Article

Digital Social Innovation and Sustainability: Theory, Practice, and Debate

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Abstract: Digital social innovation (DSI), the use of digital technologies by citizens, civil society organizations, social enterprises, and public institutions to develop novel solutions to social and environmental problems, has evolved over the past decade and a half as a distinct field of research and practice at the intersection of technology studies, innovation studies, and sustainability science. Current study explores the interdisciplinary literature on DSI and its relationship to sustainability, in its triple-bottom-line sense of environmental, social, and economic dimensions. It traces the conceptual roots of DSI in the broader social innovation literature and in information-systems research on digital innovation, reviews the major theoretical frameworks, including a nascent multidimensional framework spanning digital technology, innovation process, and sustainability focus to connect digital innovation to sustainable development, and examines empirical evidence on how digitally enabled initiatives, from open data commons and citizen science to platform cooperatives, civic technology, telemedicine, and precision agriculture, contribute to the Sustainable Development Goals (SDGs). The research engages critically with the limits of DSI's contribution, including the digital divide, the environmental footprint of digital infrastructure itself, the phenomenon of data colonialism, and the tendency toward technological solutionism, before setting out a twelve-pathway research agenda and highlights practical implications for practitioners, policymakers, and researchers. DSI offers a genuine, if bounded and unevenly distributed, set of tools for advancing sustainability, and its future contribution depends less on the sophistication of the technology involved than on the governance arrangements, funding ecosystems, and power relations within which that technology is embedded.

Keywords: digital social innovation; sustainable development goals; social innovation; platform cooperativism; digital divide; data colonialism; civic technology

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1. Introduction

The idea that digital technologies might be harnessed not merely for commercial advantage but for explicitly social and environmental ends has moved, over roughly the past fifteen years, from a marginal fraction of activists and open-source hobbyists to a recognized field of policy, funding, and academic inquiry. The term "digital social innovation" (DSI) was popularized in Europe through a series of studies commissioned by the European Commission and led by the UK innovation foundation Nesta, which in 2015 identified more than a thousand organizations across Europe using digital tools, i.e., open hardware, open networks, open data, and open knowledge to address social challenges (European Commission 2015). Since then, DSI has been taken up as an object of study by scholars of urban planning, public administration, information systems, and sustainability science, even as its boundaries remain contested and its practices fragmented across sectors and geographies.

Sustainability is one of the most widely invoked, and most widely criticized, concepts in contemporary policy discourse. Since the Brundtland Commission's 1987 formulation of sustainable development as development that fulfills the needs of the present without compromising the ability of future generations to meet their own needs, and since John Elkington's subsequent popularization of the "triple bottom line" of people, planet, and profit (Elkington 1997), sustainability is understood as a multidimensional balancing act among ecological, social, and economic imperatives, a framing that culminated in the United Nations' 2015 adoption of seventeen Sustainable Development Goals (SDGs).

The convergence of these two literatures, one concerned with how digital tools reshape social innovation, the other with how societies pursue long-term ecological and social viability, is the

subject of this paper. The convergence is not accidental. Digital social innovators have frequently framed their work explicitly in sustainability terms, from citizen-built air-quality sensors that feed environmental policy, to open-source participatory budgeting platforms that aim to strengthen the "strong institutions" targeted by SDG 16, to platform cooperatives that seek to redistribute the economic gains of the sharing economy. Conversely, sustainability scholars and policymakers have increasingly identified digital technology including artificial intelligence, the Internet of Things, blockchain, and big data analytics among them as a critical enabler of the SDGs (Varriale and Mark et al. 2025).

However, the relationship is not one of simple mutual reinforcement. Environmental costs of the digital infrastructure, from the growing carbon and water footprint of data centers to the so-called digital rebound effect, in which efficiency gains in computing are outpaced by growth in demand (Belkhir and Ahmed 2018; Lange and Johanna Pohl et al. 2020). Questions have been raised whether DSI, for all its participatory rhetoric, tends in practice to reproduce rather than redistribute existing inequalities of data, infrastructure, and power between the Global North and Global South (Couldry and Ulises 2019). Current study reviews the literature on DSI and sustainability with these tensions in view.

2. Social Innovation

Social innovation itself requires definition, a difficult task for a frequently cited term in the scholarly literature (Ayob and Simon Teasdale et al. 2016). Social innovation traces its lineage to early twentieth-century sociology, notably Lester Ward's Pure Sociology (1903), but its contemporary usage owes more to the work of policy-oriented institutions such as Britain's Young Foundation, established in 1954, and the innovation foundation Nesta where it was later absorbed.

(Phills and Kriss 2008), defines social innovation as "a novel solution to a social problem that is more effective, efficient, sustainable, or just than existing solutions, and for which the value created accrues primarily to society as a whole rather than to private individuals." A complementary definition centered on motivation and diffusion is that social innovations are "innovative activities and services that are motivated by the goal of meeting a social need and that are predominantly developed and diffused through organizations whose primary purposes are social" (Mulgan and Simon et al. 2007). While the Phills, Deiglmeier, and Miller definition emphasizes outcomes as the novelty and superiority of the solution, the Mulgan definition emphasizes process, specifically the intent behind an innovation and the organizational form through which it spreads.

Frances Westley's views social innovation as any initiative that "profoundly changes the basic routines, resource and authority flows, or beliefs" of a social system, while more instrumental definitions favored by development agencies equate social innovation simply with the application of a new idea to an unmet social need (Cajaiba-Santana 2014). This conceptual looseness reflects social innovation's status as a practice-led rather than theory-led field. This term that emerged from foundations, consultancies, and practitioner networks before it was subject to systematic academic theorizing, and its multiple definitions consequently track differences among funders and intermediaries as much as differences among scholarly traditions.

What unites most definitions, however, is a shared contrast with commercial innovation. Where business innovation is typically motivated by profit maximization and captured privately by a firm and its shareholders, social innovation is motivated primarily by unmet social need adding value that accrues broadly to society (Mulgan and Simon et al. 2007). Cross-sector collaboration among civil society, the state, and, increasingly, the private sector is frequently identified as a further defining feature (Phills and Kriss 2008). Mulgan's later work situates social innovation explicitly within the sustainability agenda, as the deliberate invention of new solutions to social needs is as urgent a task for the twenty-first century as technological and scientific innovation, and that the two forms of innovation must increasingly be developed in tandem to address most pressing social, economic, and environmental challenges (Mulgan 2019).

3. Digital Social Innovation

Digital social innovation is "a type of social and collaborative innovation in which innovators, users, and communities collaborate using digital technologies to co-create knowledge and solutions for a wide range of social needs" a definition first articulated in the European Commission-funded research led by Francesca Bria and Nesta (Bria 2014). The DSI4EU project, executed from 2013 to 2019, was the first systematic attempt to map this emerging field at continental scale. Its 2015 report, identified more than a thousand DSI organizations and 646 collaborative projects across Europe through a crowd mapping exercise conducted on the platform digitalsocial.eu (European Commission 2015).

This mapping exercise proposed a fourfold typology of the technological trends underlying DSI. These are open hardware, associated with the global maker movement and exemplified by projects such as Safecast, which enabled citizens to measure and share radiation data following the Fukushima disaster; open networks, referring to mesh networks and community-owned connectivity infrastructure; open data, encompassing both government open-data initiatives and citizen-generated data commons; and open knowledge, covering peer-production projects such as Wikipedia and open educational resources (European Commission 2015). A subsequent Nesta report, the European Digital Social Innovation Index, operationalized the concept further by ranking sixty European cities across thirty-two indicators grouped into six themes namely funding, skills, civil society, collaboration, infrastructure, and diversity and inclusion deemed important for the creation, growth, and sustainability of DSI ecosystems (Nesta n.d.).

Academic engagement with DSI initially lagged behind this policy-oriented mapping work, and surged substantially since roughly 2018. DSI in urban contexts is found to be "nascent, limited, and considered fragmented," with much of the empirical literature consisting of single case studies of individual smart-city or civic-technology initiatives rather than comparative or theory-building work (Angelidou and Artemis 2018). This fragmentation reflects DSI's inherently interdisciplinary character. It draws simultaneously on information systems research, urban and regional planning, social innovation theory, and science and technology studies, each of which brings different assumptions about causality, agency, and evaluation. DSI is misused whenever it is invoked to suggest that technology is neutral or that innovation diffuses evenly across society; properly understood. DSI names digital technologies' distinctive capacity to open up new, historically unprecedented possibilities for horizontal coordination, knowledge-sharing, and interdependency among otherwise dispersed actors, possibilities that did not exist prior to internet-enabled platforms

(WeMake 2019, Bria 2015). DSI should be recognized not merely as social innovation with a digital veneer but as an independent category of agency, with its own distinctive forms, mechanisms, and consequences (Bria 2014; Cangiano and Zoe 2017; Stokes 2020). DSI inherited from its parent field of social innovation both a strong normative orientation toward unmet social need and an emphasis on cross-sector, participatory processes of co-creation, features that made an eventual convergence with the sustainability agenda close to inevitable, since sustainable development is itself defined in cross-sectoral, multi-stakeholder terms.

Recently DSI is defined not primarily as a policy category, as in the Nesta tradition, but as the systematic synthesis of two previously distinct research streams: digital innovation (DI) and social innovation (SI). Current study treats digital innovation as innovation in which digital technologies play an essential role in either the innovation process or its outcome, and locates its distinctiveness in a small set of properties, reprogram ability, convergence, and self-referential generativity, possessed by digital technologies that require organizations to manage development, implementation, and diffusion differently than they would for conventional, non-digital innovation (Kohli and Nigel 2019). Hence, social innovation, relates to economically viable ideas that primarily create social value and address societal challenges across the economic, social, and ecological pillars of sustainability (Tracey and Neil 2017).

DI is driven principally by the deployment of digital technology within an innovation process, and SI is driven principally by the ambition to address a societal challenge (Buck and Anna et al. 2023). DSI is driven by a third, distinct logic; the exploration or exploitation of new opportunities specifically for "doing good", for generating social and economic value simultaneously through digitally enabled means. This synthesis is pursued by small civic or nonprofit actors and established firms seeking to combine digital transformation strategies with social-value creation.

This IS-theoretic synthesis indicates that the Nesta-tradition mapping studies, focused as they are on ecosystem-level indicators, tend to leave implicit. DSI is not merely the application of digital tools to pre-existing social problems, but a distinct innovation logic that reconfigures how resources are mobilized, how value is created, and how impact is measured, relative to both purely commercial digital innovation and purely analog social innovation. Recent scholarship terms Digital Resource Leverage (DRL) as the observation that social ventures, rather than building proprietary digital infrastructure from scratch, increasingly mobilize accessible, modular, and non-owned digital tools, i.e., no-code development platforms, open government and scientific data infrastructures, and existing collaborative online networks, to achieve innovation that is simultaneously frugal, given severe resource constraints, and potentially scalable, given the reach that digital tools afford. This assembling available digital resources into novel configurations has been described, by analogy with the organizational-theory concept of bricolage, as "digital bricolage", a mode of innovation under scarcity that is particularly salient for social ventures operating in low-resource or Global South contexts.

4. Sustainability from Brundtland to the SDGs

Sustainability is conventionally dated to the 1987 report of the World Commission on Environment and Development, chaired by Norwegian prime minister Gro Harlem Brundtland and published as Our Common Future. The Brundtland Report defined sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs," a formulation whose very generality as it specifies neither which needs nor how trade-offs between generations are to be adjudicated, has allowed it to be adopted across an extraordinarily wide range of political and disciplinary contexts, while also leaving open long-running debates between advocates of "weak" sustainability, which treats natural and produced capital as substitutable, and "strong" sustainability, which holds that certain forms of natural capital cannot be replaced (World Commission on Environment and Development 1987).

A second foundational moment came in 1994, when John Elkington coined the term "triple bottom line" to describe a framework in which organizational performance is assessed not only on financial grounds but simultaneously against social and environmental criteria, colloquially, "people, planet, and profit." Elkington's own later account, developed in his 1997 book Cannibals with Forks, presented the triple bottom line partly as a provocation. He asked whether it would represent genuine progress if corporations that "devour" competitors and industries did so using the three-pronged fork of sustainability accounting, rather than abandoning extractive and consolidating practices altogether (Elkington 1997). The triple-bottom-line framework has become the default heuristic through which both scholars and practitioners decompose sustainability into distinct, if interacting, environmental, social, and economic dimensions, the same decomposition this paper uses to organize its discussion of DSI's contribution.

The United Nations' 2030 Agenda for Sustainable Development, adopted in 2015, translates the Brundtland and triple-bottom-line traditions into seventeen Sustainable Development Goals and 169 associated targets spanning poverty, hunger, health, education, gender equality, clean water, affordable energy, decent work, industry and infrastructure, inequality, sustainable cities, responsible consumption, climate action, life below water and on land, peace and strong institutions, and global partnership. The SDG framework is a dominant reference point against which contemporary digital-sustainability research is organized, with a growing bibliometric literature mapping which digital technologies are most frequently associated with which goals, artificial intelligence and geospatial technologies, for instance, feature prominently in research on SDGs 2, 3, 7, 12, and 13, while a persistent gap exists in the application of digital technologies specifically to social-sustainability goals (Varriale and Mark et al. 2025).

The SDG framework, precisely because of its breadth, has itself been criticized on grounds analogous to those leveled at the Brundtland definition. It aggregates goals that may be in tension with one another (for instance, industrial growth targets alongside climate targets), ignoring the political and economic structures including the structure of digital markets themselves, within which "sustainable" outcomes are to be pursued.

5. Theoretical Frameworks Linking DSI and Sustainability

The policy-oriented DSI literature treats digital social innovation as an ecosystem phenomenon. It lables its as a population of organizations, funders, intermediaries, and infrastructures whose collective density, connectivity, and diversity determine the rate at which social innovations are generated, scaled, and diffused. This framework underlies Nesta's mapping studies and the European Digital Social Innovation Index, which operationalizes ecosystem health across the six dimensions of funding, skills, civil society,

collaboration, infrastructure, and inclusion (Nesta n.d.; European Commission 2015). The ecosystem framework treats sustainability less as a direct output of any single innovation than as an emergent property of a well-functioning innovation system, where promising initiatives are not merely piloted but adequately resourced, networked, and supported through to scale, a distinction Mulgan has argued is frequently more consequential than the initial creativity of an idea (Scholz 2016, WeMake 2019).

A second framework, drawn from strategic management, treats digital technologies as strategic resources that commercial, civic, or governmental organizations can deploy to achieve sustainability-linked competitive advantage or mission outcomes. (Varriale and Mark et al. (2025) explicitly propose extending the Resource-Based View of the firm to incorporate digital technologies as resources contributing to SDG attainment, a move that reframes sustainability not as an externality to be managed but as a source of value creation enabled by digital capability. This resource-based framing does not align with the social-innovation literature's emphasis on need-driven, non-profit-maximizing motivation. The tension between the two is visible in empirical studies of "digital service innovation for sustainable development," which identify multiple distinct mechanisms including resource substitution, information provision, and network orchestration through which digitally enabled services generate social, environmental, and economic value simultaneously, while cautioning that purposeful design toward sustainability outcomes cannot be assumed and must instead be actively engineered into service architectures.

A third framework, rooted in adult-education and organizational-learning theory, treats sustainability-oriented innovation as fundamentally a process of social learning, specifically, the kind of "double-loop" or emancipatory learning in which actors not only solve problems within existing frames but revise the frames themselves. Social learning theory is central to research connecting sustainability and innovation because it explains how the questioning of existing rules and norms, a precondition for transformative rather than merely incremental innovation, can be catalyzed through collective, dialogical processes (da Silva-Jean and Jordana 2024). Digital platforms, matter for sustainability less because of any particular functionality than because of their capacity to widen and accelerate the circles of participants engaged in such collective sense-making.

A fourth and more recent framework departs from the other three by asking not how digital technology can serve sustainability goals defined elsewhere, but whether digital artifacts and infrastructures are themselves sustainable, as being durable, maintainable, and available over the long term. This "digital sustainability" links the long-term availability of data, software, and digital knowledge commons to the broader aims of sustainable development. It treats questions of software maintainability, data preservation, and digital-infrastructure ownership as sustainability questions in their own right, not merely as means to environmental or social ends. This framework directs attention to who owns and controls the digital infrastructure underlying DSI initiatives, a question the ecosystem and resource-based frameworks tend to bracket.

Together, these four frameworks are not mutually exclusive but rather emphasize different loci of analysis. The ecosystem framework foregrounds networks and intermediaries; the resource-based framework foregrounds organizational strategy; the social-learning framework foregrounds cognitive and relational processes; and the digital-sustainability framework foregrounds infrastructure and ownership.

A fifth, more recent framework seeks explicitly to integrate the preceding four by structuring DSI analysis along three orthogonal dimensions. (Krombacher and Anna-Katharina et al. 2026) propose a theory-based multidimensional framework spanning digital technology, digital innovation, and sustainability focus. The first dimension concerns the role digital technology plays within a given DSI initiative. Technology may function as a means, an enabling tool that facilitates a social innovation whose core value proposition is not itself technological, as when a telemedicine platform simply connects an existing rural clinic to an existing pool of doctors or as an end, where the digital artifact is itself the innovative outcome, as when a purpose-built application is designed from the ground up to address a specific social challenge.

The second dimension concerns the stage of the digital innovation process at which a given study or initiative is best located: ideation, development, implementation, or diffusion. DSI scholarship has so far concentrated disproportionately on the ideation and implementation stages, documenting what initiatives exist and how they were built, while devoting comparatively little systematic attention to the diffusion stage, the process by which a successful pilot initiative scales beyond its original context (Krombacher and Anna-Katharina et al. 2026).

The third dimension is the sustainability focus of the initiative, decomposed, consistent with the triple-bottom-line framework introduced in Section 4, into economic, social, and ecological pillars, and further mapped against the seventeen SDGs. (Krombacher and Anna-Katharina et al. 2026) use this three-dimensional structure to identify six research clusters spanning the existing literature and to derive, from gaps in the coverage of those clusters, twelve concrete pathways for future research. The multidimensional framework's principal contribution is methodological.

6. Enabling Technologies and Mechanisms of DSI

Nesta's original four-part typology, open hardware, open networks, open data, and open knowledge, are a useful starting taxonomy (European Commission 2015), but the subsequent decade has added artificial intelligence, the Internet of Things (IoT), and blockchain to the technological repertoire most commonly associated with digitally enabled sustainability initiatives (Digital Technology to Support Sustainable Development Goals 2024).

Open data initiatives, ranging from government transparency portals to citizen-generated environmental datasets, function as a foundational layer beneath many other forms of DSI. They lower the cost of civic monitoring, enable comparative accountability across jurisdictions, and provide the raw material on which subsequent applications of dashboards, alert systems, participatory mapping tools are built. Open hardware and low-cost sensor technology, extend this data-generation capacity from institutions to individual citizens, enabling forms of citizen science and environmental crowdsourcing (European Commission 2015).

Civic technology platforms, purpose-built software for participatory budgeting, deliberation, and public consultation, constitute a second major mechanism. IoT and sensor networks, similarly, extend DSI into infrastructure monitoring and resource management, supporting applications from smart-grid load balancing to precision agriculture. Artificial intelligence and machine learning are particularly consequential for SDGs concerned with clean energy, responsible consumption, and climate action, where pattern recognition across large datasets can support forecasting, optimization, and early-warning functions that would be infeasible

manually (Varriale and Mark et al. 2025). Blockchain and distributed-ledger technologies, finally, with more mixed empirical support are mechanisms for supply-chain transparency and sustainable procurement, particularly in production and manufacturing contexts where the provenance of materials bears directly on environmental and labor standards.

A cross-cutting mechanism known as scalable coordination is digital platforms' capacity to reduce the transaction costs of organizing dispersed, often volunteer, participants around a shared task, whether that task is monitoring air quality, deliberating over a municipal budget, or co-producing open-source software. This coordination function is frequently identified as DSI's most distinctive contribution relative to earlier, pre-digital forms of social innovation (WeMake 2019, Bria 2015). This coordination capacity enables civic mobilization also underlies the extractive data practices associated with dominant commercial platforms, a tension that runs throughout the literature on DSI's sustainability contribution.

A systematic review of forty-five peer-reviewed studies published between 2010 and 2022 finds a marked and continuing spread in the use of blockchain, the Internet of Things, artificial intelligence, and autonomous robotics across initiatives addressing all seventeen SDGs, with these four technology families increasingly playing a coordinating role across the digital-ecosystem, social, and innovation dimensions of DSI (Dionisio and Sylvio et al. 2024). Blockchain and other Web 3.0 technologies are contested within this repertoire. Proponents argue that decentralized-ledger architectures can increase transparency and trust in DSI initiatives by removing intermediaries, enabling more equitable value distribution among participants, and reducing the transaction costs associated with cross-border or peer-to-peer exchange, features that map naturally onto the platform co-operativist aspirations. Emerging research calls for closer examination of how Web 3.0 platforms might be designed to advance, rather than merely rhetorically invoke, sustainable digital social innovation, reflecting continued uncertainty about whether blockchain's much-touted decentralization benefits are realized in practice or remain, for most DSI initiatives, more aspiration than accomplished fact.

7. DSI and Environmental Sustainability

The most mature domain of DSI's environmental contribution is citizen science. It is the use of digitally coordinated volunteer networks to collect environmental data at a scale and geographic distribution that professional monitoring networks cannot match. Platforms such as iNaturalist enable structured biodiversity observation by non-specialist participants, while low-cost sensor projects, including the Smart Citizen Kit and comparable open-source air-quality frameworks, allow communities to generate hyperlocal pollution data that can complement, and in some cases substitute for, official monitoring networks, particularly in under-monitored urban neighborhoods. Beyond routine monitoring, crowdsourced environmental data is valuable in disaster response and rapid-onset environmental events, where distributed citizen reporting can outpace the deployment of professional survey teams. Observers connected to their immediate environment are better positioned than centralized agencies to recognize the early warning signs of localized hazards such as flash flooding, a dynamic that has led United Nations environmental bodies to identify citizen science as a direct contributor to the data infrastructure underlying several environment-related SDGs.

A second environmental domain concerns digitally enabled resource-sharing and the circular economy, the strategy of extending the useful life of products and materials rather than following a linear take-make-dispose model. Online platforms enable circular-economy practices by allowing individuals and organizations to share access to underused physical assets, thereby reducing aggregate demand for new production; ride-sharing and car-sharing platforms are frequently cited examples, insofar as increased utilization of existing vehicle assets can reduce the production-related emissions associated with manufacturing new vehicles. Major technology platforms position their infrastructure as circular-economy enablers, as in Google's stated partnership with the Ellen MacArthur Foundation to support digital circular-economy tools.

The empirical evidence for these environmental claims is, however, mixed. A study of seventy-three German-language digital sharing platforms found that while virtually all identified rhetorically with circular-economy principles, their actual business models and operational goals varied widely, with a substantial subset oriented primarily toward profit rather than environmental outcomes, suggesting that the environmental benefits attributed to the sharing economy are neither automatic nor uniformly realized across the sector. Sharing-economy platforms can both contribute to and inhibit environmental sustainability depending on their design, ownership structure, and the extent to which increased asset utilization is offset by induced.

A distinct and increasingly influential strand of research inverts the usual framing by treating digital infrastructure not as a tool for environmental sustainability but as a source of environmental burden in its own right. Greenhouse gas emissions attributable to the manufacture of information and communications technology (ICT) components could rise from roughly one to one-and-a-half percent of the global total in 2007 to over fourteen percent by 2040, driven substantially by the growing footprint of smartphones and networking infrastructure (Belkhir and Ahmed 2018). Data centers, in particular, have drawn sustained scrutiny. Their combined electricity, cooling-water, and land-use footprint are rival the total electricity consumption of mid-sized countries. While individual facilities are more energy-efficient per unit of computation, workload growth intensified in recent years by the computational demands of artificial intelligence, has outpaced these efficiency gains, resulting in continued growth in absolute emissions.

This dynamic is widely analyzed through the lens of the rebound effect, sometimes termed Jevons' Paradox after the nineteenth-century economist who observed that more efficient use of coal in steam engines paradoxically increased, rather than decreased, aggregate coal consumption. Despite substantial efficiency improvements in digital technologies, ICT's aggregate energy consumption and carbon footprint are growing continuously, a pattern consistent with a digital rebound effect in which efficiency gains lower the effective cost of digital services and thereby stimulate increased demand rather than net energy savings (Lange and Johanna et al. 2020). Similar dynamics have been documented in energy-intensive industry in China, where reductions in the energy intensity of individual ICT-enabled processes were accompanied by increases in overall industrial energy use (Jin and Wenying 2022).

These studies suggest that any accounting of DSI's environmental contribution must net out the emissions embedded in the digital infrastructure of devices, networks, and data centers through which that contribution is delivered, rather than treating digital tools as environmentally costless means to environmental ends.

8. DSI and Social and Economic Sustainability: Platforms, Cooperatives, and Inclusion

If the environmental dimension of DSI centers on resource use and infrastructure, its social and economic dimension centers substantially on questions of ownership and the distribution of value generated by digital platforms. This is answered vy platform cooperativism, a term coined by Trebor Scholz in a 2014 essay criticizing the labor practices of dominant "sharing economy" platforms such as Uber and TaskRabbit and calling for democratically governed alternatives to allow workers to exchange labor without extraction by a profit-maximizing intermediary (Scholz 2014). Scholz's subsequent monograph elaborates ten organizing principles for platform cooperatives, including shared ownership, decent pay, transparency and data portability, and co-determined governance of work, and defines platform cooperatives as businesses that replicate the technological functionality of commercial platforms while redistributing ownership to unions, worker cooperatives, or municipalities (Scholz 2016).

Platform cooperatives have three distinct features as compared to conventional commercial platforms. They replicate existing platform technology under an alternative ownership model; they embed solidarity between users and owners through cooperative governance structures; and they redistribute platform efficiencies as benefits accruing to the whole membership rather than to external shareholders. Platform cooperatives are an egalitarian and communal alternative capable of "caring" for workers in ways that commercial sharing-economy platforms, oriented toward minimizing labor costs and maximizing flexibility for the platform owner, characteristically do not, addressing documented harms of platform work including income insecurity, misclassification as self-employed contractors, and lack of access to social insurance. Digital solidarity-economy initiatives, including collaboratively governed transportation platforms, indicate that such initiatives are best understood as extending long-standing cooperative principles i.e, voluntary membership, democratic member control, and economic participation into digital environments, while facing distinctive implementation challenges related to technical capacity, competition from well-capitalized incumbents, and the difficulty of achieving network effects without venture-scale investment.

A second major domain concerns civic technology platforms designed to support participatory democracy, transparency, and public deliberation, initiatives aligned with SDG 16's emphasis on accountable and inclusive institutions. Decidim, the free and open-source participatory-democracy platform developed by Barcelona City Council beginning in 2016, has supported participatory processes including the co-production of the city's strategic plan. During the contentious redesign of city traffic patterns known as the superblocks (superilles) program, residents used the platform to propose, discuss, and refine alternative neighborhood layouts prioritizing green space and pedestrian access. Unlike proprietary civic-engagement software, Decidim was deliberately built and released as open-source infrastructure, motivated partly by a concern that democratic participation should not be structurally dependent on a private vendor's continued commercial terms. The platform has since been adopted by several hundred organizations across more than thirty countries and is now governed through a multi-institutional committee involving the Catalan regional government, the province of Barcelona, and municipal partners including New York City and the federal government of Brazil.

The Decidim case is frequently cited as exemplary of DSI's capacity to advance institutional sustainability, but scholarship on the platform has also identified persistent sustainability challenges of its own including the platform's own institutional and financial durability rather than to environmental outcomes. Its long-term viability depends upon continued municipal funding and a small, precariously resourced technical team. Community discussions within the Decidim ecosystem grapple with the need to diversify funding sources beyond dependence on any single city government, alongside a stated commitment to a feminist ethics of care as integral to the platform's long-term sustainability. This illustrates a recurring theme in the DSI literature: initiatives celebrated for advancing social or institutional sustainability frequently face acute challenges achieving their own organizational sustainability.

A third strand of the social and economic sustainability literature concerns digital technology's role in extending economic inclusion, particularly financial inclusion, to previously underserved populations, alongside a growing empirical literature on the intersection of digital tools and sustainable social entrepreneurship. A systematic review of fifty-two studies published between 2015 and 2023 suggests that digital platforms enable social enterprises to broaden their reach, engage stakeholders more effectively, improve transparency, and operate more efficiently. Thy thereby amplify the social and environmental impact those enterprises can achieve relative to comparable non-digital organizations. The same review, however, identifies digital literacy and infrastructure access as critical constraints on this potential, noting that the benefits of digitally enabled social entrepreneurship are unevenly available depending on the digital capabilities of both the organizations delivering interventions and the communities they serve.

9. The Global Landscape of Digital Social Innovation

The empirical literature on DSI is geographically uneven, with the great majority of mapping studies, indices, and case research concentrated in Western Europe, reflecting DSI's institutional origins in European Commission-funded research as much as any underlying difference in the incidence of digitally enabled social innovation worldwide. The DSI4EU mapping and the subsequent European Digital Social Innovation Index are the most comprehensive comparative datasets available, ranking sixty European cities on indicators of funding, skills, civil society strength, collaboration, infrastructure, and inclusion (Nesta n.d.). DSI activity clusters disproportionately in a small number of well-resourced metropolitan hubs of London, Berlin, Amsterdam, and Barcelona while identifying weaker but still substantial activity in secondary cities across the continent, as the majority of individual social innovators remain disconnected from the larger networks and intermediary organizations that facilitate scaling (European Commission 2015).

Barcelona is a particularly influential reference case, owing partly to the city's sustained municipal investment in technological sovereignty and open-source civic infrastructure under successive administrations, and partly to the international diffusion of the Decidim platform. It is frequently cited in the DSI literature not only for its substantive achievements in participatory governance but as a model of municipalist digital policy, an approach that treats digital infrastructure as a form of public good to be built, owned, and governed collectively, in explicit contrast to the extractive data practices associated with dominant commercial platforms.

Research on DSI in the Global South is comparatively sparse, though a substantial adjacent literature on information and communication technologies for development (ICT4D) encompassing mobile financial services, agricultural extension applications, and community-network connectivity projects, addresses closely related phenomena under a different disciplinary label. This literature is increasingly in dialogue with critical scholarship on digital colonialism and data sovereignty. Global South contexts face structurally different constraints on digitally enabled social innovation than the European contexts that dominate the DSI mapping literature, This geographic imbalance in the literature is itself worth noting as a limitation of the field's current evidence base. Much

of this is generalized as "DSI" in policy discourse reflects patterns observed in relatively wealthy, well-connected European urban contexts, and claims about DSI's global contribution to sustainability should be read with this scope condition in mind.

10. Governance, Funding, and Policy Ecosystems

DSI's contribution to sustainability depends less on the ingenuity of individual technological interventions than on the governance and funding arrangements within which those interventions are embedded, the same institutional infrastructure that ecosystem-based theoretical frameworks place at the center of analysis. Nesta's research identified funding as one of six core pillars determining whether a local DSI ecosystem thrives (Nesta, n.d.), and subsequent work commissioned under the DSI4EU project examined specifically what systemic factors help DSI initiatives grow and scale rather than remaining permanently in a pilot or prototype phase (Stokes 2020).

The funding challenge facing DSI initiatives is distinctive in ways that both public and private conventional funding mechanisms are poorly suited to address. Unlike commercial technology ventures, DSI initiatives frequently cannot rely on venture capital, since their explicit orientation toward broadly shared social value, rather than privately captured financial return, does not suit investors seeking equity appreciation. Unlike conventional social-sector nonprofits, they often require ongoing technical maintenance and infrastructure costs, i.e., server hosting, software updates, cybersecurity, that grant-based philanthropic funding, typically structured around discrete projects with defined start and end dates, is not well designed to sustain indefinitely. The Decidim case illustrates this dynamic concretely: despite the platform's substantial civic impact and international adoption, its core development team has remained small, and its long-term sustainability has depended on securing diversified funding commitments from multiple public institutions specifically to escape dependence on the political cycle of any single municipal government.

Policy responses to this funding gap have taken several forms. At the European level, the European Commission's DG CONNECT directorate has directly commissioned mapping, indexing, and toolkit-development work through the DSI4EU program, aiming both to generate evidence for policymakers and to build networked infrastructure — the digitalsocial.eu hub, in particular — intended to connect otherwise isolated DSI initiatives with funders, collaborators, and scaling support (European Commission 2015; Cangiano and Zoe 2017). At the municipal level, cities including Barcelona have pursued more direct public investment in civic digital infrastructure, treating platforms such as Decidim not as one-off projects but as ongoing public utilities warranting sustained budgetary commitment analogous to physical infrastructure.

A further governance question concerns intellectual property and licensing. A recurring finding across the case literature is that DSI initiatives oriented toward long-term public value — as opposed to eventual commercial exit — disproportionately favor open-source licensing, both as an ideological commitment to shared ownership and as a practical mechanism for ensuring that a platform's future is not contingent on the survival or continued goodwill of any single originating organization. This preference for open licensing links the governance literature directly back to the "digital sustainability" theoretical framework discussed in Section 5.4, which treats the long-term availability and maintainability of digital artifacts as a sustainability concern in its own right.

11. Critical Perspectives: Limits and Contradictions

The key limitation on DSI's contribution to sustainability is the digital divide. Persistent, multidimensional inequalities in access to connectivity, devices, digital literacy, and locally relevant content determine who can participate in digitally mediated social innovation at all. Unequal access is a first-order constraint on the sector's potential, calling for targeted investment in connectivity infrastructure, affordable devices, and digital-literacy programs, particularly in developing regions. Decolonial scholarship argus that framing the digital divide primarily as a gap to be closed through connectivity investment risks obscuring its deeper structural origins in historical and ongoing patterns of global inequality, and that digital technologies, even when well-intentioned, must be designed with explicit attention to local agency, culture, and human dignity if they are to narrow rather than reproduce these patterns.

A related but analytically distinct critique is "data colonialism": the appropriation of personal and collective data by dominant, primarily American and Chinese, technology corporations, understood as continuous with, rather than merely analogous to the historical appropriation of land and resources under European colonialism (Couldry and Ulises 2019). The same platform infrastructures that enable participatory DSI initiatives are frequently owned and controlled by a small number of dominant firms whose business models depend on data extraction, meaning that DSI projects built atop commercial cloud, social-media, or mapping infrastructure may inadvertently reinforce the very concentration of digital power that platform cooperativism and open civic-technology initiatives explicitly seek to counter. This literature links data colonialism to the concept of digital sovereignty, the restoration of local control and ownership over digital infrastructure and identifies open-source, publicly governed alternatives such as Decidim as one practical response, while cautioning that public investment in local digital capacity can itself create new forms of dependency on external consultants and technology vendors if not paired with sustained investment in local technical talent. This critique bears directly on the concept of "digital sustainability". If the long-term availability and integrity of digital artifacts is itself a sustainability concern, then the concentration of that infrastructure in the hands of a small number of extractive commercial actors constitutes a sustainability problem in its own right, independent of any particular DSI initiative's social or environmental intentions.

A third critique, concerns the risk of technological solutionism: the tendency to frame complex social and political problems of inequality, democratic accountability, environmental degradation as fundamentally technical problems amenable to a digital fix, in ways that can displace attention from the underlying political and economic structures that produced the problem in the first place. Practitioners within the DSI4EU network have themselves warned against this tendency, explicitly rejecting readings of DSI that treat technology as a neutral or self-diffusing force for good, and insisting instead that digital tools' contribution to social change depends entirely on the political and organizational choices made about how they are deployed, owned, and governed (WeMake 2019; Bria 2015). Effective implementation of existing ideas typically matters more for social outcomes than the generation of novel ideas, and that governments in particular should weight their innovation investment heavily toward implementation rather than

invention can be read as a version of the same warning directed at policymakers tempted to treat DSI funding as a substitute for the harder, slower work of institutional reform.

The environmental-footprint and rebound-effect literature identifies a direct contradiction at the heart of claims that digital technology straightforwardly advances environmental sustainability: the infrastructure through which DSI initiatives operate, i.e., smartphones, networks, cloud servers carries its own substantial and, on current trends, growing carbon, water, and material footprint. Environmental gains attributed to any specific DSI application must be weighed against emissions embedded in the digital infrastructure delivering it, and against the possibility that efficiency gains in that infrastructure will simply be absorbed by increased usage rather than translated into net environmental benefit (Belkhir and Ahmed 2018; Lange and Johanna et al. 2020).

These four critiques do not suggest that DSI's contribution to sustainability is illusory, but they do suggest that this contribution is neither automatic nor evenly distributed, and that it depends substantially on design and governance choices around data ownership, infrastructure ownership, participatory inclusion, and environmental accounting that lie outside the technology itself.

12. Measuring Impact: Indices, Metrics, and Methodological Challenges

No standardized methods for measuring DSI's sustainability impact exist, limiting both academic theory-building and policymakers' ability to compare, prioritize, and fund initiatives on a consistent evidentiary basis. A measurement instrument is Nesta's European Digital Social Innovation Index, which operationalizes ecosystem-level sustainability across thirty-two indicators spanning funding, skills, civil society, collaboration, infrastructure, and inclusion, allowing comparative ranking of cities rather than of individual initiatives (Nesta n.d.). This ecosystem-level approach is valuable for policy benchmarking but does not directly measure the social or environmental outcomes achieved by any specific DSI project, a limitation shared with related composite indices used elsewhere in sustainability research, such as national or municipal SDG-progress dashboards.

Researchers have called for the development of more systematic frameworks connecting digital-service design choices to specific, measurable social, environmental, and economic outcomes, noting that much of the existing literature documents real-world applications qualitatively without establishing generalizable causal mechanisms linking design features to sustainability performance. Bibliometric approaches, which map patterns of scholarly co-citation and keyword co-occurrence across large literatures rather than measuring real-world outcomes directly, have proliferated as a complementary strategy for characterizing the shape of the field (Digitalization and the Sustainable Development Goals 2025; Varriale and Mark et al. 2025).

Methodologically, three recurring limitations characterize the empirical literature. Heavy reliance on single, often self-selected case studies rather than comparative or longitudinal designs, limiting the generalizability of findings; a scarcity of counterfactual or quasi-experimental evaluation designs capable of isolating a digital intervention's marginal contribution to a sustainability outcome from the contribution of the non-digital organizational and policy context within which it operates; and a persistent gap between environmental life-cycle-assessment methodologies, well developed for quantifying the footprint of digital infrastructure itself, and social-impact-measurement methodologies used to assess DSI's social and institutional outcomes, which remain considerably less standardized. Addressing this measurement gap, building frameworks capable of netting DSI's social and environmental benefits against the infrastructural costs of delivering them is one of the clearest priorities for future research, discussed further in the concluding section.

13. Research Pathways for DSI and Sustainability

(Krombacher and Anna-Katharina et al. 2026) articulate twelve concrete research pathways for information-systems scholarship on DSI, validated through consultation with scholars working at the intersection of digital technology, innovation, and sustainability. These pathways, are organized into five thematic clusters: the emergence of DSI, the processes and dynamics through which it develops, its governance and ethics, the measurement of its impact, and its relationship to emerging technologies and broader sociotechnical transitions.

The first cluster concerns the conditions under which DSI emerges at all. Pathway 1 asks what institutional, organizational, and technological preconditions enable DSI to take root in a given context. Pathway 2 asks how social entrepreneurs operating under severe resource constraints leverage digital technologies specifically. Building on the Digital Resource Leverage and digital-bricolage concepts, this pathway calls for closer empirical examination of how social ventures recombine accessible, non-owned digital tools into novel configurations rather than building proprietary technology from the ground up.

The second cluster concerns how DSI initiatives move through the ideation-development-implementation-diffusion sequence identified in the multidimensional framework, and in particular how and whether they scale. Pathway 3 asks how DSI initiatives develop and diffuse beyond their initial pilot context. Participatory and ethically deliberate design processes may shape development trajectories in ways that differ, potentially trading development speed for legitimacy and community trust, from those typical of purely commercial digital innovation. Pathway 4 asks what specific factors act as barriers or enablers of DSI across technological, organizational, regulatory, and cultural dimensions. Shifting resource flows and narratives can function as either barriers to, or accelerants of, mission drift depending on their direction.

The third cluster, concerns how DSI initiatives can be governed so as to remain aligned with their social missions. Pathway 5 asks what governance mechanisms, organizational structures, and accountability practices help sustain mission alignment over time, a question to which the six-pillar framework proposed by (Dal and Francesca 2025) offers one partial answer, and to which the Decidim case is a partial counter-example of successful, if precarious, mission maintenance through multi-institutional governance. Pathway 6 asks what ethical challenges DSI raises more broadly. Concerns around data privacy, meaningful consent, and the environmental impact of the digital technologies used to pursue environmental and social goals are especially acute. Pathway 7 asks how DSI can be governed to ensure inclusive rather than exclusionary outcomes, given the well-documented risk that digital technologies can reproduce as well as ameliorate existing patterns of exclusion.

The fourth cluster, concerns measurement. Pathway 8 asks how the social, environmental, and economic impact of DSI initiatives can be measured in ways adequate to their multidimensional value creation, given that traditional single-metric impact frameworks are poorly suited to interventions that. Pathway 9 asks specifically about the financial, social, and environmental sustainability of DSI initiatives themselves as opposed to the sustainability outcomes those initiatives pursue externally.

The fifth cluster looks outward toward emerging technologies and the broader sociotechnical transitions literature. Pathway 10 asks how Web 3.0 technologies of blockchain and decentralized-finance architectures might enable DSI specifically, through mechanisms including the removal of extractive intermediaries, the fostering of trust among dispersed participants, the enabling of more equitable exchange, and the reduction of transaction costs. A recent special-issue call for research on Web 3.0 platforms for sustainable digital social innovation reflects the continued openness of this question (ScienceDirect 2026). Pathway 11 asks more broadly what roles AI, the Internet of Things, and autonomous systems play across DSI initiatives, building on the finding, that these four technology families are increasingly present across initiatives addressing all seventeen SDGs (Dionisio and Sylvio et al. 2024), and calling for closer attention to the ethical, labor, and equity implications of their deployment in social rather than purely commercial contexts. Pathway 12, finally, asks how DSI as a field relates to broader sociotechnical transitions toward sustainability. Treating individual DSI initiatives not in isolation but as niche-level experiments whose success or failure is shaped by, and in turn shapes, broader regime-level and landscape-level pressures toward or away from sustainability.

14. Implications for Practitioners, Policymakers, and Researchers

The conceptual, empirical, and critical material of DSI has distinct practical implications for three audiences: social entrepreneurs and innovators building DSI initiatives, policymakers seeking to enable DSI at scale, and researchers designing future studies of the field.

For practitioners, DSI initiatives need not, and often should not, begin by building proprietary digital infrastructure. Mobilizing accessible, modular, non-owned digital tools, no-code platforms, existing open data infrastructures, and pre-existing collaborative networks, can allow resource-constrained ventures to achieve frugal yet still substantively scalable innovation, an approach consistent with the ecosystem-based theoretical framework, which locates innovation capacity as much in networked access to shared resources as in any single organization's internal capabilities. At the same time, the case studies caution against treating financial sustainability as an afterthought. Beginning with sustained community engagement, rather than with a predetermined technological solution, may produce interventions better matched to actual local needs, even at some cost to development speed.

For policymakers, enabling DSI at scale requires simultaneous attention to digital infrastructure, digital literacy, and regulatory and funding frameworks capable of sustaining initiatives beyond an initial grant-funded pilot phase. Public funding mechanisms for DSI should be designed with explicit attention to the six pillars proposed by (Dal Gobbo and Francesca 2025), I.E., time horizon, narrative, resource flow, networks, skills, and local embedding since funding instruments that inadvertently pressure initiatives to shift along any of these pillars risk undermining the very social missions the funding was intended to support.

For researchers, the twelve pathways constitute a substantial agenda in their own right. Several priorities recur across the pathways and connect directly to methodological limitations identified .These relate to the development of robust, multidimensional frameworks for measuring DSI impact that avoid collapsing social, environmental, and economic value into a single metric; deeper understanding of the dynamics of scaling and long-term financial sustainability, an area the case studies suggest remains poorly theorized relative to the ideation and implementation stages of DSI; sustained empirical attention to the ethical implications of emerging technologies, including AI, within explicitly social rather than commercial deployment contexts; and expanded cross-cultural, comparative research attentive to the Global South, where DSI activity is comparatively understudied relative to its apparent developmental promise. Methodological pluralism, combining the ecosystem-level indices with case-level diagnostic frameworks such as the six-pillar model applied to INDACO, and with the process-tracing implied by the multidimensional framework's four-stage innovation-process dimension is necessary for a field whose central claims span technological, organizational, and normative registers simultaneously.

15. Conclusion

DSI is best understood as an inheritor of the broader social innovation tradition, retaining that tradition's core emphasis on unmet social need and cross-sector collaboration while adding a distinctive capacity for scalable, low-cost coordination among dispersed participants, a capacity realized in citizen science, civic technology, and platform cooperativism. Evidence for DSI's contribution to sustainability is genuine but uneven. It is strongest, in domains such as environmental monitoring and participatory governance, where digital coordination directly substitutes for costly professional or bureaucratic processes; more equivocal in domains such as the sharing and circular economies, where environmental claims often outpace verified outcomes; and actively contradicted in the case of digital infrastructure's own growing environmental footprint, where efficiency gains have thus far been persistently outpaced by growth in demand. DSI's sustainability contribution depend less on the sophistication of any particular technology than on the governance arrangements, funding structures, ownership models, and licensing choices, within which that technology is embedded. DSI initiatives, including flagship cases such as Decidim facing challenges in their own organizational and financial sustainability, suggests that policy attention to funding ecosystems and governance design may yield greater sustainability returns than attention devoted to technological innovation as such. DSI’s benefits remain concentrated in well-connected, well-resourced contexts, predominantly European and urban. DSI initiatives are built atop commercially owned digital infrastructure risk reinforcing, rather than counteracting, the concentrated ownership of data and computing power that data-colonialism scholarship identifies as a structural feature of the contemporary digital economy. DSI's sustainability contribution that does not engage seriously with these critiques’ risks will reproduce the technological solutionism. Comparative, longitudinal empirical work is needed to move the field beyond its current reliance on single case studies, particularly work capable of isolating DSI's marginal contribution to sustainability outcomes from the broader institutional context in which any given initiative operates. Geographic coverage requires substantial expansion beyond the European contexts that currently dominate the mapping and indexing literature,

with closer integration between the DSI literature reviewed here and the adjacent, more geographically diverse ICT4D literature. Measurement frameworks can systematically net DSI's social and environmental benefits against the infrastructural and specifically environmental costs of the digital tools through which those benefits are delivered, integrating life-cycle-assessment methodologies with social-impact measurement rather than treating them as separate literatures. Attention to governance and funding models including but not limited to platform cooperativism, public digital infrastructure investment, and open licensing is needed to identify which institutional arrangements are capable of translating DSI's participatory promise into durable, equitably distributed sustainability outcomes, rather than into short-lived pilot projects dependent on time-limited grant funding. Buck and colleagues' phrase, address it as "twin transitions", the simultaneous, and not always compatible, pursuit of digital transformation and sustainability transformation. A mature research and policy agenda for DSI must account for both possibilities, rather than assuming, as some earlier policy discourse implicitly did, that digitalization and sustainability are inherently aligned goals that merely require sufficient investment to be jointly realized. Digital social innovation is neither a sustainability panacea nor merely a fashionable relabeling of pre-existing civic and cooperative practices. It is a genuinely new set of tools for coordination, monitoring, and collective deliberation, whose ultimate contribution to sustainable development will be determined not by the technology itself but by the political, economic, and institutional choices societies make about how that technology is owned, governed, and sustained.

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