

Title: Designing Inclusive Digital Capacity Building in Rural Innovation Contexts through Multi-Actor Platforms

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Abstract

Digitalisation is a central driver of regional transformation and a key dimension of the twin transition affecting European rural areas. Despite ambitious EU strategies, persistent digital divides remain: rural regions continue to lag behind urban areas not only in infrastructure provision but also in digital skills attainment and effective technology uptake. While DigComp has become the main institutional reference framework for digital competence development at EU level, limited empirical attention has been devoted to how such frameworks are operationalised within territorially embedded innovation processes. This paper asks: how can digital skills and competence development be operationalised across diverse EU rural contexts by combining DigComp as a non-prescriptive framework with participatory and context-sensitive approaches? We adopt DigComp 3.0 as a conceptual starting point and interpret it as a boundary object that provides a shared vocabulary for competence development. The study examines six rural Multi-Actor Pilots (MAPs) within the Horizon Europe project FUTURAL, which prototypes community-led Smart Solutions addressing local societal, environmental, and economic challenges. The MAPs function as territorially embedded innovation platforms where digital competence development is linked to technological deployment through co-created training strategies. Methodologically, the research applies a multi-sited comparative design based on mixed methods, combining structured post-workshop surveys with qualitative data from workshops, pilot documentation, and MAP leaders' reflections. A harmonised capacity-building framework has been used to ensure comparability, while training design remains context-sensitive, incorporating literacy adaptation, accessibility measures, multilingual materials, and differentiated competence levels. Preliminary findings indicate that competence building strategies are calibrated to the intended user base of each Smart Solution, ranging from specialised stakeholders to broader community groups. The results illustrate how participatory approaches grounded in DigComp can support territorially embedded human capital formation, reinforcing the role of capacity building as a driver of rural digital transition.

Long Abstract

Digitalisation has become a central driver of regional transformation across Europe and, together with the environmental challenge, it constitutes one of the main dimensions of the twin transition that rural areas are currently facing (Brunori 2022). Yet persistent digital divides continue to shape unequal development trajectories, with rural regions systematically lagging behind urban areas not only in digital infrastructures, but also in digital skills attainment and effective technology uptake (Salemink et al. 2017). According to Eurostat (2025), across 24 of the 27 EU countries, in 2023 only 47.5% of individuals aged 16–74 living in rural areas possess at least basic digital skills, compared to 62.6% in urban regions, with disparities particularly pronounced in advanced expertise such as digital content creation. In response, the European Union has set ambitious strategies such as the 2030 Digital Decade policy program, operationalized through cross-sector policy frameworks as the Digital Education Action Plan (2021–2027), the updated European Skills Agenda, and rural-focused initiatives under the Long-Term Vision for Rural Areas, aimed at strengthening digital competences and reducing territorial disparities.

However, the implementation of these strategic objectives remains heterogeneous across Europe's diverse rural contexts (Feurich et al. 2024). While policy frameworks articulate clear ambitions, there is limited guidance on how digital competence frameworks should be translated into structured capacity building programmes aligned with innovation processes. Among the existing competence frameworks in the digital field, the DigiComp represents the mostly institutionally recognized at EU level, developed by the European Commission's Joint Research Centre and first released in 2013 (Ferrari, 2013), with subsequent updates (Vuorikari et al. 2022) culminating in its most recent version, DigComp 3.0 (Cosgrove and Cachia 2025).

To date however, limited empirical attention has been paid to the translation of such frameworks in digital skills and competences development of different territorial contexts, in terms of processes, methods and/or evidences (Ashmore et al. 2021; Rundel and Salemink 2021). Moreover, in the current territorially tailored digital competence interventions, Digital competence frameworks and technological innovation initiatives are frequently implemented in parallel, yet their integration within locally grounded innovation processes remains insufficiently examined. In particular, the contribution of capacity building to regional human capital formation and the mitigation of spatial digital inequalities in rural areas requires further empirical investigation. Capacity building, understood as structured initiatives designed to strengthen the knowledge, competencies and resources of individuals and communities (Giua and Moretti 2024), has indeed emerged as a critical instrument for territorial development (Pertoldi et al. 2022). Yet evidence from rural digital initiatives suggests that training programs often struggle to

engage rural citizens when detached from local realities (Salemink et al. 2017), whereas participatory and context-sensitive approaches are more effective in fostering sustained engagement and demonstrable value creation (Roberts et al. 2017). Without such locally embedded human capital development, the deployment of digital technologies risks generating limited impacts, as technological infrastructures and innovation alone do not automatically translate into effective adoption, nor into innovation-driven territorial transformation (Ofori et al. 2025; Stojanova et al. 2022).

From these reflections our main research question originates: how can digital skills and competence development be operationalized across diverse EU rural contexts by combining DigComp as a non-prescriptive framework with participatory and context-sensitive approaches? To address this question, we adopt DigComp 3.0 (Digital Competence Framework for Citizens) (Cosgrove and Cachia 2025) as our conceptual starting point. DigComp 3.0 provides a comprehensive and citizen-oriented structure for digital competence development, organised into five competence areas: 1. information and data literacy; 2. communication and collaboration; 3. digital content creation; 4. safety; and 5. problem solving, all articulated across progressive proficiency levels. Building on this framework, we conceptualise competence development not as the mere acquisition of technical skills, but as a territorially embedded process requiring structured and context-sensitive support mechanisms. Additionally, this paper examines the knowledge development dynamics within the Horizon Europe project FUTURAL, which prototypes, tests, and demonstrates community-led social, technological, and business innovations across diverse rural territories. FUTURAL delivers a portfolio of digital Smart Solutions designed to address key societal, environmental, and economic challenges identified by local actors. The project is structured around Multi Actor Pilots (hereafter MAPs), which function as territorially embedded innovation platforms, similar to Living Labs. These MAPs bring together universities, technology providers, local administrations, and community organisations to co-design and implement digital solutions tailored to local challenges.

By adopting six rural MAPs as multiple case studies, this study explores how digital competence development is approached within innovation pilots and how the DigComp framework informs the design of co-created training strategies linked to Smart Solution functionalities. In doing so, the paper investigates the role of multi-actor pilots as experimental spaces for understanding and developing human capital formation in the digital transition. It explores how competence building processes can be aligned with real technological deployment and contribute to empowering local actors' capacity to address key societal, environmental, and economic challenges.

As mentioned, DigComp 3.0 is conceptualised not as a prescriptive tool, but as a boundary object that facilitates coordination among heterogeneous actors. It provides a shared vocabulary through which MAPs can articulate competence needs linked to Smart Solution deployment. However, its relevance emerges only when operationalised selectively and translated through local co-design processes. Inclusion has also been embedded at the training design stage and integrated directly with technological functionality, rather than treated as an add-on. This positioning reframes capacity building as a mechanism of regional skill formation, bridging technological innovation and territorial capability development. By aligning competence differentiation (from very low to advanced levels) with real use cases and accessibility adaptations, DigComp becomes meaningful through practice, anchored in local realities and responsive to vulnerable rural groups. In this way, competence development is embedded within innovation pilots as part of adaptation dynamics rather than as a standalone educational intervention. This paper aims to contribute to a deeper understanding of how rural regions can navigate digital transition pathways by designing and testing a place-based capacity building program. In doing so we explore how digital transformation depends not only on technological deployment but on locally tailored human capital formation.

Data and Methodology

The research adopts a multi-sited comparative design based on mixed methods, combining structured feedback surveys administered after capacity building workshops with qualitative data collected through workshops, pilot documentation, and MAP leaders' reflections. Workshop feedback instruments provide standardised measures of satisfaction, relevance, competence development, and adoption intention, while qualitative evidence captures contextual dynamics. Comparability across pilots is ensured through a harmonised capacity building strategy, common evaluation instruments, and shared operationalisation of DigComp as a competence tool. At the same time, variation is intentionally preserved in training content, delivery modalities, and solution alignment to reflect local needs, literacy levels, and technological contexts. Operational translation mechanisms include low literacy adaptation strategies, elderly accessibility measures, inclusion of participants with visual or hearing impairments, multilingual materials, and competence level differentiation ranging from very low to advanced proficiency. Structured competence development is directly linked to the development of Smart Solutions within heterogeneous rural innovation ecosystems.

Preliminary Findings

As the implementation of the Capacity Building program is still ongoing¹, the analysis presented here draws on emerging evidence rather than final impact results. Each MAP has been asked to select target groups aligned with the specific Smart Solution under development. In some pilots, participation is limited to highly specialised stakeholders, such as technicians or sectoral experts, who already possess advanced digital competences. In these cases, capacity building focuses primarily on the operational use of Smart Solution. In contrast, other pilots engage broader segments of the local community, including farmers, citizens, or school pupils, particularly where solutions such as e-learning platforms or community digital services are being developed. In these contexts, training begins with foundational digital competences and progressively builds towards solution-specific skills. This differentiation illustrates how competence building strategies are calibrated to the intended user base of each Smart Solution. This heterogeneity provides an opportunity to examine how territorially embedded digital human capital formation adapts to differing starting points and innovation objectives across rural contexts. Furthermore, the preliminary empirical results illustrate the operationalisation of a participatory and context-based approach based on the DigiComp framework. The results will allow feedback to be collected and cases to be compared and discussed in order to identify factors that may explain better performance in terms of overall satisfaction and the development of skills and competences.

¹ It will be completed in May 2026.

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