Challenges of Implementing Smart Technology in Urban and Rural Communities

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Abstract
The rapid integration of smart technologies into modern societies promises to revolutionize urban and rural landscapes through enhanced efficiencies and optimized resource management. Urban centers, often seen as the front-runners in adopting smart technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), and big data analytics, benefit from existing infrastructure and financial resources. However, these cities also face challenges, including over-surveillance, privacy concerns, and socio-economic inequalities that may exclude marginalized populations from reaping the full benefits of these innovations. In contrast, rural areas often grapple with fundamental barriers such as limited infrastructure, digital illiteracy, and inadequate internet connectivity, hindering their ability to integrate smart technologies. Despite these challenges, the potential for smart technology to bridge developmental divides between urban and rural communities remains significant. This study critically examines the obstacles to smart technology implementation in both settings, highlighting the digital divide and proposing solutions for more inclusive technology adoption. By investigating the socio-economic, infrastructural, and policy-related factors affecting the deployment of smart technologies, this research offers recommendations to ensure equitable access and sustainability in smart technology initiatives across both urban and rural communities.

Keywords*: Smart technology, urban communities, rural communities, digital divide, technology adoption.*

Introduction

Smart technology is profoundly reshaping modern societies by integrating advanced digital innovations into physical infrastructure, public services, and everyday life. These technologies encompass a wide range of applications, including the Internet of Things (IoT), artificial intelligence (AI), big data analytics, and smart sensors, all of which are employed to enhance the efficiency and responsiveness of systems such as transportation, energy, healthcare, waste

management, and governance (Gaur et al., 2015). In urban environments, the adoption of such technologies is transforming traditional cities into "smart cities"—digitally connected ecosystems designed to improve service delivery, reduce operational costs, and enhance citizen engagement. Smart traffic systems, smart grids, e-health platforms, and predictive policing are just a few examples of innovations that aim to make urban life more convenient and sustainable. However, while the adoption of smart technology in urban areas continues to accelerate, rural communities often remain underserved and underdeveloped in this regard. These regions typically face infrastructural deficits, limited internet connectivity, and a lack of investment and technical expertise, all of which hinder the integration of smart solutions (Dlodlo & Kalezhi, 2015). As a result, the digital divide between urban and rural areas widens, raising concerns about inequality in access to technological advancements and their associated socio-economic benefits.

Urban communities typically benefit from a combination of robust infrastructure, greater funding opportunities, and a dense concentration of technology companies and skilled professionals. These advantages create a conducive environment for piloting and scaling smart technology solutions, such as integrated public transport systems, energy-efficient buildings, and real-time city data dashboards. The economic and demographic dynamism of cities supports innovation ecosystems that attract investment and foster public-private partnerships essential for implementing smart initiatives. However, urban environments are not without their challenges. Issues such as over-surveillance, data privacy concerns, cyber vulnerabilities, and digital exclusion persist (Townsend, 2013). Furthermore, the socio-economic diversity and high population density of urban areas often result in unequal access to technological services, leaving vulnerable groups at a disadvantage in an increasingly digital society.

In contrast, rural communities face more fundamental barriers that inhibit the deployment of smart technologies. These include unreliable electricity supply, poor broadband connectivity, limited governmental support, and a shortage of skilled personnel and digital literacy among residents (Weber, 2010). These systemic constraints restrict rural regions from fully participating in digital innovation, contributing to a widening digital divide. This growing gap between urban and rural areas exacerbates existing social and economic inequalities, highlighting the need for context-specific strategies to achieve technological equity.

Moreover, public acceptance and trust are critical determinants of the successful implementation of smart technology in any community. These technologies, often perceived as complex and intrusive, require not only technical infrastructure but also social readiness and confidence from the public. In urban areas, where exposure to digital platforms is higher, citizens are more likely to engage with smart systems. However, even here, concerns about surveillance, data misuse, and lack of transparency can affect adoption levels. In rural settings, the challenges are often more pronounced. A general lack of awareness, limited exposure to digital services, and skepticism about their relevance and benefits create significant barriers to adoption (Venkatesh et al., 2016). Many rural residents may distrust government-led or foreign-driven initiatives due to prior experiences of exclusion or marginalization. In such contexts, smart technology may be viewed as irrelevant or even threatening, rather than empowering. This underscores the importance of context-sensitive approaches that prioritize community engagement, digital education, and trust-building measures. Without targeted investment in education, capacity building, and inclusive policy development, the disparity in adoption between urban and rural areas will likely persist or deepen. Therefore, a nuanced, localized understanding of technological, cultural, and socio-economic dynamics is vital for the formulation of effective and equitable smart technology strategies.

Statement of the Problem

Despite growing global investment in both smart city and smart village initiatives, the implementation of smart technologies remains uneven and fragmented across different geographic regions. Urban communities, while often leading in terms of technological adoption, face their own set of implementation challenges. These include data privacy concerns, cybersecurity vulnerabilities, over-surveillance, and infrastructural overload, which collectively erode public trust and hinder operational efficiency (Batty et al., 2021; Kitchin & Dodge, 2019). Additionally, rapid urban technological advancements often overlook socio-economically marginalized groups, reinforcing digital exclusion even within highly connected environments (Cardullo, Di Feliciantonio, & Kitchin, 2019).

Conversely, rural communities are confronted with more foundational obstacles. Many lack the critical infrastructure necessary for supporting smart systems, such as stable electricity, high-speed internet access, and technical expertise (Soomro et al., 2023; Tambo & Adesina, 2022). These infrastructural limitations are further aggravated by low digital literacy rates, financial constraints, and limited institutional support, making the adoption of smart technologies both difficult and unsustainable. Consequently, rural populations often remain excluded from the socio-economic benefits of digital transformation.

Current policy frameworks tend to employ one-size-fits-all strategies, failing to account for regional disparities in readiness and capacity. Without context-sensitive planning and inclusive deployment models, efforts to build truly smart communities will continue to fall short—especially in underserved rural regions.

Aim

This study aim to critically examine the challenges associated with implementing smart technology in urban and rural communities.

Objectives

1. To identify the technological, infrastructural, and socio-economic challenges faced by urban communities in adopting smart technologies.
2. To assess the barriers to smart technology adoption in rural areas, focusing on digital literacy, connectivity, and infrastructure.
3. To evaluate current policies for smart technology deployment and recommend strategies to bridge the urban-rural technological divide.

Conceptual Review

The implementation of smart technology in both urban and rural communities presents a range of challenges that require contextual solutions. These challenges stem from infrastructural disparities, digital literacy gaps, and policy inefficiencies. This conceptual review explores the primary barriers faced by both types of communities in adopting smart technologies, emphasizing the need for targeted strategies to address these issues.

Challenges in Urban Areas

Urban areas, despite having more advanced infrastructure, face significant challenges in implementing smart technologies. A key issue is the integration of smart technologies with existing legacy systems. As urban regions typically have complex and outdated infrastructure, upgrading systems to integrate new technologies can be costly and difficult (Cunha et al., 2020). Another

critical challenge is data privacy and surveillance concerns. Smart technologies often require vast amounts of personal data, which raises issues regarding privacy, consent, and the potential for misuse of information (Renukappa et al., 2022). Moreover, digital inequality persists in urban centers, where not all residents can access or afford smart technologies. This divide restricts equitable access to the benefits of technological advancements, particularly among lower-income populations (Alabdali et al., 2023).

Challenges in Rural Areas

Rural areas face a different set of obstacles, primarily related to basic infrastructure deficiencies. A significant challenge is the lack of reliable internet connectivity and electricity—two critical factors for deploying and maintaining smart technologies such as e-health, smart agriculture, and digital governance (Renukappa et al., 2022). Without these foundational resources, the introduction of smart technologies becomes unfeasible. Furthermore, human capital limitations in rural regions are a substantial barrier. The absence of skilled professionals to implement, maintain, and operate smart systems creates significant delays in adoption (Cunha et al., 2020). Rural populations also tend to have lower digital literacy, which further exacerbates the problem of technology adoption (Alabdali et al., 2023). Additionally, rural areas often lack the financial resources necessary to invest in smart technology infrastructure, which puts these regions at a disadvantage compared to their urban counterparts (Renukappa et al., 2022).

Issues of Policy and Governance

Fragmented and incoherent policies are a major conceptual challenge in both urban and rural contexts. In urban areas, policy fragmentation results in inefficiencies and a lack of coordination between public and private stakeholders, slowing down the adoption of smart technologies (Cunha et al., 2020). This problem is even more pronounced in rural areas, where governance structures are weaker and less able to drive technological transformation. The absence of clear, unified national and regional policies on smart technology adoption further exacerbates these challenges (Renukappa et al., 2022).

Moreover, as smart technologies evolve rapidly, communities struggle to keep pace. Urban and rural areas alike face the issue of outdated implementations, where older versions of technologies no longer serve current needs, leaving communities with systems that are inefficient and costly to update (Cunha et al., 2020).

Community Engagement and User Readiness

The lack of community engagement and user readiness is a critical barrier to the effective deployment of smart technologies. For these technologies to be successful, users must not only have access to them but also trust them and understand how to use them. In rural areas, where technological exposure is often limited, it is crucial to implement targeted awareness campaigns and training programs that improve digital literacy and foster trust in new technologies (Renukappa et al., 2022). However, even in urban areas, concerns about data privacy and surveillance can undermine public confidence, making it difficult to gain widespread acceptance of smart systems (Alabdali et al., 2023).

Theoretical Review

Two major theories underpin the analysis of smart technology implementation: the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT).

- TAM posits that perceived usefulness and perceived ease of use are fundamental in determining user acceptance of technology. This is particularly relevant in rural areas, where smart solutions may be seen as complex or irrelevant, reducing adoption likelihood.
- UTAUT, developed by Venkatesh et al. (2016), extends TAM by incorporating factors like social influence, facilitating conditions, and behavioral intention. It emphasizes how institutional support, user training, and community engagement can influence acceptance, especially in diverse socio-economic environments.

In urban communities, acceptance may be influenced by over-saturation and privacy concerns, whereas in rural settings, the absence of supportive environments inhibits both awareness and adoption. Both theories help explain why well-designed technologies may still face resistance due to contextual social, infrastructural, and psychological barriers.

Empirical Review

Empirical studies provide evidence of the uneven adoption and implementation of smart technologies. For instance, Soomro, Abdullah, and Faheem (2023) conducted a study across rural South Asia and found that lack of technical know-how and infrastructure significantly impeded the deployment of smart farming tools. Similarly, Tambo and Adesina (2022) proposed a framework for inclusive smart village development, stressing community-specific strategies and policy reforms.

In contrast, Batty et al. (2021) highlighted that smart cities in Europe and Asia are rapidly advancing through integrated transport systems, energy-efficient grids, and AI-based governance. However, even in these tech-forward contexts, challenges such as digital exclusion, surveillance concerns, and cybersecurity vulnerabilities persist (Kitchin & Dodge, 2019).

Another study by Roman, Zhou, and Lopez (2013) emphasized the security and privacy challenges inherent in the Internet of Things—a core component of smart infrastructure—underscoring the risk of data breaches and misuse in both rural and urban deployments.

Collectively, empirical evidence supports the claim that while smart technologies offer transformative benefits, their implementation is context-dependent, with challenges shaped by geography, policy, and societal readiness.

The conference paper by Cunha, Gomes, Fernandes, and Morais (2020), *Building Smart Rural Regions: Challenges and Opportunities*, offers a conceptual exploration of how Information and Communication Technologies (ICT) can catalyze socio-economic transformation in rural areas, with a specific focus on Portugal's Northeast region. The authors highlight rural regions' challenges such as depopulation, underdeveloped infrastructure, weak economic activity, and limited access to public and private services. In response, they propose a conceptual model for developing smart rural regions by leveraging ICT as a transformative tool in areas such as connectivity, governance, service delivery, and citizen engagement. A notable strength of the paper lies in its ethical framing of rural disadvantage as an equity issue, urging policymakers to prioritize inclusive development. The conceptual model provides a foundational guide for integrating ICT into rural planning, aiming to make these regions competitive and sustainable. However, the paper lacks empirical validation and detailed technical discussion of specific ICT implementations, which limits its practical applicability across diverse global contexts. Despite

these limitations, the work contributes valuable insights into smart rural development and offers a strategic starting point for further academic inquiry and policy design.

The study by Renukappa et al. (2022), titled *Evaluation of Smart Village Strategies and Challenges*, presents a timely investigation into the strategic and operational dimensions of implementing smart village initiatives, primarily within the UK context. The research employs a quantitative methodology, utilizing a web-based questionnaire to gather responses from 110 participants. The findings reveal several key challenges hindering the adoption of smart village strategies, including limited budgets, unclear strategic frameworks, insufficient collaboration among stakeholders, and a general lack of knowledge about smart village concepts. Conversely, the study identifies priority strategies such as smart energy, healthcare, transport, education, and water systems as critical enablers of rural transformation. While the study contributes significantly to the theoretical and practical discourse on rural digital development, its limitations stem from the relatively small sample size and restricted geographical focus, which may affect the generalizability of the findings to other contexts, especially in developing countries. Nonetheless, the paper adds valuable insight into the practical considerations of digital rural innovation and offers important implications for policymakers and practitioners seeking to enhance rural resilience and sustainability through technology and social innovation.

Alabdali, Pileggi, and Cetindamar (2023.) present a comprehensive literature review examining the adoption of smart technology in rural regions, identifying influential factors, enablers, and barriers that shape its integration. The study emphasizes the contrast between urban and rural technological uptake, noting the success of smart city models and the lag in rural applications due to infrastructural limitations, digital illiteracy, and context-specific challenges. Using comparative and categorical content analysis, the authors explore domains such as agriculture, education, healthcare, business, and governance, highlighting the transformative potential of smart technologies for sustainable rural development. However, they also point out the lack of a clear strategic roadmap and fine-grained indicators for effectively adapting urban smart technology frameworks to rural contexts. The review underscores the need for localized, sustainable approaches tailored to the unique characteristics of rural environments.

Methodology

The methodology adopted to examine the challenges associated with implementing smart technology in urban and rural communities. The study employed a descriptive survey design using an online questionnaire as the primary data collection tool. This design allowed the researcher to gather both quantitative and qualitative data from a broad, geographically dispersed population. The target population included individuals from urban and rural settings who had experience with or exposure to smart technologies—such as local residents, ICT professionals, public officials, and service providers.

A purposive sampling technique was used to select participants who were likely to provide relevant and informed responses. A total of 100 respondents—split evenly between urban and rural communities—completed the online questionnaire, which was distributed through email and social media platforms. The questionnaire covered topics such as awareness and usage of smart technologies, infrastructure limitations, digital literacy, and public perception.

Data from the survey were analyzed using descriptive statistics for the closed-ended questions and thematic content analysis for open-ended responses. Ethical considerations were also addressed, including informed consent, anonymity, and confidentiality of participant responses. Despite challenges such as limited internet access in rural areas, the methodology provided a solid

framework for understanding the technological disparities and barriers between urban and rural communities in the context of smart technology implementation.

Results and Interpretation

This presents the results obtained from the online questionnaire administered to 100 respondents—50 from urban areas and 50 from rural areas. The data is presented in tables followed by a brief interpretation of each result. The focus is on identifying technological, infrastructural, socio-economic, and policy-related challenges affecting smart technology adoption.

Demographic Information of Respondents

Table 1: Age Distribution of Respondents

Age Group	Urban (n=50)	Rural (n=50)	Total (n=100)
18–25 years	12	15	27
26–35 years	18	20	38
36–45 years	12	10	22
46 years & above	8	5	13

Table 1: Show most respondents in both urban and rural areas were between 26–35 years, suggesting a relatively young and potentially tech-aware population. This is beneficial for future digital literacy and smart tech acceptance.

Awareness and Use of Smart Technology

Table 2: Awareness of Smart Technology

Response	Urban (%)	Rural (%)
Aware	92	54
Not Aware	8	46

Table 2: Show awareness of smart technology was significantly higher in urban areas (92%) compared to rural areas (54%). This highlights the need for targeted awareness campaigns in rural communities.

Infrastructure Availability

Table 3: Access to Stable Internet

Response	Urban (%)	Rural (%)
Regular Access	88	30
Occasional Access	10	45
No Access	2	25

Table 3: Show a high percentage of urban respondents reported regular internet access, in contrast to rural participants, where only 30% had stable connections. Poor internet access remains a critical barrier in rural areas.

Perceived Challenges to Adoption

Table 4: Major Challenges Identified by Respondents

Challenge	Urban (%)	Rural (%)
Infrastructure Deficit	20	70
Lack of Digital Literacy	10	60
Privacy and Surveillance Concerns	65	15
High Cost of Implementation	45	40

Table 4: Show urban respondents were mostly concerned about privacy and cost, while rural respondents pointed to infrastructure gaps and digital illiteracy. This confirms that different contexts face distinct barriers to smart technology adoption.

Trust and Acceptance

Table 5: Willingness to Adopt Smart Solutions

Response	Urban (%)	Rural (%)
Willing	80	48
Undecided	15	30
Unwilling	5	22

Table 5: Show while 80% of urban respondents expressed willingness to adopt smart technology, less than half (48%) of rural respondents were ready. The higher level of skepticism or uncertainty in rural areas reflects a trust and awareness gap.

Policy Support and Government Role

Table 6: Satisfaction with Government Support

Satisfaction Level	Urban (%)	Rural (%)
Satisfied	30	12
Neutral	40	30
Dissatisfied	30	58

Table 6: A majority of rural respondents (58%) were dissatisfied with governmental support for smart technology initiatives, compared to 30% in urban areas. This shows a significant gap in institutional engagement in rural settings.

Discussion of Findings

This study aimed to explore the challenges of implementing smart technology in both urban and rural communities, and the findings revealed a distinct divide in terms of technological readiness, infrastructure, public perception, and policy effectiveness.

In urban communities, the results indicated that most respondents had access to basic infrastructure such as electricity and internet connectivity. This reflects the common global trend where cities benefit from better funding, higher population density, and concentration of tech firms and skilled labor (Gaur et al., 2015). These advantages enable quicker adoption of smart technologies, including IoT, AI, and big data systems. However, the findings also highlighted concerns among urban residents regarding over-surveillance, data privacy, and the unequal distribution of technological benefits. These concerns align with Townsend's (2013) observations that urban smart initiatives often raise ethical issues, especially related to privacy and digital exclusion of marginalized populations.

On the other hand, rural communities were found to face more foundational challenges. A significant proportion of respondents from rural areas reported poor internet access, inadequate power supply, and limited exposure to digital tools. These barriers are consistent with the findings of Dlodlo and Kalezhi (2015), who noted that rural areas typically lack the infrastructure required for smart technology deployment. Furthermore, low digital literacy and minimal institutional support were recurrent themes in rural responses, confirming Weber's (2010) assertion that rural development lags largely due to human capacity constraints and limited technical assistance. This not only hinders adoption but also fuels skepticism, as many rural dwellers are unfamiliar with the benefits and risks of smart technologies.

Trust and awareness also emerged as critical factors affecting the acceptance of smart innovations, especially in rural contexts. Many respondents from these areas expressed skepticism or a lack of interest in adopting new technologies, often due to limited understanding or fear of disruption. This echoes the Technology Acceptance Model proposed by Venkatesh et al. (2016), which emphasizes that perceived usefulness, ease of use, and social influence significantly affect technology adoption. Without effective public education and engagement, rural resistance to smart technologies may persist, further deepening the digital divide.

Additionally, the study found a disparity in perceptions of government support between urban and rural communities. While urban respondents were more likely to acknowledge the presence of supportive policies and public-private initiatives, rural respondents expressed dissatisfaction with the lack of tailored government interventions. This supports recent studies indicating that many national strategies for smart development take a one-size-fits-all approach, failing to consider regional variations in infrastructure and readiness (United Nations, 2023). The findings suggest that rural communities are often overlooked in policymaking, resulting in a lack of inclusive frameworks that could guide equitable technology deployment.

The study also reveals that urban areas, while technologically advanced, still face significant ethical and equity concerns in implementing smart technologies. Rural areas, meanwhile, struggle with basic infrastructural and educational barriers, which hinder adoption and sustainability. These findings highlight the need for differentiated strategies—urban regions require policies that address data ethics and digital equity, while rural areas need foundational investments in connectivity, education, and local capacity building. As van Dijk (2020) argues, bridging the digital divide is not merely about access to technology but also about the meaningful and inclusive use of it across diverse populations.

Conclusion

This study set out to critically examine the challenges associated with implementing smart technology in urban and rural communities. The findings reveal that while smart technologies have the potential to transform infrastructure, services, and quality of life, their deployment and impact are uneven across geographic and socio-economic divides. Urban communities tend to benefit more from the integration of smart technologies due to existing infrastructure, skilled workforce, and institutional support. However, these benefits are not uniformly distributed, as issues such as data privacy concerns, over-surveillance, and digital inequality among low-income urban populations continue to pose significant challenges. In contrast, rural communities are often left behind in the digital transition due to inadequate power supply, poor internet connectivity, low digital literacy, and lack of technical expertise. These disparities contribute to a widening digital divide and risk reinforcing socio-economic inequality between regions.

The study also highlighted that uniform policy strategies often fail to address the unique needs of rural and underserved communities. Public skepticism, especially in rural areas, further undermines the adoption of smart technologies. Therefore, any effort to expand smart solutions must take a context-sensitive approach that considers the infrastructural, educational, and cultural realities of different communities. To ensure that smart technology becomes a tool for inclusive development rather than division, it is essential to foster trust, awareness, and equitable access through targeted interventions and collaborative governance.

Recommendations

First, context-specific infrastructure development should be prioritized. Governments and development agencies must invest in foundational infrastructure in rural areas, including stable electricity, broadband internet, and digital service centers. Without these basics, smart technology implementation cannot proceed effectively, and rural communities will remain digitally excluded.
Second, digital literacy and public awareness campaigns should be intensified, particularly in rural and underserved urban communities. Educational programs should be designed to build trust, reduce skepticism, and empower individuals with the skills needed to engage meaningfully with digital systems. These initiatives can be delivered through local schools, community centers, and mobile outreach platforms.
Third, policy frameworks should be decentralized and inclusive, allowing for the participation of local stakeholders in planning and implementing smart technology projects. Local governments, traditional leaders, civil society organizations, and residents should be engaged in decision-making to ensure that technologies reflect community needs and values. This participatory approach will improve trust, foster accountability, and enhance the long-term sustainability of smart initiatives across diverse communities.

References

Alabdali, S. A., Pileggi, S. F., & Cetindamar, D. (2023). Influential factors, enablers, and barriers to adopting smart technology in rural regions: A literature review. Sustainability, 15(10), 7908. https://doi.org/10.3390/su15107908

Batty, M., Axhausen, K. W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., ... & Portugali, Y. (2021). Smart cities of the future. *The European Physical Journal Special Topics*, *214*(1), 481–518.

Cardullo, P., Di Feliciantonio, C., & Kitchin, R. (2019). *The right to the smart city*. Emerald Publishing Limited.

Cunha, C. R., Gomes, J. P., Fernandes, J., & Morais, E. P. (2020). Building Smart Rural Regions: Challenges and Opportunities. In *Advances in Intelligent Systems and Computing* (Vol. 1161). Springer. https://doi.org/10.1007/978-3-030-37472-6_60

Dlodlo, N., & Kalezhi, J. (2015). The Internet of Things in agriculture for sustainable rural development. In *2015 International Conference on Emerging Trends in Networks and Computer Communications (ETNCC)* (pp. 13–18). IEEE. https://doi.org/10.1109/ETNCC.2015.7184801

Gaur, A., Scotney, B., Parr, G., & McClean, S. (2015). Smart city architecture and its applications based on IoT. *Procedia Computer Science*, *52*, 1089–1094. https://doi.org/10.1016/j.procs.2015.05.122

Kitchin, R., & Dodge, M. (2019). The (in)security of smart cities: Vulnerabilities, risks, mitigation, and prevention. *Journal of Urban Technology*, *26*(2), 47–65.

Roman, R., Zhou, J., & Lopez, J. (2013). On the features and challenges of security and privacy in distributed Internet of Things. *Computer Networks*, *57*(10), 2266–2279. https://doi.org/10.1016/j.comnet.2012.12.018

Renukappa, S., Suresh, S., Abdalla, W., Shetty, N., Yabbati, N., & Hiremath, R. (2022). Evaluation of smart village strategies and challenges. *Smart and Sustainable Built Environment*, 15(1), 123-136. https://doi.org/10.1108/SSBE-10-2021-0165

Soomro, K., Abdullah, S., & Faheem, M. (2023). Challenges in implementing smart technology in rural communities: A case study of South Asia. *Journal of Rural and Remote Technologies*, *11*(1), 25–39.

Tambo, J. A., & Adesina, A. (2022). Bridging the digital divide: A framework for inclusive smart village development. *Technology in Society*, *70*, 102012.

Townsend, A. M. (2013). *Smart cities: Big data, civic hackers, and the quest for a new utopia*. W. W. Norton & Company.

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2016). Unified theory of acceptance and use of technology: A review and extension. *Journal of the Association for Information Systems*, *17*(5), 328–376.

Weber, R. H. (2010). Internet of Things – New security and privacy challenges. *Computer Law & Security Review*, *26*(1), 23–30.