Responsibility in the Era of Digital Innovation: Temporal Dynamics and Evolving Paradigms

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Abstract

Digital innovation is a burgeoning area of study which investigates how organisations and entrepreneurs leverage malleable digital resources to develop novel IT artefacts. However, despite the changing nature of systems development, our understanding of responsibility remains rooted in prior thinking which conceptualised it as a static obligation that ends, with the release of a system. In this chapter, we discuss responsibility in the era of digital innovation by investigating how practitioners and researchers think about responsibility within increasingly boundaryless digital innovation ecosystems and perpetually evolving IT artefacts. Building on insights from qualitative interviews with developers, IT ethicists, and user participant experts, our findings highlight the importance of accessibility, user-centric design, and foresight to anticipate unintended consequences and capitalise on resource and knowledge diversity. Through this research, we assert the need for responsibility to be reconceptualised as a continuous process that persists throughout the life cycle of digital innovations.

Keywords: Responsible innovation; digital resources; use recombination; bias; inclusion; unintended consequences.

1. Introduction

Digital innovation is of crucial importance in an ever-changing technological landscape (Hund et al., 2021; Nambisan et al., 2017). Increasingly, organisations and entrepreneurs seek to develop new products, services, and processes by combining 'agnostic' digital resources such as Internet of Things (IoT) devices, Application Programming Interfaces (APIs) and cloud computing in a layered modular architecture (Baiyere et al., 2023; Hylving & Schultze, 2020). With growing combinatorial opportunities of digital technologies, developers can continuously renew and add functionality to a system beyond the traditional timeframe of product development, as there is a "hard deadline" by when the version will be complete (Carroll, Hassan, et al., 2023; Yoo et al., 2012). Applications such as Instagram, ChatGPT, and Spotify are now subject to continuous release cycles as developers can seamlessly launch changes and new features through the cloud without the need for complex local installations. 'Use recombination' can further increase a digital resource's scope beyond the lead innovator's original intention when it is applied to a different setting by actors in the wider ecosystem (Ashrafi et al., 2024; Henfridsson et al., 2018). For instance, a recent security vulnerability in

the XZ open-source library exposed hundreds of platforms that relied on the component as part of their core architecture[1].

Considering these transformations, it is important to pause and reflect on what responsibility means in the era of digital innovation where development increasingly takes place beyond the walls of a single organisation or defined timeline of an IT project. The scholarly discourse on Responsible Research and Innovation (RRI) focuses on the anticipated ethical implications of innovation and the integrity of collaborative work (Ahuja et al., 2023; Owen et al., 2012; Stahl, 2012). Responsible innovation suggests that product development should be a transparent process in which innovators and societal actors work alongside each other to predict the future consequences of novel technologies (McCarthy et al., 2020; Owen et al., 2013). For instance, it asserts that Information Systems (IS) practitioners should collaborate with policymakers, experts, and other stakeholders to inform the design of future IT artefacts (Stahl, 2012).

However, responsible innovation has traditionally focused on embedding ethical considerations during the initiation stage of innovation. This assumption may now be problematic given the rapid pace of digital innovation where the long-term impacts of ever-evolving technologies are often hard to observe or anticipate. Left unmonitored, this can lead to unintended consequences arising later (Stahl, 2012). An example of this is Tay, the Twitter bot introduced in 2016 by Microsoft. Within 16 hours of launch and after 96,000 tweets, Tay was taken down from Twitter as it had begun to tweet offensive responses to conversations with other users (Neff, 2016). The algorithm was learning from interactions with users and without any ethical or moral coding, did not know right from wrong. In the absence of a long-term perspective through future forecasting, responsibility was relegated to the initial design and development of the digital innovation, ignoring any future repercussions. Innovative discoveries can have unexpected consequences as they deviate from their intended application. An example of this would be the introduction of digital technologies in education, such as online platforms for accessing classes to aid in students' learning and access to resources, however, previous research highlighted that students report a negative effect on their learning experience and motivation (Serhan, 2020). This is an example of digital innovation having unintended negative consequences.

Responsibility has also typically been isolated to developers who make design decisions that impact users. This is often predominantly male IT professionals from privileged backgrounds who comprise most of the IT sector. Without greater diversity and inclusion, essential stakeholders can be left out of decisions taken by digital innovators. In addition, the use of incomplete and unrepresentative training datasets for machine learning can lead to the repetition of societal biases in algorithms and AI (Akter et al., 2021). In 2014, Amazon introduced a hiring algorithm with the intention of removing biases from the hiring process. However, the algorithm later displayed bias against women applicants and scored their CVs lower than male applicants (Langenkamp et al., 2019). The algorithm was built from training data on current Amazon employees' CVs which traditionally had recorded a low proportion of female workers (Lavanchy, 2018). Another issue this raises is the user's lack of awareness of how such algorithms make decisions and the blind acceptance that these are the right decisions (Carroll et al., 2020). The use of facial recognition has similarly been proven flawed when being used on minority groups. An example of this was highlighted when Amazon tested its facial recognition tool, 'Rekognition.' The system was tested by using photos of US congress members and recorded 28 false matches for people of colour, who made up only 20% of congress members (Snow, 2018). Consequently, the use of facial recognition tools in areas such

[1] https://www.redhat.com/en/blog/understanding-red-hats-response-xz-security-incident

as policing and automated border control gates can lead to biased profiling, causing people to be incorrectly flagged or receive discriminatory behaviour (Vavoula, 2021). Facial recognition has been used in the UK for retrospective and real-time identification, however its use has sparked many human rights concerns (Purshouse & Campbell, 2022). Risks associated with the use of facial recognition in policing include inaccuracies in the technology, perpetuating biases, and invasions of privacy, violating the right to privacy (Gikay, 2023). Prior research has pointed towards responsible facial recognition technology development centring around transparency, accountability, and the ability to audit the systems (Almeida et al., 2022).

An awareness of the evolving nature of responsibilities and the impact of decisions on others in digital innovation is essential to avoid less inclusive and potentially harmful IT artefacts. Building on this background, this chapter, therefore, sets out to investigate the following research question: *How do IS practitioners and researchers conceptualise responsibility in the context of digital innovation?* The findings suggest that responsibility is not a static feature of systems development, it continues to grow as the digital technology evolves throughout its life cycle. The primary contribution of this book chapter is to highlight four approaches to embedding responsibility in digital innovation initiatives. This includes: (1) enhancing accessibility, (2) employing a user lens, (3) anticipating biases in decision-making, and (4) fostering diversity.

The remainder of this chapter is structured as follows. Section 2 presents a literature review of existing studies on digital innovation, ethics, and responsibility, highlighting key theories and findings that frame our study. Section 3 details the research design, including data collection and analysis techniques used to investigate the relationship between digital innovation and responsibility. Findings from our empirical study of practitioners and researcher perspectives are outlined in section 4. This is followed by a discussion in section 5 where we compare our empirical findings with existing insights from the literature and explore their implications for practice and theory. Finally, in section 6, we conclude by highlighting the main insights from our study and discuss limitations as a springboard for future research.

2. Literature review

The following section provides an overview of the existing literature on digital innovation, ethics, and responsibility from a static and continuous perspective.

2.1 Digital innovation

Digital innovation can help support an organisation's sustainability and longevity by creating new products, services, or business models that incorporate digital technologies at the core (Nambisan et al., 2017). To achieve this, actors can leverage a multitude of agnostic digital resources and malleable IT architectures that are designed to be interoperable across various platforms, devices, or environments (McCarthy et al., 2025). This can include the use of third-party APIs, cloud computing, and open-source code to accelerate and enhance the systems development process. The affordances offered by these digital resources allow them to be recombined in a multitude of ways that are agile, ambidextrous, and dynamic (Hund et al., 2021). Digital innovation supports the process of value creation through the novel recombination of existing digital resources (Baiyere et al., 2023; Ciriello et al., 2018).

In addition to digital resources, the success of a digital innovation initiative rests on the recombination of knowledge resources from actors in the wider environment (McCarthy et al., 2025). Digital innovation is initiated by knowledge capabilities from both internal and external sources, and this results in improved organisational change (Kohli and Melville, 2019). McCarthy et al. (2025) suggest that this requires the enactment of different socio-cognitive modes such as aggregating and contesting to traverse knowledge boundaries.

However, digital innovation is more than simply adopting new technologies and integrating knowledge. It often requires a complete restructuring of the organisation, its partnerships and management, including the processes by which they make decisions (Svahn et al., 2018). Traditionally, innovation management is associated with fixed organisational boundaries in which new products or services are created. This is reflected in structured product development methodologies and physical boundaries that characterise traditional innovation processes (cf. McCarthy et al., 2023). However, these do not reflect current practices of digital innovation where no such boundaries exist, and knowledge transfer is often fluid and heterogeneous in nature (Nambisan et al., 2017).

Digital transformation and digital innovation also share many common traits, such as a reliance on digital technologies to improve organisational processes (Baiyere et al., 2023). However, there are also differences between the two as digital transformation focuses on long-term organisational change (Carroll, Hassan, et al., 2023; Yoo et al., 2012) whereas digital innovation centres on the introduction of the process or technology that enables this change (Baiyere et al., 2023). Digital transformation can change existing processes and structures within an organisation, while digital innovation introduces new innovative solutions to address issues within an organisation (Baiyere et al., 2023). Hence, digital innovation often works as a catalyst for digital transformation (Robertsone & Lapiņa, 2023).

While digital innovation and transformation have helped improve many aspects of organisations, it is also important to consider the ethical and social implications of these products and services given their disruptive potential. This task is made more challenging, however, by the boundaryless nature of collaboration and the malleability of digital resources that make up layered modular IT architectures, which can remain under continuous development for extended periods of time (Ashrafi et al., 2024; Lyytinen et al., 2016). In light of this, we next turn our attention towards ethical considerations of digital innovation.

2.2 Ethical considerations for digital innovation

Ethics centres on moral principles that guide us through complex decision-making processes (Fischer, 2004). Interest in ‘digital ethics’ has grown considerably over the last two decades as technology’s scope of influence in our daily lives has continued to expand (Myers, 2021). However, despite this, research on the ethical implications of digital innovations has traditionally been overlooked in favour of studies on the affordances of digital technologies for value creation (Yoo et al., 2024). Going forward, Yoo et al. (2024) assert that ethical considerations must play a more pivotal role in the design processes of digital innovation ecosystems (ibid). They argue that it is vital to consider the potential moral and ethical implications of digital technologies as they continue to grow and adapt. This ensures that the unintended consequences of digital innovations for users and organisations are anticipated and governed in a way that mitigates any potential negative impacts (Paul et al., 2024). For instance, looking at the ethical concerns of digital innovation in e-government, Pakhnenko and Kuan (2023) list privacy and security, transparency and accountability, inclusion, accessibility, and non-discrimination as key concerns. These concerns can act as principles to guide responsible

digital innovation, embedding ethical considerations in every step of their development and use, ensuring the building of trust, equity and continuous improvement. These ethical issues are hugely important to protect users of digital technologies from issues such as AI profiling, discrimination, and exclusion.

Another concerning observation from practice is that many digital innovation initiatives do not explicitly mention who is responsible for ensuring these ethical concerns are considered, aside from references to the large multinational corporate brand that created them. This is of critical concern given the importance of transparency for addressing ethical implications in digital innovation (Pakhnenko & Kuan, 2023). As suggested by Bandura's (2002) Theory of Moral Disengagement, a lack of transparency can mean that responsibility is diffused and displaced to ensure that an actor avoids any blame for negative impacts. Prospective transparency can allow users to anticipate how their data is processed and used by digital innovation systems by embedding foresight as a critical ethical requirement (Felzmann et al., 2019). Prospective transparency involves analysing the potential impacts, risks and processes related to digital innovation prior to its design and implementation. This could involve clear communication of objectives before their development - predicting the benefits of a system, identifying potential risks, and acting to address these.

User-centric design techniques are also essential in digital innovation to ensure ethical development (McCarthy et al., 2025). A frequent problem in IS development is that a select 'few' stakeholders are in control of the products and services that create impacts for the 'many.' For instance, developers in the Western world (e.g. Silicon Valley), who are typically male and from privileged educational backgrounds, are often responsible for developing IS that affect millions of lives in other regions of the world daily (Floridi & Cowls, 2019). Developers make many important design decisions during a systems development process which can later have consequences for a multitude of user groups. Despite this, they are often unaware of the impact their unconscious biases may have on these decisions (Storm et al., 2023). Psychology research highlights the many different forms of unconscious bias that can affect human decision-making (Blumenthal-Barby, 2016). When we are unable to recognise these biases in ourselves, and can only identify them in others, bias blind spots emerge which can seep into the technology and negatively affect users (Scopelliti et al., 2015). Biases in design can negatively impact user groups, such as reinforcing stereotypes through the unfair profiling of users (N. T. Lee, 2018).

Kahneman (2011) introduced the idea that decision-making can be influenced by System 1 or System 2 thinking. Systems 1 thinking involves quick, automatic, efficient thought processes whereas Systems 2 involve a more deliberate and analytic thought process. Using System 2 thinking can become cognitively overwhelming, leading us to revert to System 1. However, using System 1 can result in the use of cognitive shortcuts and biases, such as confirmation bias (Kahneman, 2011). Balancing these two thinking systems can help us make informed decisions, avoiding biases without cognitively overloading ourselves. If developers are unaware of the types of biases that could affect their decision-making, this can also allow biases to be replicated in digital innovation.

In adopting user-centric design techniques, users' needs are a primary requirement rather than a secondary consideration during the development process (Roccetti et al., 2020). When users are at the forefront of the design process, developers can better understand their responsibilities towards diverse groups. Users are then represented during each stage of development and across different touchpoints between them and the proposed system (McCarthy et al., 2025). An example of users being involved in the design of their application was the creation of 'MySugrApp', a diabetes management app. 50% of those working on the app had diabetes and

were actively involved in its development, ensuring users felt a sense of ownership and part of the development process (*Mobile Health in Diabetes: mySugr's Monster Approach*, 2017).

Literature further suggests that diversity is another way that development teams can ensure that ethical requirements are met by introducing different viewpoints and perspectives (Østergaard et al., 2011). Diversity refers to the inclusion of different groups of people from different backgrounds or socioeconomic groups, considering things such as race, gender, age, sexuality, etc., in the decision-making process (Green et al., 1969). Diversity can greatly benefit an organisation when knowledge is exposed to criticism before being finalised by a digital innovation team (cf. McCarthy et al., 2025). Diversity also breeds empathy as individuals from diverse backgrounds can share personal stories that reveal new insights as groups work together (Roberge & Van Dick, 2010). Empathy is a key component of emotional intelligence (Ioannidou & Konstantikaki, 2008) which prior research has shown increases a team's levels of efficiency and innovation (C. Lee & Wong, 2019). This can then, in turn, help developers feel empathetic towards users - their needs and requirements.

A review of ethical frameworks for digital innovation is presented next.

2.3 Ethical frameworks

Several frameworks have been developed to ensure IS practitioners and scholars consider ethical requirements when creating IT solutions. These frameworks aim to structure how we think about responsibility within the context of digital innovation, offering standardised practices to help guide ethical decision-making across organisations. If developers follow them, they can better embed moral considerations into the digital resources and knowledge assets used to create new IT artefacts.

One example is Owen et al.'s (2013) '*Framework for Responsible Innovation*' which identifies four key components of responsibility: *Anticipation*, *Reflection*, *Deliberation* and *Responsiveness* (Owen et al., 2013). *Anticipation* relates to analysing the intended and unintended impact of innovation; *Reflection* focuses on examining the purpose and motivation behind the innovation including known and unknown factors; *Deliberation* is the inclusive engagement of diverse dialogue to broaden perspective; *Responsiveness* requires an open approach to address change in the innovation process. The framework aims to mitigate problems that may arise in innovation and argues that it is harder to intervene after a product or service has been implemented.

Another example is the *Ethics-by-Design framework,* which aims to embed ethical considerations in the design process and develop innovative IT artefacts in a more holistic approach (Nussbaumer et al., 2021). The ethics-by-design approach was created within the context of a decision-support system for emergency management and covers ethical design throughout the development process. It specifies ethical considerations, ethical requirements, and design principles to create a methodology for ethical assessment (Nussbaumer et al., 2021). The authors argue that embedding ethics in every stage of development can help to address unintended consequences.

Looking at other examples of models that centre on digital innovation, we can see different approaches to what researchers view as key for responsible innovation. Taking AI as a form of digital innovation., Felzmann et al.'s (2020) '*Transparency by Design Framework*' is one such example of a model which aims to guide developers through the transparent creation of AI systems (Felzmann et al., 2020). The model breaks down transparency into three phases (1) the

design of AI systems, (2) information on data processing and analysis, and (3) accountability. Each stage contains three principles to encourage transparency and mitigate problems. The framework outlines the importance and benefits of transparency at each stage of the development.

Comparing this with another framework '*The Responsible Design Process,'* Peters et al. (2020) focus on responsible AI and assign the concept of human well-being as an essential aspect. The framework's key stages are research, giving preference to those impacted by the technology, insights to anticipate potential harm and risks using an ethical framework, ideation of design integrating well-being, the creation of prototypes and finally evaluation in use assessing user experience. They argue that the effects of AI on users' well-being should take a central role in the design process, and developers are responsible for protecting the well-being of their users (Peters et al., 2020).

While these frameworks are useful for guiding developers through the process of creating digital innovation systems, that is where they stop. This could infer that the developers' responsibility ends once the product is created and released. Yet our research argues this is not the case and developers' responsibility should continue throughout the entire life cycle of digital innovation.

2.4 Problematizing responsibility in the era of digital innovation

What does the term responsibility mean when it comes to digital innovation? Here, we take the definition of responsibility as the task of being capable or obliged to respond (Zimmer et al., 2023). Some nascent research has discussed Corporate Digital Responsibility (CDR) as a framework to guide the management of digital innovations through shared values and norms around the operation of digital technology (Lobschat et al., 2021). CDR does not only rely on the participation of corporations but also external stakeholders such as politicians (Trittin-Ulbrich & Böckel, 2022). While this offers an interesting insight into responsibility in corporations, its scope is limited to the management of these digital innovations. While management can play a major role in the promotion of responsible innovation, designers and developers are of equal consideration.

To date, research on responsibility has been primarily conducted in the fields of management, engineering, and policymaking. Despite a socio-technical perspective being relevant to all of these areas, the IS field has been comparatively silent on this topic. The previously discussed four elements of responsible innovation (anticipation, reflection, deliberation, and responsiveness) (Owen et al., 2013) do not consider the evolving and malleable nature of digital resources, nor the challenge of making black-boxed algorithms transparent to ensure they are ethically acceptable. The importance of transparency is nevertheless essential to digital innovation as it can play a key role in the development of ethical IS.

There is now an opportunity for further research on responsibility in digital innovation using CDR to shape ethical practices (Trittin-Ulbrich & Böckel, 2022). Prior research has also called for interdisciplinary approaches to investigating the effects of rapid digital innovation on organisations and society (Nambisan et al., 2017). Similarly, research has called for further studies on responsibility in digital transformation (Zimmer et al., 2023) as well as a balance for technological progress with ethical considerations (Yoo et al., 2024). This chapter aims to add to this ongoing conversation.

2.5 A continuous view of responsibility

Prior research on ethics in IS focuses on the ethical implications during the design and application of these systems (Brey, 2000). This emerged during a period when technology had a clear endpoint - its release into society. However, more recent research has highlighted the importance of understanding that digital technologies continue to evolve post-creation.

The generative nature of digital technologies has allowed them to continuously expand and grow by constantly adding features (Ciriello et al., 2018). Once a technology is developed, it can continue to adapt through multiple life cycles. This means that even if the technology is ethically created, it does not mean the following adaptations and updates will continue to be ethical. It is vital to understand that responsibility is no longer a static idea, limited to the initial design of digital technology. Instead, in this modern and rapidly evolving age of technological change, responsibility must grow as digital technology grows (Omol, 2024).

Responsible Research and Innovation (RRI) addresses ethical, legal and societal issues in technology innovation (Stahl, 2012) and calls for greater levels of accountability and a stronger importance placed on ethical concerns. Some studies conceptualise a continuous perspective of responsibility. For instance, studies in the field of management had conceptualised responsibility as encompassing continuous honesty from companies, respect for stakeholders, standards to be followed, openness and accountability (Waddock et al., 2002). Responsibility has been defined as a collaborative effort amongst stakeholders to address the risks and benefits of new technology being integrated into society (Von Schomberg, 2012).

We seek to adopt this perspective of responsibility to the context of digital innovation and reveal key considerations relevant to digital technologies.

3. Methodology

This research aimed to investigate how practitioners and researchers in IS view responsibility within digital innovation. To answer the research question, a qualitative research approach was selected to develop an understanding of participants' lived experiences (Smythe & Giddings, 2007). This provided insights into the participants' conceptualisation of responsible innovation within digital technologies and digital innovation processes.

This study involved twelve semi-structured interviews and four structured workshops with a maximum of five participants at each session. Purposive sampling was used for this research. Purposive sampling is the deliberate selection of participants based on specific attributes that the researcher believes are significant to their study (Alkassim et al., 2016). The sampling criteria ensured that different industry sectors, nations, and genders were represented to ensure a more comprehensive and diverse understanding of responsible digital innovation (see Figure 1). The participants included researchers working in technology ethics and IS and practitioners in software engineering, citizen engagement, and consultancy. Participants came from a wide range of European countries; Ireland, France, Lithuania, Finland, Germany, Slovakia, Bulgaria, and England (See figure one). These participants were selected for their valuable insights into responsible IS and their experiences with digital innovation.

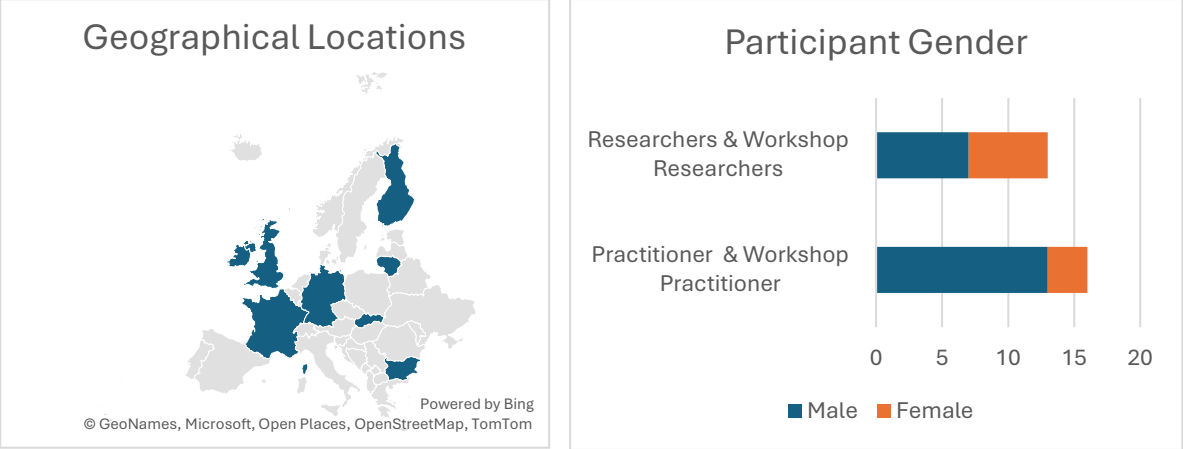

Figure 1 Participant[2] demographics

Semi-structured interviews were carried out one-on-one with the participants and the lead author. This allowed for a free-flowing conversation and supported a deeper discussion with participants (Galletta, 2013). These interviews were conducted virtually over Microsoft Teams. Interviews ran from thirty minutes to an hour and were recorded to help with later transcription. Following the interviews, workshops were conducted in groups of up to five participants for the in-person sessions. These workshops all adhered to the same structure, involving visual thinking strategies and scenario testing. The visual thinking strategies helped to break the ice amongst participants, so they were comfortable and set the tone for the workshop. The scenario-based testing meant the researcher could observe workshop participants' behaviours as they demonstrated and shared their experiences with digital innovation. The workshops ran for one and a half hours to two hours, and participants interacted with one another and the researcher.

Once the interviews and workshops had been concluded and data saturation was reached, a thematic analysis was carried out on the data. The thematic analysis allowed the authorship team to interpret qualitative data by coding and aggregating similar themes (Terry et al., 2017). The data analysis was conducted on the interviews initially, and then the workshop analysis occurred after this, however, they both followed the same method. The authors began by transcribing recordings from the data-gathering sessions. The transcripts were read multiple times to become familiar with the data and key quotes were highlighted. Our process adhered to the principles of inductive analysis (Azungah, 2018; Bingham, 2023). The authors began by creating open codes to identify salient findings in the data. This included open codes such as *Unconscious Bias*, *Diversity*, *Empathy for Users*, and *Stages of Digital Innovation*. The authors then sought to aggregate the open codes into themes. They were first organised into 1st order concepts and later organised into 2nd order concepts. Data saturation was reached when no new themes or topics emerged, this was agreed upon within the team. The themes were discussed and agreed on by the team and this helped to ensure that individual biases of the researcher had not slipped into the data analysis. Data validity was also ensured by comparing the findings with existing research.

The findings from the research are presented in the next section.

4. Findings

[2] P = Practitioner Interview, WP = Workshop Practitioner, R= Researcher Interview, WR= Workshop Researcher.

The main findings from the research showed how participants in this study currently conceptualised responsibility under four key themes: *enhancing accessibility*, *employing a user lens*, *anticipating biases in decision-making*, and *fostering diversity*. Participants' prior understanding of these terms often viewed them as static, a once-off, and occurring alongside the initial stages of digital innovation. However, as previously discussed, digital innovation is a continuous process in which technology continues to update and combine with other forms throughout its lifetime. This must be reflected in the understanding of responsibility.

The first theme of *enhancing accessibility* encompasses transparency in the development process and the communication of updates made to the technology after launch. Transparency during digital innovation ensures that when issues arise from the combination of agnostic digital resources, they can be traced back to the source, allowing for accountability (Felzmann et al., 2020). This means problems will be easier to avoid replicating in the future as developers become more aware of how they are formed. '*When you're the professional, you've got a certain obligation here that goes beyond [design],*' (WP 6). Participants recognised their responsibility during the formation of digital innovation. This should continue through every update and digital convergence. Accountability does not stop with the initial development but continues after the implementation stage. Communication of updates works alongside transparency, as it is not enough for the design process to be transparent. A universal understanding of digital technology needs to be communicated after it has been launched: '*You need someone to translate from the language of [computer] science to the language of the average citizens if we want these people to fully comprehend'* (R 2). Participants shared examples, including instances of when innovative technologies were updated. Still, the instructions on their use were hard to understand and the digital innovation was therefore not well received as the users could not understand the technology. To ensure full accessibility, designers of digital technologies are responsible for ensuring their products are transparent and offer clear communication of any updates and changes made to the digital technology. Accessibility in digital innovation ranges from assistive technologies to customisable features, and universal design. Accessibility is an evolving construct that changes as digital technologies develop.

Another key theme centred on the importance of *employing a user lens*. This is the act of designing that includes users in the process, with the users' needs and wants at the forefront of the design process (Mao et al., 2005). Participants noted how their background influenced their design decisions, highlighting the importance of involving users to accommodate alternative views: "*Developers [...sic…] try to be empathic with users, but of course, they [primarily] come from a business orientation"* (P 3). However, the user group can also expand as digital innovation rapidly grows and more diverse users become interested in the technology (Kohli & Melville, 2019). Ongoing communication between designers, practitioners, users, stakeholders, and policymakers can ensure inclusive innovation throughout a product's life cycle. Developers are responsible for ensuring that users are represented in the design process and that their needs and wants are considered. This must be a continuous process as users' needs change, and technology must adapt to these changing needs. '*And I think testing is something that keeps on going as long as the application is running. You know, it continuously involves people sort of. They kind of report new bugs, new issues, and that is as long as the project is going on*' (WP 7). Participants felt that this duty of care towards the users did not stop after the product was created and released. This responsibility for the developer continued throughout the life cycle of the product.

Anticipating biases in decision-making was another key theme highlighted by participants and centred on the need to recognise how implicit biases may affect decisions. Implicit bias is the belief that we act upon our deeply ingrained ideas that we are unaware of, and these ideas can

thus result in discriminatory behaviour (Pritlove et al., 2019). A multitude of implicit biases were uncovered through the research, such as gender bias, age bias, racial bias, stereotypes, and authority bias, to list but a few: "*My bias would be not tailoring [digital innovations] to the individuals because I don't have any personal [...]enthusiasm about it*" (WR 1). Participants shared how their own personal likes and dislikes could influence the development of digital innovation technologies. "*Things like with gender and age that like you might assume that like a man might want to use the fitness app more than a woman, which isn't necessarily true, but maybe that could be in your head when you're designing it*" (WP 1). Developers can work off assumptions and this can result in user groups not being represented in the design process and beyond. Participants shared plenty of examples of biases they had seen their family, friends, and colleagues display, such as assumption bias, authority bias and stereotyping. However, participants were often at first unable to recognise how their biases could affect their decisions. Not being aware of the different forms of implicit bias can lead to ethical issues later. As implicit biases can appear at any stage of the technology development life cycle, it is important to continuously monitor technology as it continues to develop. For instance, biases can seep in at later stages, such as when an innovation involves an algorithm that can learn and adapt over time.

The final theme that emerged from the data analysis was the importance of *fostering diversity* in digital innovation and how practitioners can ensure that different perspectives are reflected throughout the development process. Diversity can be a means to overcome unconscious bias when diverse groups of people work together in digital innovation, such that they may be able to recognise a more diverse range of user needs. "*You need to speak with [different] people so they will have an understanding of why a person acts in one way or why she or he reacts in another way or how they problem solve […sic…] I would say that this is also very important for the diversity of the team*" (P 2). Working from assumptions runs the risk of excluding groups, and it is only possible to create inclusive products by understanding how people think and act. *"I'd very much have to look into other people's understanding because I've only kind of had much experience with these [topics] recently, so I have very little knowledge about that."* (WP 6). This participant shared how, due to their lack of knowledge of the app prompt they were working on, they would consult others who had a better understanding of the topic for their input. Diversity can benefit digital innovation when practitioners are willing to collaborate during the initial design and later when completing updates. Digital innovation not only benefits from the involvement of diverse developers but also diverse forms of technology. Merging different forms of digital technology (e.g., APIs, IoT devices, cloud computing) can allow for the creation of a diverse range of products and offers teams the opportunity to diversify through collaboration with others (Ashrafi et al., 2024; Lyytinen et al., 2016).

5. Discussion

We next discuss key contributions in relation to our research question: *How do IS practitioners and researchers conceptualise responsibility in the context of digital innovation?* Through interviews and workshops with participants, the following key themes emerged from the data analysis regarding how responsibility is conceptualised: *(1) enhancing accessibility, (2) employing a user lens, (3) anticipating biases in decision-making, and (4) fostering diversity.*

Accessibility encompasses transparency throughout the development process and clear communication with users about updates. Transparency plays a key role in ensuring responsible digital innovation as it allows for accountability. Participants recognised the importance of plain language when communicating with users, so they could fully understand the technology

they are using and the effect it could have on them. Transparency in IS requires accessible explanations of technical processes to increase user trust (Schmidt et al., 2020). A lack of transparency in the decision-making process of IS design makes it difficult for those affected by the systems to analyse their results (Carroll et al., 2020). When it comes to transparency in technology, users should be able to understand how decisions are reached and able to check that systems are working properly as highlighted by '*Transparency by Design Framework*' (Felzmann et al., 2019). While this framework focuses on the importance of transparency during the creation of an AI system, our findings also highlight the importance of this continuing throughout the life cycle of digital innovation. As previously discussed, the Twitterbot created by Microsoft was removed 16 hours after its launch however it could be argued that if there had been more transparency around the learning process and clear monitoring of Tay, this could have been better managed. When users are aware of how decisions are reached, they are more likely to trust the system and recognise errors when they appear. Previous research has highlighted that responsible innovation should be a transparent process (Stilgoe et al., 2013). Accountability and accessibility are vital to responsible digital innovation

Science communication can also ensure transparency. Science communication helps others to understand scientific topics by creating general and uniform language for difficult concepts (Burns et al., 2003). Raising levels of scientific communication can result in higher levels of awareness and knowledge (Jucan & Jucan, 2014). When a digital technology is launched, the language around it must be accessible to users. However, it is also important that this language is updated as digital technology grows and develops. If developers work to ensure the language used in the development process is more accessible to users, then this can foster transparency where users can understand the stages involved. The '*Ethics-by-Design framework'* calls for the embedding of ethics throughout development, (Nussbaumer et al., 2021). Our findings add to this recommendation by highlighting the crucial role that scientific communication plays in promoting inclusion and access, two factors which can be considered an ethical obligation to uphold during digital innovation. It is the responsibility of developers to ensure the accessibility of their products, and this can be achieved through transparency and clear communication with users throughout the life cycle of digital technology.

User-centric design is another key conceptualisation of responsibility that was uncovered through the research. User-centred design concentrates on ensuring the needs and expectations of users are a core focus in the design of technology (Fleury & Chaniaud, 2024). Participants from this study felt that it is the developer's responsibility to ensure that users' needs and wants are at the forefront of the design process. User-centred design methods can enhance the usability of the digital innovation system as it focuses more on user needs and the systems created as a result are easier for the user to use (Wallach & Scholz, 2012). Within the initial development of digital innovations participants felt that developers were responsible for including user needs, they also felt that this process of incorporating user needs should be iterated when updates were made to the digital technology. Previous research has highlighted different methods of user-centred design for IS development, focusing on the iteration in the initial design and understanding user context use (Larusdottir et al., 2023). Participants, however, felt that this responsibility continued through any updates made to the technology. As digital innovation is a dynamic process, it is important that even initially responsible outcomes are constantly monitored as over time, they may no longer align with what is currently viewed as responsible (Zimmer et al., 2023). It is important developers continue to monitor digital technology through any updates and listen to users as their needs and wants change over time. '*The Responsible Design Process'* framework highlights the importance of considering the impact on users during each stage of the development process (Peters et al., 2020). Our findings

complement this framework and also highlight the need for user-centric design to be a continuous process throughout advancements and updates. An example of a digital innovation being updated without considering the users is the Snapchat redesign in 2018, which saw the app's rating in Google Play Store fall by -0.526 with users citing worsened navigation and ease of use (Franzmann et al., 2020). This shows how important it is to consider users throughout the life cycle of digital innovations, not just during their design. The responsibility lies with the development team to ensure users' needs and wants are catered for during the development of digital technologies used in digital innovation, and they can assure this by adopting a user-centred design approach.

Anticipating the impact of biases on their decisions was another area of responsibility highlighted in the research. As previously discussed, unconscious bias is the idea that we act upon deeply ingrained ideas that we are unaware of, that can negatively affect others around us (Pritlove et al., 2019). Unconscious bias in technology development can result in minority user groups being left out in the design of digital innovations. Unconscious bias in technology development does not only affect the user but can lead to the failure of the project (Macnab & Doctolero, 2020). Participants felt that it was the responsibility of the developer to be aware of their own biases and how these may impact their decision-making during and beyond the development stage. When biases are unmonitored and creep into the design of digital technologies, they can negatively impact users and discriminate against user groups (Ferrer et al., 2021). Through transparency in the development process of digital innovations, the design team can scrutinize and adjust decisions made, which is important in addressing the potential negative effects of biases (Omol, 2024). Developers must continue to monitor these digital innovation technologies throughout their life cycle, as some systems that embed algorithms in their design can introduce biases further down the line. Collaborative filtering algorithms, which learn from users' interactions, have been found to introduce statistical bias at many stages during their use, leading to the marginalisation of users (Stinson, 2022). This finding complements the '*Framework for Responsible Innovation,'* which discusses the importance of anticipation, reflection, deliberation and responsiveness on the effects of the innovation, however these steps could also be applied to analyse developers' decisions to mitigate biases (Owen et al., 2013). An example of digital innovation that would have benefited from anticipating biases is Google Photos. When Google Photos was released in 2015, users quickly highlighted that when the system scanned photos of black people, it tagged them as 'Gorillas'. The developers failed to test and question the systems they were developing, and did not anticipate racial biases that could arise; as a result, this outcome negatively impacted users (Sudmann, 2019). Developers must continue to monitor the use of digital technologies to ensure that any biases appearing later in their life cycle are promptly addressed. Developers are responsible for anticipating the impact of biases on digital technologies both during the design process and during their continued use.

Ensuring diversity throughout digital innovation processes through collaboration was considered an important topic in this research. Diversity in digital innovation increases wide representation and the inclusion of different voices and opinions. A lack of diversity can result in the creation of technology that negatively impacts users, such as the creation of self-driving cars that include programming which is less effective at recognising darker-skinned pedestrians (Alegria, 2020). Participants discussed the importance of diversity in teams to broaden one's understanding of topics from the other's perspective. As previously stated, diverse teams working on digital innovation projects can become more empathetic towards each other's needs (Roberge & Van Dick, 2010). A key pillar for successful and continued digital transformation is collaboration within an organisation where employees feel their input is valued (Carroll, Conboy, et al., 2023). Diverse collaboration across industries can also help organisations in

their response to digital change (Verhoef et al., 2021). Diversity not only benefits users from the point of representation but also benefits organisations, as diverse teams are 1.7 times more innovative than nondiverse teams (Weber-Lewerenz & Vasiliu-Feltes, 2022). For instance, the diversity of employees' education and gender has been found to positively affect a firm's innovation (Østergaard et al., 2011). If more people are represented through digital innovation, there would be less chance of future negative consequences for users, as their needs were represented in the design and following changes. An example where an anticipated digital innovation failed is the launch of Google Glass in 2012 with an estimated 2,000 people ordering the first release of the $1,500 glasses. However, by 2015, following multiple releases these glasses were removed from sale (Zuraikat, 2020). While Google was excited to launch the product, consumers were not quick to adopt the product they had concerns around privacy and the intrusive nature of the glasses. A disconnect existed between the developers and consumers. Collaboration during the initial innovation stages and throughout any following updates helps to ensure that diverse user groups are represented throughout.

These findings could guide policymakers in fostering responsible digital innovation by reconceptualizing the process to account for its evolving nature throughout its life cycle. Accessibility is vital to responsible digital innovation. Regulations are needed to ensure that accountability exists at all stages to ensure inclusion throughout the development and adaptations of digital innovation. Transparency is another important aspect based on our findings. It is vital that science communication ensures transparency for users. This could be done through the development of uniform definitions and guidelines to be followed. Regulations around user-centric design methods could further be implemented to ensure this continues throughout the life cycle of the digital innovation. If digital innovation is monitored post-development, it can ensure the user is still at the forefront of the system. This can help to ensure diversity and inclusion for different voices and opinions.

6. Conclusion

The novelty of this research centres on exploring how practitioners and researchers conceptualise responsibility in the digital era and the role they play in creating ethical digital solutions. Firstly, the results of this study highlighted the importance of accessibility for responsible digital innovation. This includes transparency during the design process to bolster accountability as well as the use of accessible language post-implementation to communicate how updates will affect users. The importance of employing a user lens was also highlighted. When practitioners design with a user-centric approach, they act as representatives for the user in the design process, ensuring that the inclusivity and accessibility of users' needs and wants are accounted for. It is important that developers continue to think with a user lens during any updates or changes made after the design process, their responsibility to represent users' needs and wants does not stop after the design stage. Practitioners must further understand the impact of the decisions they are responsible for and how these can negatively impact end users later (McCarthy et al., 2024). When implicit bias appears in the design, development, and use of digital technologies, it may not only marginalise smaller user groups but also misalign with the needs of larger user groups. Diversity is a key consideration here as it allows for the inclusion of a broader population base, which will improve the inclusiveness of digital innovation.

A key takeaway from the research is that these themes must not be viewed as static or relevant to only the initiation stage. Instead, we argue that responsibility is a dynamic process that continues through every update and every technological convergence. This does not end at the conception of digital innovation but co-evolves as digital resources are re-programmed and

recombined during the later stages of development. We find that the nature of responsibility must change to encompass digital technologies' ever evolving and rapidly progressing nature. A limitation that could be posed by the work is that the findings were derived using qualitative methods and a sample of practitioners and researchers working in specific fields. However, this methodological approach allowed the researchers to garner a deeper and richer understanding of the topic at hand rather than taking a more deductive approach to the study. Future research could continue to investigate responsibility throughout the life cycle of digital innovation technologies using other methods and a variety of participants. This could include quantitative studies involving policymakers and users affected by digital innovations.

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