

Unpacking smart village strategies in the United Kingdom: A Strategic Review

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Summary

Rural communities across the United Kingdom face significant challenges, including demographic changes, limited access to essential services, lack of investment, and economic stagnation. The 'smart village' concept, which emerged from the European Union's rural development initiative, the EU Action for Smart Villages, offers a potential solution to these issues by utilising digital technologies and social innovation. This paper aims to evaluate the challenges and opportunities in revitalising rural infrastructure by initially conducting a systematic literature review. A total of 83 relevant publications were analysed as part of the review to explore the smart village concept, its key initiatives, and potential barriers to implementation. The review revealed a lack of consensus on the precise definition of smart villages, with perspectives ranging from technology-centric approaches to those emphasising human and social capital. Key smart village initiatives include smart energy, healthcare, water management, education, agriculture, and transport solutions. The findings suggest that while the smart village concept can address rural challenges, its implementation in the UK faces several obstacles. These include a lack of national policy, limited awareness among stakeholders, potential digital skills gaps, and the need for significant infrastructure investments. This review's findings will inform the development of a blueprint for sustainable rural development and a comprehensive framework to guide future policy on smart villages in the UK.

Keywords: Smart villages, rural development, digital innovation, community resilience, and United Kingdom.

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Introduction

Since the Industrial Revolution, the trend of rural out-migration continues to shape demographic patterns in the 21st century. The United Nations Department for Economic and Social Affairs (2018) projects that by 2050, two-thirds of the global population will reside in urban areas, with urban populations growing at an average annual rate of 1.34%. This ongoing urbanisation presents significant challenges for rural communities, including the degradation of essential services, lack of infrastructure investment, and demographic imbalances characterised by an ageing population.

The 'smart village' concept has emerged as a potential solution to revitalise rural areas. This approach, which gained prominence following the European Union's 2016 Cork 2.0 Declaration and subsequent 2017 EU Action for Smart Villages, aims to utilise digital technologies and social innovation to enhance rural life. The European Commission defines smart villages as 'rural areas and communities which build on their existing strengths and assets as well as on developing new opportunities,' emphasising the enhancement of services and networks through digitisation and technology.

Despite its potential, implementing the smart village concept faces several challenges, particularly in the UK context. These include a lack of clear national policy, limited awareness among stakeholders, potential digital skill divides, and the need for significant infrastructure investment. Moreover, there is a lack of consensus on the precise definition of smart villages, with perspectives ranging from technology-centric approaches to those emphasising human and social capital.

This paper evaluates the challenges and opportunities in revitalising rural infrastructure by implementing the smart village concept in the UK. By examining key initiatives across various sectors and identifying potential barriers to implementation, this research seeks to contribute to the growing body of literature on smart villages and provide insights for policymakers, local authorities, and rural communities.

Research Methodology

This research will employ a mixed-method approach to gather data from various sources. Firstly, existing literature, such as published articles, research papers, and Government policy documents, are reviewed and analysed. Secondly, questionnaires and interviews will be utilised, the former directed towards rural residents and both targeted towards local authority professionals. Employing questionnaires to rural residents will provide insight into the current understanding of the smart villages concept, the existing rural challenges residents face, and the barriers and opportunities to implementing smart villages. The research collected from local authority professionals will offer valuable opinions regarding how they address rural infrastructure development's current challenges and directly contribute to developing a framework to aid future policy.

Strategic Review Findings and Discussion

The literature review reveals several key themes and findings. The European Commission's (2017) publication formalised the definition of smart villages, emphasising the enhancement of services through digitisation and technology; the European Network for Rural Development (ENRD, 2018) expanded on it, describing smart villages as 'laboratories' for innovative solutions. Zavratinik et al. (2018) argue against a one-size-fits-all definition due to rural areas' complexity. Despite varying definitions, common elements include leveraging rural potential, centring inhabitants, and focusing on unique village characteristics. Smart villages are rural communities where residents drive sustainable change using local knowledge, resources, and digital tools to address unique challenges.

The core concept of smart village initiatives is empowering rural inhabitants to assess needs and develop targeted solutions, a bottom-up approach supported by the European Network for Rural Development (2019) and Visvizi and Lytras (2018). However, Renukappa et al. (2022) note that knowledge deficiency can hinder implementation, suggesting additional support from public bodies is necessary. Key initiatives include energy, healthcare, transport, education, and water, as Mohanty et al. (2020) supported. These initiatives rely on renewable energy optimised by the Internet of Things (IoT) and Artificial Intelligence (AI).

Recent geopolitical events have exacerbated energy market volatility, leading to widespread energy poverty, particularly in rural areas. The European Parliament reported over 41 million Europeans living in energy poverty in 2023 (European Parliament and Widuto, 2023), while in the UK, rural households face higher rates of energy poverty than urban areas (DEFRA, 2024a). Smart village initiatives prioritise sustainable and renewable energy solutions as a foundation for other developments (Mohanty et al. (2020). Hlavacek and Skalník (2021) stress the importance of energy self-sufficiency and decentralised systems, while Budziewicz-Guźlecka and Drożdż (2022) identify challenges including lack of public awareness and trust in renewable resources. Watson (2019) highlights solar power as a primary driver for smart villages, citing successful implementations in Germany. The literature consensus suggests rural communities should pursue decentralisation and diversification of energy sources, with success depending on rural education in green skills and active community participation.

Rural healthcare faces unique challenges, with UK rural populations averaging six years older than urban areas and 24.5% over 65 (UK House of Lords Select Committee on the Rural Economy, 2023). Rural inhabitants struggle to access health services and face isolation, and poverty impacts mental health (Royal College of Nursing, 2019). Technology offers potential solutions, including health monitoring devices and telemedicine (Lučan, et al, 2024). However, implementation faces barriers such as lower rural broadband coverage (Rural Services Network, 2024) and lower internet usage among older adults (AgeUK, 2024). Philip and Williams (2019) found that older adults are willing to engage with technology if it meets their needs and they receive adequate support. Effective implementation of smart healthcare in rural areas requires a nuanced approach, user-informed design, and reliable internet access.

Access to clean water and sanitation is a recognised human right and a key target of the UN Sustainable Development Goal Six (United Nations, 2015). Despite this, two billion people globally lacked access to safely managed drinking water in 2022, particularly in rural Sub-Saharan Africa (Kashiwase and Fujs, 2023). Rural areas face unique challenges due to fluctuating water sources and a reliance on a single water source, such as boreholes and natural springs, highlighting the need for innovative solutions. Smart water meters, using sensors connected via low-power LoRaWAN networks, can monitor water quality and levels in rural areas (Manoharan and Rathinasabapathy, 2018). Malche and Maheshwary (2017) proposed IoT-based systems for real-time monitoring, though their effectiveness in real-world scenarios remains underexplored. Additionally, environmental sensors can forecast weather patterns, monitor dams to address future water demand, and support adapting to climate change impacts (Kaur, 2016).

These innovative solutions aim to prevent rural out-migration and associated skills deficits, often called 'brain drain' (Artz, 2003). Digital education offers a solution, as demonstrated by the Smart Rural 21 project in Eskola, Finland, where a remote education system was implemented to address school closures (SmartRural21, 2020). However, the success of such initiatives depends on digital technology access, reliable internet infrastructure, and teacher competence. The COVID-19 pandemic highlighted these challenges, revealing that less than 20% of European schools have high-speed internet access, with exceptions in Nordic countries such as Finland (Vanbuel, 2022).

Agriculture remains crucial to rural economies, contributing 1.3% to the EU's GDP and employing 4.2% of its workforce in 2023 (Eurostat, 2024). Adesipo et al. (2020) consider agriculture the most important smart village initiative. Precision smart farming uses advanced technologies like Global Positioning System (GPS), AI, and IoT for efficient livestock and crop management (Chowdhury, et al., 2023). These technologies help conserve resources, reduce waste, and increase yields. Soil sensors aid crop selection and yield prediction (Maheswari et al., 2019). Adesipo et al. (2020) argue for integrating climate-smart agricultural principles into smart village frameworks to enhance productivity and climate resilience while noting the need for research on implementation costs and farmer training.

Rural areas face significant transport challenges, with limited options leading to isolation and reduced access to essential services. England saw a 28% reduction in bus services between 2011 and 2024, exacerbating these issues (Research briefings, 2024). The European Network for Rural Development (ENRD, 2019) emphasises rural mobility as a key smart village theme, proposing a vision of complementary, adaptable mobility services. This includes demand-responsive transport, tailored public transport, and community-led initiatives. The SMARTA (2021) project champions shared mobility across Europe. Davidsson et al. (2016) explore integrating IoT into public transport, highlighting opportunities and challenges like data privacy, security, and scalability. They conclude that further research is needed to determine specific user needs and how IoT can address them effectively in rural settings.

Conclusion

In conclusion, this paper underscores the importance of the smart village concept in addressing the challenges faced by rural communities and revitalising rural infrastructure. The concept represents a significant shift in rural development strategies, emphasising digital technologies and social innovation to enhance rural life, aligning with the United Nations' Sustainable Development Goals and contributing to the UK's 'Net Zero by 2050' ambitions. The literature review reveals many smart village initiatives, including essential services such as healthcare, energy, water, education, and economic drivers like agriculture and transport. A key finding is the disparity between European and UK approaches to smart village implementation, with the UK, except for Scotland, appearing to lag in adopting the smart village model. There is a need for more UK-specific research on the appetite for smart village initiatives, engaging the rural communities' local authorities to study and overcome the challenges and potential barriers to their implementation. Such research would contribute to a more comprehensive understanding of the potential for smart villages in the UK context and ensure that the perspectives of those most affected are central to the development process.

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