

Digital Inclusion in Rural Communities: Lessons from FUTURAL

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Abstract: Rural areas across Europe face persistent challenges, including limited connectivity, digital illiteracy, and social exclusion, all of which hinder socio-economic development and resilience. The FUTURAL project addresses these barriers by developing, testing and demonstrating digital Smart Solutions (SS) across six Multi-Actor Pilots (MAPs) to foster digital inclusion, sustainability, and empowerment in rural communities. Using participatory co-creation methodologies, capacity-building programs, and accessible digital platforms, FUTURAL empowers rural stakeholders to co-develop tailored solutions that meet their unique needs while placing them at the forefront of innovation. This paper explores the project's strategies, preliminary outcomes, and policy implications, demonstrating how tailored, community-driven approaches can bridge the digital divide and contribute to sustainable rural development in Europe. Preliminary findings indicate that FUTURAL's participatory methodologies and tailored digital tools significantly enhance digital inclusion and promote socio-economic resilience in rural areas.

Keywords: Digital inclusion; Rural development; Smart solutions; Co-creation; Participatory governance; Digital literacy; Sustainable development; EU policy; Circular bioeconomy; Smart villages

1. Introduction

Rural areas are integral to Europe's cultural, economic, and environmental landscape, housing over 137 million people and covering 80% of the continent's territory. Despite their significance, these areas face persistent challenges, including population decline, ageing demographics, limited access to essential services, and an ever-widening digital divide. As digital technologies increasingly shape economic, social, and environmental systems, rural communities risk being left behind, excluded from the benefits of this transformative shift. Digital inclusion is more than just providing access to technology—it involves equitable access to connectivity, digital skills, and opportunities to engage in the digital economy. In rural contexts, this requires addressing unique barriers such as geographic isolation, affordability constraints, and socio-demographic inequalities that hinder technology adoption. The European Union's long-term vision for rural areas emphasises digital inclusion as a key driver for achieving resilience, connectivity, and sustainability (European Commission, 2018, 2021).

In line with this vision, the FUTURAL project seeks to empower rural communities by implementing innovative digital SS designed to address their unique challenges. Through participatory methodologies and capacity-building initiatives, FUTURAL enables rural communities to take an active role in shaping their digital futures. Spanning six diverse Multi-Actor Pilots (MAPs), the project integrates technological innovation with local needs, tackling systemic barriers and fostering co-created solutions that are both

relevant and impactful for stakeholders (FUTURAL Project, 2024). This paper examines the challenges and opportunities of digital inclusion in rural areas, explores the strategies adopted by FUTURAL, and reflects on the early lessons emerging from its implementation. Through a focus on inclusivity, sustainability, and community-driven innovation, FUTURAL demonstrates the potential of bridging the digital divide to foster resilient, connected, and thriving rural communities.

The Digital Divide in Rural Areas: Challenges and Pathways to Inclusion

Rural areas across Europe face significant and entrenched barriers to digital inclusion, which hinder their ability to fully benefit from technological advancements and contribute to socio-economic development. Limited connectivity remains a primary challenge. Geographic isolation and low population density deter investment in broadband infrastructure, leaving many communities without access to essential digital services. This urban-rural divide is stark: only 20% of rural households in Europe have access to high-speed internet, compared to significantly higher percentages in urban areas (Organisation for Economic Co-operation and Development, 2018). Even where infrastructure is available, the quality and speed of services often lag behind urban standards. Affordability further exacerbates the issue. The high costs associated with devices and internet services disproportionately affect low-income households, making technology adoption prohibitively expensive for many rural residents. In 2022, approximately 2.4% of people in the European Union could not afford internet access, underscoring the economic barriers to digital inclusion (World Economic Forum, 2023). This financial disparity not only restricts individual access but also prevents rural communities from leveraging digital tools to address broader socio-economic challenges. Digital illiteracy represents another critical barrier to inclusion. Many rural populations lack access to the training and resources necessary to develop the digital skills required to navigate modern tools. This gap is particularly pronounced among older adults and underserved groups, who face significant challenges in acquiring digital competencies. In 2021, only 20% of individuals in rural EU areas possessed above-basic digital skills, compared to 33% in urban centres (Eurostat, 2023). This disparity limits opportunities for rural residents to engage with digital services, participate in governance, and access economic opportunities. Demographic factors compound these challenges. Ageing populations and youth migration reduce the pool of digitally literate residents, creating a cycle of exclusion that is difficult to break. Women in rural areas face systemic barriers to digital participation, including limited access to training and fewer opportunities to engage in decision-making processes. This gender gap further undermines efforts to achieve inclusive digital transformation in rural settings. Cultural resistance also plays a role, as some communities view new technologies with skepticism or question their relevance. This mistrust often stems from a lack of exposure to digital tools, a fear of change, or a perception that innovations are imposed without considering local contexts and needs (Rantanen & Toikko, 2024). These factors collectively marginalize rural areas, restricting their access to education, governance, and economic opportunities in an increasingly digital world. Addressing these challenges is essential to ensuring that rural areas are not left behind in Europe's digital transformation. The digital divide not only limits individual opportunities but also perpetuates broader socio-economic inequalities, undermining the resilience and sustainability of rural communities. Bridging this divide requires comprehensive strategies that integrate infrastructure development, affordability measures, capacity-building initiatives, and culturally sensitive approaches to technology adoption. For example, targeted investments in rural broadband infrastructure could help close the connectivity gap, while subsidized access to devices and services could alleviate affordability challenges. Similarly, digital literacy programs tailored to the needs of older adults, women, and underserved groups could empower more residents to participate in the digital economy. Holistic and inclusive efforts are necessary to enable rural areas to fully engage with and benefit from digital advancements. By addressing systemic barriers and promoting equitable access, rural communities can become active participants in Europe's digital transformation, contributing to a more connected, resilient, and sustainable future.

2. FUTURAL's Approach to Digital Inclusion

FUTURAL embeds digital inclusion into its core methodology, recognising that equitable access to and effective use of digital tools are critical for sustainable rural development. The project's approach integrates accessible digital tools, targeted capacity-building initiatives, and participatory co-creation methodologies to tackle the unique challenges faced by rural communities. By addressing connectivity, affordability, and literacy barriers, FUTURAL ensures that technological advancements benefit rural populations and foster inclusive transformation.

Accessible Digital Tools

FUTURAL's Smart Solutions reflect the EU's vision of leveraging digital innovation to revitalise rural areas, as outlined in the Smart Villages initiatives (European Network for Rural Development, 2018). They are designed to be intuitive, adaptable, and relevant to the diverse needs of rural communities. By combining advanced functionality with user-friendly interfaces, these tools empower rural residents to address pressing challenges and seize new opportunities. For example, the Citizen Engagement Platform, piloted in Jonava, Lithuania, serves as a digital bridge between residents and local authorities, enabling meaningful participation in eGovernment initiatives and policy co-creation. Designed to empower citizens, the platform allows users to report community issues—such as infrastructure damage or waste management concerns—directly to municipal officials. Branded as Man Rūpi ("I Care"), it promotes transparency by offering real-time updates on reported issues and fosters accountability by ensuring residents are informed about actions taken. This innovative tool not only enhances civic participation but also strengthens trust and collaboration between citizens and governance systems, making it a model for inclusive digital governance in rural areas. Similarly, the Lifelong Learning Platform, implemented in Birda, Romania, and Kythira, Greece, serves as a comprehensive digital education tool designed to meet the unique learning needs of rural communities. The platform delivers open-access courses on topics such as sustainable resource management, precision agriculture and specialized agricultural practices equipping participants with practical skills to address local challenges and opportunities. By incorporating multimedia content and local languages, it ensures accessibility and engagement for diverse audiences, including farmers, small business owners, and community leaders. This innovative approach to lifelong learning not only bridges educational gaps but also fosters economic resilience and sustainable practices, empowering rural communities to thrive in an evolving digital landscape. These tools not only enhance individual skill sets but also contribute to broader community resilience by addressing knowledge gaps and fostering innovation. Another example is the Circular Bioeconomy Platform, which will be piloted in Pongau, Austria, to facilitate the transition toward a circular bioeconomy in rural areas. This innovative digital tool enables the efficient exchange, upcycling, and reuse of local resources such as biomass, food, and building materials. Equipped with a powerful decision-support system, the platform uses techniques like mind-mapping of resource flows, multi-criteria analysis, and material flow diagrams to help stakeholders visualize potential circular economy scenarios. By providing clear and actionable insights, it aims to transform regional waste streams—such as ashes from biomass heating plants, sewage sludge from wastewater treatment, and food waste from tourism—into valuable resources. Through these capabilities, the Circular Bioeconomy Platform exemplifies how digital innovation can drive sustainability, reduce waste, and promote economic resilience in rural communities.

Capacity Building

Beyond providing digital tools, FUTURAL places significant emphasis on capacity building to empower rural stakeholders with the skills and knowledge needed to maximize the potential of these technologies. Recognizing that access alone is not enough, FUTURAL invests in equipping communities with the

ability to confidently navigate and apply digital tools in ways that address their specific needs and challenges. This involves a combination of hands-on workshops, targeted training sessions, and accessible online resources tailored to diverse user groups. Workshops and training sessions focus on teaching rural communities how to effectively use the SS. These sessions are often conducted in collaboration with local experts, ensuring that the content is contextually relevant and easily relatable for participants. For example, training on the Circular Bioeconomy Platform might include demonstrations on how to map and analyze resource flows, helping participants understand how to implement upcycling strategies for regional waste streams.

Participatory Co-Creation

Central to FUTURAL's methodology is the co-creation of SS with local stakeholders. This participatory approach ensures that digital tools are tailored to the specific needs and priorities of each MAP. By actively involving community members—such as policymakers, farmers, and educators—in the design and implementation process, FUTURAL builds trust, fosters a sense of ownership, and increases adoption rates. For instance, the Citizen Engagement Platform in Jonava is being co-developed with input from local residents, who identified essential features like real-time tracking and direct communication channels. Similarly, the Circular Bioeconomy Platform in Pongau is being designed in collaboration with local waste management authorities and community groups, ensuring its functionality aligns with regional priorities and sustainability goals.

The Role of Digital Tools in Transforming Rural Areas

The transformative role of digital tools in rural areas cannot be overstated, as they offer innovative solutions to long-standing challenges while creating new opportunities for growth and collaboration. FUTURAL's SS exemplify how digital tools can catalyse change across multiple domains, fostering resilience, inclusivity, and sustainability. Digital tools enhance civic participation by empowering rural residents to engage more actively in governance processes. For instance, the Citizen Engagement Platform piloted in Jonava, Lithuania, allows residents to report local issues, track their resolution in real time, and communicate directly with municipal decision-makers. This fosters greater transparency and trust between citizens and authorities, ensuring that governance is both inclusive and responsive to community needs. In education and skills development, the Lifelong Learning Platform bridges critical gaps by offering tailored courses designed to meet the unique challenges of rural communities. Participants can learn practical skills in areas such as sustainable farming, resource management, and specialized agricultural practices. By equipping residents with relevant knowledge, these opportunities not only enhance individual economic prospects but also contribute to the environmental and economic sustainability of the region. Sustainable resource management is another area where digital tools are making a significant impact. Platforms such as the Circular Bioeconomy Platform help communities harness data to manage resources more efficiently. By promoting the upcycling of food, biomass, and other materials, the platform reduces waste and creates new economic opportunities. Similarly, the Hydrological Modeling Platform employs predictive analytics to address water management challenges, supporting communities as they adapt to climate-related risks such as flooding and droughts. Social cohesion is also strengthened through the use of digital tools (ITU, 2021). Platforms like the Accessibility Analysis Platform, tested in Westhoek, Belgium, and Durangaldea, Spain, help identify and address gaps in essential services, including healthcare and transportation. By fostering collaboration and dialogue among community stakeholders, these tools build stronger networks and promote a sense of collective action and belonging. These examples demonstrate the transformative potential of digital tools in rural areas, showing how they can address persistent barriers while unlocking opportunities for growth, innovation, and resilience. The integration of such tools is a critical step in enabling rural communities to

participate fully in Europe's digital transformation and in shaping a future that is both inclusive and sustainable.

3. Early Insights and Lessons Learned from FUTURAL

As FUTURAL progresses, the project has begun to uncover valuable lessons about the complexities of achieving digital inclusion in rural areas. These lessons highlight the importance of tailoring solutions to local contexts, fostering collaboration, and establishing trust among stakeholders. Each of these elements plays a critical role in ensuring that digital tools are not only adopted but also create long-term positive impacts in rural communities.

Tailoring Solutions to Local Contexts

One of the most significant lessons learned from FUTURAL is the necessity of tailoring digital solutions to meet the unique needs of individual rural areas. Rural communities across Europe are incredibly diverse, with distinct economic conditions, cultural values, environmental challenges, and varying levels of digital readiness. A one-size-fits-all approach to digital inclusion is insufficient in addressing these differences. Instead, FUTURAL employs a co-creation methodology to ensure that digital tools are designed, developed, and implemented in ways that align with local contexts. The co-creation process is central to FUTURAL's approach, actively involving local stakeholders—such as policymakers, community leaders, and practitioners—throughout the development lifecycle of SS. Stakeholders participate in workshops, focus groups, and iterative feedback sessions to identify their community's priorities, challenges, and goals. This participatory approach allows the solutions to reflect local realities and ensures that they are both relevant and actionable. By fostering collaboration during the design phase, co-creation builds trust and ownership among stakeholders. Local voices are not only heard but are also integral to shaping the functionality and delivery of the tools. This inclusivity not only enhances the usability of the solutions but also increases the likelihood of successful adoption. FUTURAL's commitment to co-creation highlights the importance of understanding and respecting the unique characteristics of rural areas to ensure the long-term success of digital inclusion initiatives. For instance, the Citizen Engagement Platform piloted in Jonava, Lithuania, is specifically adapted to meet the needs of the local community. By incorporating user-friendly interfaces and allowing residents to report issues such as infrastructure damage or waste management, the platform addresses Jonava's priorities while fostering a stronger relationship between citizens and local authorities. Similarly, the Lifelong Learning Platform in Birda, Romania, and Kythira, Greece, is designed with multimedia content, such as videos, interactive modules, and visual aids, presented in the local languages to ensure accessibility and engagement. This approach ensures that the platform meets the educational needs of the local population, including farmers, small business owners, and other rural stakeholders, by making complex concepts easier to understand and culturally relevant. These tailored approaches ensure that digital solutions are relevant, practical, and readily embraced by the communities they serve.

Collaboration is Key

Another vital lesson from FUTURAL is the role of collaboration in overcoming challenges and driving the successful adoption of digital tools. Rural innovation cannot happen in silos. Instead, partnerships between public institutions, private companies, and community organizations are essential for pooling resources, sharing expertise, and creating solutions that address multiple dimensions of rural challenges. In FUTURAL's pilots, collaboration has proven instrumental. Public institutions, such as municipal governments, have provided access to data and policy frameworks that guide the implementation of digital tools. SMEs and NGOs, have contributed their technical expertise to develop platforms like the Circular Bioeconomy Platform and the Accessibility Analysis Platform. Community organizations, on the

other hand, have played a crucial role in fostering trust and ensuring that local voices are represented in the decision-making process. For example, the Circular Bioeconomy Platform piloted in Pongau, Austria, was made possible through collaboration between local waste management authorities, technology providers, and community groups. This partnership allowed the platform to map resource flows and develop actionable scenarios for upcycling materials, simultaneously addressing economic and environmental concerns. Such collaborations demonstrate how different sectors can work together to ensure that digital inclusion initiatives are well-rounded, effective, and sustainable.

Trust Drives Adoption

Building trust in digital tools is another crucial factor for their successful adoption. Rural communities may initially view new technologies with skepticism, particularly if they perceive them as being imposed from external entities without sufficient understanding of local needs. FUTURAL addresses this challenge through transparent communication, participatory design, and the demonstration of tangible benefits. The co-creation approach used in FUTURAL ensures that communities are involved from the very beginning, giving them a sense of ownership over the solutions being developed. By engaging stakeholders in workshops, focus groups, and iterative testing, the project fosters a collaborative environment where community members feel heard and valued. For example, the Citizen Engagement Platform in Jonava, Lithuania, is being developed with input from local residents who identified the specific features they needed, such as real-time issue tracking and direct communication channels with municipal authorities. This participatory approach not only enhances the platform's relevance but also builds trust in its effectiveness. Visible impact is another driver of trust. When rural stakeholders anticipate tangible improvements resulting from digital tools, they become more likely to engage with and adopt these solutions. In Westhoek, Belgium, the Accessibility Analysis Platform, currently in its prototype phase, is being designed to identify gaps in critical services such as healthcare and transportation. Once fully operational, it will provide actionable data to inform policy decisions and guide infrastructure improvements. By addressing specific community needs, the platform aims to demonstrate its utility and build trust among users, showcasing the potential of digital tools to drive meaningful change in rural areas.

Essential Principles for Advancing Digital Inclusion

Although FUTURAL is still in its early stages, several essential principles for advancing digital inclusion have emerged:

- ➔ **Tailored Solutions Are Imperative:** Addressing the unique characteristics of rural communities requires flexibility and locally relevant solutions. Co-creation ensures that digital tools align with community needs and priorities, fostering adoption and long-term sustainability.
- ➔ **Collaboration Enhances Impact:** Partnerships among diverse stakeholders—including public institutions, private companies, and community organisations—enable resource sharing, expertise integration, and holistic problem-solving, which are critical for addressing the multifaceted challenges of digital inclusion.
- ➔ **Trust is the Foundation of Adoption:** Transparent communication, participatory design, and visible impacts build trust, increasing community confidence in digital tools and accelerating their adoption.

By integrating these principles into its ongoing activities, FUTURAL not only addresses the barriers to digital inclusion but also sets the foundation for rural communities to thrive in an increasingly digital

world. Through innovation, collaboration, and empowerment, FUTURAL demonstrates how rural areas can be active participants—and leaders—in Europe’s digital transformation.

4. Anticipated Impact and Policy Implications

FUTURAL is set to make substantial contributions to advancing digital inclusion in rural Europe by addressing systemic barriers and fostering innovation. One of the project’s core achievements lies in enhancing access to digital tools and resources through initiatives like the Metasearch Platform. This comprehensive digital hub integrates the SS developed by FUTURAL and other EU initiatives, promoting user-friendly and inclusive access for diverse rural stakeholders. Additionally, FUTURAL prioritizes improving digital literacy across a wide range of demographics. Targeted capacity-building initiatives, such as workshops, training sessions, and hands-on learning opportunities, equip community members with the skills necessary to effectively utilize the SS. These efforts are especially focused on marginalized groups, ensuring that digital inclusion is both equitable and sustainable. The project also demonstrates the scalability of co-created solutions, presenting a model for broader implementation across the EU. By embedding participatory methodologies, FUTURAL ensures that digital tools are not only relevant to local contexts but also adaptable to other rural regions with distinct socio-economic and cultural characteristics.

Driving Policy Change for Rural Innovation

FUTURAL will provide policy recommendations designed to address critical gaps, inconsistencies, and barriers in existing policy frameworks that impact the adoption of SS in rural areas. These recommendations will aim to align with major EU frameworks, including the European Green Deal, the European Digital Strategy, and the EU’s Long-Term Vision for Rural Areas, ensuring that rural innovation is supported by robust and coherent governance structures. The recommendations will be evaluated and refined through the European Rural Innovation Forum (EU-RIF), a series of three interactive events organized by FUTURAL, bringing together policymakers, community representatives, and researchers to discuss their practical applicability. These forums will provide an opportunity to test the recommendations against real-world challenges and align them with broader policy objectives, fostering solutions that are both practical and impactful. FUTURAL will also work closely with EU institutions and networks, such as the Rural Pact Support Office and the EU CAP Network, to ensure its findings are integrated into ongoing policy discussions. This proactive engagement will enable the project to contribute to the development of governance frameworks that facilitate smart, community-led innovation while addressing systemic barriers to rural development. By the conclusion of the project, FUTURAL’s policy outputs will provide clear and actionable pathways to support digital inclusion and sustainable growth in rural Europe. These recommendations will not only address immediate challenges but also create enabling environments for long-term innovation and resilience in rural areas. Through these efforts, FUTURAL demonstrates its commitment to bridging the gap between policy and practice, empowering rural communities to thrive in an evolving digital landscape.

5. Conclusions

Digital inclusion is far more than a technological challenge; it is a societal and economic necessity for rural areas. FUTURAL’s innovative SS and participatory methodologies highlight the transformative power of bridging the digital divide. FUTURAL addresses access barriers, fosters digital literacy, and tailors tools to local contexts, empowering rural communities to become active participants in the digital age. The project offers a scalable and adaptable model for advancing digital inclusion in rural Europe, ensuring that no community is left behind in the digital transformation. As FUTURAL evolves, its lessons provide critical insights for policymakers, practitioners, and rural stakeholders worldwide, shaping

strategies to build more connected, equitable, and resilient societies. Through collaboration, innovation, and empowerment, FUTURAL lays the groundwork for a sustainable and inclusive digital future for all.

Author Contributions: Conceptualisation, A.L. and A.K.; methodology, A.L.; writing—original draft preparation, A.L.; writing—review and editing, A.L. and A.K.; project management, A.L.; project administration, A.L.. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the European Union’s Horizon Europe research and innovation programme, under the FUTURAL project ‘Empowering the Future Through Innovative Smart Solutions for Rural Areas’ (Grant Agreement ID: 101083958).

Data Availability Statement: The datasets generated during the current study, funded by the European Union’s Horizon Europe research and innovation programme under the FUTURAL project ‘Empowering the Future Through Innovative Smart Solutions for Rural Areas’ (Grant Agreement ID: 101083958), are available upon request from the corresponding author.

Acknowledgments: The authors sincerely acknowledge the contributions of all colleagues and collaborators involved in the FUTURAL project, whose efforts have been instrumental in achieving the outcomes reported in this manuscript. We are particularly grateful to the participants and stakeholders across the Multi-Actor Pilots (MAPs) for their active involvement and invaluable insights during the co-creation and implementation phases.

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