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DIGITALLY SOCIAL: REVIEW, SYNTHESIS, AND FUTURE DIRECTIONS FOR DIGITAL SOCIAL INNOVATION

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Research Paper

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Abstract

Innovation contributes to solving the grand challenges of our time. Currently, two innovation research streams coexist mostly separated, without leveraging the potential at their interface: 1) Digital innovation using the generative power of digital technologies to trigger novel, incremental and/or disruptive solutions, and 2) social innovation accelerating sustainable development. To leverage the potential of digital innovations for reaching the goals of social innovation, we aim at advancing research on digital social innovation (DSI). A comprehensive literature review reveals 78 current DSI studies. We analyse them via a theory-based multidimensional framework. In that, we bring together both research streams, identify relevant research gaps at their interface, and derive a research agenda based on eight clear-cut research questions for DSI scholars. Our findings guide advancing DSI research and enable practitioners to leverage DSI in light of the current societal challenges.

Keywords: Digital Social Innovation, Literature Review, Research Agenda.

1 Introduction

The world is facing severe challenges. Almost 5 million people have lost their lives in less than two years due to Covid-19 (World Health Organization, 2021). Simultaneously, climate change is continuing to be one of the most pressing grand challenges of our time. While these challenges address different facets of societies, economies, and science, they are all related to sustainability. Traditionally, sustainability is viewed as integrating the three pillars of economic, social, and ecological well-being (Elkington, 1997; Wiedmann et al., 2009) and is often addressed in the form of the 17 Sustainable Development Goals (SDGs) (United Nations, 2015; Wu et al., 2018). However, achieving sustainable development is a wicked and challenging undertaking with no clear path to follow (Gimpel et al., 2020). Due to its complex and multi-faceted nature, sustainability has emerged as a central theme in many academic disciplines (Elliot, 2011; Gholami et al., 2016; Watson et al., 2010). Information Systems (IS) research holds enormous potential in accelerating sustainable development due to its interdisciplinary nature and broad methodological approaches (Thomas et al., 2020). Thus, our IS community faces the

moral responsibility to contribute to finding solutions (e.g., Melville, 2010; Venkatesh et al., 2019; Watson et al., 2010).

IS research contributes to innovative socio-technical solutions (Thomas et al., 2020), being pivotal to addressing entrenched social problems like climate change. Digitalisation has drastically changed innovation in the past years entailing an even higher potential of innovation to achieve sustainable development (Yoo et al., 2012). For example, smart irrigation systems can help save valuable resources and increase water security around the globe (Gimpel et al., 2021). Today, digital innovation (DI) enabled by digital technologies (DTs) is at the heart of many organisations' innovation activities (e.g., Ciriello et al., 2018; Fichman et al., 2014; Kohli and Melville, 2019). What differentiates DI from its non-digital counterparts is its massive convergence and generative power, yielding fundamental and disruptive business transformations (Yoo et al., 2012; Blume et al., 2020). With each new DI, the abundance of data and the digital nature of processes, products, services, and business models create an enormous potential for additional innovation. Research and practice have just started to understand how to best exploit the generative power of DTs for business purposes, while a sustainability orientation in DI is often neglected (Bican and Brem, 2020). From a sustainability lens, it is, however, fundamental to not only promote this generative power for economic purposes but simultaneously achieve social and ecological sustainability goals (Henkel et al., 2017).

In contrast to DI, social innovation (SI) refers to innovation activities that comprise economically viable ideas to primarily create social value (Tracey and Stott, 2017). Originating from the perspective that profit orientation at the expense of human and environmental well-being is morally reprehensible, social innovators have proved that the potential of innovation could also yield sustainable development (Dacin et al., 2011). SI, however, has only begun to acknowledge the potential of DTs (Eckhardt et al., 2017). So far, both valuable research streams (i.e., DI and SI) coexist mostly separated without leveraging the synergies at their interface. However, we are convinced that the exceptional value of both streams for targeting sustainability is greatest when the generative power of DI is used to create social value as in SI. Thus, we aim to join the forces of both research streams advancing research on *digital social innovation* (DSI), understood as "digital solutions to social challenges" (Bria, 2015, p. 4).

In the existing DSI literature, scholars have, for example, investigated social networks related to health issues, online platforms for citizen participation, open data in agriculture to improve food security, conceptual models for DSI, or introduced future research pathways for DSI (Buck et al., 2020; Bria, 2015; Qureshi et al., 2021; Gebken et al., 2021). However, despite these contributions, literature on the matter reveals inconsistent terminology. As a result, existing DSI research is highly scattered across disciplines, outlets, and terminologies, making it difficult to grasp the richness of prior contributions. Thus, complementary to Qureshi et al. (2021), who show future research pathways for DSI drawing from information and communication technologies (ICTs) for development, social entrepreneurship, and SI literature, we intend to grasp the richness of prior research across all disciplines drawing from a variety of research themes (e.g., digital eco-innovation or green ICTs). As DTs and digital innovation are a central component of DSI, IS research should know how to contribute to DSI in a meaningful way. Therefore, it is essential to understand the 1) different dimensions of DSI, 2) existing contributions, and 3) critical research pathways for DSI. Such an integrated understanding is crucial to creating a common ground on DSI for advancing future knowledge quickly (Webster and Watson, 2002). Our research question reads: *What are relevant DSI research pathways?*

To answer the research question, we bring together the research streams of DI and SI, building upon a theory-based multidimensional framework for analysing existing DSI literature. We identify relevant dimensions of DSI to structure and capture both well-researched themes and critical paths for future research to derive a research agenda for DSI. Specifically, we assess contributions and propose critical research questions through the three key dimensions of DSI: 1) the differentiation of DTs as a means or an end to DSI, 2) the core elements of the DI process as presented in the seminal paper by Kohli and Melville (2019), and 3), the three pillars of sustainability as incorporated in SI. To this end, we conducted a structured literature review across disciplines revealing a final set of 78 studies (Webster and Watson, 2002; Leidner, 2018). We contribute to solving the grand challenges of our time by joining

the forces of previously isolated research streams, identifying central research gaps, and deriving a research agenda. Our findings offer a synthesis of six research clusters and eight clear-cut research questions for future DSI scholars. In sum, our work guides advancing DSI research and enables practitioners to tackle real-life societal challenges.

2 Theoretical Background

DSI uses DTs to solve societal challenges through commercially viable innovation (Bonina et al., 2021b). DSI is a newly coined term. Table 1 displays recent definitions in the IS domain, which allow for different interpretations as scholars build on and combine the concepts of DTs, DI, and SI differently (Dong and Götz, 2021; Bonina et al., 2021b; Tim et al., 2021; Qureshi et al., 2021). In line with Buck et al. (2020), we view DSI as an approach that draws knowledge from both DI – with an integral part being DTs – and SI. Thus, to fully grasp DSI, it is necessary to understand the underlying concepts of DTs, DI, and SI. We develop a theory-based multidimensional analysis framework to identify and structure current research on DSI and derive a meaningful research agenda. The framework intends to sweep up all relevant – to date not yet well connected – DSI dimensions: 1) *digital technology*, 2) *digital innovation*, and 3) *social innovation.* Following, we elaborate on all three dimensions as the theoretical backbone of our study.

Source	Definition
Qureshi et al. (2021, p. 647) based on Qureshi et al. (2017) and Shalini et al. (2021)	"Digital social innovation (DSI) involves the **use of digital technologies** in the development and implementation of innovative products, services, processes, and business models that seek to improve the well-being and agency of socially disadvantaged groups or **address social problems** related to marginality, inequality, and social exclusion."
Tim et al. (2021, p. 324) based on Majchrzak et al. (2016) and Pan and Zhang (2020)	"Digital social innovation (DSI)—the **novel use of digital technology to address major societal challenges**—has been the bedrock of sustainable development and has therefore garnered increasing attention amongst researchers and practitioners particularly in recent years."
Bonina et al. (2021b, p. 698)	"[…] we define DSI broadly as the development of new products, services or processes, that are either **embodied on IT or enabled by IT**, whose goal is to **meet social needs or stimulate social change**."
Dong and Götz (2021, p. 673)	"Open source software (OSS) is a typical digital social innovation […] OSS is a **combination of digital innovation and social innovation**, or digital social innovation."

Table 1: Definitions of DSI

First, regarding the *digital technology* dimension, DTs comprise different loosely coupled layers, i.e., device, network, service, and content (Yoo et al., 2010; Henfridsson et al., 2018). To date, the boundaries and scope of DTs have not been clearly defined, and the term is often used interchangeably with the notions of IT, IS, and ICT. ICTs are tools that enable communication and collaboration, such as smartphones or tablets (Dittes and Smolnik, 2019; Zuppo, 2012). Overlapping with ICTs, DTs are described as a combination of connectivity, information, computing, and communication technologies (Bharadwaj et al., 2013). Further, DTs are understood – more vaguely – as an umbrella term for IT within the context of digitalisation (Denner et al., 2018). DTs comprise the three constitutive characteristics, *re-programmability*, *self-referential nature*, and *homogenisation of data* (Yoo et al., 2010). They further include the complexity-inducing characteristics of *embeddedness*, *connectedness*, *communicability*, *editability*, *identifiability*, and *associability* (Benbya et al., 2020). Considering DTs' characteristics, DTs offer various opportunities in reaching new markets and gaining new sources of profit due to their high affordability and availability (Fichman et al., 2014; Walsham, 2017). Hence, DTs enable opportunities to go beyond traditional industry and product boundaries (Yoo et al., 2010) and change the nature of innovation (Mendling et al., 2020; Oberländer et al., 2021). In the context of

DI, DTs play different roles. On the one hand, DTs are pivotal for supporting the innovation process itself, for example, through providing digital platforms or other digital infrastructure on which various stakeholders can innovate (i.e., DTs as a means). On the other hand, they can be an integral part of the DI outcome, such as new digital processes, products, services, or business models (i.e., DTs as an end) (Ciriello et al., 2018; Kohli and Melville, 2019). In other words: *As a means* describes the role of DTs in enabling the creation of an innovation during the innovation process, whereas *as an end* describes DTs as a component of the DI's outcome. To fully capture the role of DTs in DSI, we thus differentiate between the two characteristics a) DTs as a means of DSI or b) DTs as an end to DSI.

Second, regarding the *digital innovation* dimension, research on DI focuses on combining digital and physical components in novel ways to create new processes, products, services, or business models (Yoo et al., 2010; Fichman et al., 2014; Nambisan et al., 2017; Kohli and Melville, 2019). Therein, the digital component – as an enabler of entrepreneurial endeavours (Briel et al., 2021) – influences the opportunity recognition through several effects (e.g., *digital invasiveness, dissolving product and industry boundaries*, and *dissolving company and customer boundaries* (Kreuzer et al., 2022). Conceptualisations of DI differ in their foci on the process versus the outcome. We follow Kohli and Melville's (2019) work as the most recent and well-cited literature review on DI. They take a broad view covering *DI actions*, *outcomes*, and the *environment*[1]. The DI actions consist of the four steps 1) *initiate* a DI to gather relevant information and explore opportunities amendable to the DI, 2) *develop* a new digital solution or enhance an existing one, 3) *implement* the digital solution, and 4) *exploit* the digital solution to leverage its maximal value (Kohli and Melville, 2019; Baumbach et al., 2020). In terms of outcomes, Kohli and Melville (2019) outline new business processes, products, and/or services. On top of that, scholars also acknowledge the transformation of business models as a relevant DI outcome (Fichman et al., 2014; Ciriello et al., 2018). Further, the development of DI strongly depends on the respective innovation environment. This refers to the broader organisational context, such as culture or knowledge management (i.e., internal organisational environment) and an organisation's competitive marketplace (i.e., external competitive environment) (Kohli and Melville, 2019). To date, the innovation ecosystem of an organisation is conceptualised beyond its competitive marketplace and includes actors that support innovation, such as end-users (i.e., the person directly using and working with the DI after its development) or innovation networks (Jacobides et al., 2018; Schmitt and Muyoya, 2020; Hosseini et al., 2018; Abrell et al., 2016). For our analysis framework, we apply an integrated perspective following Kohli and Melville (2019) and assess the DI dimension through the characteristics a) actions, b) outcome, and c) environment.

Third, regarding the *social innovation* dimension, a plethora of non-technological research streams has engaged in social topics at the intersection of innovation. Corresponding knowledge has emerged on sustainable innovation, eco-innovation, green innovation, environmental innovation, responsible innovation, frugal innovation, and SI (Franceschini et al., 2016; Lubberink et al., 2017; Albert, 2019; Eckhardt et al., 2021). Further, scholars have examined IS in social contexts without emphasising an explicit innovation-focus, resulting in dedicated research streams such as ICT4D, Green IS, or social tech (Watson et al., 2010; Walsham, 2017; Tarik et al., 2021; Arena et al., 2018). DSI focuses on SI enabled by DTs to create social value (Phills et al., 2008). Thus, we incorporate social needs in SI as the third dimension of our analysis framework, including improving human and environmental well-being (Lubberink et al., 2017). An innovation is classified as a SI when its underlying rationale attains social instead of purely economic goals (Phills et al., 2008). Today, interpretations of SI are generally broad and address different social needs, such as doing good for nature or people. Thus, SI is often associated with attaining the SDGs (Eichler and Schwarz, 2019). The SDGs comprise 17 sub-goals spanning from social (e.g., quality education) over ecological (e.g., climate action) to economic sustainability (i.e., decent work and economic growth) (Wu et al., 2018). All three sustainability dimensions are subsumed through the concept of sustainable development and target the protection of natural resources (i.e.,

[1] Please note that we use the term "environment" here to refer to the organisational environment.

ecological sustainability) and providing social and economic welfare (i.e., social and economic sustainability) (WCED, 1987). On this background, our analysis framework captures the three sustainability dimensions addressed by SI through the characteristics a) social sustainability, b) ecological sustainability, and c) economic sustainability.

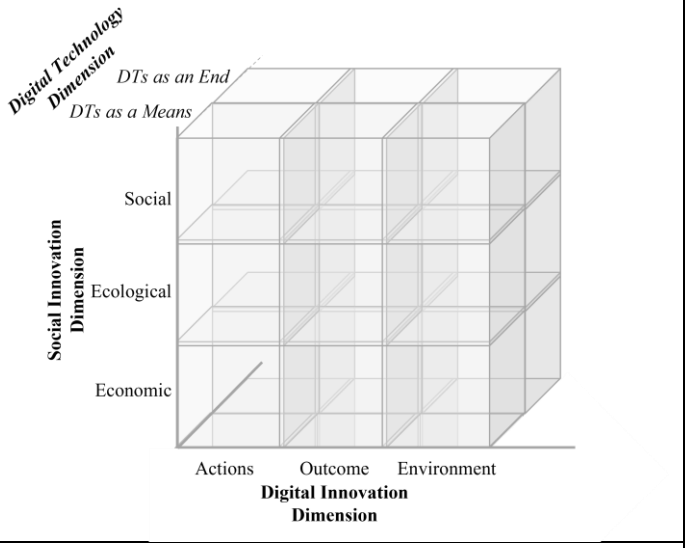

Figure 1. DSI Analysis Framework

DSI research relying on integrating the three dimensions DT, DI, and SI holds a lot potential in attaining sustainability (Bonina et al., 2021b; Rodrigo and Palacios, 2021). For our research, we integrate the three dimensions (DT, DI, SI) to assess prior contributions according to the core components of DSI and derive a DSI research agenda. Figure 1 depicts our resulting analysis framework.

3 Research Method

We used the analysis framework to synthesise existing DSI contributions, uncover research gaps, and derive a research agenda worth investigating (Webster and Watson, 2002; Leidner, 2018). Based on Leidner's (2018) "polylithic framework of research and theory development papers," we classify our literature review as an "assessing review" with the research objective to synthesise literature and the review focus to identify gaps. Specifically, we conducted a systematic DSI literature review following Boell and Cecez-Kecmanovic (2015) alongside five-steps detailed in Figure 2.

(1) Define Search Protocol: We selected literature bases covering both IS and other fields. For IS, we focused our search on high-impact IS journals and conference publications, i.e., the *IS Senior Scholars' Basket of Journals* (AIS, 2011), the *International Conference on Information Systems* (ICIS), and the *European Conference on Information Systems* (ECIS). The latter two are included to address the trade-off between the topicality of DSI and long review cycles in top journals. Following Buck et al. (2021),we chose ICIS and ECIS as the two most renowned IS conferences capturing the discipline's latest findings. For the other fields and to cover the whole picture of DSI in other disciplines, we additionally used the database *Web of Science (WoS)*. Within WoS, we searched journals across disciplines with an impact factor higher than 2.5 to ensure a high-quality sample. This criterion is in line with Henkel and Kranz (2018) and a popular numerical measurement method in scientific work (Garfield, 2006). While Garfield (2006), creator of the Social Science Citation Index (SSCI), acknowledges that the journal impact factor is not a flawless measure, he argues that it is well established and that a superior metric remains to be found. Typically, an impact factor larger than 3.0 is conceived as a good threshold (Sci Journal, 2020).

A factor of 3.0, however, would exclude relevant sustainability-focused journals (e.g., *Sustainability*). We, therefore, reduced the threshold to 2.5 to capture valuable contributions.

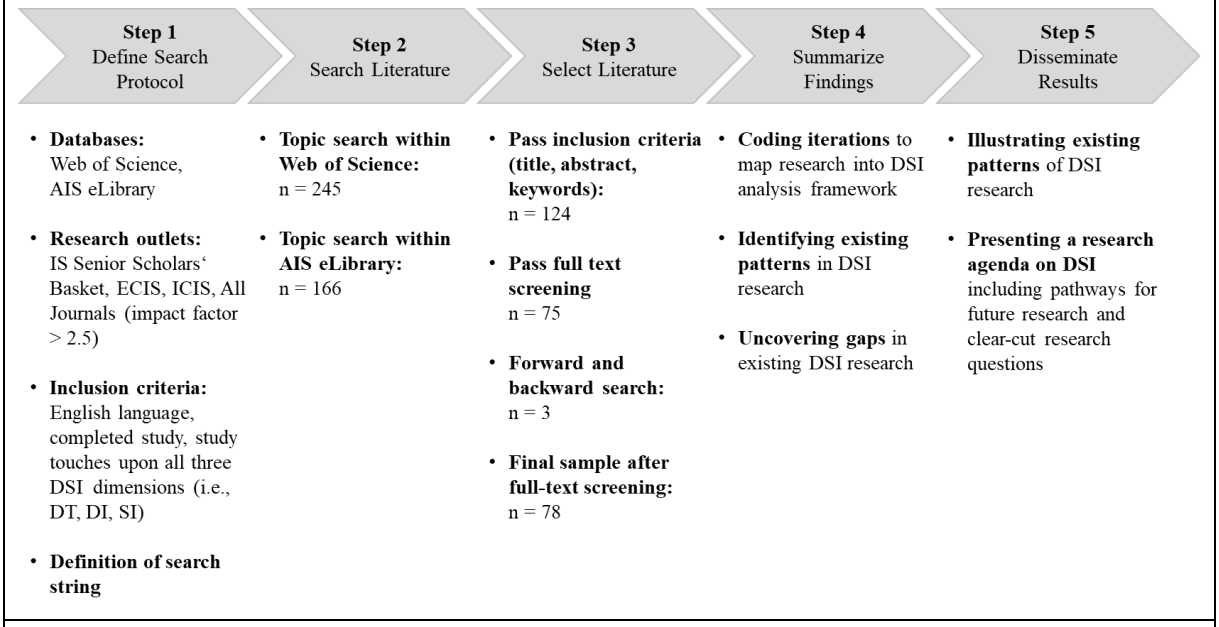

Figure 2. Five-Step Approach as Proposed by Boell and Cecez-Kecmanovic (2015)

We defined our search string, focusing on relevant DSI contributions while simultaneously yielding the largest possible set of relevant studies. Accordingly, we devised three search strings consisting of multiple terms related to the DSI dimensions, as summarised in Table 2. DSI is an emerging phenomenon in many academic disciplines and is characterised by inconsistent terminology use (e.g., social innovation, sustainable innovation, green innovation, frugal innovation). We reflect this diversity in our search strings, which capture the DT dimension (e.g., "digital technolog*" or "tech"), the DI dimension (e.g., "digital innovation" or "ICT innovation"), and the SI dimension (e.g., "green" or "sustain*"). While there is no dedicated search string with "digital social innovation", we ensured that all articles directly mentioning "digital social innovation" in the title, abstract, or keywords are included in the sample and covered by either of the three search strings.

Search String #1	**Search String #2**	**Search String #3**
(ICT4D or "Green IS" or "social tech") AND innovation*	("digital* innovation*" OR "ICT innovation*" OR "information technolog* innovation*" OR "information system* innovation*") AND (social OR sustain* OR green OR environmen* OR responsib* OR eco* OR frugal)	("social innovation*" OR "sustainab* innovation*" OR "green innovation*" OR "environmen* innovation*" OR "responsib* innovation*" OR "eco-innovation*" OR "eco innovation*" OR "frugal innovation*") AND ("digital technolog*" OR ICT OR "information technolog*" OR "information system*")

Table 2. Overview of Search Strings

(2) Search Literature: We conducted a literature search across WoS and the AIS eLibrary. The initial search yielded 411 results (245 studies in WoS and 166 studies in the AIS eLibrary), excluding duplicates and all papers from journals with an impact factor lower than 2.5.

(3) Select Literature: In a first relevance check, we screened the titles, abstracts, and keywords of the 411 studies (vom Brocke et al., 2015). Studies included (at least partly) address the outlined DSI

dimensions, i.e., DT, DI, and SI. Further, a study had to be both composed in English and be a completed research paper. To ensure uniformity in screening, three authors screened a sample of 20 studies independently. The three authors agreed in 19 cases and disagreed in one, leading to a very high agreement level of p_0=98.41%. The remaining studies were split among two authors and screened independently. To dissolve potential ambiguities, all authors met in regular workshops. After the first screening, 124 studies remained for a full text screening. We analysed the respective studies and evaluated whether they appropriately address all three defined dimensions of DSI, i.e., DT, DI, and SI. As a result, 75 studies remained. Finally, we included three further studies resulting from a forward and backward search, yielding a final sample of 78 studies[2].

(4) Summarise Findings: To address our research question and identify pathways for further research, we investigated the contributions of prior work and developed a research agenda from the questions left open. We coded the final 78 studies using coding techniques of Stock et al. (1996) and Wolfswinkel et al. (2013) as an orientation. We read each study in detail during coding and assigned pre-defined characteristics grounded in the existing literature. These characteristics reflected the three DSI dimensions, i.e., DT (characteristics: *DTs as a means, DTs as an end*), DI (characteristics: *actions, outcome, environment*), and SI (characteristics: *social, ecological, economic sustainability*). Further, we grouped the studies to form research clusters alongside the postulated analysis framework. Studies in the same cluster resembled in DSI characteristics (per dimension) and study purpose. While assigning the characteristics, we found meta-insights regarding the dimensions, which we summarised and further developed into pathways for further research. We refined the contents of each cluster until theoretical saturation was reached, i.e., while re-reading studies, no new insights to the clusters appeared, and we did not add new findings. Two co-authors each coded the articles independently to ensure high coding quality, and the results were discussed in regular author workshops. In terms of coding, we achieved an average agreement of p_0=0.7979 and a 'substantial' to 'moderate' (Landis and Koch, 1977) inter-rater reliability (Cohen's kappa) between 0.8092 and 0.5716 (overall average: 0.7215, median: 0.7965) per dimension (Cohen, 1960).

(5) Disseminate Results: We compiled and illustrated our results along with the outlined DSI analysis framework, which conceptualises DSI considering the DT, DI, and SI dimensions and establishes relations among the identified clusters. The framework depicts existing research patterns in DSI research and helps uncover relevant gaps and pathways for further research. Moreover, following established research agendas such as those by Hund et al. (2021), Nambisan et al. (2017), Qureshi et al. (2021), or Yoo et al. (2010), we built on the findings from the literature review, thus the six DSI research clusters, to derive a research agenda for DSI. The research agenda is based on a set of eight research questions.

4 Research Clusters of Digital Social Innovation

We classified the 78 studies according to the three DSI dimensions (i.e., DT, DI, SI) and their characteristics highlighted in the Theoretical Background. Next, we combined these three dimensions (i.e., DT, DI, SI) to assess which patterns of characteristics have been well researched and defined six research clusters (Figure 3). First, we split the studies between *DTs as a means* and *DTs as an end*. Second, we differentiate between DSI *actions*, *outcome*, and *environment*. The six possible combinations of these two dimensions form the six research clusters. To understand differences in the sustainability dimensions addressed, we differentiate between social, ecological, and economic sustainability within each cluster. Figure 3 shows the boundaries of the six clusters. To visualise the distribution of studies across the clusters, Figure 3 also demonstrates the numerical results. Each dot represents the focus (i.e., 1st order) of a study in our sample. If a study peripherally touched upon a second characteristic (for example, the focus is on the DSI environment, but a small part also considers DSI actions), we plotted an "x" in the respective field. Accordingly, the dots show the studies' central

[2] An overview of the final sample of 78 studies including their characteristics in terms of the DT, DI, and SI dimensions can be found here: https://figshare.com/s/e8d23c84f12f43b33754

DSI focus and the "x" the peripheral themes they relate to. Referring to each of the three dimensions of Figure 1 individually, from the full sample of 78 studies and their respective focus, 19 (24%) consider DTs as a means and 59 (76%) as an end. Further, 33 (42%) studies investigate DSI actions, 23 (29%) DSI outcomes, and 22 (28%) DSI environments. Lastly, 44 (56%) studies address social sustainability, 26 (33%) ecological, and 8 (10%) economic sustainability. Overall, it becomes clear that research has addressed the six clusters with highly different intensity. Considering the focus of the 78 studies, only three studies address cluster 2, which is the least recognised of all clusters. In contrast, 24 studies address cluster 4, the most well-researched cluster in our review. In the following, we discuss each cluster in detail, outlining exemplary relevant contributions.

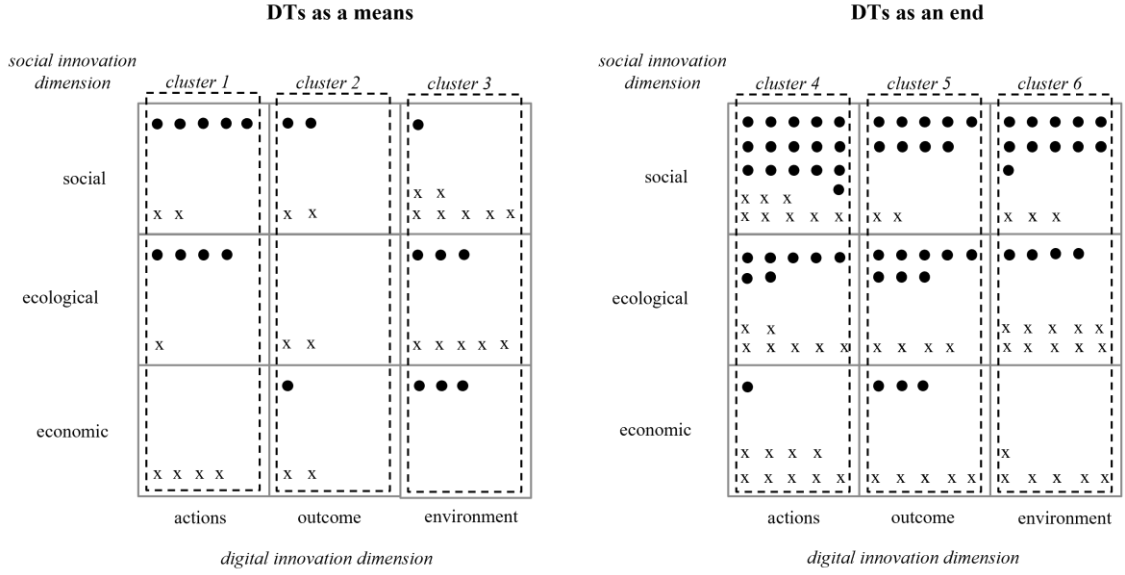

Figure 3. DSI Clustering Results

Research Cluster 1 - DTs as a Means and Actions: Research activities in cluster 1 centre on DT-enabled DSI actions. The two key findings of this cluster are 1) the successful demonstration of leveraging data-based insights during DSI actions through data analytics (e.g., Kelly and Noonan, 2017), and 2) an analysis of the potential of fostering broad stakeholder involvement for DSI actions through digital platforms and tools (e.g., Ketter et al., 2016). First and regarding data, information has been recognised as a central component for creating meaningful DSI (Arts et al., 2015). Associated DSI actions systematically identify, collect, and analyse data to detect sustainability improvement opportunities. Knowledge in this cluster presents the processes and actions performed to exploit the value of data. For example, Kelly and Noonan (2017) contribute to research by conceptualising the difference between systematic and edifying datafication practices. Second and regarding digital infrastructure, DTs as platforms and open-source software (e.g., Bhatt et al., 2016; Ketter et al., 2016) have proven to be a suitable tool for streamlining DSI actions fostering inclusion and participation of broader stakeholder groups. DI competitions, open-source environments, or platforms allow broad stakeholder groups to participate in DSI actions (Richardson-Ngwenya et al., 2019). In this realm, the first theme on data practices is investigated, for example, in the context of institutional health service provision (social sustainability) (Kelly and Noonan, 2017) or fostering nature conversation initiatives (ecological sustainability) (Arts et al., 2015). The second theme (i.e., the potential of digital infrastructure for stakeholder involvement) was shown to improve sustainability efforts on the economic development of marginalised communities (economic sustainability) (Bhatt et al., 2016) or the development of sustainable electricity (ecological sustainability) (Ketter et al., 2016).

Research Cluster 2 - DTs as a Means and Outcome: Research activities in cluster 2 centre on DSI outcomes that create social value driven by DTs as a means (i.e., not necessarily incorporated in the DSI

outcome). As apparent in Figure 3, research in this cluster is limited. The two key findings are: 1) specific DTs supporting social needs (Ahuja and Chan, 2020; Ketter et al., 2016) and 2) the general role of DTs for creating SI (Bonina et al., 2021a). First, and regarding the usage of specific DTs as a means for DSI, scholars illustrate, for instance, how digital platforms can be leveraged for inclusive growth and how they should be designed to meet the needs of marginalised populations (Ahuja and Chan, 2020). These design principles include, among others, integrating social and digital capabilities, affordable access, universal usability, and using existing infrastructure (Ahuja and Chan, 2020). Moreover, as another example, scholars show how using competitive simulation games in DSI development can transform electronic power systems towards sustainability (Ketter et al., 2016). Second, scholars synthesising the role of DTs' more generally give an overview of how digital platforms can be used for sustainable development and illustrate different research directions such as how to classify digital platforms for development or what the dark sides of platforms for development are (Bonina et al., 2021a). This cluster investigates DSI through all three sustainability perspectives, i.e., electronic power systems in terms of ecological sustainability (Ketter et al., 2016), inclusive growth to alleviate poverty in terms of social sustainability, or spurring economic growth in terms of economic sustainability (Ahuja and Chan, 2020).

Research Cluster 3 - DTs as a Means and Environment: Research activities in cluster 3 centre on identifying contextual factors that either promote or hinder the success of DSI. Key findings comprise 1) internal and 2) external dynamics of DSI environments when innovating with big data, platforms, or other DTs. First, and regarding the internal organisational environment, various factors were found to either promote or hinder the success of DSI. Management commitment and well-structured HR practices, an open and participative corporate culture and ethics, as well as a willingness to change, are among the relevant factors that positively impact the success of DSI (Arts et al., 2016; El-Kassar and Singh, 2019; Yang et al., 2017). Further, certain roles are crucial for DSI success: project leaders and innovation intermediaries (Munthali et al., 2018; Dong and Götz, 2021). Second, the external environment can strongly influence the success of DSI. External partners in the DSI ecosystem, such as pro-social stakeholder views (El-Kassar and Singh, 2019) or demographic and socio-economic characteristics such as a high level of democracy positively impact DSI. Simultaneously, a low gross domestic product and low social expenditure negatively influence the success of DSI in international DSI projects (Huh and Kim, 2019). In addition, in the context of frugal innovation (i.e., innovation focusing on minimising price, rather than maximising functionality), actively leveraging ecosystems fosters the effective use of DTs for producing frugal innovations (Ahuja and Chan, 2014; Ahuja and Chan, 2016). The sustainability of DSI in this cluster is mainly understood in the ecological sense, for instance, by investigating projects from environmental regulators (Arts et al., 2016) or green innovation initiatives in general (Yang et al., 2017).

Research Cluster 4 - DTs as an End and Actions: Research activities in cluster 4 centre on DSI actions resulting in DT-based outcomes. The key findings of this cluster are 1) reporting on existing DSI cases and 2) synthesising the learnings. The cluster contains case study insights into initiating, developing, implementing, and exploiting DSI initiatives in different contexts resulting in DT-based outcomes. Different contexts are, for instance, the public sector, established organisations, or specific industries. To name examples: When *initiating* a DSI, end-users should be included through open innovation approaches (Hosseini et al., 2018). Further, when *developing* DSI within healthcare, the underlying processes and services within primary healthcare need to be considered (Emilsson et al., 2020). For *implementing* a DSI, end-users should be integrated through co-creation and direct participation (Witteveen et al., 2017). Lastly, *exploiting* a DSI refers to scaling it. Hence, considering the example of the case M-Pesa, five phases of scaling were identified, i.e., pilot, incremental rollout, aggressive growth, standardisation, and functional expansion (Foster and Heeks, 2013). Regarding sustainability, for one, this cluster reports on social sustainability, such as women empowerment and gender equality (Harvey and Fisher, 2013; Suseno and Abbott, 2021; Schmitt et al., 2020), and health care (Essén and Conrick, 2008; Wu et al., 2020). For the other, ecological sustainability is examined through, for example, smart towns (Hosseini et al., 2018) or nature conservation (Arts et al., 2015).

Research Cluster 5 - DTs as an End and Outcome: Research activities in cluster 5 centre on 1) numerous successful DSI initiatives, 2) use cases for certain technology groups, and 3) DT-enabled social business models. As a key finding, this cluster demonstrates the diverse nature of DSI outcomes, as well as the potential of DTs to not only affect individual products or services, but also to transform and enable entire business models. This cluster incorporates DSI knowledge that focuses solely on digital or physical-digital hybrid innovation as outcomes of DSI. Rather than considering the path it took to develop the respective DSI outcome, this cluster considers the nature or usage of outcomes once readily developed. First, one central theme refers to specific digital tools or platforms that positively affect the three sustainability dimensions. Therewithin, either the DSI outcome itself or effect mechanisms such as increased information availability, higher connectedness, or smarter and automated decision support are in focus (e.g., Ahuja and Chan, 2020; Abejirinde et al., 2018; de Georgio Ferrari Trecate et al., 2020). Second, use cases for technology types in specific contexts have been identified (e.g., Bonina et al., 2021a; Hanelt et al., 2017; Tarafdar et al., 2013). For example, research has demonstrated the diverse opportunities of IoT in smart cities in use cases such as pollution control or waste management (Cvar et al., 2020). Third, on a more abstract level, DSI can lead to IT-enabled business models (e.g., circular economy business models) (Cioffi et al., 2020; Han et al., 2020; Shomali and Pinkse, 2016) and can be classified through a taxonomy of DSI outcomes (Buck et al., 2020). In terms of sustainability, this cluster covers a wide range of topics on ecological sustainability (e.g., clean electricity or conservation management) (e.g., Arts et al., 2020), social sustainability (e.g., substance abuse, recovery, maternal health) (e.g., Michard et al., 2017), or economic sustainability (e.g., economic development at the bottom of the pyramid) (e.g., Tarafdar et al., 2013).

Research Cluster 6 - DTs as an End and Environment: Research activities in cluster 6 centre on the impact of DSI environments when innovating for DT-based outcomes. In this realm, there are two key findings: 1) internal organisational environment, for example, capabilities or knowledge management, 2) external environment, for example, innovation spaces or competition. First and regarding the internal organisational environment, the current focus is on non-human capabilities, for example, supporting IS (Hanelt et al., 2017) as well as human capabilities, for example, capabilities of project leaders (Dong and Götz, 2021), coordinators (Arts et al., 2020) or personnel in general (Rodrigo and Palacios, 2021; Wunderlich et al., 2013). In this context, supporting IS can address sustainability on a larger scale and contribute to business success (Hanelt et al., 2017). Further, a professional's network, experience, and dedication are pivotal for DSI success (Dong and Götz, 2021). A high degree of anxiety and lack of life satisfaction, in contrast, leads to a lack of commitment from professionals in DSI organisations' development (Rodrigo and Palacios, 2021). Second and regarding the external environment, the focus is on collaborations (Koch et al., 2018; Galán-Díaz et al., 2015), or the role of the public, such as social movements (Carberry et al., 2019), governments (Bloom et al., 2017; Arts et al., 2016; Butler and Hackney, 2015), or public value co-creation (Chatfield et al., 2019) influencing DT-based DSI. Social movements are more successful when applying field-level pressure. Thus, organisations comply with legal necessities, for example, the need for sustainability reporting. Organisations then innovate to develop DTs that can be leveraged to comply with these legal necessities (Carberry et al., 2019). Further, collaborations, for example, between organisations and academics can have positive and negative impacts. Hence, academics can support organisations in creating new ways of engaging with audiences. In contrast, negative impacts are reflected in the time and resources required to adopt new technologies or learn new skills (Galán-Díaz et al., 2015). This cluster's primary sustainability focus is on ecological sustainability (e.g., nature conservation (Arts et al., 2020)) and social sustainability (e.g., health system transition (Bloom et al., 2017)). Economic sustainability is regarded as a by-product when considering sustainability as a whole (e.g., Hjalmarsson and Lind, 2011).

5 Research Agenda for Digital Social Innovation

Based on the 78 studies, their classification into the six research clusters, and the in-depth analysis of their contributions, we identified relevant research gaps that helped us form a DSI research agenda. Inspired – among others – by the DSI special issue editorial by Qureshi et al. (2021), we analysed all

papers based on our systematic review of extant research on DSI and our framework's different dimensions and characteristics. Hence, we outline a future research agenda highlighting existing gaps including unanswered research avenues, and their relevance for advancing DSI research and practice. Therein, we follow other valuable and established research agendas in synthesising existing knowledge to derive future research opportunities (e.g., Hund et al., 2021; Ramdani et al., 2022; Watson et al., 2010; Qureshi et al., 2021). In the following, we discuss these research gaps in detail. While research questions 1-6 follow specific clusters (Figure 3), questions seven and eight address the nature of sustainability-related to DSI as an overarching theme.

In cluster 1 and 4, DSI actions are covered quite thoroughly. DSI actions comprise all actions undertaken in the DSI process: initiation, development, implementation, and exploitation. Existing studies in this realm touch upon at least one of these actions. Due to the novelty of the research field, scholars so far have demonstrated the functioning of DSI actions in the context of single case studies (e.g., Foster and Heeks, 2013; Witteveen et al., 2017). These studies are highly valuable as they show the practicability of DSI solutions in very tangible settings. Advancing this case study focus of DSI research, it is now important to generalise and synthesise prior findings. This should yield general, less context-related theories and methods for all actions alongside the DSI process. In terms of newly developed theories, such a synthesis needs to enhance our understanding of DSI dynamics. Like well-established theories in IS research (e.g., technology acceptance models such as TAM or UTAUT (Venkatesh et al., 2003)), a general theory allows both research and practice to build on a common understanding of the matter when investigating DSI (Whetten, 1989). Such an understanding of the relationships between social innovation, technology, and all integrated innovation steps is important, in order to provide scholars and practitioners alike with science-based guidelines for leveraging DSI. In the DSI realm, Antonioli et al. (2018) provide one such example for a more general assessment, by analysing factors that influence the adoption of environmental innovations. In a second step, scholars could then use the general theory to transfer it to individual contexts (Hong et al., 2014). For example, one such general theory could identify components and relationships impacting the success of DSI initiatives, which would in turn help to create an understanding of why certain initiatives succeed or fail.

Similarly, research and practice would benefit from generalised methods for mastering the four DSI actions in real-life scenarios. In the case of DI, existing research has contributed to operationalising co-creation, opportunity exploration, or innovation implementation (Lang et al., 2015; e.g., Benitez et al., 2018; Klein and Sorra, 1996). For the research field of DSI to advance, an in-depth analysis of which methods from SI and DI can be transferred to DSI directly, and the development of new methods where needed, is critical. Such methods could remove the barriers to leveraging DSI. Summarising the argumentation above, two central research questions emerge:

RQ1: Which theories are fundamental to DSI?

RQ2: Through which innovation methods can DSI be enabled?

A plethora of studies investigate the role of DTs as an end and thus focus on digital artifacts as outcomes of DSI. DTs as a means are investigated less frequently. Moreover, research clusters 1 and 2 reveal a lack of knowledge on how DTs are leveraged within the overall DSI process to improve the effectiveness of DSI actions and the DSI outcome itself. Only a limited number of studies describe the role of DTs in DSI actions. For example, Kelly and Noonan (2017) investigate DT-enabled data practices in the Indian public health service and differentiate two forms of datafication, i.e., systematic practices and edifying practices. Further, Ketter et al. (2016) investigate best designs and societal implications of different design choices for dynamic electricity trading through a competitive gaming platform. DTs, however, are associated with various opportunities in DSI actions to address social needs more efficiently. DTs can identify and assimilate knowledge to initiate innovation for social needs (Kohli and Melville, 2019). For example, sensors can generate data-based insights, and in return, support solutions that address social needs (Da Xu et al., 2014).

Further, when developing innovation for social needs, DTs enhance the efficiency and inclusiveness of the development process. For instance, platforms enable virtually connecting people (Fichman, 2004)

to co-create solutions for social needs faster and at a larger scale (Bria, 2015). Lastly, when exploiting an innovation for social needs, DTs can scale the solution more efficiently. Today, DTs are becoming more available both in industrialised and developing countries, enabling to reach large parts of the population and to scale DSI faster (Fichman et al., 2014; Foster and Heeks, 2013; Walsham, 2017). Despite the opportunities of DTs for DSI actions, there is no comprehensive knowledge on how DTs can be leveraged regarding DSI actions and how the usage of DTs improves DSI actions (e.g., compared to analogue actions). In this realm, clusters 1 and 2 reveal a lack of knowledge regarding DT usage within DSI actions to positively affect sustainability goals. Further, there is limited knowledge regarding the difference between reaching sustainability goals with and without using DTs in DSI actions. Given the potentials of DTs for addressing social needs, however, these research gaps should be addressed. We, therefore, propose the following research questions:

RQ3: How can DTs be effectively leveraged in DSI actions?

RQ4: How do DTs as a means change DSI actions and DSI outcomes compared to analogue innovation processes?

The research clusters on the DSI environment (clusters 3 and 6) and the DSI actions (clusters 1 and 4) reveal that end-users of DSI have not played a pivotal role yet. Only a few studies focus on end-users in a specific context. For example, Hosseini et al. (2018) develop a digital innovation approach in the public sector integrating end-users through an open innovation process. Further, Carberry et al. (2019) analyse how social movements foster corporate social innovation in the context of adopting Green IS. In this realm, end-users can be part of an organisation's external environment or part of DSI actions, as clusters 4 and 6 show. On the one hand, end-users should influence an organisation's decisions in acting socially responsible. Thus, end-users can facilitate sustainability changes, such as their raised awareness of societal challenges (Porter and Kramer, 2006). Therefore, organisations are expected to behave socially responsible beyond the mere goal of profit-making. Acting socially responsible can open up various potentials for organisations that can be further leveraged through the usage of DTs (Grigore et al., 2017). First, DTs increase efficiency in addressing changing end-user needs and open new sources of profits. Second, DTs provide access to information, the sustainability of business practices, and services enabling organisations to actively engage in creating a better society. Third, DTs open potentials in engaging with key stakeholders (Grigore et al., 2017).

Next to the potential of end-users to drive sustainable business practices, end-users can also be included in DSI actions. This refers to the role of end-users actively engaging in creating DSI initiatives through, for example, open innovation approaches. Organisations can integrate end-users for developing DSI by including them, for example, in brainstorming activities, prototyping, or idea evaluation. This helps develop DSI initiatives that address end-user needs and incorporate sustainability to a larger extent (Elmquist et al., 2009). Therefore, the role of end-users is twofold, i.e., in pressuring organisations regarding acting socially responsible and in engaging within DSI actions. However, knowledge on how these roles are changing in DSI and how DTs affect the role of end-users is scarce. Further, knowledge on how end-users can be integrated into DSI, such as DSI actions or the DSI environment, and how these contexts differ from each other, has not been fully grasped. To effectively make use of the wisdom of the crowd, these research gaps need to be closed. We propose the following research questions:

RQ5: What are the different roles of end-users for leveraging DSI?

RQ6: How can organisations successfully integrate end-users in DSI development?

The above research questions focus on the DI and DT dimension in specific clusters. Additionally, the six research clusters demonstrate the potential of DSI for all three pillars of sustainability: for example, economic development at the Bottom of the Pyramid through ICT-enabled solutions (Tarafdar et al., 2013) (economic sustainability), the use of health data to prevent severe diseases and promote healthy lifestyles (Nittas et al., 2019) (social sustainability), or a digital platform for facilitating conservation management (Arts et al., 2020) (ecological sustainability). Sometimes, the progress in one sustainability dimension positively impacts another. For example, fighting world hunger also leads to increased health,

as healthy nutrition is one requirement for good health. Unfortunately, not all sustainability dimensions inhibit positive synergies only. Most prominently discussed in the past, ecological and social targets can sometimes lower economic sustainability. While this does not hold true for all social and ecological sustainability initiatives, reasons include lower profit margins caused, for example, by more expensive (sustainable) materials or higher wages (e.g., Weitzman, 2000). But even when neglecting economic considerations, conflicts between sustainability dimensions can arise. For instance, higher resource efficiency potentially leads to lower demand for the workforce and increases unemployment. Projects such as the Agenda 2020 Compass - a collaboration between the *Stockholm Environment Institute*, the *MIT Center for Collective Intelligence*, and industry - have investigated these positive and negative synergies between all dimensions of sustainability (Hallding and Blixt, 2020). Their results support practice in evaluating the direct and indirect positive and negative effects of sustainability projects.

However, the corresponding impact of DSI regarding these effects has not been examined and understood to a full extent yet. DSIs potentially impact conflicts and synergies between sustainability dimensions in two ways: first, by causing conflicts when addressing one dimension of sustainability. For example, Arts et al. (2020) examine the role of a digital platform that simultaneously creates ecological benefits for conservation management while also hindering the elderly, less technology-savy from participating in such initiatives, thus leading to a decrease in social sustainability. Second, DSIs impact synergies by potentially solving existing conflicts between sustainability dimensions. For example, offering easy-access online retraining to those who lost their job because of resource efficiency initiatives. To reach sustainable development in the long run, it is indispensable to understand how DSI affects the conflicts and relationships between sustainability dimensions early on. Otherwise, well-intentioned DSI initiatives could cause more damage than good. Research should therefore address:

RQ7: Which sustainability conflicts are caused or aggravated by DSI?

RQ8: How can DSI solve sustainability conflicts?

6 Conclusion

Research on DSI is still in its infancy, with contributions being scattered across disciplines. In order to grasp the richness of prior research, our study builds upon a theory-based multidimensional framework for analysing existing DSI literature. We identify relevant dimensions of DSI to structure and capture both well-researched themes and critical paths for future research to derive a research agenda for DSI. As with all research, our research has certain limitations that open further research opportunities. First, our study focuses on deriving critical research pathways for IS research based on existing research on DSI, which has mostly taken qualitative approaches. However, further research should build upon our work to examine relevance and applicability in practice. For instance, our framework could help provide the conceptual clarity required to support the development of quantifiable metrics. Second, conducting a broad literature review requires a focus on broadness rather than depth (Leidner, 2018). While this allows a breadth of existing knowledge to be analysed and makes literature streams accessible more easily, it comes at the expense of diving into the details of specific characteristics of our multidimensional framework. For instance, designs, technologies, and mechanisms might differ within the different characteristics. Thus, further research should deep-dive into different characteristics analysing the articles in more depth and account for the dynamism of DSI. For example, the articles should be analysed in more detail regarding the different DI actions (i.e., initiating, developing, implementing, exploiting). Third, we briefly summarised the existing contributions in the different clusters. Further research should describe the clusters in a more detailed way, for example, by focusing on one specific cluster only. In addition, specific propositions should be developed that can serve as the bases for hypotheses to be tested in future studies.

Our aim with this paper is to provide a comprehensive overview of the emerging phenomenon of DSI, including future pathways for the IS community. We hope our research agenda provides fellow scholars with a foundation for their research and makes a small contribution to the ongoing sustainability challenges of our time.

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