International Academic Institute for Science and Technology

International Academic Journal of Social Sciences
Vol. 13, No. 3, 2026, pp. 1-14.

ISSN 2454-3918

International Academic Journal of Social Sciences

www.iaiest.com

Sustainable Digital Communities Through Social Innovation and Inclusive Technology Adoption

Dr. Arasuraja Ganesan [a*]

[a*] *Associate Professor, Department of Management Studies, St. Joseph's College of Engineering, OMR, Chennai, Tamil Nadu, India. E-mail: arasuraja.mba@gmail.com*

Abstract

Digital technologies have transformed communities' ways of connecting, discussing and acting; however, the sustainability of digitally enabled community living is contingent upon more than just connectivity. The aim of this paper is to develop a theoretical framework based on the notion that the mechanism of social innovation should be used in order to transform digital technologies into tools of sustainable community development and not just a source of new exclusion. The reasoning behind such an approach is based on three premises found within the current literature. Firstly, digital social innovation, which is defined as a novel application of digital technology to solving societal problems, has become a field of research, although its conditions of sustainability at the community level are poorly described. Secondly, the problem of digital divide has been redefined from mere technological gap in connectivity into multidimensional concept, including access, affordability, skills and inclusion, therefore just infrastructure investment cannot generate sustainable participation. Thirdly, barriers to adopting innovations are cumulative and not individualistic, especially those for rural residents, seniors and disabled people. The paper combines these themes into the Sustainable Digital Communities framework that consists of four interconnected pillars: capacity for digital social innovation, inclusive conditions of adoption, co-design, and governance necessary for securing sustained community ownership. The next step is the formulation of a research agenda for validating the framework through comparative analysis of cases, longitudinal study of adoption, and participatory design. The framework changes the perspective on digital inclusion from an outcome of technology adoption to its prerequisite for community resilience and reveals the conditions of design, policy, and capability for sustaining digital communities after their establishment.

Keywords: Sustainable Digital Communities, Digital Social Innovation, Inclusive Technology Adoption, Digital Divide, Participatory Co-Design, Digital Literacy, Community Resilience, Digital Equity.

DOI: 10.71086/IAJSS/V13I3/IAJSS1318
Received: 17 June 2026/Revised: 01 July 2026/Accepted: 24 August 2026/Published: 30 September 2026

Introduction

It is now clear that digital technologies form the very core of community life rather than merely supplement it. Social networking tools, mobility solutions, collaboration technologies, and open-source software have been adopted as the means for establishing connections and performing deliberations and actions, and provide true opportunities for participation, transparency, and sustainable development (Armenta et al., 2011). However, this process has resulted in an irony that constitutes the core issue explored by this paper. Communities that can benefit the most from the digital participation are precisely those that cannot afford the continuity thereof. Rural communities are those that require better connectivity because of their remoteness, yet at the same time, they are the least connected and the least included. Ineffective diffusion of technologies along with lower average level of education and skills has a detrimental effect on adoption and use (Ahmadu et al., 2025).

There have been two independent research paths addressing different parts of the same issue without linking them together. First, there is social innovation that is defined as the creation and implementation of new solutions to common social issues created through the efforts of a variety of stakeholders in top-down and/or bottom-up strategies (Gupta et al., 2019). Second, there is literature on the digital divide that started by quantifying the technical factors of access to computer networks but which has since been redefined. The technical factors were used to define the scale of the issue initially but did not describe its essence and context fully, which explains why grassroots involvement and socioeconomic development combined with human values play such an important role in its new definition (Salemink et al., 2015). These converging streams have led to the development of the idea of digital social innovation, defined as the use of digital technology to tackle societally important problems in new ways, which has proven itself to be an essential element in sustainable development as a collective endeavor. A systematic review of 135 articles from this field has started the process of consolidation in this area based on a theoretical multi-dimensional framework encompassing digital technology, digital innovation, and social innovation, along with a research agenda of 12 well-defined research paths (Carlomagno et al., 2026).

What such consolidation has not yet achieved is an explanation of how the combination of social innovation, adoption, and governance of the community lead to sustainable digital communities (Kazanskaia, 2025a). There are three specific issues that have not been solved. First, the sustainability of grassroots digital social innovation is fragile. A thorough study of communities in a distant county that used e-commerce to jump start their development shows the three opportunities for jumping start that communities utilized in order to embark on their transformation, but also the three hurdles encountered while attempting to jump-start the technology and which made the process of developing sustainability difficult; three top-down approaches turned out to be crucial for overcoming the bottleneck and fostering a sustainable community. Sustainability is not, thus, an inevitable outcome of adoption but a different achievement altogether. Community engagement through technology can contribute to bridging the digital divide in terms of digital access, participation, and community development that is inclusive (Kazanskaia, 2025b).

In the second place, inclusion is characterised by structural inequality in ways that tend to mask average statistics. Digital exclusion happens on account of inequality in terms of access, affordability, competencies, and inclusion. Structural inequalities in terms of connectivity, affordability, and literacy continue to exclude marginalised people from accessing education, healthcare, economic opportunities, and civic engagement. It has been observed that generic policies often ignore specific local requirements, which is why future research is aimed at localities in an attempt to create specific policies for digitally excluded rural areas (Krombacher et al., 2026). Finally, adoption is a compound challenge rather than an obstacle to be overcome. Problems in digital literacy of older adults involve interactions between different personal, sociological, and environmental factors rather than deficiencies in skills, and barriers may occur simultaneously, with health factors, availability of support, technology characteristics, and other factors all having impact on digital participation (Tim et al., 2020). Solutions that assume single barrier overcome will tackle only part of the problem (Lee & Coughlin, 2014). Digital inequalities are affected by many factors, including access, digital literacy, and utilization of technology, pointing to the significance of adopting an inclusive approach in addressing the digital divide (Raihan et al., 2024).

The issue becomes evident in developing countries, where there has been rapid progress in increasing connectivity through national digital strategies, even as community capacity to realize the benefit from the connectivity has remained wanting. Huge investments in terms of broadband infrastructure, public Wi-Fi, digital identification and online service provision have laid down the groundwork for digital participation, but usage remains skewed along geographical divides of rural versus urban, age groups, gender and educational levels (Salemink et al., 2017). In such circumstances, an individual living in one household may own a smartphone that is utilized only for making phone calls and entertainment purposes, with other applications of services, market information, and civic engagement

staying out of reach. The distance between being connected and participating in a meaningful manner becomes the decisive factor on the question of sustaining the digital community.

Another issue is that many community digital projects are initiated as projects of limited time span. Pilot projects that have been funded by governmental sources, development organizations, or corporate social responsibility programs tend to show positive outcomes in terms of enrollment in training programs, rapid growth in number of users, and the presence of community excitement during the implementation phase. However, once the project is completed, most of such projects tend to lose momentum due to the fact that they lacked the necessary institutional, skills, and governance framework for sustaining them (Kazanskaia, 2025a). The issue of why certain digital community projects last whereas others do not can thus not be answered in purely technical terms.

These three challenges imply the need for a framework where social innovation, inclusive adoption, and participatory design are seen as interdependent aspects. Current literature tends to treat the three issues individually (Khan et al., 2026): social innovation studies focus on the creation of value and its deployment contexts, digital divide studies focus on distributional access and capability, and platform studies focus on the design and interaction of platforms. The contribution of this paper lies in the fact that it brings the three together. The proposed framework of Sustainable Digital Communities consists of four interacting pillars: capacity for digital social innovation, conditions for inclusive adoption, participatory co-design, and governance for sustained community ownership, and provides insight into the conditions when each of the four pillars contributes to the sustainability of the other three. Finally, a research agenda and validation strategy based on mixed methods are described, in line with the acknowledged requirement for context-based measures of digital exclusion targeting its root causes via collaborative efforts of government, civil society, NGOs, and communities.

The rest of the paper is organized as follows. Section 2 gives an overview of digital social innovation, the re-conceptualized digital divide, and the inclusive uptake of technology. Section 3 identifies the research gap and contributions. Section 4 describes the proposed framework. Section 5 describes the methodology and research agenda. Section 6 deals with the implications for policy, design, and practice in communities. Section 7 concludes.

Literature Review

Social Innovation and the Digital Turn

Social innovation provides a sustainable way of solving existing social problems and is developed through a combination of individuals belonging to different sections of the society following a top-down and/or bottom-up strategy. The distinguishing factor of the current time frame is the advent of new-age technology and its disruptive influence on the field of social innovations by offering resource efficient solutions and various outcome benefits. Researches conducted in the above area include an understanding of social innovation, innovative offerings of new-age technology for social good, location of social innovation in society, ways of deploying social innovation for reaching out to the masses and necessity of the same. By using a triangulation research design, the above literature provides a complete model understanding the different environments in which social innovation occurs, probable outcomes, boundary conditions and implications for businesses, policy makers and social entrepreneurs.

In particular, the literature on the digital stream of research has coalesced into that of digital social innovation. This is because a structured literature review with 135 papers within the area was conducted, synthesizing the contributions through a theory-driven multidimensional framework that encompasses digital technology, digital innovation, and social innovation. Following the synthesis, a research agenda has been developed consisting of 12 distinct paths of research validated by experts in the field. In general terms, the reasoning provided as justification of the synthesis of digital innovation and social innovation is the promise of tackling the negative sustainability problems facing the world today, since digital innovation uses digital technology to develop innovations, whereas social innovation provides social value and promotes sustainable development.

The most robust data in terms of what follows from success is the result of longitudinal case work. In the case of the remote county, local grassroots have used e-commerce to jump-start out of poverty and become successful entrepreneurs running their own global online business, but it is made clear that obstacles occurred in the process of leapfrogging and posed challenges to the sustainability of the grassroots venture. The solution came from outside; it was three top-down interventions that were vital in solving the problem of grassroots leapfrogging development and creating self-sustainable, resilient communities. The two conclusions to be drawn for the theory of sustainability are as follows. First, grassroots digital social innovation is capable of causing quick economic transformation but does not create its own continuity conditions in the process. Second, the interventions that help achieve sustainability do not need to be those that help create emergence.

The Reconceptualised Digital Divide

There have been many changes in the concept of the digital divide literature. Initially, there were attempts to create the criteria for estimating the divide between countries, regions, and different social strata, based on the technical parameters connected with computer usage and Internet accessibility. However, these parameters failed to show a whole picture of the dimensions and context of the problem. In order to re-conceptualize the problem of the digital divide, grassroots participation and socioeconomic development along with the human value, together with emerging mobile wireless and efficient broadband technologies, were offered as crucial factors. The conclusion here is that the understanding of the new paradigm of broadband penetration, sustainable development, technology adoption, and participation in the communities is vital for developing a national agenda of digital inclusion.

More recent synthesis, however, has cemented this approach, and taken it even further in terms of practical solutions. Specifically, the systematic integrative review of barriers to digital equity found that the present-day digitalisation era has brought about a great deal of opportunities but also systemic exclusion of intersectional groups whose exclusion has differential effects. It is important to stress that these recommendations are very practical and also structural, not individualistic: they include focusing on state investment in cost-efficient broadband connectivity and programmes, training, as well as culturally tailored content in different languages to increase affordability and accessibility for disadvantaged and deserving groups of people. Other recommendations include development of culturally-tailored online and offline training programs, human-centered digital services, community-based digital literacy programs, and increasing public awareness about existing digital educational resources. From the point of governance, the suggestion is to develop a digital equity plan through coordinated work on a federal, state, and local level to ensure that everyone has the necessary digital means and access.

The most important recommendation of the methodology of this review is that in order to understand the origins of the digital divide, not just its manifestations, more context-specific methods are required, which should be pursued in cooperation with the relevant governmental, civil, non-governmental, and community organizations. This is an explicit formulation of the problem which is discussed in this paper. Such measures will show some success in terms of access indicators but won't solve the real problem of exclusion since it won't address the factors causing it. One can see how it works by the example of rural data: poor technology diffusion and lack of education/skills among rural residents impact adoption and use; generic policy is not able to address special needs of rural communities and thus the result is that they are both most in need of connectivity to overcome their remoteness and most disconnected and excluded.

Inclusive Technology Adoption as a Lifecycle Problem

Adoption research now takes into consideration more than the existence and cost of adopting a certain type of technology. A review of the perspectives and decision making of older adults concerning technology-based products and services reveals that although various technological solutions have already been brought into the market, the rate of adoption is low because of the advantages they may afford despite the possibility, and the reasons for this reveal that adoption is not only an issue of performance and cost but something complex, involving different factors. Ten different determiners or facilitators of adoption are identified in the study as value, usability, affordability, accessibility, technical support, social support, emotion, independence, experience, and confidence. For the implementation of community strategies, ten different factors make up a holistic view considering social settings and means of delivery of the technology, along with the individual and the technological factors – showing that the determiners of adoption are dispersed throughout the individual, the product, and the surrounding social system.

The evidence on digital literacy also supports the idea of compounded barriers. The difficulties with digital literacy faced by the aging population consist of interactive individual, social, and contextual factors rather than skill gaps, and barriers are compounded, meaning that health barriers, access to help, technological design, and resource scarcity all affect digital participation. The suggested strategy is integrated digital literacy that will account for compounded barriers and the diversity of experiences of the aging population, with the future research focusing on defining digital literacy consistently, measuring the impact of digital inclusion programs, and catering to subpopulations with extra barriers. There are three aspects of this evidence that have direct connection to community sustainability: barriers do not accumulate separately but are grouped; design is a barrier factor, not a neutral one; and there is no evidence on the long-term effects of inclusion programs.

Participatory Design as an Inclusion Mechanism

The adoption literature provides the solution to the way that adoption is perceived as a personal deficiency. Digital platforms operate as intricate socio-technical ecosystems where data visualization and social networks are mediated through the platforms, and which are not only technical tools but are also cultural tools through which practices can

be shaped, information transferred, and content managed. This duality of nature has implications for inclusion because of the decisions which are embedded in the design of the platform.

The comparative analysis of cases has divided the platforms into four groups – Low Impact, Accessibility and Inclusion, Data Exploration and Visualization, and Algorithms and AI – with identification of repeated design patterns as well as design features related to sustainability and platform use. Within such an analysis, co-design appears to be a methodology of testing and validating the platforms with active involvement of users, stakeholders, and communities in the processes of ideation, prototyping, and validation of user experience and interface, thus creating an opportunity for a more responsive and inclusive design process. The practical outcome of such an effort is a list of pre-design requirements and parameters for development of accessible, low tech, and sustainable platforms which would contribute to economic sustainability and increase access to digital content. The specification of pre-design requirements is crucial because it means that the decisions on inclusion are made at the stage of pre-build when they actually influence architecture of platforms, but not post-deployment when they become remedial.

Policy Conditions for Digital Equity

Lastly, there is a consensus in the policy literature that inclusion outcomes depend heavily on public policy design. Policies designed for digital inclusion and equality focus on the importance of the state to provide the necessary infrastructure, education, and regulations needed for digital inclusion, and they include national broadband strategies, digital literacy programs, and subsidization of the poor. Moreover, they consider the adaptation of policies according to the requirements of the marginalized communities like rural inhabitants, older adults, and the disabled, and they relate these policies to various theoretical frameworks of digital inclusion, such as the digital divide theory and the capability approach. The orientation should be holistic, considering both the infrastructure and digital literacy among others.

The constraints during implementation are also stated in literature and are useful to the sustainability of planning. They comprise budget constraints, rapid changes in technology, and opposition to digitization with possible solutions through public-private partnerships, continuous evaluation of policies, and focused efforts on needs-based areas based on cooperation among the government, industry, and civil society to develop a sustainable digital environment. Since continuous evaluation of policies and collaboration among various sectors constitute the proposed solutions, it means that the sustainable digital equity is seen as a governance process and not a capital project.

Community Engagement and Digital Resilience

Another strand of research looks at how communities use technology together rather than as individuals on their own. Technology-based community involvement has been viewed as an operational way of closing the digital divide, as it involves access, involvement, and development all in one process (Kazanskaia, 2025b). The involvement of people from the community in problem identification, tool selection, and use gives digital technology an embedded nature rather than a superimposed nature. It is important for sustainability that technologies are integrated in the routines of community life and not introduced separately, for example, local market places, self-help group coordination, health information networks, and grievance mechanisms at the village level.

Digital resilience can be viewed in this way. The experience of rural communities which jumped into sustainable development via e-commerce indicates that being resilient is more about absorbing shocks, adapting to changes, and reshaping capacities in light of new circumstances rather than the capability to embrace innovations fast enough (Tim et al., 2021). From this point of view, a digitally resilient community is able to create value even after its champions have gone away, even if the platforms change their policies or if the subsidies disappear. Therefore, resilience bridges innovation studies with those related to governance as it is dependent both on the innovative capacity of grassroots and on the institutional framework which stabilizes it.

Another thing that comes to the fore with practical digital community engagement is the role of intermediaries. It is not uncommon for non-governmental organizations, local libraries, schools, cooperatives, and even community volunteers to serve as reliable intermediaries between technology providers and residents who are reluctant or novice users of technology (Kazanskaia, 2025a). These intermediaries explain technology capabilities in terms of their relevance to the local context and offer technical assistance in addition to providing the trust and confidence necessary for sustained usage (Lee & Coughlin, 2015). It is a factor that often gets overlooked as to why similar technologies yield such different results in different communities.

Theoretical Lenses: Capability Approach and Socio-Technical Systems

Two theories assist in bringing together both sets of literature. Firstly, the capability theory provides a perspective where the focus is shifted away from resource ownership to freedoms people have to obtain desired results. If we

consider digital divide in light of capability theory, then device ownership or internet connection becomes a mere resource, which is not important by itself. It is more important that people can transform this resource into certain functionings such as gaining knowledge, earning money, accessing healthcare or participating in civic engagement activities (Jumai et al., 2025). Conversion processes, namely personal competencies, social norms, institutional and environmental factors can account for different outcomes generated from the same amount of resources. This perspective is highly compatible with the reconceptualized digital divide where skill, affordability, and inclusion are key components besides access (Raihan et al., 2025).

The second perspective examines digital platforms as socio-technical systems where technical artifacts, people, organizations, and regulations evolve together. According to this perspective, platforms are not neutral intermediaries but cultural tools that influence practices and the flow of information (Carlomagno et al., 2026). Interface languages, data requirements, bandwidth needs, and communication channels determine who can interact on the platform and how. A socio-technical perspective thus helps to defend the claim that the question of inclusion has to be considered during design, and it illustrates why the system of governance that establishes rules about the ownership and adaptation of the platform is inevitably related to technical issues.

In combination, the capability approach and the socio-technical perspective provide two conditions under which sustainable digital communities can form: people should have capabilities to employ technology in their own interests; technologies have to be designed in a way suitable to particular settings; there should be institutions that sustain and adapt technologies to new situations. All these conditions are precursors to the pillars of the proposed framework (Section 4).

Research Gap and Contributions

Three gaps have been identified as a result of this synthesis.

First, there is a Sustainability Gap in Digital Social Innovation. The field has reached conceptual maturity – 135 papers synthesised into multidimensional framework with 12 validated pathways of research – but the circumstances of sustained existence beyond successful launch of digital social innovation projects have yet to be studied theoretically. The most detailed existing case study shows that the leapfrogging resulted in transformation along with obstacles to its sustainability, solved through top-down interventions from outside. There is no framework that integrates knowledge about which community capacities determine the sustainability of digital social innovation.

Second, there is an Aggregation Gap in Digital Inclusion. The issue is recognized as multidimensional today; adoption depends on interaction between ten factors including product, individual, and social contexts, and the barriers to literacy compound each other rather than add up. Inclusion projects are still designed against single types of barriers, and general solutions do not consider specifics of particular communities. While literature explicitly requires context-specific interventions solving root causes and not symptoms, it does not provide such framework.

Third, there is an Integration Problem between Design and Governance. Co-design has been validated as the means of achieving inclusive platform development, with pre-design requirements set out for accessible, low-tech, eco-friendly platforms, and policy analysis has established the tools available for achieving digital equity. These two literatures seldom intersect: the former leaves off at the artifact, the latter at the tool, without specifying the governance structures that support participatory design.

The three contributions of this paper are, therefore, as follows. The first contribution is a theoretical framework linking the capacity for digital social innovation, conditions for inclusive adoption, participatory co-design, and governance for community ownership. The second is an enumeration of measures for each construct within the framework. The third is a design for validating these against the literature's own methodological recommendations for root cause and contextual longitudinal research.

The Sustainable Digital Communities Framework

Pillar 1 — Digital Social Innovation Capacity

The first pillar relates to local capacity to create and implement social value enabled by digital technology. The concept of social innovation is created and implemented by a diverse group of actors in society using both top-down and bottom-up approaches. Its modern version is influenced by new age technologies that offer resource-efficient and multi-beneficial outcomes. Therefore, capacity consists of two factors: availability of the actors who can initiate and sustain innovation and access to technological resources for it to be resource efficient. From the experience of grassroots level case, one can see that capacity is real and transformational — the communities of a distant county

were transformed into entrepreneurs and their internet-based business was flourishing on a global scale. Nevertheless, from the same experience one can conclude that capacity alone is not enough because three problems emerged in the leapfrogging process and jeopardized sustainability.

The digital social innovation capacity could thus be viewed through three inter-related components. The first of these is the component of human capacity that refers to the people within the community who are eager to try out new digital innovations and have enough credibility to motivate others to act. The second component is the organisation capacity of cooperatives, self-help groups, local governments, civil societies and other entities that are capable of coordinating collective actions and pooling resources. The last is the technological component of having access to affordable, reliable and relevant digital tools that enable solutions to be created efficiently (Gupta et al., 2020). If only one of the above components is present within the communities, some innovations might take place in isolation but will not result in continuous social value creation.

Pillar 2 — Inclusive Adoption Conditions

The second pillar puts into practice the ten adoption determinants found in the literature, namely, value, usability, affordability, accessibility, technical support, social support, emotion, independence, experience, and confidence. Addressing these ten variables as ten individual variables might overlook the interplay among them, hence the need for a framework which addresses them within the context of three distinct bands according to the findings. Affordability and accessibility form the material band. Usability, experience, and confidence make up the capability band. Social support, technical support, value, emotion, and independence are within the relational band. Such an approach is due to the recognition that barriers tend to co-occur, whereby the presence of health-related limitations, availability of support, technological design issues, and limited resources all determine digital engagement, and that barriers have been found to be influenced by the interaction among individual, social, and contextual factors as opposed to skills deficit.

The pillar is also the absorber of the new conception of the gap. It is due to the fact that only the technical factors cannot give a full picture of the dimensions and context of the gap and that structural inequalities in terms of connectivity, price, and literacy deprive the marginalized people of access to education, health care, jobs, and civic opportunities.

The three-band framework further elucidates the ordering of the inclusion process. Material conditions, such as low-cost technology and data, are certainly an important place to start, but there is clear evidence that even significant advances in this band only result in superficial and usually fleeting usage. Capability conditions establish whether individuals are able to go from mere use to meaningful use, and relational conditions determine if meaningful use continues once challenges present themselves. In the case of older adults, for instance, the presence of someone in their family, among their peers, or from a community group to help them solve problems is often critical in continuing their usage (Khan et al., 2026). Inclusion conditions should thus not be considered a set of barriers to remove but a set of interdependent supports

Pillar 3 — Participatory Co-Design

The third component offers the way of making inclusion decisions prior to, rather than after, the building process. Platforms are cultural devices that can be used to shape practices, communicate information, and manage content, not just technical infrastructures, which implies that design becomes critical for participation. The proposed model uses the co-design approach described in the platform literature – engagement of users, stakeholders, and communities in ideation, prototyping, and evaluation of user experience and interface in order to provide responsive and inclusive design – and uses the pre-design requirements and parameters established for accessible, low-tech, and environmentally sustainable platforms ensuring economic sustainability and accessibility to digital content. The fact that similar platform cases are grouped into low impact, accessibility and inclusion, data exploration and visualization, and algorithms and AI categories offers a benchmark framework for measuring whether the design model of a community platform promotes inclusion or presupposes it.

The participatory approach to co-designing creates benefits in addition to the final product's effectiveness. Through the process of ideation and prototyping, community members learn to use digital technologies, get a sense of ownership over the solution created and act as informal advocates encouraging other people to engage in the process. Hence, co-design is important for the development of both Pillars 2, related to strengthening of capabilities and relationships, and Pillar 4, because a constituency is created that will ensure the sustainability of the platform. In some cases, it might be necessary to adapt co-designing for low-resource environments by holding meetings in local

language, designing paper prototypes or speech interfaces for illiterate users and organizing events taking into account agricultural work schedules.

Pillar 4 — Governance for Community Ownership

Pillar four looks at durability, with its tools being derived from policy analysis, and include infrastructure development, education, and regulation to facilitate digital access and literacy, realised in the form of national broadband strategies, digital literacy initiatives, and subsidisation of disadvantaged communities, including rural inhabitants, elderly individuals, and disabled persons. Its theory foundation rests on digital divide theory and capability approach, in line with the holistic philosophy of infrastructure development together with digital skill development and awareness campaigns. The implementation strategy recognises the limitations of budgets, fast technology evolution, and difficulties of acceptance, employing public-private partnerships, continuous evaluation, and high-need intervention in high need areas implemented through collaboration between the state, industry, and civil society. Due to the evidence that external top-down interventions play an important role in solving grassroots challenges and creating self-sustainable communities, this pillar serves as the instrument through which innovation is transformed into durability (Table 1).

The governance of community ownership also includes the question of who will be responsible for making decisions regarding the digital assets. The options for community ownership can vary widely, from the co-operative management of local platforms, control over data created by locals, community participation in budgeting for digital services, and representation of community members on the boards of initiatives which serve them. All of these ensure that digital initiatives will be accountable to those they aim to serve and that decisions regarding upgrades, pricing, and use of data will be made according to local needs. Otherwise, without any such mechanisms, local platforms could be appropriated by outside providers or local elites, thus reproducing exclusions which digital inclusion seeks to eliminate (Jumai et al., 2025).

Table 1: Framework Pillars, Functions, and Grounding Evidence

Pillar	Function	Grounding evidence
1 Digital Social Innovation Capacity	Generate and deploy digitally enabled social value through varied actors	Top-down and bottom-up deployment models; resource-efficient outcomes from new-age technologies; grassroots transformation alongside sustainability obstacles
2 Inclusive Adoption Conditions	Ensure participation across material, capability, and relational bands	Ten adoption factors spanning product, individual, and social context; compounding barriers; multidimensional divide; structural inequities in connectivity, cost, literacy
3 Participatory Co-Design	Fix inclusion decisions before build through pre-design requirements	Platforms as cultural devices; co-design across ideation, prototyping, evaluation; pre-design parameters for accessible low-tech platforms
4 Governance for Community Ownership	Sustain the other pillars through policy instruments and evaluation	Infrastructure, education, regulatory frameworks and targeted instruments; top-down interventions nurturing resilient communities

Interactions Among the Pillars

They [the four pillars] are not sequential stages; rather, they are interconnected elements whose impacts rely on each other. The potential for digital social innovations helps create the idea and momentum behind the digital initiative of the community, but unless there are inclusive adoption conditions in place, the initiative will favor only the connected and competent individuals. The inclusion of adoption conditions brings about more engagement, yet when the platforms are not designed jointly with the people in the community, the new members might experience interfaces and services that do not suit them, resulting in their withdrawal from the initiative. The participatory co-design results in better-matched platforms, but without proper governance structures, the results become unstable.

There is feedback in the other direction too. If there is effective governance, it provides stability for innovation to happen, because local participants are more likely to put effort into something if they know their efforts will be recognized and protected. A successful design process develops innovation capabilities, while wider participation increases the number of possible innovators by integrating new views into problem solving in the community. Thus, the model shows a reinforcement cycle where sustainability comes from the interaction of all pillars and not just their strength.

Theoretical Propositions

In order to render the framework testable, the following hypotheses are proposed. Hypothesis 1: Digital community initiatives that demonstrate innovation capacity alongside community ownership mechanisms in terms of governance would have greater sustainability beyond their initial funding compared to initiatives which have innovation capacity but lack governance mechanisms of community ownership. Hypothesis 2: Inclusion programs that cover material, capability and relational conditions will have more sustainable adoption among marginalized individuals compared to inclusion programs which cover only material conditions. Hypothesis 3: Participation co-design platforms that are designed using participatory co-design process with clear pre-design accessibility as well as low technology needs would have greater sustained usage among rural inhabitants, seniors and people with disabilities compared to participation co-design platforms without the process mentioned above. Hypothesis 4: The positive impact of participation co-design on sustained adoption would be greater in case where governance structures provide communities with a formal decision-making power with regard to platform maintenance and adaptation.

These hypotheses translate the theoretical assertions made in the framework into empirical relationships. In addition, these hypotheses indicate that interaction effects, rather than just direct effects are expected by the framework.

Methodology and Research Agenda

Research Design

The suggested design will be mixed methods design which will employ the approach of comparative case study, participatory design research, and longitudinal quantitative study. This approach takes care of the suggestion that context-specific metrics are needed in order to understand the causes of the digital divide as opposed to its symptoms, and the need for research on specific places that will combine connectivity and inclusion.

Phase 2 — Comparative Case Analysis

Comparative analysis will leverage the known typology of platform design cases — low impact, accessibility and inclusion, data exploration and visualisation, and algorithms and AI — and case evidence of digital social innovations from below, which identifies three opportunities for leapfrogging, three barriers and three top-down interventions from the remote county study. Case samples must differ in terms of rurality, infrastructure development, and community governance type, because of the known rural paradox where the need for connectivity is inversely correlated with access to connectivity.

Phase 3 — Participatory Co-Design Cycles

User, stakeholder, and community collaboration in co-design cycles takes place around ideation, prototyping, and evaluation of experience and interface while pre-design considerations such as accessibility, low tech, and eco-friendliness are used as constraints rather than goals. Participants need to be stratified to ensure inclusion of subgroups with intersectional obstacles.

Phase 4 — Longitudinal Adoption Study

The adoption construct comprises the ten determinants — value, usefulness, affordability, availability, technological support, social support, emotional appeal, autonomy, experience, and self-confidence — categorized under the material, capability, and relational rings of Pillar 2. There are three measurement waves proposed for the particular purpose of assessing the long-term consequences of the inclusion programs, which the literature indicates as one of the most prominent needs. As there is inconsistency in the definitions of digital literacy, it is important that the study specifies its definition and tests for robustness against alternative definitions.

Phase 5 — Equity and Access Audit

The audit documents the distribution of services among the differentiated groups, not their aggregate access, considering that systemic exclusion is evident among intersectional groups with differential consequences. The indicators have to take into account affordability, cost of connectivity compared to household income, and literacy because these are the factors found to be responsible for excluding marginalized communities; the indicators must also include those groups mentioned specifically in the policy analysis—rural communities, senior citizens, and disabled persons (Table 2).

Expected Contributions and Evaluation Dimensions

Table 2: Evaluation Dimensions and Candidate Indicators

Dimension	Indicator focus	Grounding rationale
Innovation capacity	Presence of local initiating actors; deployment mode; access to enabling technology	Social innovation deployed top-down and/or bottom-up by varied societal actors
Adoption across bands	Change across material, capability, and relational determinants	Ten adoption factors spanning product, individual, and social context
Compounded barrier reduction	Co-occurrence of health, support, design, and resource constraints	Barriers co-occur and jointly influence engagement
Design inclusion	Application of pre-design requirements; participation in ideation, prototyping, evaluation	Co-design as validation method; pre-design parameters for accessible platforms
Distributional equity	Access, affordability, and literacy distribution across groups	Structural inequities in connectivity, cost, and literacy; intersectional exclusion
Sustainability of the initiative	Continuity of the community initiative beyond initial funding	**Sampling and Case Selection** The process of selecting the cases to conduct the research on will involve employing purposive sampling, which implies conducting the tests in different conditions instead of one favourable one. The criteria of selection will include variations of four dimensions: level of rural nature/physical isolation, maturity of the digital infrastructure at the local level, method of initiative implementation (top-down, bottom-up, or mixed one), and strength of the community institution. At the local level, the interviewees will include members of the household, local organizations, and service providers with intentional over-sampling of those categories that include older people, women, people with disabilities, and poor families to ensure sufficient representation of the groups that experience multiple difficulties (Khan et al., 2026). It is critical to include both the initiatives that survive and those that fail because examining only the former will not help in revealing the factors that make communities sustainable and vulnerable. The sample size in the household survey needs to be sufficiently large so that comparisons can be made among subgroups within each community, whereas the qualitative cases need to be sufficiently numerous so that cross-case comparisons can be made without losing depth. The use of a sample of six to ten community cases, all of which are studied in depth, provides an effective compromise in this case. Obstacles to grassroots sustainability; role of top-down interventions

Data Collection and Analysis Strategy

In addition, the research agenda uses various sources of data to measure the various dimensions in the framework. The sources of qualitative data are the semi-structured interviews conducted with the community leaders, platform developers, government representatives and intermediaries; focus group discussions with the various stakeholders; and observations from the co-design workshops. Documented sources of data include reports of the programme,

policies and records of the use of the platforms. Sources of quantitative data are household surveys carried out during the three measurements.

Thematic analysis of the qualitative data will be carried out, adopting the four pillars as a starting point for coding while being open to any emerging themes. Case comparisons will help determine the patterns of conditions related to both sustained and unsustained initiatives in an area where outcomes can result from the presence of more than one factor and not a single factor alone. The quantitative data obtained from the survey will be analyzed using panel methods in order to measure the differences in adoption across the three bands of material, capability, and relational, and moderation analysis will be used to find out whether the governance structure moderates the relationship between co-design and sustainability as postulated in Proposition 4.

Ethical Considerations

Research conducted among digitally disconnected groups carries its own ethical challenges. Procedures for obtaining informed consent need to be tailored to those who have little or no literacy and knowledge about the technology, requiring oral informed consent and using language that participants can understand. Information gathered via the platform needs to be managed in such a way that the confidentiality of participants is preserved and no new risk is created, especially for older people and people with disabilities. Participating in co-design should not create excessive burden for communities in terms of time and travel costs, and results need to be shared back. In line with the participatory approach of the framework, communities need to be viewed as partners in research.

Discussion and Implications

Three arguments follow from the framework.

firstly, the concept of sustainability is a governance success, not an Adoption Success. Detailed case evidence indicates that in instances where technology leapfrogging led to economic transformation but created bottlenecks for further development, and external interventions played a critical role in breaking through the obstacle, enabling the growth of a sustainable community. As such, the governance element must be placed above innovation in the framework and ensure that continuity is seen as a success in its own right, independent of early adoption success. The problem of funding is thus redefined as follows – emergence and sustainability interventions may have to be treated as separate endeavors with different timeframes.

Second, the Disaggregation of Barriers is a Prerequisite for Successful Inclusion. Because the issues related to digital literacy are the result of interactions between individual, social, and contextual factors, as opposed to individual deficiencies, and because barriers tend to occur together within the context of health issues, access to support services, technology, and other resource constraints, a one-barrier approach will invariably fail to adequately serve those who are at greatest risk. As the evidence indicates that adoption is influenced by factors going beyond mere performance and cost to encompass social support, emotions, independence, and confidence, so community initiatives must be assessed not only on the basis of the material band but also on the relational band.

Thirdly, Design Choices are Governance Choices. Since platforms act as cultural tools in practice and content management, and since user participation during the ideation, prototyping, and evaluation stages can make design processes more effective and inclusive, inclusion is decided prior to the development of the platform. The definition of the pre-design specifications of accessible, low-tech, and sustainable platforms which ensure economic sustainability and increase accessibility to digital content is a practical way of including inclusion into the platform.

The Role of Emerging Technologies

Advanced technology, including artificial intelligence, voice assistants, and inexpensive mobile apps, presents challenges as well as advantages for digital communities that are sustainable. Firstly, voice-operated and AI-enabled interfaces have a potential to lower the literacy and expertise requirements of digital services, thus giving a chance for first-generation users to obtain information, conduct transactions, and communicate with government authorities in their native language. In such a way, the advanced translation, voice recognition, and conversation assistants can help overcome the hurdles in the capability component of Pillar 2, especially for elderly people and illiterate population (Gupta et al., 2020).

Alternatively, these technologies may generate new kinds of exclusion when they are developed using undersampled data regarding marginalised populations, when they need high-tech equipment and always fast connectivity, or when the decision-making processes of such technologies remain unclear for communities relying on them. Algorithm-driven platforms, which fall into one of the categories found in comparative platform analysis, call for

special consideration of the issue of transparency and accountability (Carlomagno et al., 2026). The framework argues that emerging technologies need to be implemented in the same manner as other community platforms by applying a participatory approach to their development and governance to determine whether a new technology actually improves the capabilities of a community or just changes its dependency on some external provider for another.

The fast speed of development of technology further emphasises the need for governance. Due to constant changes in tools, platforms and standards communities require institutional arrangements to make sure that they have the opportunity to assess and adapt the technology used and to replace them if needed. Multi-stakeholder approach and policy evaluation seen in the policy literature as reactions to fast technological change are the basis for adaptive governance (Jumai et al., 2025).

These four groups of implications exist for practice. For policy makers, the model provides a basis for adopting holistic strategies which integrate infrastructure, skills, and public awareness campaigns through public-private partnerships, policy evaluation, and intervention strategies in high need communities through a process of cooperation among government, industry, and civil society sectors. The model is also consistent with the specific priorities for investment that are determined by synthesis efforts: affordable broadband connectivity, specific programmes and training, as well as culturally appropriate content in multiple languages, together with culturally relevant training both online and offline, human-centric digital services, community-based digital literacy programmes, and a digital equity strategy across all three tiers: federal, state, and local. For community-based organizations, this model implies that support for adoption needs to be based on the ten determinants of digital inclusion and not on device delivery alone, as well as programs taking into consideration the barriers among older adults and other marginalized subpopulations. Platform developers are supposed to implement the pre-design accessibility and low technology requirement before the build while seeing participation in ideation, prototyping, and evaluation as a form of validation and not a consultation process. For the funder, the model means a move away from capital investment towards the provision of operations funds, since sustainability beyond the initial funding period is the weakness of grass root digital social innovation.

Implications for Emerging Economies

This framework finds particular importance in emerging countries where digital infrastructure has developed very quickly but unevenly. In such cases, national programs have focused more on connectivity and public digital services while overlooking the contextual aspects that decide whether digital tools can be put to effective use (Salemink et al., 2017). The framework proposes that the future development of digital services should be based on institutional strengthening at the local level and providing an intermediary role for the community to ensure their ownership of digital programs. Self-help groups, farmer producer organisations and local governance institutions find themselves well suited to this purpose, as long as there is consistent investment in building their capabilities rather than one-off projects.

Language and culture need special consideration. Many digital services have been built to cater to people comfortable in using a dominant language and interacting with a text-based interface. Investing in multilingual content, voice-based interactions and culturally appropriate design can reduce capability barriers faced by first-time users considerably (Raihan et al., 2025). In the same vein, the gendered aspects of access such as differential ownership and availability of devices must be considered in order to avoid widening inequalities that exist within households and communities.

Implications for Theory

Theoretically, the framework makes its contributions through linking three separate literatures that have grown largely independently of each other. The first contribution made by this framework is in extending digital social innovation studies in a way that identifies the conditions of continuity of innovation instead of emergence (Krombacher et al., 2026). The second contribution made by the framework is in refining digital divide studies by grouping adoption drivers into physical, capability, and relational groups. Moreover, it connects participatory design studies to governance by demonstrating that design process itself is an instrument of community ownership. In this way, the framework addresses the need to focus research on the root causes of digital exclusion within particular contexts (Raihan et al., 2025).

Limitations

The model is conceptual and lacks empirical validation; its variables are suggested for testing and not stated as established research results. The model is based on case evidence taken from a single grassroots investigation of leapfrogging, which restricts generalisation due to other infrastructure and market environments. The research base used to build Pillar 2 faces the challenge of ambiguous understanding of digital literacy as one of the most serious

issues, thus, the capability range needs to be carefully formulated before being measured. Lastly, since systemic discrimination affects different intersectional groups differently, it is necessary to take into account that one-dimensional measures of equity will fail to capture this fact.

Future research may address these limitations by pursuing multiple directions. Comparative studies across countries with varying levels of infrastructure development, markets, and traditions of governance may serve to test the generalizability of the conceptual framework. Studies that focus on particular groups, like women in rural communities, migrant workers, people with disabilities, and older adults living alone, may help understand whether there is any difference in the importance of the adoption bands for these subgroups. Research related to novel technologies, like artificial intelligence and voice assistants, can be used to see if these technologies make the process more accessible or less. Lastly, longitudinal studies for a number of years may show how the relationship between the four pillars changes over time.

Conclusion

A sustainable digital community cannot be achieved by investments in connectivity alone, and the reasons behind this statement are clearly stated in the evidence that has been discussed above. While digital social innovation is able to change the economic life of a particular area by creating challenges to its further implementation, it means that sustainability should be planned and managed separately. The process of exclusion happens through the combination of a number of different barriers including access, affordability, skills, and design that make the majority of constraints unaffected by particular interventions.

The response by this paper is a framework consisting of four pillars, namely the capacity for digital social innovation; inclusive adoption conditions at material, capability, and relational levels; participatory co-design with inclusion criteria even before the design stage; and the governance mechanisms ensuring community ownership. Taken together, these pillars redefine digital inclusion not as an end product of technology adoption but rather as a prerequisite for community resilience. The value of the proposed framework lies in connecting three literature streams, namely those of social innovation, digital divide, and participatory design, separately developed until now, and providing concrete constructs to test the connections rather than just assert them.

For professionals and policy-makers alike, the main lesson to take away is that sustainable practices need to be considered from the very start of any community-based digital initiative. This will involve developing innovation capabilities locally, considering the entire spectrum of conditions for adoption, bringing communities into the process of making decisions about the design of platforms before they are developed, and creating governance mechanisms which ensure long-term control by communities. Those initiatives which consider all four pillars will stay relevant, adaptable and appreciated long after their initial cost has paid off.

This forward plan is an empirical one. The next step that is needed is longitudinal data on whether decisions regarding participation in design, taken prior to building, have any effect on the adoption results for those communities most likely to be marginalized, and whether tools of governance that are intended to ensure continuity do, in fact, enable the sustainability of community digital initiatives beyond the initial stage of development. Until this is established, digital community planning will keep measuring success at the moment of adoption, when in fact, this is where the real challenges begin.

References

Armenta, Á., Serrano, A., Cabrera, M., & Conte, R. (2012). The new digital divide: the confluence of broadband penetration, sustainable development, technology adoption and community participation. *Information Technology for Development*, *18*(4), 345-353. https://doi.org/10.1080/02681102.2011.625925

Jumai, A., Rahman, A. S., Oluwakemi, F., Godwin, N., Ogechukwu, N. E., Abbey, N. I., ... & David, A. (2025). The role of US government policy in advancing digital access and equity. *International Journal of AppliedResearch in Social Sciences*, *7*(3), 152-168. https://doi.org/10.51594/ijarss.v7i3.1827

Carlomagno, M., Izzo, F., & Veneziano, R. (2026). Digital and Interactive Platforms as networking and data-sharing tool. *Fashion Highlight*, (SI2). https://doi.org/10.36253/fh-3946

Gupta, S., Kumar, V., & Karam, E. (2020). New-age technologies-driven social innovation: What, how, where, and why?. *Industrial Marketing Management*, *89*, 499-516. https://doi.org/10.1016/j.indmarman.2019.09.009

Kazanskaia, A. N. (2025a). Digital community engagement in practice: Toward inclusive and sustainable futures. NEYA Global Journal of Non-Profit Studies. https://doi.org/10.64357/neya-gjnps-tchdrcmeng-13

Kazanskaia, A. N. (2025b). Tech-driven community engagement: Addressing digital divide challenges. NEYA Global Journal of Non-Profit Studies. https://doi.org/10.64357/neya-gjnps-tchdrcmeng-12

Khan, S., Webster, S., Puxty, J., & Robertson, M. (2026). Key challenges and barriers to digital literacy for older adults: Scoping review. *JMIR aging*, *9*, e80647. https://doi.org/10.2196/80647

Krombacher, A., Lindenthal, A. K., Oberländer, A. M., & Schäfer, R. (2026). Sustainable through Digital–A Research Agenda for Digital Social Innovation. *Information Systems Frontiers*, *28*(1), 381-417. https://doi.org/10.1007/s10796-025-10664-5

Lee, C., & Coughlin, J. F. (2015). PERSPECTIVE: older adults' adoption of technology: an integrated approach to identifying determinants and barriers. *Journal of Product Innovation Management*, *32*(5), 747-759. https://doi.org/10.1111/jpim.12176

Raihan, M. M., Subroto, S., Chowdhury, N., Koch, K., Ruttan, E., & Turin, T. C. (2025). Dimensions and barriers for digital (in) equity and digital divide: A systematic integrative review. *Digital Transformation and Society*, *4*(2), 111-127. https://doi.org/10.1108/dts-04-2024-0054

Salemink, K., Strijker, D., & Bosworth, G. (2017). Rural development in the digital age: A systematic literature review on unequal ICT availability, adoption, and use in rural areas. *Journal of rural studies*, *54*, 360-371. https://doi.org/10.1016/j.jrurstud.2015.09.001

Tim, Y., Cui, L., & Sheng, Z. (2021). Digital resilience: How rural communities leapfrogged into sustainable development. *Information Systems Journal*, *31*(2), 323-345. https://doi.org/10.1111/isj.12312