGIO-tim: Multi-Modal Mobility Network: Establish a multi-modal mobility network	Styria, Austria	Technical (skills on multi-modal mobility), digital and technological, social
Energy Transition and Climate Neutrality	Energy Bag: Support energy transition with portable solutions	Gotland, Sweden	Technical (on energy portable tools)
Sustainable Agrifood Systems and Ecosystem Management	Constructed Wetlands of Jurvasenlampi Lake: Create constructed wetlands	Pudasjärvi, Finland	Digital and technological, social, financial and business
	These Legs Are Made for Walking: How Finnish Reindeer Leg Skins Entered the International Shoe Business	Ranua, Finland	Technical in agrifood systems, social, organisational, financial and business
	Iijoki River Agreement for restoring the migratory fish stocks, improving water quality by watershed restorations, and develop tourism, recreation and livelihood opportunities.	Ii, Finland	Social, organisational, governance
	Mobile Compost for Biodegradable Waste: Provide effective biodegradable waste management	Zadar, Croatia	Technical competences on effective biodegradable waste management
	Marteloscopes for training on sustainable forest ecosystem management (Establishing Marteloscopes for Capacity Building based on virtual forest on an online platform) for training forest professionals to enhance their decision-making capabilities based on real data)	Switzerland and Ukraine	Technical (forest management), digital and technological
	Digitalize soil monitoring (Digitalization of Monitoring and Reporting of Soil Characteristics)	Aberdeenshire, Scotland/ UK	Digital and technological, technical (soil monitoring), social
Nature-based and Cultural Tourism	Poro-Panuma Reindeer Farm: Develop a nature-based and cultural tourism site	Pudasjärvi, Finland	Digital and technological, social, financial and business
	EchoLoci: Conserve and promote local biodiversity	Zagori, Greece	Technical (know-how in biodiversity conservation), social, organisational
	Live the Ports: Promote nature-based and cultural	La Mata de Morella, Spain	

	tourism		
	Kellerstöckl-Resort Südburgenland: Promote nature-based and cultural tourism	South Burgenland, Austria	Digital and technological, social, financial and business
	Synevyr-Eco: Establish a sustainable tourism model	Synevyr National Nature Park, Ukraine	Technical (in eco-friendly tourism), social, organisational
	Slow Food Travel Alpe Adria Carinthia: Promote sustainable food tourism	Lesachtal, Gailtal and Gitschtal valleys &Lake Weissensee in Carinthia in Austria	Organisational, financial and business
Culture and Cultural Innovation	Maratonda Folkloristic Competition in Streaming for Accessibility: Enhance accessibility of cultural events	Marche, Italy	Digital and technological, social
	Pannonian Nature Experience Days:Promote nature-based tourism	Burgenland in Austria and western Hungary	Technical (tools in nature-based tourism), social, organisational
Local Services, Health, and Wellbeing	Advanced Telediagnosis through Telemedicine: Provide health services via telemedicine	rural Spain	Digital and technological, technical (health services with telemedicine), social, organisational, governance, financial and business
	Monitoring of the Elderly with Sensors: Health monitoring using sensors	Zamora, Spain	Digital and technological, technical (health monitoring), social
	CAS Rebuild Ukraine Program: Build capacity for post-crisis recovery for refugees and migrants from Ukraine	Switzerland (in cooperation with Ukraine)	Digital and technological, technical (climate-smart reconstruction with new approaches in services and well-being), social, organisational, financial and business
	Participatory Budgeting Project: Involve local residents in budgeting	Zadar, Croatia	Social, organisational, governance, financial and business

Evidence from the solutions implemented by Dynamos regarding the competences needed in the process is explained below, highlighting the specific learning needs that were identified and addressed to ensure the successful implementation of solutions. This evidence can serve other communities aiming to implement similar solutions, providing them with insights into the competences required for successful implementation.

RDD: SUSTAINABLE MULTIMODAL MOBILITY

1. **REGIO-tim: Multi-Modal Mobility Network**
   - Location: Styria, Austria
   - Solution: Establish a multi-modal mobility network to enhance transportation options and connectivity by integrating various modes of transport, such as buses, trains, and bicycles, into a cohesive network that improves accessibility and reduces reliance on private cars.
   - Competences needed: Technical, Digital and technological, Social.
   - Primary RDD: Sustainable multimodal mobility.
   - Secondary RDD: Local services, health and well-being

The REGIO-tim project established a multi-modal mobility network to enhance transportation options and connectivity. This solution involves integrating various modes of transport, such as buses, trains,

and bicycles, into a cohesive network that improves accessibility and reduces reliance on private cars. Innovators and entrepreneurs are the primary stakeholders involved. The project required several key competences: technical skills for designing and implementing the mobility network, digital and technological skills for developing and managing digital platforms and applications, and social skills for engaging with the community and encouraging the use of sustainable transport options. The primary RDD addressed by this project is sustainable multimodal mobility.

RDD: ENERGY TRANSITION AND CLIMATE NEUTRALITY

2. **Energy Bag**
    - Location: Visby, Sweden.
    - Solution: Support energy transition and climate neutrality through the use of portable energy storage solutions, developing and distributing energy bags that store and supply renewable energy.
    - Competences needed: Technical skills in energy management, digital skills, social competences
    - Primary RDD: Energy transition and climate neutrality.
    - Secondary RDD: Local services, health, and wellbeing.

The Energy Bag project supported energy transition and climate neutrality using portable energy storage solutions. The project focuses on developing and distributing energy bags that store and supply renewable energy, promoting sustainable energy practices and reducing carbon emissions. The competences required for this project include technical skills in renewable energy technologies and energy storage systems, digital and technological skills for energy management, and social skills for educating and engaging the community regarding renewable energy benefits. The primary impact of this project was to ensure energy transition and climate neutrality, with secondary impact on local services, health, and wellbeing.

RDD: SUSTAINABLE AGRIFOOD SYSTEMS AND ECOSYSTEM MANAGEMENT

3. **Constructed Wetlands of Jurvasenlampi Lake**
    - Location: Pudasjärvi, Finland.
    - Solution: Create constructed wetlands to enhance water quality, biodiversity and increase carbon sinks, leveraging natural filtration and habitat creation properties to improve ecosystem services.
    - Competences needed: Digital and technological, Social, Financial and business competences.
    - Primary RDD: Sustainable agrifood systems and ecosystem management.
    - Secondary RDD: Energy transition and climate neutrality.
    - Tertiary RDD: Nature-based and cultural tourism.

In Pudasjärvi, Finland, the Constructed Wetlands of Jurvasenlampi Lake project focused on construction of wetlands to enhance water quality and biodiversity in the area. This eco-friendly initiative leverages the natural filtration and habitat creation properties of wetlands to improve ecosystem services. The project involved various stakeholders and competences required in digital and technological fields, social engagement, and financial management. Digital competences included the use of Geographic Information Systems (GIS) and environmental monitoring

technologies, while social competences were needed to engage local communities and collaboration of expert and advisory organisations. Financial competences involved securing funding and managing project budgets. The primary RDD addressed by this project is sustainable agrifood systems and ecosystem management, with impacts on energy transition and climate neutrality, and benefits for nature-based and cultural tourism.

4. **Mobile Compost for Biodegradable Waste**
    - Location: Ist Island, Croatia
    - Solution: Provide an effective solution for managing biodegradable waste on Ist Island by developing and using mobile composting units, promoting environmental sustainability and reducing waste.
    - Stakeholders: Innovator/entrepreneur involved
    - Competences needed: Technical skills in waste management
    - Primary RDD: Sustainable agrifood systems and ecosystem management
    - Secondary RDD: Energy transition and climate neutrality

The Mobile Compost for Biodegradable Waste project focuses on developing sustainable agrifood systems and ecosystem management through the innovative use of mobile composting units. The project aims to provide an effective solution for managing biodegradable waste on the island, promoting environmental sustainability and reducing waste. The implementation required technical competences in ecosystem and waste management, which involve understanding composting processes, operating mobile composting units, and managing organic waste streams. The primary RDD addressed by this project is sustainable agrifood systems and ecosystem management, with impacts on energy transition and climate neutrality.

5. **Establishing Marteloscopes for Capacity Building of Forest Professionals and Civil Society to Promote Close to Nature Forestry**
    - Location: all over Switzerland and scaleup to Ukraine
    - Solution: Establish marteloscopes—online platform for training to enhance the skills of forest professionals and civil society in forest management adaptation to climate change
    - Competences needed: Technical skills in forestry management, digital skills, social
    - Primary RDD: Sustainable agrifood systems and ecosystem management
    - Secondary RDD: Nature-based Tourism
    - Tertiary RDD: Local services, health and well-being

This project, implemented in Switzerland and then also in Ukraine and France, focuses on establishing marteloscopes for martelage.sylovotheque.ch - an internet platform hosting a library of forest landscapes – marteloscopes (plots of one-hectare size with individually numbered, mapped, & recorded trees). This online platform serves as a digital training site to enhance the skills of forest professionals and civil society, promoting close-to-nature forestry practices to improve forest management and conservation. Various types of stakeholders are involved, including forestry professionals and civil society organisations. The competences needed for this project include technical skills in forestry management, which encompass knowledge of sustainable forestry practices, the ability to conduct forest inventories, and the use of marteloscopes for training and education. Digital skills have been instrumental in establishing and managing such a platform,

enabling data analysis, comparisons of marteloscopes, and promoting the sharing of experiences both in the forest and through virtual reality. The martelage.sylvotheque.ch (MSC) internet platform, along with the complementary MSC Mobile smartphone app, were developed for this purpose. Currently, there are over 200 marteloscopes in four countries. Already six marteloscopes are established in Ukraine. The primary RDD is sustainable agrifood systems and ecosystem management with possible use for Nature-based Tourism.

6. **Digitalization of Monitoring and Reporting of Soil Characteristics, to Inform Tackling Climate Change**
    - Location: Scotland, UK
    - Solution: Digitalization of monitoring and reporting of soil characteristics.
    - Competences needed: Digital and technological, Technical, Social.
    - Primary RDD: Sustainable agrifood systems and ecosystem management.
    - Secondary RDD: Energy transition and climate neutrality.

This project focuses on the digitalization of monitoring and reporting soil characteristics to support efforts in tackling climate change. The solution aims to improve the accuracy and efficiency of soil monitoring, providing valuable data to inform climate action strategies. The competences required include digital and technological skills for developing and implementing digital monitoring systems, technical skills in soil science and data analysis, and social skills for communicating the importance and impact of the project to various stakeholders. The primary RDD addressed by this project is sustainable ecosystem management with secondary benefits for energy transition and climate neutrality.

7. **These Legs Are Made for Walking: How Finnish Reindeer Leg Skins Entered the International Shoe Business**
    - Location: Ranua, Finland.
    - Solution: Sustainable agrifood systems and ecosystem management.
    - Competences needed: Technical, Social, Organisational, Financial and business.
    - Primary RDD: Sustainable agrifood systems and ecosystem management.
    - Secondary RDD: Nature-based and cultural tourism.

This project focuses on integrating sustainable agrifood systems and ecosystem management into the international shoe business using reindeer leg skins. The solution involves creating value-added products from reindeer leg skins, which are typically considered waste, and entering the international shoe market with these unique materials. Networks of stakeholders, including local businesses and international partners, are involved in this initiative. The competences needed include technical skills in processing and manufacturing reindeer leg skins, social skills for engaging with various types of stakeholders and promoting the products, organisational skills for managing production and supply chains, and financial and business skills for entering and sustaining a presence in international markets. Digital skills / digital literacy was also instrumental. The primary impact of this project is on sustainable ecosystem management, with secondary impacts on nature-based and cultural tourism.

8. **Iijoki River Agreement**
    - Location: Ii, Finland.
    - Solution: enhance sustainable river management through collaborative efforts among various stakeholders
    - Competences needed: Social, Organisational, Governance.
    - Primary RDD: Sustainable agrifood systems and ecosystem management.
    - Secondary RDD: Nature-based and cultural tourism.

The Iijoki River Agreement project aims to enhance sustainable agrifood systems and ecosystem management through collaborative efforts among various networks of stakeholders. The solution focuses on improving water quality and biodiversity in the Iijoki River basin by implementing sustainable land and water management practices. The competences required include social skills for effective stakeholder engagement and collaborative decision-making, organisational skills for managing projects and coordinating activities, and governance skills for understanding and implementing regulatory frameworks and policies. The primary impact of this project is on sustainable ecosystem management, with secondary benefits for nature-based and cultural tourism.

RDD: NATURE-BASED AND CULTURAL TOURISM

9. **EchoLoci**
    - Location: Zagori, Greece.
    - Solution: Conserve and promote local biodiversity and cultural heritage through eco-tourism and educational activities, creating immersive experiences that connect visitors with nature and local culture.
    - Competences needed: Technical, Social, Organisational.
    - Primary RDD: Nature-based and cultural tourism.
    - Secondary RDD: Sustainable agrifood systems and ecosystem management.

The EchoLoci project aims to conserve and promote local biodiversity and cultural heritage through eco-tourism and educational activities. By creating immersive experiences that connect visitors with nature and local culture, the project seeks to enhance both environmental conservation and cultural awareness. Innovators and entrepreneurs were deeply involved in this solution, which required competence in technical, social, and organisational fields. Technical competences in environmental conservation and eco-tourism practices were essential, alongside social skills for community engagement and cultural promotion. Organisational competences were also crucial for managing tourism activities and educational programmes. The primary impact of this solution is on nature-based and cultural tourism and on sustainable agrifood systems and ecosystem management.

10. **Live the Ports**
    - Location: La Mata de Morella, Spain.
    - Solution: Promote nature-based and cultural tourism by organising cultural events, guided nature tours, and producing informational materials about the local environment and traditions.
    - Competences needed: Not specified.

- Primary RDD: Nature-based and cultural tourism.
- Secondary RDD: Culture and cultural innovation.

The Live the Ports project focuses on promoting nature-based and cultural tourism. The initiative aims to utilize the natural and cultural resources of the region to attract tourists and enhance local economic development. The project involves organising cultural events, guided nature tours, and producing informative materials about the local environment and traditions. Various networks and local organisations are involved in implementing this project. The required competences include technical skills in event planning and tourism management, social skills for community engagement and effective communication, and organisational skills for project coordination and management. The primary impact is on nature-based and cultural tourism, with a secondary focus on culture and cultural innovation.

11. Kellerstöckl-Resort Südburgenland

- Location: 11 municipalities in South Burgenland, Austria
- Solution: Promote nature-based and cultural tourism by leveraging the natural beauty and cultural heritage of South Burgenland, Austria, to attract tourists and foster local economic development and cultural preservation.
- Competences needed: technical in tourism, social, governance
- Primary RDD: Nature-based and cultural tourism
- Secondary RDD: Sustainable multimodal mobility

This project focuses on promoting nature-based and cultural tourism. This initiative aims to leverage the region's natural beauty and cultural heritage to attract tourists, thereby fostering local (small-scale) economic development and cultural preservation. The competences needed for this project are the skills in tourism management, cultural heritage promotion, and community engagement. The primary RDD addressed by this project is nature-based and cultural tourism, with contribution to sustainable multimodal mobility (as a secondary RDD).

12. Synevyr-Eco

- Location: Synevyr National Nature Park, Ukraine.
- Solution/Aim: Establish a sustainable tourism model by developing eco-friendly tourism infrastructure, promoting conservation efforts, and enhancing local economic development.
- Competences needed: Technical, Social, Organisational.
- Primary RDD: Nature-based and cultural tourism.
- Secondary RDD: Sustainable agrifood systems and ecosystem management.

The Synevyr-Eco project, located in Synevyr National Nature Park in western Ukraine, aims to establish a sustainable tourism model by developing eco-friendly tourism infrastructure, promoting conservation efforts, and enhancing local economic development. This initiative focuses on leveraging the natural beauty and biodiversity of Synevyr National Nature Park to attract eco-tourists, thereby supporting conservation efforts and boosting the local economy. Various competences were needed for the solution to succeed. Technical competences were essential for developing and maintaining eco-friendly infrastructure and conservation technologies. Social competences are crucial for engaging with the local community and tourists, fostering an understanding and appreciation of

conservation efforts. Organisational competences are necessary for planning and coordinating various activities, ensuring the smooth execution of tourism and conservation programs. The primary RDD addressed by the project is nature-based and cultural tourism, with secondary – contributions to sustainable agrifood systems and ecosystem management.

13. Pannonian Nature Experience Days

- Location: Burgenland in Austria and western Hungary
- Solution: Promote nature-based tourism by organising events that highlight the natural beauty and biodiversity of the region, attracting tourists and educating them about the local environment.
- Competences needed: Technical, Social, Organisational.
- Primary RDD: Nature-based and cultural tourism.

The Pannonian Nature Experience Days project aims to promote nature-based tourism by organising events that highlight the natural beauty and biodiversity of the region. This initiative involves a series of activities designed to attract tourists and educate them about the local environment. Innovators are the main stakeholders involved in this project. The competences needed include technical skills for organising and managing tourism events, social skills for interacting with tourists and providing educational information, and organisational skills for coordinating various activities and ensuring their successful execution. The primary RDD addressed by this project is nature-based and cultural tourism.

14. Poro-Panuma Reindeer Farm

- Location: Panuma village, Municipality of Pudasjärvi, Finland.
- Solution: Develop a nature-based and cultural tourism site centred around reindeer farming, offering a unique cultural experience tied to traditional reindeer herding.
- Competences needed: Digital and technological, Social, Financial and business competences.
- Primary RDD: Nature-based and cultural tourism.
- Secondary RDD: Sustainable agrifood systems and ecosystem management.
- Tertiary RDD: Local services, health, and wellbeing.

The Poro-Panuma Reindeer Farm project developed a nature-based and cultural tourism site centred around reindeer farming. This innovative solution seeks to attract tourists by offering a unique cultural experience tied to the traditional livelihood of reindeer herding. Researchers were deeply involved in this solution with competences in digital and technological fields, social skills, and financial and business management. The project primarily drives nature-based and cultural tourism, with impacts on sustainable agrifood systems and ecosystem management, and creating benefits for local services, and human health and wellbeing. By integrating digital and technological competences, the project utilized information and data literacy to handle effectively digital platforms and technological tools. Social competences were crucial for engaging with visitors and promoting cultural heritage, while financial and business skills were necessary for managing business finances and developing strategies. The primary RDD addressed by this project is nature-based and cultural tourism, and secondarily sustainable agri-food systems and ecosystem management.

15. Slow Food Travel Alpe Adria Carinthia

- Location: Hermagor-Pressegger See, Weissensee, Lesachtal, Kötschach-Mauthen, Kirchbach, Dellach, Gitschtal, S.Stefan.
- Solution: Promote sustainable food tourism by creating tourism experiences centered around local, sustainably produced food, which supports local farmers and food producers while providing unique culinary experiences for tourists.
- Competences needed: Organisational, Financial and business, social, governance.
- Primary RDD: Nature-based and cultural tourism.
- Secondary RDD: Sustainable agrifood systems and ecosystem management.
- Tertiary RDD: Energy transition and climate neutrality.

The Slow Food Travel Alpe Adria Carinthia project focuses on promoting sustainable food tourism. The solution involves creating tourism experiences centered around local, sustainably produced food, which supports local farmers and food producers while providing unique culinary experiences for tourists. The competences required include organisational skills for planning and managing tourism activities, financial and business skills for developing sustainable business models and marketing strategies, and social skills for engaging with local communities and tourists. The primary RDD addressed by this project is nature-based and cultural tourism, with secondary impacts on sustainable agrifood systems and ecosystem management, and tertiary benefits for energy transition and climate neutrality.

RDD: CULTURE AND CULTURAL INNOVATION

16. Maratonda Folkloristic Competition in Streaming for Accessibility

- Location: Marche, Italy
- Solution: Enhance the accessibility of cultural events by using streaming services to make folkloristic competitions available to a broader audience, promoting cultural heritage and inclusivity.
- Competences needed: Digital and technological, Social.
- Primary RDD: Culture and cultural innovation.

The Maratonda Folkloristic Competition project focuses on enhancing the accessibility of cultural events through streaming services. The solution aims to make folkloristic competitions available to a broader audience by using digital platforms, thereby promoting cultural heritage and inclusivity. Innovators are the key stakeholders involved in this project. The competences required include digital and technological skills for setting up and managing streaming services, and social skills for engaging with participants and viewers to ensure a positive and inclusive experience. The primary RDD addressed by this project is culture and cultural innovation.

RDD: LOCAL SERVICES, HEALTH, AND WELLBEING

17. Advanced Telediagnosis through Telemedicine

- Location: Several municipalities.
- Solution: Provide health services via telemedicine to improve access to healthcare in remote areas by using digital health technologies to connect patients with medical professionals for remote diagnostics and consultations.
- Competences needed: Digital and technological, Technical, Social, Organisational, Governance, Financial and business.
- Primary RDD: Local services, health, and wellbeing.

The Advanced Telediagnosis through the Telemedicine project, implemented in several municipalities, focuses on providing health services via telemedicine to improve access to healthcare in remote areas. The solution involves using digital health technologies to connect patients with medical professionals for remote diagnostics and consultations. The competences needed include digital and technological skills for developing and using telemedicine platforms, technical skills in medical diagnostics, social skills for interacting with patients and healthcare providers, organisational skills for managing healthcare services, governance skills for understanding healthcare regulations, and financial and business skills for managing the economic aspects of telemedicine services. The primary RDD addressed by this project is local services, health, and wellbeing.

18. CAS Rebuild Ukraine Program - Building Capacity for Women-Refugees to Rebuild Ukraine after War

- Location: Switzerland
- Solution: Capacity building in post-crisis recovery
- Competences needed: Digital and technological, Technical, Social, Organisational, Governance, Financial and business
- Primary RDD: Local services, health, and wellbeing

The *CAS Rebuild Ukraine Program* in Switzerland, was launched by the Bern University of Applied Sciences in collaboration with other Swiss Universities and with support of Swiss Government to build capacity of Ukrainian women-refugees to rebuild Ukraine after the war. This capacity-building initiative aims to equip refugees with the necessary skills to contribute to the reconstruction and development of their home country. The competences required to launch the Program include a diverse set of skills: digital and technological competences for utilizing modern reconstruction technologies, technical competences in construction and infrastructure, social competences for stakeholders engagement and to ensure support from different stakeholders, including Swiss and Ukrainian governments; organisational competences for managing projects and coordinate efforts, governance competences for understanding regulatory and policy frameworks, and financial and business competences for acquiring and managing funds and resources efficiently. The primary RDD is local services, health, and wellbeing.

19. Monitoring of the Elderly with Sensors in Their Homes in Rural Areas

- Location: Zamora, Spain
- Solution: Health monitoring using sensors
- Competences needed: Digital and technological, Technical, Social
- Primary RDD: Local services, health, and wellbeing

The Monitoring of the Elderly with Sensors project focuses on health monitoring for elderly individuals in rural areas using sensor technology. This solution aims to enhance the safety and wellbeing of the elderly by providing continuous health monitoring, which allows for timely medical interventions and support. Stakeholders involved in this project include healthcare providers and technology companies with digital and technological skills for developing and implementing sensor technologies, technical skills for installing and maintaining the sensor systems, and social skills for interacting with the elderly and their caregivers. The primary Rural Development Driver (RDD) addressed by this project is local services, health, and wellbeing.

20. Participatory Budgeting Project

- Location: Zadar/Zadar Islands, Croatia.
- Solution: Involve local residents in the decision-making process for municipal budget allocations to enhance democratic governance and ensure that public funds are used to address the most pressing community needs.
- Competences needed: Social, Organisational, Governance, Financial and business.
- Primary RDD: Local services, health, and wellbeing.

The Participatory Budgeting Project focuses on involving local residents in the decision-making process for municipal budget allocations. The solution aims to enhance democratic governance and ensure that public funds are used to address the most pressing community needs. Various stakeholders, including local government officials and community members, are involved in this initiative. The competences needed include social skills for engaging with the community and facilitating discussions, organisational skills for managing the participatory process and coordinating activities, governance skills for understanding and applying democratic principles and public administration, and financial and business skills for budget planning and financial management. The primary RDD addressed by this project is local services, health, and wellbeing.

Lessons learned from Dynamos

Solutions implemented (or co-implemented and co-designed) by RURACTIVE Dynamo Partners have showed that digital and technological competences are frequently needed for most of the solutions outlined by Dynamos evident in tourism, environmental monitoring, and telemedicine, as exemplified by the Poro-Panuma Reindeer Farm, Energy Bag, and Advanced Telediagnosis through Telemedicine projects. Social competences are essential for community engagement and cultural promotion projects such as the EchoLoci, Participatory Budgeting Project, and Monitoring of the Elderly Health with Sensors projects. Technical competences are essential in specific domains / sectors e.g.

agriculture, forestry, water management, waste management, energy, and healthcare, as demonstrated by projects such as Mobile Compost for Biodegradable Waste, or Digitalization of Soil Monitoring. Organisational competences are necessary for managing complex projects as seen in Synevyr-Eco to develop rural eco-tourism and in the Slow Food Travel Alpe Adria Carinthia project. Financial and business competences are crucial for developing new, innovative and sustainable business models for sustainable viability of implemented solutions such as evident in the projects These Legs Are Made for Walking and Live the Ports.

Lessons learnt from Dynamos suggest that social competences are critical for projects involving community engagement and stakeholder collaboration, ensuring successful implementation and community support. Technical competences are of importance for projects focused on specific domains such as energy, waste management, and healthcare, etc., yet this expertise might be outsourced (external actors` knowledge as indicated in Kluvankova *et al*., 2021). Organisational competences are necessary for managing and coordinating complex projects and activities, especially in sectors like tourism and healthcare. Financial and business competences are crucial for developing sustainable business models and ensuring the economic viability of projects. Governance competences play a significant role in projects involving regulatory compliance and policy implementation, particularly in areas such as environmental management and participatory budgeting.

It is important to highlight that digital and technological competences are frequently required across various solutions in rural areas, underscoring the importance of digital literacy, digital connectivity as key enablers for better wellbeing and diversification of economic activities in rural Europe.

4.4. Outlining rural learning needs in digital skills and digital literacy

This section outlines digital competences required by rural communities. As stated in the EU Long Term Rural Vision for rural areas and the EU Digital Agenda "Shaping Europe's Digital Future", digital competences and "*technology must work for people to enable an open, democratic, and sustainable society, and help in fighting climate change and achieving the green transition*". This section sets out the digital competences which are considered to be crucial for rural communities, to support these overarching goals, with a particular focus on addressing the RURACTIVE cross-cutting priorities: climate change mitigation and adaptation, biodiversity, and social justice and inclusion.

In RURACTIVE, there is a particular emphasis on addressing groups at risk of social exclusion and underrepresentation, as outlined in RURACTIVE D4.1 on Activating RIEs for community-led development and empowerment (Bertuca *et al*., 2024; RURACTIVE Del. 4.1). Specifically, the elderly, women, and young people are identified as the main target audiences. Digital skills and literacy are

crucial in supporting the needs of these target groups, especially in rural areas where access to digital resources and opportunities can be limited. This emphasis is based on the results of literature review highlighting the role of digital inclusion in enhancing social participation, economic opportunities, and community resilience in rural areas.

Digital Skills and Digital Literacy to bridge the digital urban-rural divide

Addressing the digital competences of rural communities is crucial for their integration into the digital economy and for fostering their innovation potential. Digital skills and digital literacy competences are essential for enabling rural communities to bridge the digital divide, participate fully in the digital economy, and leverage technological advancements to foster innovative solutions to the challenges they face including: poverty and exclusion (c1); low services and infrastructure (c2); low education and skills (c3); digital divide (c4); climate change and natural disasters (c5); ageing (c6); gender gap (c7); over-tourism and uneven development (c8); depopulation (c9); unemployment (c10), as well as to address the specific needs of groups at risk of social exclusion and underrepresentation e.g. elderly individuals, women, young people and migrants (see Annex 2). Digital competences will help ensure that these groups are empowered to benefit from and contribute to digital era.

According to the EU Digital Skills Divide Report (EUROSTAT, 2023), there is a significant disparity in digital skills between urban and rural populations. It highlights that people living in rural areas generally have lower digital skills compared to those in cities, underscoring the need for targeted digital skills initiatives to address this gap. Statistical data from this report provides a compelling case for focused efforts to enhance digital literacy in rural communities, ensuring they are not left behind in the digital transformation.

The *Digital Education Action Plan* (2021-2027) outlines the European Union's strategies for enhancing digital education, including updating the European Digital Competence Framework to incorporate AI and data-related skills, and implementing the European Digital Skills Certificate. This plan is critical for understanding the broader educational framework that supports digital literacy, particularly in rural areas where educational resources may be limited. By focusing on enhancing digital education, the plan aims to equip all citizens with the necessary digital competences to thrive in a rapidly changing technological landscape.

The EU Digital Competence Framework (EU DigComp, 2021) provides a detailed structure for essential digital competences across the EU. It outlines key areas such as information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. EU DigComp Framework serves as a valuable tool for identifying specific digital skills that need to be developed in rural communities to enhance their digital literacy. By leveraging this framework, rural communities can systematically address their digital competence gaps and foster a more inclusive and capable digital society.

By integrating insights from these pivotal resources, we can better understand the digital and technological competences required to empower rural communities. This understanding will guide the development of the effective training programme (in Task 3.3) and initiatives tailored to the unique needs of rural areas, ensuring that all members of these communities can participate in and benefit from the digital era.

Digital Skills and Digital Literacy Needs in Rural Areas

Digital and technological competences play a crucial role in addressing key cross-cutting priorities such as social justice and inclusion, biodiversity, and climate change (see Table 12, Digital and Technological Competences Contributing to RURACTIVE Cross-Cutting Priorities – DTCCCP). This figure provides an overview of how digital and technological competences can contribute to address the cross-cutting priorities. It is important to note that not all competences indicated in Table 12 will be addressed and resolved by RURACTIVE. There will be a selection process to determine the specific competences on which to focus, which will be further detailed and decided in Task 3.3 on S*upporting RURACTIVE Dynamos in Overcoming the Digital Divide*. Competences presented in Table 12 form the baseline of the content, activities to be used during RURACTIVE *Train-of-Trainers (ToT) programme*.

Table 12. Digital and Technological Competences Contributing to RURACTIVE cross-cutting priorities

CROSS-CUTTING PRIORITIES Digital & technological competences	SOCIAL JUSTICE AND INCLUSION	BIODIVERSITY	CLIMATE CHANGE - MITIGATION	CLIMATE CHANGE - ADAPTATION
Information and data literacy	Training in information and data literacy, combined with AI technologies for data analysis, empowers groups at risk of exclusion and underrepresentation to access essential information & services.	Utilizing information and data literacy skills, rural communities can gather and analyse data on local biodiversity, helping to monitor and protect local ecosystems.	Data literacy skills enable communities to understand and analyse climate data, helping to develop strategies to reduce carbon footprints and promote sustainable practices.	Data literacy skills help communities analyse climate impact data, informing adaptation strategies such as improved agricultural practices to cope with changing weather patterns.
Digital communication and collaboration	Enhancing digital communication skills allows individuals in rural areas to participate in online forums and community decision-making processes, thereby fostering greater social integration and involvement in policymaking.	Digital communication tools can facilitate collaboration between rural communities and environmental organisations, promoting shared efforts in biodiversity conservation.	Digital collaboration platforms can connect rural communities with experts and resources to implement climate mitigation projects, such as renewable energy initiatives.	Digital communication tools enable the sharing of best practices and adaptation strategies between communities and experts, enhancing local resilience to climate impacts.
Digital content creation	Teaching digital content creation skills enables individuals to produce and share their own stories, cultural practices, and local news, thereby promoting cultural inclusion and visibility.	Creating digital content that highlights local biodiversity can raise awareness and engage broader audiences in conservation efforts.	Creating digital campaigns to promote energy-saving practices and renewable energy use can help mitigate climate change at the community level.	Developing digital educational materials on climate adaptation can inform and prepare communities for climate-related challenges.
Digital safety and cybersecurity	Training in digital safety and cybersecurity helps protect groups at risk of exclusion and underrepresentation from online threats, ensuring they can participate in the digital economy safely &confidently.	Ensuring digital safety when sharing sensitive environmental data helps protect biodiversity information from misuse or exploitation.	Protecting data related to climate initiatives ensures the integrity and confidentiality of information critical for climate action plans.	Ensuring the security of digital tools and data used in climate adaptation projects protects sensitive information and enhances trust in digital solutions.
Digital technologies for problem solving	Using digital tools for problem solving, such as decision-support systems, can help communities address local issues like efficient transportation, thus improving quality of life & social equity.	Applying digital problem-solving skills, such as using data analytics to track species populations and health, can inform conservation strategies and actions.	Using digital tools like energy management systems can optimize resource use and reduce greenhouse gas emissions, contributing to climate mitigation.	Using decision-support systems and IoT devices to monitor environmental changes and manage resources can enhance community resilience to climate impacts.
Digital technologies for rapid prototyping	Competences in rapid prototyping enable rural entrepreneurs to develop and test new products quickly, fostering innovation and economic inclusion.	Rapid prototyping technologies can be used to develop innovative solutions for biodiversity conservation, such as creating custom-made sensors for ecosystem/ biodiversity / soil monitoring.	Rapid prototyping technologies can develop new products that reduce energy consumption and carbon emissions, aiding climate mitigation efforts.	Rapid prototyping technologies can develop adaptive solutions such as flood barriers or efficient irrigation systems to mitigate the impacts of climate change.

These digital competences will provide groups at risk of exclusion and underrepresentation, especially elderly people, with digital skills to actively participate in our digital society, ensuring they can access essential services and interact with their families and communities. Furthermore, our ambition is that RURACTIVE can help specific groups at risk of social exclusion and underrepresentation develop digital skills for the digital economy, improving their employment opportunities, fostering economic growth, and addressing challenges in rural areas (according to *EC policy on Digital skills and jobs coalition*).

RURACTIVE will empower rural communities and support them in exploiting the opportunities offered by digital tools and solutions to trigger rural development, specifically working with elderly, women and young people. An explanation follows of which subcategories of digital competences will be in the focus in RURACTIVE:

- **Basic Digital Literacy.** Basic digital literacy is foundational for any further digital skills development. It includes understanding how to use digital devices such as smartphones, tablets, and computers, as well as navigating the internet effectively. According to the EU Digital Skills Divide Report (Eurostat, 2023) rural populations often lack these basic skills compared to their urban counterparts. This gap necessitates targeted initiatives to enhance basic digital literacy, making digital tools accessible and usable for all members of rural communities.

  Main target group: Elderly people. Elderly people, especially in rural areas, often have less exposure to digital technologies compared to younger generations, making the need for basic digital literacy more pronounced.

- **Information and Data Literacy.** Information and data literacy are crucial for managing, organising, and critically evaluating digital content. The DigComp framework highlights the importance of these skills, particularly in recognizing credible sources and understanding data privacy and security. Rural communities often lack access to training that can help them develop these competences, which are essential for both personal and professional activities.

  Main target group: Women. Women in rural areas often face barriers to education and professional development. Enhancing their information and data literacy can empower them to participate more fully in both personal and professional spheres.

- **Digital Communication and Collaboration.** Effective digital communication and collaboration are vital for engaging with broader networks and accessing remote work opportunities. Skills in using email, social media, and collaborative platforms such as Google Workspace or Microsoft Teams are necessary. The Smart Villages Initiative emphasizes the need for digital literacy to fully utilize broadband connectivity and benefit from digital services, which can enhance community engagement and economic activities.

Main target group: young people. Young people are often more adaptable to remote work environments and can benefit significantly from learning to use various collaborative platforms. This aligns with their career development and entry into the job market.

- **Digital Content Creation.** Creating and editing digital content, including text, images, videos, and websites, is essential for promoting local products and services. The Digital Education Action Plan (2021-2027) includes measures to update digital skills frameworks, including content creation and the ethical use of digital content. These competences enable rural communities to effectively communicate their unique offerings and connect with wider markets.

  Main target group: women. Women in rural areas can leverage digital content creation skills to start and grow small businesses, promoting local products and services effectively.

- **Problem Solving with Digital Technologies.** Using digital tools to solve local problems is an advanced skill that can drive innovation in rural areas. Skills in basic troubleshooting, as well as more advanced problem-solving using digital tools, are necessary. This includes the ability to use data analytics, AI, and other emerging technologies to address specific challenges faced by rural areas.

  Main target group: young people. Young people are typically more adaptable and open to learning about emerging technologies such as data analytics and AI, which are crucial for advanced problem-solving.

- **Digital Technologies for Rapid Prototyping.** Competences in utilizing digital software, coding environments, and digital fabrication technologies are essential for rapidly prototyping ideas and products to promote innovation and accelerate the digital transition in rural areas. This includes recognizing basic programming concepts and developing digital coding for the creation of applications and machines. Understanding the principles of rapid prototyping techniques such as 3D printing, CNC machining, and laser cutting is crucial, as it involves knowledge of digital design, materials, processes, and the limitations and strengths of each technique. Additionally, knowing electronic circuits design and digital tools for prototyping products is necessary. Being able to find and interact with open-source repositories to share, reuse, and accelerate prototyping processes further enhances the ability to innovate effectively within rural communities.

  Main target group: young people. Young people are early adopters and learners in advanced technologies, making them ideal for mastering digital tools and creating prototypes quickly. Their innovative mindset drives forward-thinking solutions in rural areas. Developing these skills prepares them for future job markets

and business opportunities, fostering economic growth and collaboration.

Although each subcategory has a specific target group, the rest of the groups can get involved and actively participate in developing digital skills, training the local community and contributing to Dynamos' innovations.

RURACTIVE Innovative Approach to Address Needs in Digital Skills

The Train-the-Trainers programme to be developed in RURACTIVE WP3 on *Upgraded learning, capacity building and knowledge transfer approaches for smart rural communities* in Task 3.3 on *Supporting RURACTIVE Dynamos in Overcoming the Digital Divide.* To support Dynamos in overcoming the digital divide, RURACTIVE will follow the approach "*from guided to an autonomous strategy*" (explained in Schmidt *et al.*, 2021 and seen in Figure 7).

The Train-the-Trainers programme in Task 3.3 will be co-designed by RURACTIVE Technical Partners and Dynamos to equip future RURACTIVE Local Community Trainers (LCT). Local Community Trainers in RURACTIVE Dynamos will act as "digital changemakers". LCT will be individuals or groups (organisations or informal collectives) who possess basic digital competences and the willingness to share these competences with other actors in their rural areas. LCT will be selected through open calls and will need to have an essential knowledge of the community challenges (e.g. to develop microsolutions as seen in Fig. 7). They will require to have basic digital skills, which will be expanded by RURACTIVE Task3.3 (phase Guided in Fig. 7). LCT will need to be motivated to drive actions in their communities (phase Autonomous in Fig. 7), and to build digitals skills by incorporating universal design (Meyer *et al.*, 2014) for learning principles to enhance an inclusive learning environment.

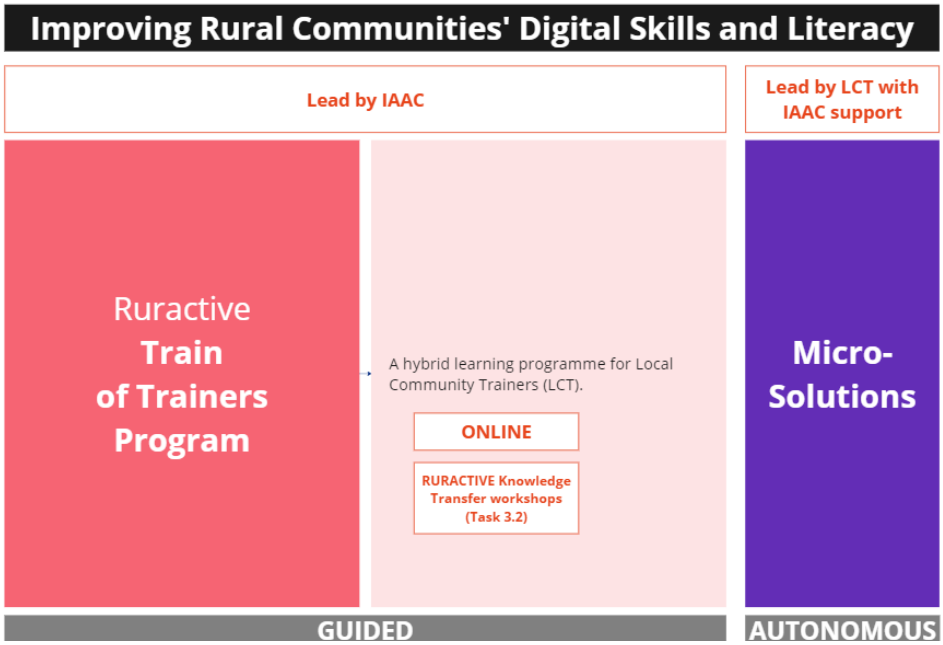

Figure 7. Train-of-Trainers Learning Process in RURACTIVE: From Guided to Autonomous

The Train-of-Trainers programme will emphasize practical know-how, adhering to STEAM learning principles and 'learning by doing' methodologies. It will be further enriched with thematic topics addressing RURACTIVE's cross-cutting priorities (Table 12) and the needs of Dynamos in digital skills and digital literacy including basic coding, internet of things, artificial intelligence, digital fabrication and circular maker practices.

The ToT programme will incorporate hands-on classes within a hybrid digital-physical learning environment, fostering local-based interventions. The aim of this is to promote interactive, practice-based capacity building and peer-learning. The ToT programme will be co-designed with Dynamos representatives and developed and implemented by month 17 of the RURACTIVE project (January 2025), alongside selected LCT, to support each Dynamo effectively.

The programme will be implemented in three phases and will be core activities of Task 3.3 on *Supporting Dynamos in overcoming the digital divide*:

Phase 1. Local Community Trainers (LCT) Selection: Trainers will be identified within local communities through open calls disseminated among local stakeholders and RIE networks. This outreach will be accompanied by collaboration with local educational institutions, NGOs, and community centres, and by hosting community workshops and events at which individuals will have opportunities to express their interest. This process will involve multiple steps including establishing selection criteria, conducting informational webinars and an evaluation process, between IAAC (leader of Task 3.3) and each Dynamo, to choose the most suitable candidates.

Phase 2. Training the Trainers: LCT will be trained by the IAAC team through online and in-person sessions. LCT will develop competences, knowledge and facilitation skills needed to autonomously train their local communities (possibly with the support of IAAC remotely).

Phase 3. Micro-solutions: Training sessions with local communities (with a focus on young people, women, elderly people and selected groups at risk of social exclusion and underrepresentation) will be conducted by the LCT, with support from the IAAC team (Task 3.3 Leader). Training materials will also be translated into e-learning courses and open educational resources (Task 3.4) to be integrated into Massive Open Online Courses (MOOCs) and other eLearning and gamified capacity building resources to be developed in RURACTIVE (Task 3.5) and inform masterclasses for science audiences and policymakers (Task 3.6).

Building a supportive community of local trainers will facilitate ongoing knowledge exchange and ensures the sustainability of digital literacy efforts. Accessible open educational resources will be developed to support these community trainers, providing them with the tools needed to be effective in disseminating digital knowledge within their local areas. By fostering a network of trained individuals, rural communities can continuously enhance their digital skills and adapt to technological advancements.

5. Concluding remarks

This report D3.1 is the outcome of RURACTIVE Task 3.1 on understanding learning needs and gaps for enhancing rural community-led innovation. To understand learning needs and gaps in rural Europe in six RURACTIVE RDDs, three types of knowledge have been employed: science-based evidence, evidence of the community of practice and insights of RURACTIVE Dynamo Partners. Learning needs and gaps in RURACTIVE are associated with missing competences to support innovative solutions in rural areas across the six RURACTIVE RDDs while considering cross-cutting priorities such as climate change mitigation and adaptation, biodiversity, and social justice and inclusion.

Findings from D3.1 suggest that learning needs and gaps in rural Europe are associated with both "hard" skills (technical, technological, and digital expertise) and "soft" skills (social, organisational and governance competences such as communication, community-building, collaboration, adaptability, participatory decision-making and policy engagement and advocacy). Leadership, good governance, financial, business, and digital competences are crucial for rural actors to actively engage in designing, implementing, and sustainably managing innovative solutions within their local rural innovation ecosystems (RIEs).

D3.1 findings suggest that addressing learning needs of rural actors to acquire digital competences (digital skills and digital literacy) is crucial for their integration into the digital economy and for fostering their innovation potential. Findings of D3.1 will inform subsequent RURACTIVE tasks, including the development of training materials and e-learning resources (T3.4), ensuring that the key learning needs of rural actors are addressed via online open courses (T3.5) to be produced in RURACTIVE, including on digital skills and digital literacy, as well as masterclasses for scientists and policymakers (T3.6).

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Annexes

Annex 1. RURACTIVE RDDs and cross-cutting priorities

Source: De Luca, et al., 2024; RURACTIVE Deliverable 2.1

RURACTIVE RDDs:	
Sustainable Multimodal mobility	Although sustainable transport services are key for the connection and wellbeing of rural inhabitants and for decarbonization goals, sustainable rural mobility has received less attention than urban mobility. Planning and provisioning of mobility services, such as demand-responsive transport and shared mobility, with the involvement of local stakeholders is key to answering site-specific challenges of rural areas and granting mobility solutions for all rural inhabitants. (Main source/sources: A long-term Vision for the EU's Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040; SMARTA 1 Rural Mobility Matters)
Energy transition and climate neutrality	While attention has been directed to climate neutral strategies in cities, rural areas are often neglected by climate action despite playing a crucial role in the green transition, including through the generation of renewable energy and facilitation or management of principal carbon sinks (soil and peat carbon, woodland expansion). In the rural context the energy transition is supported through the development of community-led solutions, including the creation of sustainable energy communities of prosumers, protection of carbon sinks by investing in Nature-Based Solutions (NBS), development of farm biogas/biofuel, efficient renewable energy use through forecasting services, extending the uptake of smart grids and smart meters to empower prosumers, promoting behavioural awareness and change. (Main source/sources: A Long-Term Vision for the EU's Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040)
Sustainable agrifood systems and ecosystem management	While rural agrifood systems and natural ecosystems are of primary importance for food production and ecosystem services, rural areas are facing challenges in achieving sustainable agrifood transformations. Introducing nature-based and digital solutions for the whole food supply chain (including food production, processing, distribution, consumption and resource re-cycling), as well as for agroecological practices that contribute to sustainable ecosystem management, is crucial for maintaining ecosystem health and contribute to social wellbeing of all rural communities. Sustainable agrifood systems support building resilient communities by providing job opportunities and adequate livelihoods for all while supporting synergies with other RDDs (i.e., nature-based and cultural tourism). (Main source/sources: A Long-Term Vision for the EU's Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040; Interreg programme SHAREs; Covenant of Majors; H2020 UNISECO)
Nature-based and cultural tourism	With an increasing interest in rural and proximity tourism raised during and after the COVID-19 pandemic, rural areas remain particularly suitable for nature-based and cultural tourism, responding to the willingness of travellers to learn about and experience the rural context. Nevertheless, rural communities struggle to manage tourism in a sustainable and smart way and to align decision-making with the needs of local communities and desires and expectations of tourists. These challenges can be tackled through the implementation of innovative solutions by provisioning services based on local resources that can be valued and organised to enhance tourism services. (Main source/sources: A Long-Term Vision for the EU's Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040; Behavioural changes in tourism in times of Covid-19, JRC)
Culture and cultural innovation	While culture is recognized to be a fundamental dimension of sustainable development (4th pillar) both in urban and non-urban areas, rural areas are often not seen as cultural hubs and centres for creativity. Both tangible heritage and intangible heritage, represented by arts, festivals, music, artisan and crafts, dance and local traditions, are assets which are significant in sustainable and inclusive innovation. The use of digital, technological and social innovations can make culture

	accessible to a wide range of groups including young people, women, migrants, old people, and people with disabilities, and improve the quality of life for all in rural areas. (Main source/sources: A Long-Term Vision for the EU's Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040; The role of culture in non-urban areas of the European Union)
Local services, health and wellbeing	Lack of access to basic services such as housing, healthcare, or e-governance in combination with ageing and depopulation, are key issues that inhibit the sustainable development of rural areas. The introduction of innovations such as digital platforms for managing a wide range of services, or solutions for further increasing the provisioning of services, can mitigate barriers to accessing care and improve quality of life and wellbeing of all rural inhabitants. (Main source/sources: A Long-Term Vision for the EU's Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040)
CROSS CUTTING PRIORITIES IN RURACTIVE:	
Climate change adaptation	Climate change adaptation is the process of adjusting, preparing and responding to actual or expected climate change effects and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise. It is not a one-time emergency response, but a series of proactive measures to deal with the nexus of hazard (e.g. drought, sea level rise), exposure (e.g. less water in the South), and vulnerability (e.g. poverty or lack of education). Adaptation measures include, for example, infrastructure changes, as well governance, behavioural and economic shifts. (Main source/sources: European Environment Agency; Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change; European Climate Law)
Climate change mitigation	Climate change mitigation refers to actions or activities that make the impacts of climate change less severe by reducing the emissions, enhancing their sinks, and removing greenhouse gasses (GHGs) from the atmosphere. Mitigation includes reducing the GHGs emitted from energy production and use, land use, and methods to mitigate warming, for example, by carbon sinks which remove emissions from the atmosphere through land-use or other (including artificial) mechanisms. (Main source/sources: European Environment Agency; Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change)
Biodiversity	Biodiversity refers to the variety of ecosystems, species and genes in the world or in a particular habitat. It has intrinsic value, and it is instrumental to human wellbeing, as it delivers ecosystem services, or the services that nature supplies that sustain economies and societies. (Main source/sources: European Commission, Directorate-General for Environment, EU Biodiversity Strategy for 2030; Nature Restoration Law)
Social justice and inclusion	Social inclusion and justice seek to ensure that all citizens have the equal opportunities and resources necessary to participate fully in economic, social and cultural life and to enjoy an equitable environment and a standard of living and wellbeing. It encompasses, but is not restricted to, social integration, better access to the labour market, equal access to facilities, services and benefits, as well as involvement in policies and investments, developing and implementation of solutions for human wellbeing. (Main source/sources: European network for rural development; European Foundation for the Improvement of Living and Working Condition)

Annex 2. Learning needs in groups at risk of social exclusion and underrepresentation

In 2019, around 23.6% of the rural population in Europe was at risk of poverty or social exclusion (Source: European Network of Rural Development 2021). To promote diversity, inclusion and equity within rural communities and enhance rural development, it is crucial to address the specific learning needs and gaps of these groups at risk of social exclusion and underrepresentation. Such groups encounter a multitude of barriers to learning. These barriers include situational factors like financial constraints and family responsibilities, institutional challenges such as inflexible course offerings, and dispositional obstacles like lack of confidence or interest. Furthermore, barriers related to cost, childcare, awareness, and guidance exacerbate the challenges they face (Source:Barriers to learning for disadvantaged groups (learningandwork.org.uk)).

According to the European Academy for Sustainable Rural Development also mental health issues, disabilities, and social norms further hinder participation in learning. When these challenges are compounded, learning becomes even less likely for residents of rural and remote areas. Regardless of the cause, when individuals feel excluded from services or opportunities, the barriers and issues often increase (Source: 5thGuide.qxd (euracademy.org), p. 60). By providing tailored learning opportunities and support services, rural development initiatives can empower groups at risk of social exclusion and underrepresentation to overcome such barriers and actively engage in community life, and economic activities and thus ensure inclusive, sustainable development that benefits all members of society. Therefore, understanding the learning needs and gaps these groups is essential for effectively addressing their challenges.

Based on the definition of the *European Network of Rural Development*, RURACTIVE considers the following groups at risk of exclusion and underrepresentation are in Europe: Youth, women, elderly people, people with disabilities and migrants. Across all these groups there are some key aspects that can influence social exclusion and inequity. These encompass a range of elements, such as limited access to resources (including information, knowledge, and technology), restricted access to political power and representation, social capital including networks and connections, cultural beliefs and customs, individuals with physical limitations, and the type and density of infrastructure (Cutter, 2001; Tierney, et al, 2001; Putnam, 2000; Blaikie et al., 1994). Social Vulnerability to Environmental Hazards* (wiley.com) p.244.) Exploring the diverse learning needs of specific groups at risk of exclusion and underrepresentation reveals a range of challenges and opportunities for tailored support and intervention. Within each group, distinct requirements and gaps emerge, highlighting the importance of targeted approaches to address their educational needs effectively.

Youth: Young people living in rural areas suffer more than other age groups from unemployment, difficult access to education and training, obstacles to set up new businesses, and lack of basic service, often causing young people migration to bigger towns and cities. In rural areas, young people encounter challenges similar to urban areas. However, the major issue revolves around rural youth facing exclusion from the job market, mainly due to difficulties accessing crucial services such as education, training, and transportation in rural areas. Additional social barriers pose significant obstacles to their full engagement in social activities related to leisure opportunities, and cultural life, which further contribute to their exclusion and disadvantage. Structural issues within the labour market, particularly in the low-skilled agricultural sector, compound these challenges,

especially for educated young women, pushing them toward urban centers in search of better opportunities. (Source: European Commission 2008)

Women: Women have always played a key role in the development and sustainability of the agricultural sector and rural areas more generally. Yet their role and contribution – both on and off-farm – are still undervalued and understated. According to the report of "Poverty and social exclusion in rural areas" challenges to labour market participation and social inclusion are particularly acute for women due to factors such as limited access to education and employment opportunities. Especially in regions where agricultural jobs predominate, they often face greater difficulties in finding suitable employment. Cultural norms and traditional gender roles further influence women's decisions regarding labour market participation, with informal caregiving arrangements (childcare and elderly care) often hindering their ability to work outside the home. Additionally, the geographical remoteness and the lack of social services may further contribute to disparities in employment prospects for women. (Source: European Commission 2008)

Elderly people: Elderly people often face isolation, social exclusion and difficult access to basic services, such as health care, transportation, civic participation etc.). Europe's aging population, marked by declining birth rates and longer life expectancy, is a prevailing trend across most countries. In rural areas, where the elderly constitute a significant portion of the population, issues of social exclusion often stem from economic challenges like poverty and limited access to essential services. Factors such as restricted mobility, inadequate healthcare accessibility, and diminishing community support exacerbate the isolation experienced by rural elders, particularly affecting women. (Source: European Commission 2008)

People with disabilities: The lack of specialised support services for people with disabilities can be one of the major barriers to their living independently in rural areas.

Migrants: Migrants residing in rural areas and mostly working in temporary and precarious agriculture job are a particularly underrepresented group mostly left out from decision making processes and practices.

Ethnic minorities: In rural areas, social exclusion among ethnic minorities, particularly the Roma population in Eastern countries, often stems from a combination of poverty and cultural factors. Limited access to essential services and discrimination contribute to their marginalization, with issues ranging from employment and education to housing and healthcare. Similarly, immigrants in rural areas face unique risks, including precarious employment in informal sectors, particularly prevalent in regions with strong seasonal economies like Southern Europe. (Source: European Commission 2008) .