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Future directions for scholarship on data governance, digital innovation, and grand challenges

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Abstract:

This introduction to the special issue on Data Governance, Digital Innovation, and Grand Challenges highlights the importance of data governance when seeking to address grand challenges through the innovative use of digital technologies. The benefits, risks, and consequences of data, ubiquitous in today's data-rich world, can be harnessed for innovation and societal good. However, there are no guarantees that (only) desirable outcomes will develop. The creation and exploitation of vast data stockpiles raise substantial concerns about privacy, data security, equity, and the potential for harm from data misuse. Meaningful approaches to data governance within and across organizations are critically important to facilitate digital innovation and to balance social, economic and technical benefits and risks for individuals, organizations, and societies. In this introductory paper, we reflect on foundations established to date in information systems (IS) research and highlight possible future directions for scholarship on data governance across multiple levels to enhance digital innovations for transformation and societal good

Keywords: Data governance, Grand challenges, Open data, Digital innovation, Multi-level research, Academic-practitioner relationships

1. Grand challenges and data governance

Grand challenges are critical national or global problems, which might be addressed in part through digital innovation but require radically new organizational, technological, and scientific approaches (Winter & Butler, 2011). The term "Grand Challenges" has been defined as the "specific critical barrier(s) that, if removed, would help solve an important societal problem with a high likelihood of global impact through widespread implementation" (George, Howard-Grenville, Joshi, & Tihanyi, 2016: 1881). For instance, the United Nations identifies 17 sustainable development goals including no poverty, zero hunger, good health and well-being, quality education, and gender equality.¹ Politicians, policy makers, philanthropists, non-governmental organizations (NGOs), and business leaders are looking for innovative new approaches to tackle grand challenges (Albani & Henderson, 2014; UK Department Business Energy & Industrial Strategy, 2021). Scholars across the fields of management and information

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systems (IS) are calling for research into solutions for global problems that would transcend organizational boundaries and might contribute to achieving these goals (Becker, vom Brocke, Heddier, & Seidel, 2015; George et al., 2016; Gümüşay, Claus, & Amis, 2020; Majchrzak, Markus, & Wareham, 2016). The enormous varieties and volume of data accumulating through digitized information systems could contribute in myriad ways to tackling grand challenges and advancing societal well-being. For example, data gathered via contact tracing apps improved responses to COVID-19 during early stages of the global pandemic (Trang, Trenz, Weiger, Tarafdar, & Cheung, 2020). As the global population ages, data generated from smart devices and home monitoring technologies can help individuals and families cope with the challenges of aging at home (Kulik, Ryan, Harper, & George, 2014; Wessel et al., 2019). Our call for this special issue is motivated by the understanding that data can be a powerful resource for digital innovation and societal action. As data have become more central to policy and actions, new questions are coming to the foreground about how data should be, and can be, governed to bring about socially beneficial innovations while avoiding or mitigating undesirable outcomes (de Freitas et al., 2021; Liu, 2022; Tiffin, George, & LeFevre, 2019). Data are not simply neutral objects reflecting an independent reality (Jones, 2019; Jones et al., 2019). Data and their interpretation are contingent upon practices of production, dissemination, and use (Bailey, Leonardi, & Barley, 2011; Monteiro & Parmiggiani, 2019; Parmiggiani, Østerlie, & Almklov, 2022). Datafication, in which data become arbiters of realities and thus of social and economic policies, raises substantive concerns regarding how and by whom data are created and accumulated, what data are used and for what purposes, and what outcomes result and for which societal groups (Jones, 2019; Leidner and Tona, 2021; Liu, 2022). These are data governance issues writ large.

Today, the management and control of the data resources critical for digital innovations are distributed across organizations and ecosystems. Effective and equitable mobilization of data to address grand challenges will require dramatically new approaches to conceptualizing, designing, implementing and enacting data governance within and especially across organizations (Gregory, Henfridsson, Kaganer, & Kyriakou, 2021; van Donge, Bharosa, & Janssen, 2022; Verhulst, Zahuranec, Young, & Winowatan, 2020). Because data are inherently equivocal and malleable to the interpretations, interests, and values of varied actors, we must look closely at how these stakeholders work collaboratively or competitively to orchestrate data governance (Gümüşay et al., 2020). Only then can we hope to align diverse interests to engage grand challenges through data-enabled innovations (Grafenstein, 2022; Rosenbaum, 2010; Shabani, 2022; Winter & Davidson, 2017).

Our goal in this special issue is to foster a dialogue on novel socio-technical approaches to data governance for grand challenges in information systems (IS) research and adjacent fields. This dialogue begins within organizational settings but necessarily extends across networks and ecosystems of individual and collective actors. In the following section we consider foundations for this dialogue in the IS literature on data governance. We then outline five general research themes that broaden the IS field's focus on data governance within organizational settings towards the challenges of governing data for grand challenges. We conclude with the contributions of the publications in this special issue that advance this dialogue.

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2. Data governance foundations in IS scholarship

Enterprise data governance has long been of interest to IS practitioners and researchers. The Data Management Body of Knowledge (DAMA-DMBOK2) defines data governance as the exercise of authority and control (planning, monitoring, and enforcement) over the management of data assets, identifies governance as central to an array of enterprise data management activities (e.g., data architecture, modeling, storage and operations, ethics, security, interoperability, quality, warehousing, metadata, master data management), and outlines normative policies, practices, procedures, and structures for firm-level data governance (DAMA, International, 2017). IS researchers have also long considered the opportunities and challenges of managing digital data for organizational advantage, typically in terms of business and IS infrastructure alignment (Tallon, Ramirez, & Short, 2013; Tallon, Short, & Harkins, 2013), data infrastructures such as data warehouses for business intelligence and strategic advantage (Inmon, 1996; Ross & Kimball, 2013), and data quality (Wang & Strong, 1996).

The exponential increases in the volume and variety of digital data (so-called "big data") have revitalized interest in data governance among IS researchers (Abraham, Schneider, & vom Brocke, 2019; Alhassan, Sammon, & Daly, 2019; Khatri & Brown, 2010; Lis & Otto, 2021). Much of this research focuses on data governance activities within organizational settings and on frameworks for enterprise data management best practices. This meso-level research lies between the individual and the societal levels of analysis, for instance, between individuals' attitudes towards privacy and privacy-enhancing data regulation and policy, and provides useful insights about data governance and organizational outcomes such as financial performance or mitigation of data-related risks (Abraham et al., 2019; Khatri & Brown, 2010; Markus & Bui, 2012; Otto, 2011; Tallon, Ramirez, & Short, 2013).

Recent review papers that have systematically summarized the IS literature on data governance identify the primary goals of data governance as managing data as a strategic enterprise asset and managing associated risks (Abraham et al., 2019; Brous, Janssen and Vilminko-Heikkinen, 2016; Jagals, Karger, & Ahlemann, 2021; Lillie & Eybers, 2019; Nielsen, 2017). Data governance mechanisms include formal reporting structures (structural mechanisms), standardization of how the enterprise records and processes data (procedural mechanisms), as well as employee training on how to relate to data (relational mechanisms) (Abraham et al., 2019). These mechanisms are analogous to IT governance mechanisms for the alignment of IS/IT and business strategy (Brous et al., 2016; Gerow, Grover, Thatcher, & Roth, 2014). Organizations implement such mechanisms to improve the quality, security, or architecture of data, manage data lifecycles, reduce risk and enhance regulatory compliance, and to generally optimize data management within the organization (Abraham et al., 2019; Khatri & Brown, 2010).

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Wide scale digitalization and consumer adoption of mobile devices and apps has brought new sources of data into organizations and new possibilities for innovation with and monetization of data (George, Haas, & Pentland, 2014; Gregory et Al., 2021; Yoo, 2010; Yoo, Henfridsson, & Lyytinen, 2010). For example, data from social media (Tallon, Short, & Harkins, 2013), streaming services (Ballard et al., 2014), or genomic data of individuals (Rothe, Jarvenpaa, & Penninger, 2019) hold great potential for commercialization.

Exploiting big data for the firm's advantage comes with risks that extend well beyond challenges such as cybersecurity or data interoperability (Abraham et al., 2019; Kitchin, 2014; McMahon, Buyx, & Prainsack, 2020). Whether the risk-reward tradeoff is consistent with corporate strategy increasingly rises to a Board of Directors-level decision about whether to take on these data governance responsibilities (Black, Davern, Maynard, & Naseer, 2023, this issue). While IS research has considered emerging governance issues within organizations seeking to realize business value from big data (Günther, Rezazade Mehrizi, Huysman, & Feldberg, 2017), many data resources are situated outside a single organization's boundaries and beyond its unilateral control; they are within digital platforms, shared infrastructures, or distributed resources managed by varied collective actors (Kitchin, 2014; Winter, Berente, Howison, & Butler, 2014). Thus, how firms govern data in their quest for strategic and economic value at aggregate levels such as platforms, ecosystems or inter-organizational networks is now garnering IS researcher interest (Abraham et al., 2019; Jernite et al., 2022; Lis & Otto, 2021; Markus & Bui, 2012; van Donge et al., 2022).

3. Future directions for research

Grand challenges are typically global or societal concerns about aggregate outcomes (Gümüşay et al., 2020; Majchrzak et al., 2016), but they are rooted in actions at less aggregate levels (Faik, Barrett, & Oborn, 2020) that require coordinated and collaborative efforts across organizations, governments, and other collective actors (George et al., 2016; Winter & Butler, 2011). Similarly, mobilizing data resources to address grand challenges requires multi-level efforts. Issues such as data provenance, ownership, legitimate uses, and corporate responsibility for outcomes transcend intra-organizational concerns (Gregory, Kaganer, Henfridsson, & Ruch, 2018; Hicks, 2022; Winter & Davidson, 2022). Addressing these data governance issues requires a broader perspective that at times de-centers the organization to encompass public policy, regulatory actions, and societal values and interests (cf., Comandè & Schneider, 2022; Grafenstein, 2022; Hicks, 2022; Madison, 2020; Winter & Davidson, 2022). In what follows, we highlight five research themes that complement IS research on enterprise data governance to develop this broader perspective.

3.1. Data governance beyond the organizational boundary

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Increasingly the management and control of data resources and thus data governance are nested across societal levels, as neither entirely top down nor bottom up approaches are likely to be effective (Constantinides & Barrett, 2015; Madison, 2020). IS research to-date has primarily focused at the meso (organizational) level; heightened attention to the micro-level (individual) and macro-level (industry, sector), as well as interaction across levels, is called for (Haack, Sieweke, & Wessel, 2019).

3.1.1. Micro-level data governance

Individual-level, personal data are aggregated from mobile phones, apps operating on phones, consumer wearables, smart technologies in the home, and even devices implanted in the human body (Matt, Trenz, Cheung, & Turel, 2019). These data can enable individualized services to enhance wellbeing, health, and convenience (Beverungen, Matzner, & Janiesch, 2017; 2019; Gregory et al., 2021; Wessel et al., 2019). However, this micro-level surveillance of human activity by businesses (particularly by IT platform owners) and by governments raises numerous concerns about privacy, autonomy, and voice in how data are aggregated, monetized, and shared (Zuboff, 2015). IS researchers have long considered individuals' willingness to entrust data about themselves to organizations that collect and govern personal data (Belanger & Crossler, 2011; Belanger, Hiller, & Smith, 2002; Xu, Teo, Tan, & Agarwal, 2009). Recent research in individual privacy highlights the importance of different perceptions of privacy risks (Karwatzki, Trenz, & Veit, 2022). A micro-level perspective would extend this research beyond these important privacy concerns to problematize theoretically and practically how individuals' autonomy, choice and voice in governing their personal data might be realized (Zuboff, 2015). For instance, individuals have different preferences for how their data are governed, and they may be more willing to donate personal data for societal welfare initiatives, despite potential privacy costs, to governmental and research organizations rather than to corporations (Hillebrand, Hornuf, Müller, & Vrankar, 2023, this issue).

Enabling individuals' voice and choice in organizational decisions about what personal data are collected, monetized, or otherwise (re)used, and hence in governance of personal data, is difficult. Many people have limited understanding of the ubiquity of data collection in daily activities. Even if they are aware, their only options may be to forego an online service or to surrender personal data to the technology platform owner. How individuals can be made aware of the personal data that they generate through digital actions, how technologies can be designed so that individuals understand what happens with their data and can share governance or give informed consent (or not) for their data use, and how these individual-level interests and values can be translated into policy and regulations that also allow for data-driven innovations, are all important open questions (de Freitas et al., 2021; Grafenstein, 2022; Zaeem & Barber, 2020). A micro-level perspective in data governance research could begin with individual-level values and interests in governance of personal data to consider the efficacy of various socio-technical

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designs and regulatory approaches aimed at balancing opportunities for digital innovation and preserving individual rights. Design science research could be particularly useful to examine how individual preferences and choice might be realized in organizational data governance practices and IS infrastructures, for instance, through adopting privacy by design principles (Spiekermann, 2012) or updating informed-consent practices (Custers, 2016).

3.1.2. Macro-level data governance

As data resources develop beyond organizational boundaries, industry-level and sector-level data governance initiatives come to the foreground. For instance, the (re)use of digitized health data resources, created and managed across multiple organizations and by consumers using mobile health apps, is expected to engender transformative innovations in health services, quality, and access

(Figueiredo & Chen, 2020; Hripcsak, Bloomrosen, Flatley Brennan, et al., 2014; Rosenbaum, 2010). IS research interest in health industry IT/IS developments has blossomed in the last two decades (Davidson, Baird, & Prince, 2018) but seldom problematizes the critical role data governance will play in realizing or curtailing socially beneficial innovations from health data resources beyond privacy and security concerns (Winter & Davidson, 2017, 2019). Incompatible health IT systems and data standards, barriers to data sharing across organizations including regulations intended to protect health data privacy, and organizational reticence to sharing valuable data all present substantial barriers to mobilizing health data resources to address societal concerns (Hripcsak et al., 2014; Rosenbaum, 2010; Vest & Gamm, 2010). Most recently, the COVID-19 pandemic demonstrated the benefits of widely shared public health data but also exposed the persistent social, political, and technical barriers to health data sharing (Bradford, Aboy, & Liddell, 2020; Price & Cohen, 2019).

Industry- and sector-wide data governance issues require concerted efforts among many organizational and governmental actors (Shabani, 2022; Winter & Davidson, 2022). Extending IS research on data governance beyond the organizational (meso) level to the macro-level directs attention towards the interplay of organizational and societal values, interests, and risks in play when digitized data are widely shared and (re)used, and to the diverse stakeholders involved in governance actions (Gray, Briscoe, & Diaz Ferraro, 2022). A deeper understanding of multi-level, multi-stakeholder data governance could be developed in collaboration with practitioners and policy makers working to establish macro-level data governance (Bari, Ricker-Kiefert, Penix, & Ritzo, 2022; Verhulst et al., 2020). IS researchers bring an understanding of socio-technical theory and digital infrastructure to help make sense of these initiatives and their outcomes. Paparova and colleagues (Paparova, Aanestad, Vassilakopolou, & Bahus, 2023, this issue) illustrate this theory- practice synergy in their study of a personal health "data space" in Norway by surfacing governance tensions that inform theory, practice, and policy.

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3.2. New organizational forms of data governance

Although we advocate that IS data governance research extends beyond traditional organizational boundaries, we also acknowledge that data governance processes and practices are inherently organizational phenomena, encompassing both informal and formal forms. Madison (2020, p. 33) comments that governance is "collective or coordinated decision-making by individuals working together, about decisions on matters of collective interest." This processual view of governance problematizes questions about why individuals come to work together, how they coordinate and direct their work collectively, whether and how they exert authority and control over data resources, and what organizational structures or mechanisms may evolve as a result. IS research provides a starting point to examine organizational data governance structures and practices (e.g., Abraham et al., 2019). However, when individuals, organizations, and state actors come together as data stewards, the data stockpiles that they jointly create and utilize challenge assumptions that data ownership as well as rights and responsibilities for data quality and authenticity lie within any one organization's boundaries. Instead, data governance necessarily entails new, distributed organizational forms enacted by individuals, technology vendors, data-holding (or using) organizations, and regulatory agencies.

Policy researchers are investigating a variety of data collaborative forms, which may include privately held corporate data that are shared with academic researchers or government agencies in the public interest (Verhulst et al., 2020). Micheli and colleagues (Micheli, Ponti, Craglia, & Berti Suman, 2020) outline four prototypical data governance models (data sharing pools, data co-operatives, public data trusts, personal data sovereignty) involving individuals, firms, or other collective actors in terms of "situated, contingent and relational instantiation of the stakeholder roles, their interrelationships, their articulations of value, and the organization of governance principles, instruments and mechanism" (p. 3). The success of collaborative forms depends in large part on data stewardship (van Donge et al., 2022). In contrast to its definition in enterprise data governance literature, the stakeholder role is broadly defined as individuals or teams within the data-holding organizations empowered to proactively promote data collaboratives in the public interest (Verhulst et al., 2020). Whether and how collaborative forms of governance advance social welfare through data sharing depends on the interests of the partnering organizations, particularly when data-sharing partnerships cross sectoral boundaries such as private firms and government agencies (Susha, Rukanova, Zuiderwijk, Gil-Garcia, & Gasco-Hernandez, 2023, this issue). These studies present theoretical and practical research questions about how data governance forms arise and which forms are more likely to sustainably enable digital innovation for societal welfare. Whether new forms promote democratization of data governance across stakeholders, that is, stakeholder voice and choice, and if so through what mechanisms, are also important questions (Madison, 2020).

3.3. Governance concerns with exposing open data to digital innovation

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Often digital innovations arise when data that have been collected for specific purposes in various organizational settings are aggregated, integrated or linked, and then (re)analyzed to improve existing products and services or develop new ones. Sometimes producing a novel data resource for sharing is itself an important innovation. For instance, open data science initiatives harness digitalization to create new forms of collaboration around data and analytic tool sharing and dissemination (Shahin, Bhattacharya, Silva, et al., 2020) to address grand challenges in fields such as chemistry, physics, or astronomy. Open innovation hackathons, in which individuals and firms engage in competitions to develop innovative uses and new value from open data, are an organizing innovation that has also inspired considerable interest (Johnson & Robinson, 2014; Kitsios & Kamariotou, 2022). Government-held data in particular are viewed as having vast, untapped economic and social value that could be developed by non-governmental actors such as private firms. Governments at all levels have employed open data initiatives to advance openness and transparency and reduce corruption (Bertot, Jaeger, & Grimes, 2010), and to foster digital innovation in government communication and services (Kitsios & Kamariotou, 2022), including urban planning and smart city initiatives (Boeing, Higgs, Liu, et al., 2022).

Researchers have studied how government data might be made open through data sharing platform infrastructures and data sharing policies (van Donge et al., 2022; Zuiderwijk & Janssen, 2014). These initiatives involve a wide range of stakeholders that share data governance responsibilities such as data stewardship roles (e.g., data preparation, standardization, archiving, delivery) within an ecosystem of loosely coupled actors and technical systems (van Donge et al., 2022; Zuiderwijk, Janssen, & Davis, 2014). Governance in data ecosystems is not hierarchical per se, and instead involves both horizontal and vertical dynamics across the network (Paparova et al., 2023, this issue). Whether intra-organizational policies, practices, and mechanisms scale effectively to open-data ecosystem governance, or whether these novel goals and stakeholder networks require different approaches to data governance, are important research questions.

In their essay in this issue, Gegenhuber and colleagues (Gegenhuber, Mair, Lührsen, & Thäter, 2023, this issue) argue that open data intersect with novel questions of accountability and power that arise when distributed stakeholders coordinate with one another in responding to grand challenges. Governance challenges begin with how to surface valuable data resources for reuse and how to effectively open data resources for discovery and innovation beyond the boundaries of the primary data-governing organization. Expectations are high that open data initiatives stimulate economic growth and societal well-being, but outcomes are mixed and uncertain, as are their sustainability over time and the differential outcomes for social groups that benefit (or not) from them (Jetzek, Avital, & Bjorn-Andersen, 2019). Allowing private sector actors to appropriate most of the economic value generated by their open- data-sourced innovations could enable the value of open data to be realized (Jetzek et al., 2019). However, when public data are appropriated for new uses in new contexts, there may be unexpected, harmful consequences for some groups and societal sectors (Marjanovic & Cecez-Kecmanovic, 2020). And, despite the promise of future transformative innovations, sharing open data without the consent of the individual subjects of the data can deny their autonomy and choice (Winter & Davidson, 2019). These are critical questions about societal governance of open data resources. Cross-disciplinary

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research is needed to investigate the varied governance goals and stakeholder values involved in open data initiatives and to assess how innovation benefits are shared across stakeholders.

3.4. Equity and fairness in data governance

Digital innovations hold great promise for tackling societal grand challenges but there remain important questions about who will benefit and who could be harmed or disadvantaged (Benbya, Pachidi, & Jarvenpaa, 2021; Kane, Young, Majchrzak, & Ransbotham, 2021; Kordzadeh & Ghasemaghaei, 2021; Winter, 2019). The implications of data governance on differential outcomes are particularly evident in the potential for AI innovations. AI algorithms are "trained" in deep learning, which relies on massive amounts of raw data. Researchers have highlighted the potential for discriminatory impacts across domains (e.g., law enforcement, HR and hiring decisions, healthcare, and finance) arising from inherent biases (Raji, Smart, White, et al., 2020). Although biases may exist at every stage of an AI system's design and implementation, biased training data sets are especially problematic because identifying and correcting bias in data may not be possible. Bias then becomes embedded into AI systems as pre-trained algorithms, making them opaque, protected by a firm's intellectual property rights and shielded from regulatory or market scrutiny (Pasquale, 2015). Concerns about bias in AI- algorithmic decision support are emerging in IS research, leading to questions of why the algorithms are biased (and even how they operate) and what we should do about it (Benbya et al., 2021; Kordzadeh & Ghasemaghaei, 2021). Data-related algorithmic bias highlights questions about data provenance and traceability, particularly as data are reused in new contexts. How can the history of a data resource be considered during the design of algorithmic systems so as to better manage their social, economic and technical outcomes? Technical solutions such as metadata management software and interorganizational data stewardship practices are a starting point. However, innovative uses of data resources are difficult to foresee and thus to account for when the information systems that generate data stockpiles are designed and implemented (Winter & Butler, 2021).

How might we account for (and thus govern) potential reuse of data in unknown and emergent futures? The values and interests that shape technologies are reflected in the data resources they generate. As new values and interests gain currency, technologies change, as do interpretations of and applications for the data they generate (Chiasson, Davidson, & Winter, 2018). Jarvenpaa and Ess'en (2023, this issue) tackle these questions in terms of data sustainability, arguing that data must transition across socio-technical environments over extended time frames to support future potential uses while also retaining meaningful interpretations of data that are embedded in historical social and material networks. Addressing these governance tensions presents socio-technical design as well as ethical questions. Regulatory guidance such as the General Data Protection Regulation's (GDPR) principles for lawfulness, fairness, and transparency and data minimization begin to incorporate today's societal concerns into information systems design and data aggregation practices (Grafenstein, 2022; Zaem & Barber, 2020). However, fair, transparent, and equitable data governance often conflicts with firms' self-interest in maintaining intellectual property rights and monetizing data resources. Cross-disciplinary research into how

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organizations respond to data regulations in the design and operation of information systems, and what societal outcomes result, can help to inform policy and practices for data governance.

3.5. Academic-practitioner partnerships in data governance research

First-hand practical knowledge by policy makers, industry practitioners and indeed everyday people can inform our scholarly understanding of a host of emerging and complex issues (Hillebrand, Hornuf, Müller, & Vrankar, 2023, this issue). In turn, academic insights can be put to work directly and inform solutions to important problems when researchers engage with practitioners (Barrett & Oborn, 2018; Corley & Gioia, 2011). The array of complex theoretical and practical problems associated with data governance in this digital age, particularly the opportunities to contribute to grand challenges through data-enabled innovation, clearly could benefit from and will require close academic-practitioner relationships (Bartunek, 2007; Van de Ven, 2007, 2018). IS researchers often rely on

action design research (ADR) (Sein, Henfridsson, Rossi, & Lindgren, 2011; Sein & Rossi, 2019) or design science research (DSR) (Hevner, March, Park, & Ram, 2004; Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007) to engage with practically relevant problems. However, to utilize these research project methods effectively in this domain presents significant barriers and challenges that must be surfaced and addressed.

Orchestrating data governance in inter-organizational networks and with participants from policy sectors and society more generally (Gegenhuber et al., this issue; Papparova et al., this issue) means that the range of stakeholders to participate in action design research projects extends well beyond members of a client organization (Sein et al., 2011). Questions of who to include and how to manage the 'ADR team' (Sein et al., 2011) must be carefully considered to ensure there is a consideration of fairness and equity and to design data governance for the voice of everyday people. These issues surface novel concerns such as who holds the rights to emerging artifacts, who is the 'client' of the artifact, and what role does potential commercial exploitation of designs or artifacts play in design of data governance mechanisms. Researchers adopting action design research approaches thus may have to accept paradoxes and competing aims as central tenets when the potential to commercialize digital innovations is at odds with advancing societal aims for fair and equitable data governance (Vial, this issue).

Recent advancements of design science research would also be of great value when designing data governance practices and infrastructures for digital innovations directed towards grand challenges (Abraham et al., 2019; Becker et al., 2015; Hevner et al., 2004; Hevner, vom Brocke, & Maedche, 2019; Peffers et al., 2007). Design science research is classically considered a stage-gate process where solutions to practical problems were deducted from existing theory (Seidel,

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Chandra Kruse, Sz'ekely, Gau, & Stieger, 2017). However, data governance issues that transcend social levels are more amenable to an 'ideas first approach' (Seckler, Mauer, & vom Brocke, 2021). Here, various sources of knowledge (academia, industry practice, society) are treated as equally valid and important and are leveraged to generate solutions (Barrett & Oborn, 2018; Bartunek, 2007; vom Brocke, Weber, & Grisold, 2021). The "ideas first" approach alters the sequential logic of design science models (Hevner et al., 2004; Peffers et al., 2007) by giving voice from the beginning to diverse stakeholders involved with designing data governance. To work effectively, industry practitioners partnering with academic researchers must take into account the ramifications of data flowing within and across organizations for data governance (Vial, 2023, this issue) and thus be open to including and considering all affected stakeholders from early on in the design process.

4. Contributions to the special issue

There is immense potential for the wealth of data resources in today's digital world to contribute to addressing grand challenges. There are also substantive tensions between the potential for data-driven digital innovations and the possibilities of harm rather than (or in addition to) societal good arising from these innovations, particularly for vulnerable populations. How data are governed – by whom, for what purposes, on whose behalf and through what socio-technical practices and structures – thus presents an imperative question to business leaders, policy makers, technologists, and researchers. Our call for papers in this special issue was intended to stimulate dialogue and advance research through the lens of data governance. In this introductory article, we outline five themes that we hope will inspire IS and organizational researchers to continue this dialogue in future research. We first emphasize the need to move beyond organization-level IS research to explore more fully how data governance is nested across micro-, meso-, and macro-levels. We then highlight opportunities for research on new organizational forms for data governance emerging within and across these levels. We point to the potential for open data initiatives to foster digital innovations for social welfare and economic development, along with the data governance challenges these initiatives engender. We also highlight more generally the importance of studying whether fair and equitable data governance is possible and how it might be brought about as data flow across socio-technical systems over time. Finally, we argue the importance of researchers collaborating closely with practitioners, policy makers, and societal actors to design better data governance artifacts and practices, despite some challenging methodological concerns.

The articles in this special issue on Data Governance, Innovation and Grand Challenges demonstrate these themes and contribute new insights to the dialogue that we hope to foster.

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In their article, "Data Governance and the Secondary Use of Data: The Board Influence," Black, Davern, Maynard, & Naseer (2023, this issue) examine the factors that influence the strategic position of a firm's board of directors regarding secondary data use as a business strategy. The authors argue that board members are widely encouraged to adopt such strategies, but they also must consider the considerable data governance risks for the firm. They identify nine key factors that influence the board's strategic position and use a configurational approach to characterize board strategy in terms of secondary data as a critical enabler or as a minimal enabler of strategy. Through fuzzy set qualitative case analysis (fs-QCA) methods the authors surface configurations of board attributes associated with strategies for adopting (or not) secondary data uses. These findings provide insights for practitioners seeking to transition a board's big data governance strategy. The authors' configurational approach and use of fs-QCA analysis also suggest how partnership characteristics and factors might be analyzed in comparative cases of new organizational forms such as data collaboratives.

In their article, "The Social Dilemma of Big Data: Donating Personal Data to Promote Social Welfare," Hillebrand, Hornuf, Müller, & Vrankar (2023, this issue) explore the important question of what calculus individuals use when deciding whether to donate personal data expected to contribute towards a public good. Using an online survey experiment, they examine how one's stated willingness to donate personal data changes based on the perceived likelihood that the resulting database will be large enough to foster effective decision making for the public good – even where there is risk of data leakage. Their results provide evidence that individuals are willing to donate personal data in spite of privacy costs and uncertainty about how much data is necessary to increase social welfare and whether other individuals have contributed enough data to meet that threshold. This work brings to the fore micro-level data governance and the importance of considering individuals' perspectives and voice in how their personal data are governed. This highlights the interplay of individual's willingness to share personal data for societal benefit and organizational or societal data management practices.

In their article, "Data Governance Spaces: the Case of a National Digital Service for Personal Health Data," Paparova, Aanestad, Vassilakopoulou, and Bahun (2023, this issue) offer a dynamic multi-level account of data governance. Through a longitudinal, retrospective study of Health Norway, a national digital service for citizens' personal health data, the authors develop the concept of data governance spaces in terms of the authorized relationships of decision-making authority, rights, roles and responsibilities around data within multi-actor networks. They distinguish data governance dynamics in terms of data handling and data handover. In the former, organizational authority over data is delegated to multiple actors to enable uniform data processing for agreed-upon purposes. In the latter, authority over data multiplies when data are handed over to multiple organizations for their own purposes under their own governance rules. This study extends beyond organizational boundaries to examine an emerging organizational form and its novel data governance challenges to argue that these dynamics are central to conceptualizing data governance structures, mechanisms and relationships in multi-actor networks.

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In their paper, "Achieving Voluntary Data Sharing in Cross Sector Partnerships: Three Partnership Models," Susha, Rukanova, Zuider-wijk, Gil-Garcia, and Gasco-Hernandez (2023, this issue) investigate how organizations from different sectors (private industry, government, not-for-profit) can achieve data sharing in partnerships to tackle societal challenges. They find that the type of partnership model (resource based, social issue, or societal) in part determines drivers and challenges to sharing data. A key difference between models is the extent to which partners are willing to engage with the broader societal issues without immediate direct gains. Organizational challenges were evident in all models, highlighting the complexity of aligning multiple stakeholder interests, expectations, and capabilities in open data initiatives. Mechanisms such as articulating a value proposition, relying on open government laws and regulations, or building a culture of information sharing also varied across partnership models and influenced the partners' commitment to sustainable data sharing arrangements to promote societal outcomes. This study brings depth and nuance to our understanding of interorganizational data sharing in open data initiatives and the differential implications for data governance.

In their paper, "Data Sustainability: Data Governance in Data Infrastructures Across Technological and Human Generations," Jarvenpaa and Ess'en (2023, this issue) argue that data sustainability, which they define as the capacity of data to endure across technological and human generations, is critical to social and environmental sustainability and therefore to addressing grand challenges now and in the future. They explore the challenges of data sustainability from three meta-theoretical perspectives – evolutionary, relational, and durational – to consider how data can remain accessible over time to allow for historical and longitudinal insights to emerge in the future while also preserving meaningful interpretations embedded in socio-historical and technical contexts. Each perspective foregrounds unique but also interrelated challenges to data sustainability and highlights areas of research ranging from study of data infrastructures to socially-informed studies of data curation and preservation given the uncertainties of future needs. They conclude that data sustainability is itself a grand challenge that requires research attention and societal investments.

In their paper, "Orchestrating Distributed Data Governance in Open Social Innovation," Gegenhuber, Mair, Lühsen, and Thäter (2023, this issue) explore relationships between data governance, open social innovation (OSI), and grand challenges. The authors argue that data governance is central for orchestrating OSI hackathons, as hackathons often involve coordinated actions of distributed stakeholders cooperating with each other to acquire and utilize data resources. Drawing on their study of hackathons orchestrated to generate responses to COVID-19, the authors highlight the value of open data resources to enable participants to understand contextual factors and situations associated with this grand challenge. Accounting for how data are acquired, analyzed, interpreted and applied is key to justifying policies and actions that result from a hackathon. Understanding the power relations that data represent is important in predicting what actions data use may stimulate among other actors. Accounting for these data governance dimensions – openness, accountability, and power – is key to influencing the possible and likely societal consequences of digital innovations through OSI. In these ways, the

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authors bring an important data governance lens to our understanding of open data initiatives as well as fairness and equity in data governance to address grand challenges.

Based on extensive experience teaching executives about data governance, in his paper "Data Governance and Digital Innovation: A Translational Account of Practitioner Issues for IS Research," Vial (2023, this issue) identifies four areas where current IS research on data governance could be extended to provide better guidance. He argues that prior research on paradoxical thinking could reconcile the need to control data to ensure privacy and security while also making it accessible to drive digital innovation. Adopting a more nuanced understanding of the affordances and constraints created by configurations of data governance mechanisms would yield a more grounded understanding. Vial also argues that understanding data governance in practice requires viewing it as a process and focusing on emergent phenomena. Finally, moving away from a view of data at rest to an understanding of data flowing within and across organizational boundaries through digital services can enable broader access while maintaining standards and data quality. Research in these areas could advance our theoretical understanding while also informing practitioners and enabling them to implement comprehensive data governance practices.

To conclude, we hope that through this special issue we inspire IS and other researchers to look for the data governance story in digital innovation phenomena they study. We hope also some will consider research on data governance, digital innovation and contributions to grand challenges in their future endeavors. We thank all the researchers who submitted articles for this special issue and the authors in this issue for their contributions that further the dialogue. We also thank the reviewers for their valuable guidance and critique to authors. Finally, we thank Editor-in-Chief Michael Barrett for supporting us in this editorial project.

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