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Abstract:

Digital technologies and their uptake in society have advanced more rapidly than any innovation in history. However, research into how the public sector uses digital innovation has been slow to develop. Government has an essential role to play in sustainability by setting and enforcing policies around subjects such as pollution and carbon taxes, making digital innovation in government critical for digital sustainability. Further, the public sector's values and priorities differ from those of the private sector, which confounds simple comparisons in areas such as digital ways of working and efficiency drivers. This paper draws on the public management literature and uses an exploratory and interpretive field study of a leading digital government. The research identifies six barriers to digital innovation within the New South Wales government, a world-leader in digital integration. The barriers are: varying digital maturity, non-digital mindset, slow mobilization, service-based silos, premature solutioning, and failure to align investment in digital innovation with broader government priorities. The paper identifies initiatives enabling world-class digital innovation and driving effective change. These enablers are structural service integration, ecosystem engagement, technology modernization, customer-centric strategies and processes, and agility in management. This paper finds that digital capability gaps and core rigidities interact requiring a comprehensive approach to realize the significant benefits offered to citizens and the environment.

Keywords: Digital Innovation, Sustainability, Digital Government, Public Sector, Sustainable Development Goals.

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1 Introduction

Sustainability concerns are common in the objectives of both government and private sector organizations. Many initiatives aiming to improve sustainable development include digital components. The private sector alone is not capable of implementing sustainable development. There is a need for governments to be present, effective, and innovative, and technology is essential for innovation and sustainable development across the private and public sectors (George et al., 2021; Pradana et al., 2022). While the UN 2030 Agenda for Sustainable Development provides directions on how to employ technology toward this goal, digital innovation has the potential for emergent radical sustainable practices (Leong et al., 2020; Schoormann et al., 2022). Digital innovation requires different strategies, skills, and mindsets to traditional innovation and demands new approaches to innovation theory (Hinings et al., 2018; Nambisan et al., 2017).

The process of digital innovation in the private sector is receiving attention (Gittelman & Kogut, 2003; Kohli & Melville, 2019; Magnusson et al., 2020). However, less attention is being devoted to the public sector (Kohli & Melville, 2019; Lindquist & Buttazzoni, 2021; Magnusson et al., 2020; Nambisan et al., 2017). Magnusson et al. (2020) showed how efficiency and shadow innovation work in government. They found that prioritizing efficiency investments reduces innovation. Lindquist (2022) used the Competing Values Framework to examine reform in public administration, highlighting similarities and differences. They proposed that digital-era tools and social technologies can enhance and expedite the principles and methods of Traditional Public Administration, Public Value Management, New Public Governance, and the Public Sector Leadership reform movement. Park, Cho, and Lee (2021) summarized the two strategies that encourage innovation in the public sector. One is to evaluate the outcomes of innovation routinely. The other is to develop an organizational culture favorable to innovation. Agencies can deploy one or both strategies, and the second strategy has been widespread in recent years.

This paper reports on the challenges of digital innovation in a world-leading digital government and explores how digital innovation was enabled and promoted in the context of sustainable development. This paper adapts the Scott Morton framework (Morton, 1991) to show how the Australian state of New South Wales successfully used digital innovation. The Organization for Economic Cooperation and Development (OECD) and United Nations (UN) consistently rank Australia as one of the leading countries for digital government (OECD, 2017). Within Australia, New South Wales (NSW) benchmarks as the top digital government, with many innovations over the last five years – digital driver's licenses, COVIDSafe check-in, dine-out vouchers, driver cellphone detection systems, digital twins, geospatial systems, etc. (NSW Government, 2022).

Our fieldwork identifies six barriers to digital innovation: varying digital maturity, non-digital mindset, slow mobilization, service-based silos, premature solutioning, and failure to align investments in digital innovation with broader government priorities. The data also show a coordinated program of eight initiatives felt necessary to enable and promote these world-class digital innovations in the public sector. Some of these were made possible through legislation and included machinery of government changes to structures, funding models, ecosystem collaboration, and programs to encourage new digital mindsets. The analysis shows how the initiatives interact to drive effective change.

This study contributes to the existing literature by applying Chan et al.'s (2019) framework to public sector organizational contexts. The findings indicate that public sector organizations must address both core rigidities and innovative capabilities to respond to the disruptive changes caused by digital innovation. The study applies Scott Morton's framework (Morton, 1991) to provide theoretical insights into the importance of organizational alignment for public sector organizations. This alignment is crucial to promote digital innovation, which, in turn, facilitates the achievement of sustainable development in response to disruptive changes. It also details the organizational elements that can enable and promote digital innovation in the public sector. The study emphasizes the importance of public sector organizations holistically adapting their organizational alignment to incorporate newer digital models while preserving their unique contextual priorities and processes to innovate digitally in the face of rapid technological advancements.

The structure of the remainder of this paper is as follows. First, a literature review on digital innovation in the public sector is presented. Second, a detailed overview of the investigation, the types of data collected, and their analysis is given. Third, the paper presents the challenges and the organizational elements to enable and promote digital innovation. The discussion includes recommendations and is followed by the contributions, limitations, and future work.

2 Digital Innovation in the Public Sector

2.1 Digital Innovation and Sustainability

Digital innovation delivers new products and services, which present opportunities to create experiences, relationships, processes, and organizational forms (Yoo et al., 2012). The digital medium provides cost-effective ways to engage customers in innovation (Yang & Han, 2021) to improve societies, markets, and governments (Lindquist, 2022). The adopters perceive the product or service as novel (Daft, 1978; Rogers, 2010) and are willing to change in response (Damanpour & Schneider, 2006). The goal of innovation is to improve performance (Baregheh et al., 2009) and create value (Francis & Bessant, 2005) for the stakeholders' benefit (West & Anderson, 1996). Digital innovation leads to new products, materials, processes, services, and organizational forms (Tidd et al., 2005). Traditionally, innovation was a linear process, with discrete stages that culminated in successfully launching a new product or service (Tidd et al., 2005).

Traditional innovation may no longer apply (Hinings et al., 2018; Nambisan et al., 2017; Svahn et al., 2017; Yoo et al., 2012). The digital landscape has disrupted the linear model by enabling an iterative, collaborative, and dynamic approach to innovation (Lindquist & Buttazzoni, 2021; Nambisan et al., 2017; Yang & Han, 2021). Established theories may no longer capture the nuances of the innovation landscape (Magnusson et al., 2020).

The increased integration of digital technologies into products, services, and business models has motivated organizations to innovate and devise ways to remain current (Sebastian et al., 2017). In digital innovation, value creation paths need more emphasis on the ecosystems, including co-creating value with customers, distributors (Lucas et al., 2013), partners, and competitors (Bharadwaj et al., 2013). From this perspective, structural change is necessary to adapt to ecosystems and digital technologies (Bharadwaj et al., 2013). One key success factor is the merging of business and IT to allow organizations to embed digital technologies into products and services (Tilson et al., 2010) and to devise strategies that embrace digital transformation (Hess et al., 2016). The proliferation of technology has transformed the way organizations invest and innovate in the digital landscape (Hinings et al., 2018; Kohli & Melville, 2019; Sargeant et al., 2020; Yang & Han, 2021), and the nature of innovation itself has evolved (Yang & Han, 2021) to develop digital solutions and encompass sustainability (Cosimato & Vona, 2021; Leong et al., 2020; Schoormann et al., 2022).

Digital technologies have enabled new business models and opportunities that promote digital sustainability in the private sector, such as shared mobility and collaborative consumption platforms (George et al., 2021). Digital sustainability is the seamless integration of sustainability and digital imperatives (George et al., 2021), for example, innovating for positive human, societal, economic, and environmental well-being (George et al., 2021; Pan et al., 2022; Pan & Nishant, 2023). Digital sustainability has sparked new research opportunities in information systems by exploring the relationship between digital sustainability and its contribution to achieving the United Nations Sustainable Development Goals (SDGs) (Pan & Zhang, 2020). Digital sustainability requires that innovations are environmentally responsible, socially equitable, and economically viable in the long run (Cosimato & Vona, 2021; George et al., 2021; Leong et al., 2020; Pradana et al., 2022; Schoormann et al., 2022).

Three digital innovation and sustainability themes are emerging. First, digital technology encourages innovation (Abrell et al., 2016; Burtch et al., 2010; Ciriello et al., 2018; Fichman et al., 2014; Lokuge et al., 2019; Nambisan, 2003). Second, digital technology leads to innovation processes (Fichman et al., 2014; Kohli & Melville, 2019) that facilitate sustainable development (George et al., 2021; Pan et al., 2022; Zhang et al., 2022). Third, through digital innovation, organizational structure, culture, and processes shape and are shaped by the next generation of new IT-enabled outcomes (Kohli & Melville, 2019; Nambisan et al., 2017; Yang & Han, 2021).

2.2 The Case of the Public Sector

In the public sector, digital technologies are being integrated into many government services (Lindquist, 2022). Governments have been cultivating digital technologies to improve and provide more sustainable and effective products and services when interacting with citizens and stakeholders (Schoormann et al., 2022). The external operating environment often drives government innovation (Dawson et al., 2016) by forcing change (Lindquist, 2022). In this way, digital technologies are instrumental in sustaining the relevance and legitimacy of government (Dawson et al., 2016; Pang et al., 2014). Mulgan and Albury's

(2003, p. 3) definition of public innovation is the "creation and implementation of new processes, products, services, and methods of delivery, which result in significant improvements in outcomes efficiency, effectiveness or quality." If government agencies do not embrace innovation, they are less responsive and flexible in fulfilling the dynamic demands of the public, including their concerns about sustainable development (Pang et al., 2014). Governments play a crucial role in promoting sustainability within their agencies by delivering low-cost operating environments to create innovative activities (Australian Government, 2016; Domingues et al., 2017; Park et al., 2021; Pradana et al., 2022). For example, the Australian Federal Government promoted innovation by encouraging universities to collaborate with businesses, setting transparent policy objectives for areas affected by development in technologies and improving the functioning of cities to attract and retain highly-skilled workers (Australian Government, 2016).

Digital government has been initiated to reform and transform the public sector and not to drive incremental change alone (Lips, 2019). Digital government is synonymous with innovation and the reform of the public sector and the label digital-era government has been used to refer to the latest public sector reform movement (Lindquist, 2022). Digital government has evolved as government and public relationships have been redefined (Sharma, 2004). Both parties are becoming more participative, interactive, and informational (Katsonis & Botros, 2015) via digital channels (Janowski, 2015). Digital government services often positively impact inclusion and accessibility for citizens unable to attend government offices in person and reduce the environmental footprint for service delivery.

The public sector is moving from end-to-end program and financial planning in favor of an agile methodology and outcomes-based budgeting[1]. Reiter and Klenk (2019) reflect on the effectiveness of New Public Management (NPM) and Post New Public Management (Post-NPM) reforms by drawing parallels with contemporary reform objectives. While both NPM and Post-NPM focus on efficiency and effectiveness, as does digital government, the customer focus emphasized by digital government reforms has yet to mature in relation to NPM and Post-NPM priorities (Christensen & Lægreid, 2007; Ferlie et al., 2003; Lodge & Gill, 2011). Digital advancements such as social media, mobile devices, robotics, and artificial intelligence (Lips, 2019) reinforce this movement. Digital government builds on some common foundations in NPM and Post-NPM reforms. Significantly, in implementing digital government reforms, administrations "haven't stopped their operations and activities to undertake a complete *reset* in the digital age" (Lips, 2019, p. 5), which is another significant parallel with NPM and Post-NPM approaches.

Governments face growing citizen demand to prioritize speed and virtualization within e-communities and e-commerce (Dutil et al., 2008; Roy, 2001). Digital holds the promise for transforming government by making agencies more agile, simpler and responsive to citizens, and more capable of social problem-solving (Fattore et al., 2012; Sargeant et al., 2020), thus enabling governments to achieve sustainable development (Zhang et al., 2022). Ideally, digital government enables the sharing of information, knowledge, and technology across silos and agencies to provide an integrated response to complex social problems (Kraemer & King, 2008).

Digital can transform the way governments deliver and improve services to citizens (Bertot et al., 2016; Carter & Bélanger, 2005; Gil-Garcia et al., 2014; Lindquist, 2022). Citizens' uptake of these technologies changes how people consume government services. People and businesses want greater flexibility and new ways of dealing with the government. Being responsive to digital expectations is necessary for the government to maintain credibility. For the public sector, digital changes include new agendas, languages, and narratives, which lead to innovative solutions (Lindquist, 2022). This demand makes digital innovation a priority for the government (Lindquist, 2022; Osborne, 2006).

2.3 The Need to Study Digital Innovation in the Public Sector

Governments do know what competencies and co-creation capabilities they need to innovate and be creative (Lindquist, 2022), However, agencies can be insensitive to change and slower than private sector counterparts due to rules and hierarchies (Park et al., 2021). Government agencies must account for multi-department, multi-level-government, and multi-sector involvement (Lindquist, 2022). Public organizational arrangements sometimes restrict endeavors that promote innovation (Moussa et al., 2018)

[1] See https://www.treasury.nsw.gov.au/budget-financial-management/reform/outcome-budgeting for an example.

because governments adopt deliberative approaches designed to mitigate the potential of unintended negative consequences (Bertot et al., 2016).

Digital technologies have led to innovations in service accessibility and diversified the citizen experience (Omar & El-Haddadeh, 2016). The new approach to innovation uses quick feedback to support rapid learning and adjustment (Lindquist, 2022). The pace of this change has implications for how governments operate and innovate to achieve sustainable development – there is a need to change structures and processes to fit the new pace of development (Henfridsson et al., 2014; Nylen & Holmstrom, 2015).

Matching digital with traditional innovation processes in government is different from the private sector in that the public sector operates to serve all citizens and their interests (Lindgren & Jansson, 2013), not just profitable customers. Unlike the private sector, political and social goals, such as community well-being and sustainability, drive digital government (Grimsley & Meehan, 2007). Governments demonstrate legitimacy by being accountable and transparent, allowing citizens to assess the actions, services, and products (Harrison & Sayogo, 2014). This context differs from the private sector in relation to understanding information and digital technology (Lindgren & Jansson, 2013).

The public sector's values and priorities also differ from those of the private sector (Lindgren & Jansson, 2013), which confounds simple comparisons and requires the adaptation of digital ways of working. Governments protect public value, so procurement must be transparent, rigorous, and achieve the best possible value. Managers must argue for investment in digital innovation over other claims to the public purse, such as caring for the needy, public education, and policing. Governments experience different challenges in innovating with new technologies (Criado et al., 2013).

According to Bertot et al. (2016), the private sector focuses on gaining a competitive advantage, while the public sector aims to enhance service performance and safeguard public value (Bommert, 2010). The public sector finds that changing technical skills and demographics can be more difficult than the private sector (Dawes, 2008). For example, some agencies maintain systems to preserve knowledge and experience, leading to resistance to innovation (Vigoda-Gadot et al., 2005). Further, the public sector has an asymmetrical relationship with its customers in that some agencies are monopolies, and others can compel consumption (Lindgren et al., 2021). For example, agencies are the only workable defense and public health options. Consequentially, public organizations must ensure responsibility, legitimacy, and accountability (Lindgren et al., 2021). Therefore, when facing environmental change, governments must take a more holistic approach than the private sector (Park et al., 2021).

All these challenges are apparent, as 80% of agencies are still at the initial or developing digital maturity stages (Gartner, 2021). Public organizations want to know how they can align structures and modes of thinking with new digital technologies and ideas to achieve sustainable development (OECD, 2017). Managers want to understand how to govern and manage digital innovation within their context (Cram et al., 2016; Magnusson et al., 2020; Nambisan et al., 2017; Svahn et al., 2017). There is also an increasing awareness of innovation in the public sector, with calls for research (Park et al., 2021; Pradana et al., 2022).

To overcome these challenges and effectively respond to digital sustainability changes, Chan et al. (2019) found that organizations must develop capabilities and mitigate core rigidities. They can develop innovative capabilities such as human-centered design and user research skills (Abrell et al., 2016; Diller et al., 2005; Gibbert et al., 2002; Von Hippel, 2006). Organizations mitigate core rigidities by developing organizational agility to adapt business models, strategies, and actions quickly (Ferrier, 2001; Lucas & Goh, 2009), transition into more agile modes of product delivery (Sood & Tellis, 2005; Teubner & Stockhinger, 2020; Tumbas et al., 2018), and develop modular and distributed cross-functional approaches (Pavlou & Sawy, 2010; Rai et al., 2012).

In summary, the digital innovation phenomenon is an emergent and popular focus within research and practice. We identify two specific areas in need of further investigation. One is the challenges of innovating within traditional processes (Cram et al., 2016; Nambisan et al., 2017; Svahn et al., 2017) and “traditional forms of public organizations using new generations of digital information technologies” (Criado et al., 2013). We noted a lack of detail on the barriers specific to digital innovation (Meijer, 2015; Moussa et al., 2018) and an insufficient explanation of how public organizations can respond to promote sustainable development. Gruenhagen and Parker (2020) recommended analyzing barriers to innovation to inform an understanding of appropriate strategies to stimulate a culture of innovation. Addressing this research gap will lead to further insight into how governments are enabling and promoting digital innovation for sustainability.

The other area for further investigation is to ascertain what changes are necessary to accommodate new digital innovation approaches. Digital innovation is non-linear and requires organizational change (Cram et al., 2016; Nambisan, 2003; Svahn et al., 2017). More research would benefit this area (Magnusson et al., 2020; Meijer, 2015). Studies of government change driven by technology typically investigate a specific technology, such as social media and cloud computing (Criado et al., 2013). There could be more specific details about what is happening in practice to enable and promote digital innovation at organizational levels within the public sector (Magnusson et al., 2020) and how innovation can facilitate sustainable development.

Further, scholars such as Kohli and Melville (2019) and Nambisan et al. (2017) argue for a deeper understanding of enabling digital innovation through orchestration and management. They call for empirical investigation into how public sector organizations enable digital innovation. The literature suggests that the effective enabling of digital innovation is crucial to the success of public sector organizations (Meijer, 2015). As such, public sector organizations must develop strategies and policies that enable digital innovation for sustainable development systematically and effectively.

This paper reports on how a leading digital government enabled innovation that facilitates sustainable development, including the challenges faced and the methods employed for digital innovation. The research question is:

RQ: How do public sector organizations enable and promote digital innovation for sustainable development?

3 Methodology

This study explores the phenomenon of digital innovation for sustainable development within the public sector. It investigates how a successful digital government responds to disruptive change and manages digital innovation. The research is exploratory and adopts an interpretive paradigm (Figure 1), which aims to understand the social context of the phenomenon (Walsham, 1995).

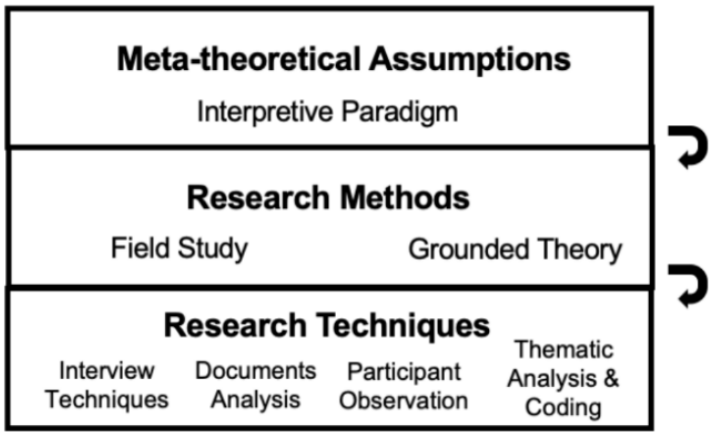


Figure 1. Interpretive Paradigm Methodological Landscape (Cecez-Kecmanovic & Kennan, 2013)

Adopting the interpretivist research paradigm, this study takes the form of a qualitative field study, which is research that is undertaken in the real world (Salkind, 2010). As part of this qualitative inductive field study, semi-structured interviews, participant observation, and document analysis were conducted. Data and thematic analysis were also conducted using the grounded theory approach.

3.1 Research Site Selection

The focal organization that forms the research site is the New South Wales (NSW) State Government in Australia and its associated agencies. To further reinforce our study in digital innovation for sustainable development, we not only selected a government that prioritizes technological advancements but also had the added benefit of having a member of the Senior Executive Service (SES) on our research team. The NSW Government is well known for investing in and progressing digital innovation and has consistently been recognized as a leader in digital government, setting the benchmark for other governments to follow.

This recognition is attributed to digital innovative initiatives that have been implemented by the government over the past five years to achieve sustainable development. During this period, the NSW Government has made significant progress in the space of digital innovation, transforming the way services are delivered to citizens. The government has implemented various digital initiatives such as online service portals, mobile applications, and digital kiosks to make it easier for citizens to access government services. The government has also embraced emerging technologies such as artificial intelligence and blockchain to improve service delivery and enhance citizen experience (NSW Government, 2022).

Further, the NSW Government in 2020 invested $1.6 billion into its digital-centric investment fund to accelerate digital projects and cyber security over the next three years (NSW Government, 2020). The government is also driven by a set of "Premier's Priorities". These priorities "represent the government's commitment to making a significant difference to enhance the quality of life of the people of NSW" (NSW Government, 2021c). One of the priorities is Government Made Easy, which is a goal for citizens to "receive high-quality services as seamlessly as possible" (NSW Government, 2021c). Digital innovation is a key strategic focus for NSW, contributing to its suitability as a research site. To provide further description and context, the NSW Government houses departments and approximately 220 agencies and organizations arranged into nine clusters: Premier and Cabinet, Treasury, Customer Services, Planning, Industry and Environment, Transport, Health, Education, and Stronger Communities, along with Regional NSW (NSW Government, 2021b).

3.2 Data Collection

This qualitative field study investigates government digital innovation for sustainable development in practice. We used qualitative and exploratory data collection techniques because digital innovation in government is both emerging and underexplored. We gained knowledge through social constructions such as language (Klein & Myers, 1999), and through meaning- (versus measurement) oriented methodologies (Cecez-Kecmanovic & Kennan, 2013). Such methods include semi-structured formal interviews, participant observation, and secondary document analysis.

We conducted twelve semi-structured interviews of around an hour duration each with public senior leaders from the NSW State Government (as presented in Table 1**.**). We leveraged professional contacts to identify relevant potential participants. The participant selection process involved effective sampling parameters set around the study's purpose and research questions (Punch, 2014). Selected participants were either policy and technology leaders who are involved in technology decision-making and influence an agency's digital strategies, or technology implementers who have direct involvement in executing digital innovation initiatives. The respondents work within central agencies providing infrastructure to other agencies or are in core service agencies such as health, transport, or education.

Table 1. Participants

Participant Type	Participant	Organization	Role Type	Interview Date	Interview Duration
Policy Leader	Interviewee 1	Central Agency	Director	29/7/21	47:11
Technology Leader	Interviewee 2	Central Agency	Senior Executive	5/8/21	52:34
Policy Leader	Interviewee 3	Central Agency	Director	10/8/21	55:42
Policy Leader	Interviewee 4	Central Agency	Director	10/8/21	56:45
Tech Implementer	Interviewee 5	Service Agency	Director	12/8/21	57:43
Tech Implementer	Interviewee 6	Service Agency	Director	27/8/21	45:18
Tech Implementer	Interviewee 7	Central Agency	Director	31/8/21	49: 23
Policy Leader	Interviewee 8	Central Agency	Head of Branch	3/9/21	58:42
Tech Implementer	Interviewee 9	Service Agency	Executive Director	7/9/21	56:22
Tech Implementer	Interviewee 10	Central Agency	Executive Director	8/9/21	47:21
Tech Leader	Interviewee 11	Central Agency	Project Lead	14/9/21	49: 52
Tech Implementer	Interviewee 12	Service Agency	Head of Branch	14/9/21	45: 27

The interview script of questions followed a flexible and semi-structured composition. All individuals in the selected sample were asked the same open-ended interview questions. The questions were structured in a way that provided flexibility to look for surprises (Myers & Newman, 2007). This allowed for improvisation and openness (Myers & Newman, 2007) and patterns of similarity and variations that characterize the study sample of individuals to emerge (Given, 2008). The interview questions were aligned with the research question listed at the end of section 1. We began the interviews by asking

participants for context on their organization to gain an understanding of their strategic priorities, service offerings, and digital innovation initiatives. We then asked questions about the challenges their agencies experience when innovating digitally and what they are doing in practice to enable digital innovation and overcome these challenges.

We delved deeper into the topic of digital innovation assessment by posing a series of follow-up questions. Our aim was to explore the intricacies of evaluating digital innovation from various perspectives and identifying the critical factors that impact its success and lead to sustainable development. We probed further into the metrics used to measure the efficacy of digital innovation, the challenges encountered during the assessment process, and the best practices for conducting comprehensive evaluations. By broadening the scope of our investigation and asking probing questions, we were able to gain a more comprehensive understanding of the complexities of digital innovation evaluation.

We observed an online "Cross Jurisdiction Meeting for Digital Government" involving thirty Australian public sector managers from different agencies and state and federal governments discussing digital innovation and transformation topics. We took notes and collected secondary data (see Appendix A), which supported insights and themes from the semi-structured interviews. By observing people in their natural context, we understood how they organize and prioritize things and how they interrelate (Schensul et al., 1999).

We also analyzed publicly available documentation from government websites and the press, such as digital capability frameworks and standards, and government agency annual reports. Examples include NSW's Customer & Digital Strategy (Digital.NSW, 2019) [2] and publicly available descriptions of government agencies, such as the NSW Data Analytics Centre (Data.NSW, 2021)[3]. These were sourced from interview participant referrals and independent research. The data provided empirical evidence on the context within which the participants operate (Mills et al., 2006).

We collected data through these methods, contributing to triangulation across data sets and reducing the impact of potential biases.

3.3 Data Analysis

Data coding and analysis followed a grounded theory approach. This method involves identifying, analyzing, organizing, and describing themes (Braun & Clarke, 2006) and identifying categories and concepts within a text (Corbin & Strauss, 2008). We also applied a force field analysis (Lewin, 1951), which is a powerful strategic tool used to find opposing and enabling forces to change and develop the overarching sub-themes. The challenges of digital innovation are the forces resisting change for digital innovation and the enabling forces constitute the organizational elements enabling digital innovation. The development of themes was also consistent with the research questions.

In reviewing the semi-structured interview transcripts and field notes from the participant observation, we recorded codes using NVivo12. First, we utilized open coding, which entails breaking data into smaller parts to capture the key ideas of each data aspect (Vollstedt & Rezat, 2019). To maintain a record of the overview of ideas, we created memos of document ideas, good quotes, and interesting examples in the data. Transcripts and field note comparisons illustrate the patterns and themes.

The first level coding was followed by axial and selective coding. Axial codes involved identifying relationships between open codes to abstract concepts of a higher order (Corbin & Strauss, 2008). We abstracted the open codes to a higher level to further refine the key topics. This process was iterative and performed simultaneously with open coding. These centered on challenges and the enablement of digital innovation in the public sector, aligned with the research question (see Appendix B). Subsequently, we performed selective coding by abstracting and integrating axial codes to identify the core categories (Vollstedt & Rezat, 2019). A core category describes the central phenomenon around which all the other categories integrate (Strauss & Corbin, 1990), which enabled the identification of a grounded theory emerging from data to answer the original research questions (Vollstedt & Rezat, 2019). Last, we performed conceptualization to abstract the emerging relationships between core categories (selective codes). For example, we demonstrated the relationship between eight selective codes detailing what the public sector is doing to enable digital innovation. This led to the conceptualization of the Organizational

[2] See https://www.digital.nsw.gov.au/strategy for an example
[3] See https://data.nsw.gov.au/nsw-data-analytics-centre for an example

Alignment and Enabling Digital Innovation framework as discussed in section 5. This thematic analysis process was iterative. Data saturation was deemed to have occurred when we collected data already known and previously mentioned by other interviewees. We also ensured findings were confirmed with the participants.

Finally, we used an alignment model, the Scott Morton framework (Morton, 1991), to explore the relationships between the elements such as management processes, strategy, individuals and roles, technologies, structures, and the external environment. This analysis underscores the importance of the interrelationships among the organizational components and their co-alignment (Segars & Grover, 1998). For an organization to benefit from change, each part must align (Morton, 1991).

4 Findings

Aligned with our research aim, we identified six themes of challenges to digital innovation that the public sector faces (see Section 4.1). Additionally, our respondents revealed eight themes of organizational elements that the NSW State Government has successfully implemented to enable digital innovation (see Section 4.2).

4.1 Challenges of Digital Innovation in the Public Sector

During our research, we explored the challenges encountered by agencies while orchestrating digital innovation. These challenges arise from the lack of alignment between skills, organizational structures, and management processes with the constantly evolving digital demands. Our study revealed six key challenges, namely inconsistent digital maturity, non-digital mindset, slow mobilization, service-based silos, premature solutioning, and failure to align investment in digital innovation with broader government priorities.

4.1.1 Inconsistent Digital Maturity

The inconsistent levels of digital skills within and between agencies pose significant challenges to digital innovation efforts. Such inconsistencies create inconveniences and inefficiencies that hinder collaboration between agencies. Interviewees noted that there are varying levels of digital maturity across agencies and different digital capability levels within agencies. As Interviewee 9 observed, there is a need to bring together multiple actors with different levels of awareness and maturity. These differences in knowledge of technology and innovation approaches create misalignments and incompatibilities in ways of working when organizational units collaborate. For instance, Interviewee 7 pointed out that collaboration between agile and non-agile modes of operation between agencies poses a challenge of inconsistency in digital innovation.

The analysis reveals that discrepancies in digital maturity levels among agencies necessitate extra effort in collaboration. This is especially true when agencies operate at different touchpoints on a customer's journey. Interviewee 10 provided an example of collaboration where they attempted to improve customer service and move to a digital platform with a partner agency. However, they received "different responses from different parts of the organization. Further, Interviewee 7 argued that there is a constant need to "cater for quite a broad audience before being able to drill down into more detailed stuff." Such discrepancies can lead to difficulties in aligning goals and priorities, impeding progress in digital innovation initiatives that can achieve sustainable development.

Interviewees argued that the public sector faces a significant challenge in retaining and attracting digital talent, which in turn hinders efforts in implementing digital innovation. As Interviewee 2 pointed out, it is crucial to have a robust internal pipeline of talent and to make digital roles attractive to potential employees. However, the scarcity of resources, particularly those with cybersecurity expertise, poses a significant obstacle to these efforts. This is consistent with the findings of Interviewee 8, who emphasized that the public sector competes with other employers in Australia for limited digital talent. According to the interviewees, the lack of skilled professionals in the public sector can result in a shortage of resources necessary for successful digital transformation and may negatively impact the ability to innovate in this area.

4.1.2 Non-Digital Mindset

Interviewees explained that the intangibility of digital technology makes it difficult to understand and articulate its value, unlike physical infrastructures. The non-physical and abstract nature of technology, such as back-office systems, can be challenging for public sector employees who are used to working with distinct and physical commodities. This unfamiliarity with digital complexity and intangibility can make it hard to build a case for investment. Interviewees revealed that despite developing digital capabilities within the public sector, there is still a lack of understanding and familiarity with digital technology. Some people prefer to adhere to familiar approaches and underestimate the complexity of technology, as evidenced by their difficulty in understanding the input sources required for a dashboard.

Managers are also reluctant to adopt digital technologies due to their apprehension regarding the potential negative consequences that may arise from such a transformation. The complex and often obscure nature of digital technologies leads to misconceptions surrounding their social, technical, and operational implications, and consequently, may be fearful of the unknown. For instance, interviewees revealed that proposals to digitize a process or transaction were met with resistance due to concerns about potential job losses. Such mistranslations of the effects of digital transformation have created a sense of discomfort, and their reluctance to embrace digital technologies is driven by their desire to prevent any adverse repercussions. Additionally, interviewees stated that some peers expressed a fear of being held accountable for failures, which has contributed to their reluctance to adopt digital technologies.

Based on the data analysis, it also appears that concerns over the security of digital approaches can severely hinder efforts to encourage digital innovation and impede sustainable development. Sensitive attitudes towards technology's perceived insecurity have led to a lack of trust, which creates significant barriers to adopting digital technologies. For example, Interviewee 11 noted that acquiring data from data custodians to facilitate digital innovation can be challenging due to their unwillingness, inability, or lack of permission to provide the necessary data. This reluctance is often due to sensitivities surrounding the governance structures, skill sets, and expertise required to handle sensitive data appropriately. Interviewee 11 further explained that many people are genuinely concerned about the unintended consequences of their actions and strive to ensure that “their efforts do not harm children and young people”. For instance, Transport NSW initially refrained from sharing transport data with third-party apps due to concerns regarding potential unintended consequences.

4.1.3 Slow Mobilization

One of the major challenges faced by managers is the difficulty in rapidly innovating when all available resources are occupied in keeping day-to-day operations running, making it essential to carve out space for digital innovation.

A further complication is slow engagement with ecosystem partners due to policy requirements. The existing rules and policies on procurement pose a significant limitation for industries to engage or re-engage in digital innovation. This, in turn, creates obstacles for government agencies that seek external capabilities and resources to facilitate the mobilization of digital innovation. The prevailing procurement policies make it challenging for industry partners, particularly small and medium-sized enterprises (as stated by Interviewee 3), to propose innovative solutions to the government as they are unsure of the value they will receive in return. Furthermore, certain procurement regulations prevent industry partners from participating in innovation opportunities if they fail to comply with specific prerequisites.

Consequently, finding appropriate partners is a challenge due to a lack of capability. Public practitioners encounter difficulties in ensuring that they are communicating with the appropriate individuals. The identification of "effective curation" is a hurdle in securing the correct external resources, as expressed by participants who highlighted a current deficiency in partnering capabilities. One of the participants emphasized the need for practical guidelines that would aid individuals in discovering suitable partnerships outside of their organizations. In one instance an agency, despite having the necessary funding, faced delays because it was unable to locate experienced resources.

4.1.4 Service-based Silos

Further analysis reveals that service-based siloes within the government operate in a compartmentalized manner, challenging collaboration on shared customer outcomes. First, interviewees provided evidence that agencies have their own swim lanes and program logic. They discussed the budget-related obstacles that arise when multiple agencies collaborate on a customer issue. They questioned who would be

responsible for funding such collaborations. This creates challenges as each agency operates under its own program logic and methods of operation, making it difficult to establish a shared budget.

In addition to budgetary concerns, allocating responsibility for problem-solving and attribution becomes equally challenging. Interviewee 3 noted that determining the responsibilities for achieving a desired outcome, such as between the Health and Education agencies, can be difficult to define. They further elaborated on the challenge by asking, "How much of that outcome should be attributed to Health, Education, and other agencies?" As a result, the distribution of problem ownership between different agencies is unclear, making inter-agency collaboration challenging when implementing digital innovation initiatives.

Another challenge to inter-agency collaboration is the varying agendas between different government agencies, which can result in conflicting priorities and hinder productive collaboration. Interviewees 1 and 10 gave examples of how state and local governments have different agendas, as they operate on different electoral cycles. They explained that each level of government is preparing for elections at different times of the year, and collaboration with other agencies may become less of a priority. As a result, the lack of coordination in individual priorities can lead to inconsistent levels of commitment from agencies when collaborating on shared goals.

Technology integration poses significant challenges to collaboration both within and between government agencies. This is due to the presence of disparate systems within a vast digital government environment, as well as the difficulty of integrating legacy and modern technologies. Interviewees highlighted the complexity of working with existing technological systems within a large context, and the challenges of achieving interconnectedness within thousands of disparate systems to achieve a single view of the customer. The existence of legacy and modern technologies add to integration obstacles, which can cause delays and impact collaboration efforts.

For instance, the NSW Government published a Net Zero Plan[4] as the foundation for action on climate change and the goal to reach net zero emissions by 2050. The Plan includes four priority areas for action, including Priority 4 - Ensure the NSW Government leads by example. We observed that while new ICT funding through the Digital Restart Fund required alignment with clear innovation objectives, connections to broader government strategies such as Net Zero were not considered as part of the assessment process.

4.1.5 Premature Solutioning

The existing investment and procurement processes in the public sector “do not promote innovation or an innovative way of thinking" (Interviewee 4). Instead, they encourage premature solutioning. First, funding approaches challenge agile, user-centric, and incremental digital service development and delivery methods. This approach poses a challenge for continuous and iterative development, which is essential to promote digital innovation and foundational to achieve sustainable development. It requires work to be done in bounded increments and distinct phases, hindering flexibility and adaptability. A participant pointed out that the "gated funding tranches" necessitate the "spin-up of new teams to pick up where the last team left off". Some highlighted how the current waterfall and gated funding processes compel digital innovation to be performed discontinuously, promoting linear rather than iterative development.

Second, procurement models and processes encourage a prescriptive approach to partnering with the ecosystem (Interviewee 3). The waterfall nature of extant traditional funding models requires specific solutions prematurely when creating a business case for investment. Such processes mandate a definition of a good and successful solution. This early specification conflicts with the digital principle of iterative exploration; it can limit creativity and flexibility in the design process, leading to suboptimal outcomes.

4.1.6 Failure to Align Investment in Digital Innovation with Broader Government Priorities

The little investment in digital innovation that takes place has limited explicit links to government priorities. For example, the NSW Government published its strategic objectives relating to a wide range of government policy priorities that could be more powerfully aligned with digital innovation. As section 4.1.4 outlines, the operations of government are typically structured in silos, and little reference is made to

[4] https://www.energy.nsw.gov.au/sites/default/files/2022-08/net-zero-plan-2020-2030-200057.pdf

priorities led by individual government agencies when considering investment decisions. This research has identified examples where digital technologies should be included as innovation priorities or enabling the objectives of the individual portfolio strategies:

- Ageing Well in NSW: Seniors Strategy 2021–2031[5]
- The State Infrastructure Strategy 2022-2042[6]
- Housing 2041: long-term strategy for better housing[7]
- Future Health: Strategic Framework Guiding the next decade of care in NSW 2022-2032[8]
- Future Transport 2056 Strategy[9]
- The Net Zero Plan Stage 1: 2020-2030

According to the NSW Government's Net Zero Plan, "The NSW Government purchases around $20 billion of goods and services each year, employs 10% of the State's workforce and manages approximately 15% of all NSW land, including schools, hospitals, conservation areas and national parks". As part of the plan, the NSW Government has made it a priority to play a leading role in bringing sustainable goods, services, and practices into the market and maximizing the environmental value of the assets it oversees.

Digital has brought many benefits that also have a positive impact on the fight against climate change and the effort to reduce CO_2 emissions. However, no reference has been made in the Net Zero Plan to target investment in digital solutions, and in funding digital innovation, no priority has been considered for proposals that may contribute to achieving the objectives of the strategy.

In summary, the impact of digital technologies on service innovation has been well-established in the existing literature. Nonetheless, managers face a range of obstacles that complicate the process of integrating digital technologies into service innovation initiatives. While these hurdles make it difficult to predict and control the outcome of digital innovation efforts, we have identified a number of initiatives that can help overcome these challenges. In this regard, this study examines eight such enablers that address these challenges and are helping to make progress toward achieving sustainable development.

4.2 Organizational Elements Enabling and Promoting Digital Innovation for Sustainable Development

The NSW government has made progress in digital innovation, despite obstacles along the way. Respondents shared valuable insights into the initiatives that public sector organizations are currently undertaking to facilitate digital innovation. We found eight organizational elements promoting digital innovation in sustainable development: integrated and collaborative government structures, external ecosystem collaboration, digital technologies and infrastructure, digital and customer strategies, entrepreneurial mindsets, trust-building management processes, customer-centricity, and agile management processes.

4.2.1 Integrated and Collaborative Government Structures Help Multi-Agency Collaboration.

To facilitate multi-agency collaboration on shared citizen outcomes, integrated and collaborative government structures enable and promote digital innovation and achieve sustainable development. Interactive channels are being built within and between service-based agencies that impact common customer touchpoints. Adequate connectivity between service-based siloes for collaboration is necessary as most government processes involve multiple teams or parts. To enable this, public sector employees are building networks for intra and inter-organizational connectivity and dedicating central structures for digital innovation.

For intra and inter-organizational connectivity, the public sector has been laying the groundwork for enhanced multi-agency collaboration aimed at resolving shared problem spaces. This development is an

[5] https://www.facs.nsw.gov.au/download?file=798429
[6] https://www.infrastructure.nsw.gov.au/media/3503/state-infrastructure-strategy-2022-2042-full-report.pdf
[7] https://www.planning.nsw.gov.au/sites/default/files/2023-03/housing-2041-2021-22-action-plan-nsw-housing-strategy.pdf
[8] https://www.health.nsw.gov.au/about/nswhealth/Publications/future-health-report.PDF
[9] https://media.opengov.nsw.gov.au/pairtree_root/9a/76/83/89/3b/f3/45/7c/a5/a2/97/82/13/55/89/18/obj/168352.pdf

opportunity to integrate diverse domain expertise and perspectives from different service-based silos. Interviewees emphasized the importance of joint input from siloed agencies that have a stake in a common customer problem space to gain a comprehensive understanding of the problem. In one example of successful collaboration, Interviewee 9 recounted a scenario involving actors from a road agency, a state law enforcement agency, and a local government authority. This collaboration was described as a "symbiotic relationship" between local and state government entities, with the former providing insights into place-based challenges and community connections, while the latter provided technical expertise and resources for specific functions. Consequently, agencies are leveraging and integrating diverse domain expertise, perspectives, and skills to collaborate more effectively on shared problem spaces.

The public sector is beginning to share knowledge and learning, which is crucial to improving efficiency and collaborative momentum for digital innovation. Interviewees highlight exchanging experiential insights and capability expertise, as well as sharing knowledge on capabilities, skills, and best practices. Interviewee 9 stresses building networks and relationships to facilitate the sharing of information among government employees who have overcome similar challenges or taken similar opportunities. Initiatives such as whole-of-government community of practice, which includes boot camps to learn the basics of human-centered design, provide management across government the opportunity to leverage research and learnings from specific projects to enrich their own practices. Such sharing of knowledge allows people to embed proven approaches, leading to increased productivity and success in their work.

Another key component of networks for inter and intra-organizational connectivity includes technological integration and interoperability. According to the interviewees, the appropriate integration and exchange of data with separate systems can provide greater insights and support informed decision-making. The integration of technologies and data across government enables the instantaneous sharing of information, providing managers with a holistic view that leads to smarter decisions and more empowered strategies. For instance, Interviewee 9 reflected on the covid-19 pandemic, stating the need for quicker access to more readily available data to generate insights. Such efforts have helped the government respond to the pandemic more effectively by identifying real cases of need.

The NSW public sector has taken significant steps to formalize the coordination of digital innovation across service-based silos by *dedicating central structures* to this purpose. Interviewees have identified several examples of such structures aimed at improving capabilities and integration across three primary themes: (i) *centralizing the delivery of digital customer services*, (ii) *allocating capacity to enhance digital capability across the government*, and (iii) *establishing dedicated structures to accelerate digital innovation for sustainable development*.

An example of a structure newly created to (i) *centralize delivery on digital customer services* includes the Department of Customer Services (DSC). Interviewee 8 said that the DSC is responsible for the ownership of customer strategy across all agencies within the sector and serves as a point of convergence for needs and aspirations in a consistent and clear manner. Its main objective is to establish the customer at the center of all programs and initiatives across the NSW Government, enabling the delivery of a more consistent and efficient digital experience with the government (NSW Government, 2021a).

An instance of a structure with (ii) *allocated capacity to uplift digital capability* across the government is the Data Analytics Centre. The center provides digital support to all operating units that require it and shares its resources with them. The center has collaborated with other agencies to address various issues, including improving pedestrian safety and investigating property overcrowding (Data.NSW, 2021).

To (iii) *accelerate digital innovation*, service-based organizational silos that address a common customer problem space are increasingly collaborating in interactive networks. Participants claimed that the public sector is making efforts to establish suitable channels, spaces, and structures that enable multiple stakeholders from service-based silos at all levels of government to collaborate effectively.

4.2.2 External Ecosystem Collaboration

The NSW Government recognizes the importance of building pathways for external ecosystem collaboration to increase internal innovation capacities and capabilities. This involves establishing pathways for effective collaboration with private and non-profit organizations. By collaborating with external ecosystems, governments can access and leverage available resources and capabilities “from outside the public sector” (Interviewee 7). This expands what the government can do and helps to develop effective public-external partnerships. This can include expertise, funding, technology, and knowledge. By

partnering with private and non-profit organizations, the government can work towards achieving common goals and objectives. Interviewee 6 emphasizes that the ecosystem collaboration “brings in a new set of eyes and minds”. This is important as it provides fresh perspectives and ideas that can help to enhance public sector initiatives. Collaboration with external ecosystems can help to identify innovative solutions to complex problems and can also provide valuable learning opportunities for public sector employees. Additionally, ecosystem collaboration helps when people "come in and work with teams to educate" (Interviewee 8).

The NSW Government is increasingly adopting a strategy of leveraging industry resources, including existing technologies, methodologies, ways of thinking, ideas, and data, to facilitate innovation in information systems. Interviewee 5 provided an example of this approach, describing the use of vendor technology that was “predominantly outsourced, with the vendor providing both camera hardware and an artificial back-office solution”. Another interviewee, Interviewee 3, shared an example of leveraging industry methodologies and ways of thinking, particularly the “agility of thinking” characteristic of “start-ups and their ability to scale up quickly”. Agencies are also making use of research and development (R&D) skill sets available outside the public sector. External capabilities in this area are characterized by "deep thinking," allowing external researchers to devote more time and resources to analyzing problems and conducting research than public sector employees. As Interviewee 3 noted, external research capabilities "have time to actually think through on a problems basis and do the research to a degree that we just don’t have the capacity to do". To further enable and promote innovation, the public sector is actively developing and building open innovation ecosystems, as evidenced by Interviewee 5's example of stimulating innovation in the external ecosystem by providing a test environment for promising technology providers to demonstrate their solutions before moving to procurement.

4.2.3 Digital Technologies and Infrastructure

The NSW Government is actively adopting digital technologies and infrastructure, along with corresponding digital standards. This implementation and application of both existing and emerging technologies have enabled the public service to leverage new methods for (i) *developing services* and (ii) *delivering citizen outcomes*. The public sector has put in place (iii) *digital standards and frameworks* to formalize the execution of digital delivery and the use of technology.

Participants in the study highlighted that digital technologies such as cloud infrastructure and modern web development tools are providing new ways of *service development*. Cloud infrastructure has facilitated virtual connectivity, provided flexibility in adapting to demand capacity, and enabled integrated information exchange. Modern web development technologies like React have replaced outdated technologies and made service development more accessible to a larger pool of developers. There are estimates that digital technologies can contribute to reducing global CO2 emissions by around 15%. Cloud computing can also help reduce emissions by providing a virtual environment for applications, platforms, and software[10].

Participants also mentioned that emerging technological functionalities provide opportunities for some people to create innovative digital solutions, resulting in new service outcomes. Interviewee 2 mentioned that people are developing "new cool features," while Interviewee 6 cited "digital twins" and "LiDAR technology" as examples of how emerging technologies are transforming spatial data. Additionally, some people are using artificial intelligence to better predict violent behavior in the network (Interviewee 7).

To ensure the consistent replication of best practices, the NSW government has established digital standards and frameworks that formalize the execution of digital delivery. Additionally, the government has developed manuals, systems, and procedures that provide guidance and direction to agencies throughout the state. These guidelines include the Digital Design Standards and Privacy by Design principles, which promote a culture of innovation and encourage agencies to think differently about how they approach digital solutions. Interviewee 4 emphasizes the importance of these principles and standards in promoting “organic innovation”, while Interviewee 3 highlights their role in providing direction and objectives for other agencies to consider in their “own digital innovation work”.

[10]https://edicomgroup.com/blog/sustainable-digitalization.

4.2.4 Digital and Customer Strategies

The analysis suggests that having clear digital and customer strategies is a key factor in driving digital innovation and achieving sustainable development in the public sector. The NSW government has established a shared vision for digital and customer priorities across agencies through the implementation of such strategies. Interviewees identified the presence of (i) *digital' and customer-first strategies*, as well as (ii) *political and senior leadership priorities*, as evidence of this organizational element.

The NSW Government has implemented dedicated strategies to drive digital and *'Customer-First' strategies* across the government. These strategies include customer outcomes strategies, digital strategies, and digital and customer strategies, which provide guidance and transparency on what will receive funding and for what purpose. An example of a customer outcomes strategy is the Future Transport 2056 Strategy which outlines a 40-year vision, directions, and principles for customer mobility in NSW (Transport for NSW, 2021). Digital strategies drive consistency and standardization of digital ways of working, such as the Digital Capabilities Uplift Framework which outlines core capabilities for succeeding in the digital context (Public Service Commission, 2019). The Beyond Digital Strategy, owned by Digital NSW, endeavors to accelerate the complementary relationship between customer and digital priorities and proposes six commitments to ensure the public sector meets the needs and expectations of customers and enables a consistent customer experience (Digital.NSW, 2021b).

Political and senior leadership priorities play a key role in driving the digital and customer-first objectives across the NSW government, according to interviewees. The Minister for Customer Services and Digital, Victor Dominello, was mentioned by all interviewees as a passionate driver of the digital innovation of NSW government services. The Premier's Priorities (NSW Government, 2021c), which includes the objective of "Government made easy," was also highlighted as providing strategic direction and purpose for their people when digitally innovating. These priorities aim to increase the number of government services where citizens of NSW only need to "Tell Us Once" by 2023 (NSW Government, 2021c), encouraging public sector employees to work towards a seamless digital customer experience.

4.2.5 Entrepreneurial Mindsets

The analysis further reveals that the NSW Government is cultivating *passionate and entrepreneurial mindsets* amongst internal staff for enabling and promoting digital innovation for sustainable development. It is developing an empowered internal workforce. Interviewees revealed that the government is driving innovative behaviors through (i) *senior leadership empowerment* and (ii) *providing staff with opportunities for organization-led innovation*.

Interviewee 6 pointed out that senior leaders encourage teams to look for innovative solutions and embrace courageous behaviors that are not strictly “risk-averse”. They also mentioned that senior leadership should promote the idea that “it is okay to fail” and encourage people to try their ideas. Ultimately, this approach “helps build staff confidence in expressing new ideas and empowers them to pursue them”.

The NSW Government is increasingly cultivating an organization-led culture of innovation by pursuing opportunities for internal staff to voice new ideas and by developing an internal passion to solve a problem space. This "bottom-up" and "internally led" (Interviewee 7) approach to innovation is driven by public sector organizations that seek to push autonomy down the organizational hierarchy. Interviewees reported that public organizations are providing avenues for organization-led innovation via internal initiatives and forums created to provide people with a chance to give input. For example, the "Bright Ideas Project" by Transport for NSW allows any staff member to pitch their ideas and encourages innovation from the bottom up (Interviewee 5). Passion to solve customer problem spaces is important. Interviewees noted that staff are incentivized by their passion for what they are doing and the desire to make a contribution and generate impact. Creating an environment that promotes these passionate mindsets is critical. Providing opportunities for staff to give feedback and input to redesign processes is an important aspect of empowering them to feel valued and to make suggestions that can improve the organization.

4.2.6 Trust-Building Management Processes

Effective management processes play a critical role in facilitating secure data exchange and consumption, as highlighted by the participants in this study. Trust-building processes were identified as a key enabler of digital innovation within the public sector. One such process involves the demonstration of adherence to data frameworks, policies, and legislation that facilitate interoperability and exchange of data, as noted by

Interviewee 6. Such exchanges promote "an ecosystem where everybody can play and start sharing information under appropriate access arrangements and conditions," thus building trust in the system (Interviewee 6). For instance, the Personal Information & Privacy Act (PIPA) was cited as an example where the methods and processes used to safeguard personal and sensitive information have become more advanced and sophisticated over time due to various factors, including technological advancements, increased awareness of privacy issues, and the implementation of new regulations and standards.

4.2.7 Customer-Centric Management Processes

To enable and promote digital innovation that can achieve sustainable development, the NSW public sector has pivoted to developing services for major events in citizens' lives rather than the agency's organizational structure. Customer centricity enables "outcomes rather than outputs" as the objective (Interviewee 5). Interviewee 2 said this was about "big picture thinking about what customers need, instead of how we deliver".

Interviewees said that some parts of government are implementing approaches to understand and frame customer problems and life journeys, with a focus on improving citizens' experiences. This approach involves focusing on what will make life easier for citizens and understanding the things that wrap around a citizen that do not just connect to one cluster or agency. The ability to understand and act on citizen life journeys is enabled through employing methodologies to unpack and define customer problems, reframe complex problems using a data-driven approach, and implement principles of human-centered design.

Interviews highlighted that the public sector is increasingly adopting customer-centric principles by formalizing outcomes-based funding models. This involves investing based on customer impact and establishing centralized funding mechanisms for a whole-of-government approach. Interviewees noted that Treasury NSW has adopted an Outcomes Budgeting model to ensure that the public sector stays focused on delivering outcomes for people "putting the needs of people at the center of investment decision making" (Treasury NSW, 2021). The funding mechanism uses an "outcomes framework" to "articulate the primary purpose for which public resources are spent, and the goals that the government is seeking to achieve for its citizens" (Treasury NSW, 2021). The focus is on achieving results, rather than tracking how funding is allocated. Interviewees emphasized that budget funding needs to be tied to the outcomes being delivered for the end-user.

4.2.8 Agile Management Processes

The NSW Government is implementing *agile management processes* to enable experimentation to solve complex problems with no obvious answers and reduce the cost of failure. The approach is useful in developing novel digital solutions that create "real customer impact whilst navigating the unknown" (Interviewee 11). To facilitate these demands, interviewees highlighted the significance of agile ways of working to break down complex problems into more manageable parts. They defined agile ways of working as a practice that involves testing and validating hypotheses through proof of concepts. According to Interviewee 3, some people are engaged in developing hypothetical scenarios and validating them through research and customer engagement. This approach allows for continuous learning and the ability to emphasize effective practices and de-emphasize those that do not work. Furthermore, the practice of "failing fast" enables public sector employees to identify when the expected benefits of a project cannot be achieved, allowing for the ability to stop and refocus efforts elsewhere, minimizing the waste of public funds (Interviewee 9).

Agile ways of working emphasize the need for rapid iteration and incremental development to enable the quick delivery of benefits. According to Interviewee 5, rapid iteration facilitates "continuous improvement", while Interviewee 3 notes that it allows people to "quickly respond to the needs and expectations of customers". By building "incrementally and rapidly, managers are able to create a better way of making innovation achievable", as noted by Interviewee 11. They can continuously explore opportunities and possibilities, allowing them to evolve and improve their products or services. For example, Service NSW's App was built iteratively, allowing for the addition of new features through thirty different updates since its release, as highlighted by Interviewee 2. Rapid iteration and development enable fast development, enabling managers to "get beta products to customers quickly", as noted by Interviewee 3.

Further, the NSW government is implementing agile investment models to enable "iterative funding" (Interviewee 4) that "drives and motivates behavioral shifts towards agile approaches" (Interviewee 3).

One practical example is the Digital Restart Fund (DRF), which provides "funding for iterative, multi-disciplinary approaches to planning, designing and developing digital products and services in NSW" (Digital.NSW, 2021a). This investment mechanism enables people to test and prove a concept with a minimum viable product, providing funding for delivering quick benefits and wins in small packages. The DRF reduces risk as it allows managers to first start small and demonstrate a relative degree of certainty that it has a very high return if it works. Managers are also able to inform or remove some of the big assumptions and validate the value of an idea or concept. Interviewees have reflected on how agile investment models enable funding for testing by doing something smaller, while also providing an opportunity to fail fast and not burn lots of money. The DRF funds "iteratively allow people to build an idea, test it, research it, and get perspectives from the community before sinking in more money to move forward" (Interviewee 4). Table 2 demonstrates the relatively small amount of investment allocated to a large number of projects, a complete reversal of traditional government funding approaches.

Table 2. DRF Projects Funded – by Category

Category	Projects funded	Amount Approved ($m)
Legacy Modernization	72	$1057
State Digital Assets	73	$421
NSW Cyber Security uplift	49	$297
Life Journeys	52	$159
Smart Places	27	$45
Enabling Capability	29	$108
Fund management	2	$21
Total	277	$210.8

A deeper dive into the initiatives supported by the DRF reveals that just $31 million of the $210.8 million invested was directly committed to environmental programs. The focus of these included: building resilience and biodiversity to protect the future of NSW's threatened species through greener neighborhoods and support for the National Multi-Hazards Digital Alert Service to respond to fire and flood emergencies.

In addition, under the Smart Places Acceleration Program[11], three 'innovation challenges' were funded for a total of $4.2 million as opportunities for the NSW Government to collaborate with the start-up community. The goals included involving the emerging technology sector, driving innovative smart technology solutions for places and people, setting new pathways for partnerships between the technology and innovation sector and the NSW Government, growing the number of innovative smart places products, services, and solutions in NSW, and increasing the commercialization of NSW Government-funded innovation for smart places.

In summary, by investing in these elements, government agencies in NSW can cultivate a culture of innovation, bolster their digital skills and capabilities, ensure that they are well-equipped to tackle the challenges of the modern digital landscape and achieve sustainable development. Such measures include the development of effective governance structures, endorsing a culture of innovation and collaboration, investing in digital infrastructure and tools, promoting digital skills development, and establishing partnerships with the private sector and academic institutions.

5 Discussion

This section presents a discussion of the research findings and examines how digital innovation is enabled and promoted to achieve sustainable development in public sector organizations. The discussion contextualizes the research findings within the existing literature, research objective, and research question. In section 5.1, we contextualize the six digital innovation challenges in the public sector and draw an explicit link to Chan et al.'s (2019) framework for Responding to Disruptive Change. We extend the framework by exploring two additional relationships to explain the complexity of overcoming such challenges. In section 5.2, we explore the link between the eight organizational elements enabling digital innovation and Scott Morton's framework (Morton, 1991), and we emphasize the strides taken by the

[11] https://www.transport.nsw.gov.au/system/files/media/documents/2022/Smart-Places-Acceleration-Program-Guideline%20%281%29.pdf

public sector in enabling and promoting digital innovation, which is vital for sustainable development, through strategic organizational strategic alignment.

5.1 Contextualizing the Public Sector's Digital Innovation Challenges

We identified six key challenges that make it difficult to orchestrate digital innovation in the public sector (Section 4.1): (1) inconsistent digital maturity, (2) non-digital mindset, (3) slow mobilization, (4) service-based silos, (5) premature solutioning, and (6) failure to align investment in digital innovation with broader government priorities.

We found that Chan et al.'s (2019) Framework for Responding to Disruptive Change can be used to analyze capabilities and rigidities in responding to disruptive change, and it could be adopted for classifying these challenges into two categories: insufficient innovative capabilities and core organizational rigidities. According to the framework, an effective response to disruptive change requires an organization to *develop its capabilities* and *mitigate its core rigidities*. Table 3 provides a brief summary of the adopted framework's dimensions.

Table 3. Dimensions of Framework for Responding to Disruptive Change

Framework Dimension	Description
Develop Capabilities	Organizations must increase their capacity to change (Lucas & Goh, 2009) "In responding to disruptive changes, organizations often need to develop capabilities in the face of new situations brought about by the changes" (Chan et al., 2019) For example, such capabilities may include enacting specific organizational processes such as product innovation and development that create value for the organization in responding to dynamic changes (Teece et al., 2016).
Mitigate Core Rigidities	Organizations must mitigate rigidities to change (Lucas & Goh, 2009). "Organizations need to mitigate against rigidities to reconfigure themselves in responding to disruptive changes" (Chan et al., 2019). "Systems, structures, cultures, processes, routines, and even capabilities may become institutionalized and rigid that its ability to respond to disruptive changes becomes challenged" (Leonard-Barton, 1992).

This conceptual lens explains how core rigidities and insufficient capabilities hold back the public sector, reducing agencies' capacity to respond to disruptive change. Figure 2 visualizes this relationship.

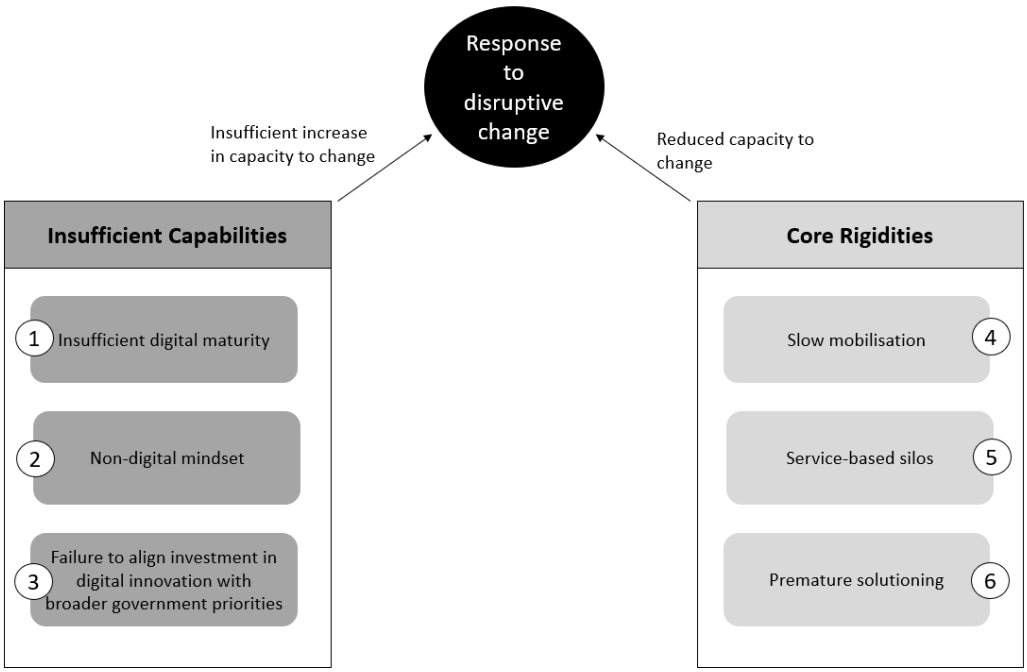


Figure 2. Challenges of Digital Innovation in the Public Sector

Insufficient Capabilities: The inconsistency of digital skills (1), the non-digital mindset (2), and failure to align investment in digital innovation with broader government priorities (3) are significant challenges for public sector organizations seeking to orchestrate digital innovation and tackle sustainable development. Henfridsson et al. (2014) suggest that organizations must develop new capabilities to identify novel ideas within existing institutional contexts to embrace digital innovation. This research finding is consistent with the challenges faced by public sector organizations that lack innovative digital capabilities. In particular, there is a need to develop more consistent digital delivery skills and experience among government employees, as well as address challenges in retaining and attracting digital talent. Dawes (2008) also recognizes the challenge of changing digital and technical skill needs in the public sector. Some public sector employees may be unfamiliar with the complexity of digital disruption and may be hesitant to embrace it due to a desire to protect public value and resources, creating a culture of mindsets that prefer to stick with the "known". This aligns with Vigoda-Gadot et al.'s (2005) propositions that the public sector may be uncomfortable with rapid changes and associated risks. In combination, these challenges contribute to the prevalence of insufficient innovative capabilities in public sector organizations, thereby constraining government efforts to enable and promote digital innovation that can effectively achieve sustainable development.

Table 4. Core Rigidities and Innovative Capabilities

		Challenge	Organizational Components	Description of the challenge	This challenges the development of innovative capabilities by ...
Capabilities Insufficient	**1**	Inconsistent Digital Maturity	Individuals & Roles (skills)	There are insufficient **digital skills** for digital project delivery and agile ways of working that enable digital innovation.	Intensifying challenges for collaborating on shared problem spaces caused by the core rigidities of service-based siloes. E.g., Inconsistent digital capabilities across the public sector (i.e., agile & non-agile) challenge the effective implementation of inter-disciplinary teams to collaborate on shared customer problems.
	2	Non-Digital Mindset	Individuals & Roles (mindsets)	Some individuals are unfamiliar with the complexity of digital technologies. In addition, driven by a desire to protect public resources (data, customers, money), they are uncertain of unintended and potentially negative consequences that may result from embracing digital disruption. In combination, this cultivates mindsets that prefer to adopt familiar approaches and stick to the 'known'.	Intensifying the persistent practice of established management processes, rather than embracing newer ideas and practices. e.g., some investment decision-makers can be uncomfortable with the uncertainty of unintended 'digital' consequences when building a case for a change in investment. This intensifies existing core rigidities that result in their inability to mobilize ideas quickly
	3	Failure to align investment in digital innovation with broader government priorities	Strategy	Individual government agencies are unable to attract interest or investment for broader strategic objectives which lie outside their own portfolio, meaning opportunities to align digital investment are lost.	Fosters an environment where agencies compete for funding to address multiple priorities instead of looking for opportunities for co-investment where digital innovation programs could deliver against multiple objectives.
		Challenge	**Organizational Components**	**Description of the challenge**	**This challenges the development of innovative capabilities by…**
	4	Slow Mobilization	Management Processes (Funding & Procurement)	Securing access to resources (time & human resource capacity, investment, external partners & capabilities) for the mobilization of ideas is prolonged due to established **management processes** that	Challenging the execution of agile approaches to digital service development such as rapid delivery and iterative development. e.g., securing money via yearly funding cycles slows agile ways of digital service development that

Core Rigidities				do not support 'digital' as effectively.	deliver and build on digital products rapidly in increments.
	5	Service-based silos hinder customer journey reforms	Structures	Decentralized program and project management, disparate technology systems, and insufficient connectivity and sharing within and between **service-based silos** challenge effective collaboration for citizen life journey reform.	Challenging the formation of appropriate multidisciplinary teams for collaboration that enables agile development required to execute on shared citizen problem spaces.
	6	Premature Solutioning	Management Processes (Funding & Procurement)	Gated and waterfall funding and procurement **management processes** encourage public practitioners to specify and define a solution prior to exploring the problem when requesting funding and engaging with the market.	Encouraging the bypass of critical digital innovation activities such as: adequate discovery to understand and unpack a problem space and understand customer needs. adequately testing concepts, minimum viable products, or prototypes with customers

Core Rigidities: Challenges (4), (5), and (6) are rooted in established management processes and siloed structures, which pose significant obstacles to the public sector's ability to respond to disruptive change and implement newer digital ways of developing and delivering services. This is consistent with Leonard-Barton's (1992) arguments that core rigidities can arise due to institutionalized systems, structures, cultures, processes, and routines that challenge an organization's ability to respond to disruptive changes. Firstly, extant funding, procurement, and governance management processes can hinder the quick mobilization of ideas for digital innovation, as they are designed to be rigorous in ensuring the efficient use of public resources and protecting public value. Rana, Dwivedi, and Williams (2013) also found that experimental approaches to digital innovation are often hindered by complex lines of accountability, which are promoted by the need for government to provide assurance for the effective use of taxpayer resources. Secondly, public sector management processes encourage premature solutioning, where a solution is specified and defined before exploring the problem. This is reflected in the findings of Dunleavy, Margetts, Bastow, and Tinkler (2006), which indicate that public sector organizations typically only make resources available if new technologies have proven their value beyond doubt. Finally, service-based siloed structures create another core rigidity for the public sector, as they hinder effective collaboration for digital innovation and impede sustainable development. Decentralized program and project management, disparate technology systems, insufficient connectivity, and sharing within and between service-based silos are major challenges that impede collaboration. Therefore, established processes and structures become core rigidities for public sector organizations when responding to disruptive change for digital innovation.

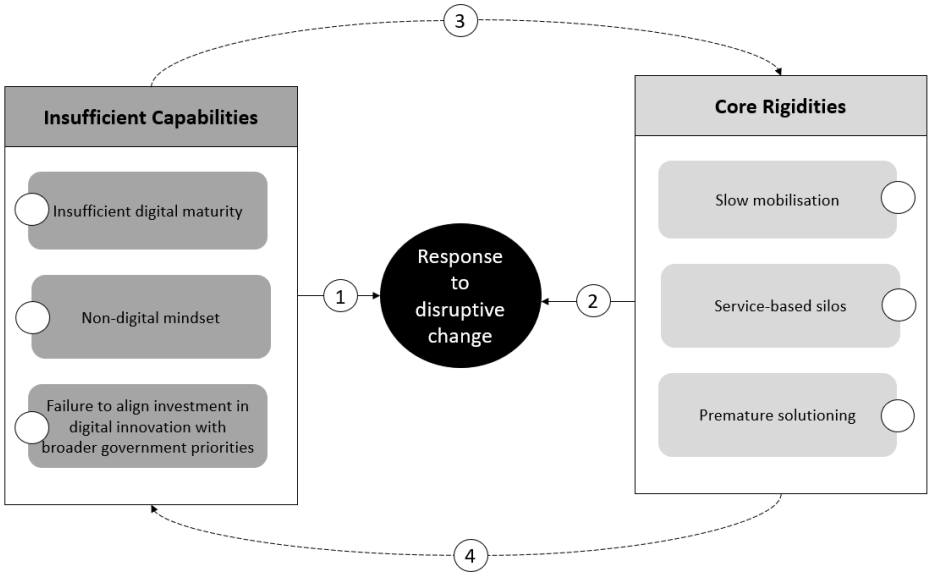
Chan et al.'s (2019) Framework for Responding to Disruptive Change describes how organizations must mitigate core rigidities and develop innovative capabilities to effectively respond to disruptive change. There are, however, additional relationships that emerge from the analysis. We extend the framework by demonstrating the reciprocal relationship between core rigidities and insufficient innovative capabilities. This extension presents an explanation as to why the challenges identified are so difficult to overcome and are therefore complex. Table 4 provides practical evidence and an explanation of how core rigidities and innovative capabilities interact within the NSW Government. It lists examples of capability shortfalls that hinder mitigation activity. In the same way, the table presents rigidities that make it difficult to develop capabilities.

We identified a robust correlation between the core rigidities and the insufficient innovative capabilities that arise due to the challenges of digital innovation within public sector organizations. To illustrate this relationship, we devised an adapted model called the Challenges of Responding to Disruptive Change for Digital Innovation, which is graphically represented in Figure 3. This model provides a comprehensive and insightful depiction of the interplay between the factors that impede the adoption of digital innovation and the resulting impact on an organization's ability to innovate.

The concept of core rigidities is widely recognized as a significant challenge to the development of innovative capabilities within organizations. Scholars such as Chan et al. (2019) and Lucas and Goh (2009) have argued that an organization's core capabilities and activities can become so entrenched and inflexible that they impede its ability to respond to changing circumstances. Building on these insights, this

study proposes a theoretical extension that posits that the primary reason for this phenomenon is that core rigidities create barriers to the development of necessary innovative capabilities. Established government processes and structures, designed to safeguard public value and resources, can become core rigidities that hinder the development of digital and innovative capabilities. These rigidities can impede the execution and scaling of ideas in a digital and agile manner. For example, yearly budget cycles that may be appropriate for funding physical infrastructure, such as roads, may not be suitable for funding digital products that require agile ways of working. Although established processes and structures aim to maintain familiar and secure ways of service development and delivery in the public sector, they can present challenges when developing innovative capabilities for a new digital era. The concept of organizational inertia proposed by Islam, Buxmann, and Ding (2017) and Kohli and Melville (2019) support this argument, suggesting that core rigidities arising from existing resources and capabilities inhibit the ability to effectively reinvent for change. As a result, insufficient innovative capabilities are developed.

Reciprocally, insufficient innovative capabilities of an organization challenge the mitigation of core rigidities to intensify their effects. As noted by Chan et al. (2019), "organizations need to develop new capabilities in the face of new situations brought about by changes to respond to disruptive change." Building on their argument, we propose that insufficient innovative capabilities not only hinder an organization's ability to respond to disruptive change, they also contribute to the persistence of core rigidities. From the findings, it appears that public sector organizations lack digital innovative capabilities, such as a mindset that embraces 'digital', which makes it difficult for them to overcome core rigidities. As a result, core rigidities persist, such as a lack of understanding among investment decision makers to justify funding for digital innovation, which complicates the ability of government organizations to respond to disruptions caused by digital innovation, thereby hindering sustainable development. This concept is consistent with the propositions put forward by Svahn et al. (2017), who argue that established organizations are confronted with the "competing concern of needing to balance the exploitation of existing capabilities while also building new digital capabilities that are compatible with the path dependencies of the past." In the public sector context, a lack of digital skills, maturity, and innovative mindsets contributes to the persistence of existing core rigidities.



(1) Innovative capabilities are insufficient in public sector organizations, reducing their capacity to respond to disruptive change.
(2) Core rigidities reduce the public sector's capacity to respond to disruptive change.
(3) Innovative capabilities are insufficient to overcome challenges of core rigidities in public sector organizations, intensifying their effect.
(4) Core rigidities are challenged, developing necessary innovative capabilities.

Figure 3. Challenges to Responding to Disruptive Change for Digital Innovation

As argued by Chan et al. (2019), adapting operations and processes to newer digital realities is intrinsically challenging for organizations. This complexity is due to the inherent challenge of responding to

disruptive change caused by digital innovation. Parviainen, Tihinen, Kääriäinen, and Teppola (2017) support this idea, positing that firms struggle to make organizational changes in habits and ways of working to capture the maximum benefits of digital efforts. Furthermore, Warner and Wäger (2019) explain that this challenge arises because organizations must adapt to address the tensions between established business and newer digital realities.

As identified through the research findings and visualized in Figure 3, public sector organizations are caught in a continuous reciprocal loop of challenges. This research extends Chan et al. (2019) framework by articulating how responding to disruptive change is complex and challenging due to the tightly coupled nature of core rigidities and insufficient innovative capabilities, which feed into each other.

The analysis provides new insights into the challenges agencies face in enabling and promoting digital innovation for sustainable development but does not offer a feasible solution. Despite these challenges, respondents report progress in the public sector. Strategic organizational alignment principles suggest that organizations perform well when their technology resources, including infrastructure, technical and managerial digital skills, and knowledge assets, are aligned with their digital strategy, and appropriate structures are in place the ensure the effective deployment and management of these resources (Coltman et al., 2015; Yayla & Hu, 2012).

5.2 Organizational Alignment and Promoting Digital Innovation

We utilized the Scott Morton framework (Morton, 1991) to analyze a network of eight organizational components in a network. These components include management processes, strategy, individuals and roles, technologies, structures, and the external environment. Our analysis indicates that alignment is crucial between these internal and external components. According to the Scott Morton framework, modifications to any of the components necessitate corresponding changes to others to ensure their objectives and actions remain in sync. Figure 4 provides a visual representation of the interconnection between the eight organizational elements that promote digital innovation and the Scott Morton framework. By applying this conceptual framework, we examine how the NSW Government is adapting and aligning its operations to promote digital innovation and achieve sustainable development.

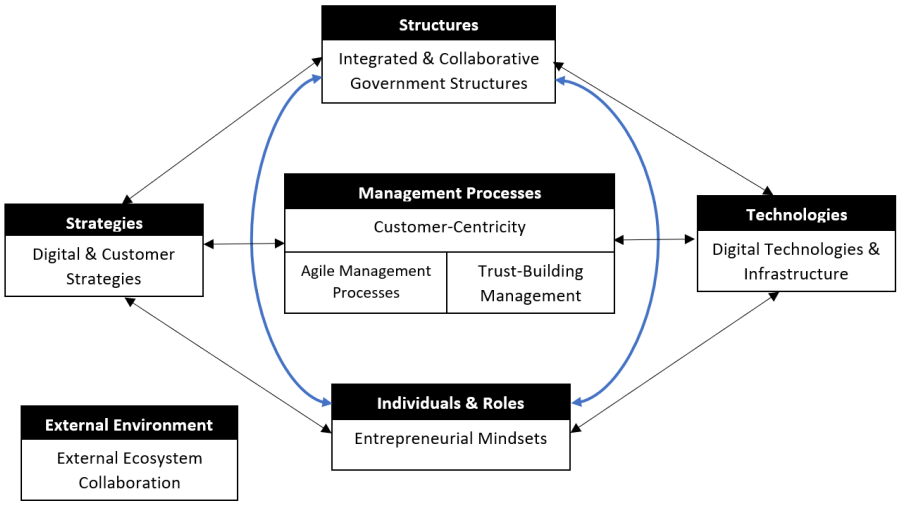


Figure 4. Organizational Alignment and Promoting Digital Innovation for Sustainable Development

Scott Morton's framework (Morton, 1991) underscores the importance of the interrelationships among the organizational components and their co-alignment (Segars & Grover, 1998). It proposes that because such components closely interact with one another, changes to any of the components require changes to others to bring their objectives and activities back into alignment. For an organization to benefit from IT-enabled shifts, all its parts must be aligned to work together (Morton, 1991).

To fully benefit from the adoption of new technology or paradigm shift, an organization must examine its interrelated organizational components, and if necessary, realign them so they are consistent and support one another. Strategic organizational alignment is essentially "the degree to which the information

technology mission, objectives, and plans support and are supported by the business mission, objectives, and plans" (Reich & Benbasat, 2000).

The following practical example illustrates how achieving digital innovation in agencies can be a challenging and complex task, requiring strategic alignment within the organization. However, such alignment is crucial for making progress in digital innovation that can achieve sustainable development.

The NSW government has adapted agile models, processes, and practices to align with its unique organizational context. Table 5 summarizes how public sector organizations are making multiple simultaneous interventions to organizational components. It also includes practical examples shared by interviewees.

1. **Strategies:** Agencies implement strategies that prioritize, formalize, and guide digital capability development. However, established ways of working, processes, and structures challenge the execution of digital agile practices as previously highlighted. Strategies as guidelines alone are therefore insufficient.
2. **Management Processes:** Simultaneously, agencies incentivize and enable innovative behaviors by adapting funding models to become correspondingly agile. A practical example includes the NSW Digital Restart Fund. It provides a seed funding pathway to test ideas and assumptions, enabling the execution of "discovery phases, building prototypes or releasing beta services for testing by customers". However, adapted funding mechanisms only minimize barriers to agile ways of development. Further intervention is required to enable public organizations to leverage these newly built opportunities.
3. **Digital Innovation Capabilities:** Correspondingly, agencies are developing passionate and entrepreneurial mindsets in their people that tolerate risk and embrace experimentation through political and senior leadership empowerment.

Table 5. Practical Example of Realignment to Support Digital Innovation for Sustainable Development

	Organizational Component (1) STRATEGY	**Organizational Component (2) MANAGEMENT PROCESS**	**Organizational Component (3) INDIVIDUALS & ROLES**
Organizational Components	Digital and Customer Strategies Government is implementing strategies that drive digital priorities to promote agile across the public sector.	Agile Management Processes To enable behavioral shifts to embrace more agile approaches, government has begun "investing in ICT and "digital" differently, in an agile way, through iterative funding" (Interviewee 4).	Digital Innovation Capabilities Simultaneously, government is developing passionate and entrepreneurial mindsets to drive agile ways of working, enabling and promoting digital innovation for sustainable development.
Practical Examples	e.g., Digital Capabilities Uplift Framework by the Public Service Commission (PSC) drives: Collaboration and Agility: "denotes how we work together across clusters, agencies and teams, to deliver outcomes and value at speed (i.e., Agile Project Methodology)" (Public Service Commission, 2019).	e.g., Digital Restart Fund (DRF) enables "iterative, multi-disciplinary approaches to planning, designing and developing digital products and services in NSW" (Digital.NSW, 2021a).	e.g., Digital senior leadership encourages staff to embrace agile and digital mindsets. Examples of desired behaviors include cautious but courageous risk-taking and the exploration of ideas outside boundaries and defined roles. Minister Victor Dominello: "If the leadership is not there, it doesn't happen. If the Premier did not back this digital journey, then this rock would become a boulder that no one would move" (Burton, 2020).

From the above, we determined that in the context of the public sector, the adoption of interrelated organizational components is crucial to promote digital innovation and achieve sustainable development. Scholars such as Lucas & Goh (2009) emphasized the importance of organizational agility to enable organizations to quickly adapt their business models, strategies, and actions to enhance their performance and promote successful digital innovation. To achieve this, public sector organizations are incorporating digital models and principles, adapting their processes, practices, and models to their specific context. To promote digital innovation and achieve sustainable development, public sector organizations must align their strategies, structures, individuals and roles, technologies, and management

processes with external socioeconomic and technological environments. This strategic alignment is essential for enabling and promoting digital innovation and has been linked to Scott Morton's (1991) framework for organizational alignment. The eight organizational elements enabling digital innovation discussed in Section 4.2 provide insight into the specific strategies that public sector organizations are using to enable and promote digital innovation. Our research suggests that adapting digital models and principles, along with strategic organizational alignment, is key to promoting successful digital innovation and achieving sustainable development in the public sector.

The public sector is driving digital innovation by adapting its organizational alignment to incorporate digital ways of working that are appropriate for its context. To facilitate digital innovation and achieve sustainable development, the public sector is making concurrent adjustments to its interrelated organizational components while maintaining alignment. Organizational alignment is necessary to uphold the public sector's values of safeguarding public resources while enabling innovative digital service development. Fichman et al. (2014) call for further research, asking if organizations should reconsider their technology infrastructure investments, human resource policies, and project structures to address disruptive change. The findings of this empirical research study provide insight into the most effective ways to re-imagine these approaches, which is strategic organizational alignment. Responding to disruptive change and promoting digital innovation requires a holistic organizational transformation that can facilitate sustainable development.

Enabling digital innovation in the public sector through organizational alignment is a complex process, which requires a careful and interlinked adjustment of all organizational components to ensure that they work in unison and achieve sustainable development. This complexity is supported by previous studies which indicate that rigid or overly restrictive links between business and information technology can hinder an organization's ability to adapt quickly to environmental change (Benbya & McKelvey, 2006; Coltman et al., 2015). While strategic organizational alignment can facilitate holistic organizational change that helps the public sector advance with digital innovation and achieve sustainable development, it is simultaneously intricate and difficult to orchestrate. As a result, it is necessary to approach alignment in a flexible and adaptive manner to enable the necessary changes while maintaining the principles of protecting public value and resources.

6 Contributions, Limitations, and Future Work

6.1 Theoretical Contribution

This research makes a significant contribution to the understanding of digital innovation in practice within public sector organizations which is necessary to achieve sustainable development. Specifically, it sheds light on the relatively under-explored topic of how digital innovation is enabled and promoted in the public sector. In this study, we offer key theoretical contributions to the existing body of research on digital innovation and sustainability.

The first theoretical contribution of this research builds upon Chan et al.'s (2019) Framework for Responding to Disruptive Change, which proposes that organizations must mitigate core rigidities and develop innovative capabilities to respond to disruptive change in digital innovation. While there is consensus that public sector organizations face challenges in digital innovation, there is a lack of theoretical or practical understanding to explain the complexity of these challenges. This study provides a theoretical extension to Chan et al.'s (2019) framework by identifying and explaining the reciprocal relationships of the challenges to digital innovation, demonstrating why they are difficult to overcome. These challenges, in turn, hinder the achievement of sustainable development. This is presented in the adapted framework, Challenges to Responding to Disruptive Change for Digital Innovation, as shown in Figure 3.

This research study makes a second theoretical contribution by providing more specific details on the orchestration of digital innovation in practice, which is necessary for the public sector to achieve sustainable development. The framework offers a theoretical explanation for the complexity of enabling digital innovation in this sector. To this end, we apply Scott Morton's framework (Morton, 1991) to provide theoretical insight that public sector organizations must engage in organizational alignment to enable digital innovation in response to disruptive change. This is presented in the Organizational Alignment and Enabling Digital Innovation model (Figure 4) and discussed in Section 5.2. This contribution explains that enabling digital innovation in the public sector requires comprehensive organizational change. It also

offers further theoretical insight into the complexity of this process, which involves making multiple simultaneous interventions to interlinked organizational components.

6.2 Practical Contribution

In addition to theoretical contributions, this research offers practical insights for people in the public sector seeking to advance digital innovation and thereby promote the achievement of SDGs. Specifically, the study provides six explanatory mechanisms that elucidate the specific challenges faced by the public sector in this context. Furthermore, a practical framework is proposed, which outlines a holistic approach to guide public sector employees in adapting and aligning their organizations with the emerging digital landscape.

First, the study proposes six explanatory mechanisms that underpin the challenges and barriers that must be overcome to digitally innovate in the public sector. These findings are presented in the Challenges to Responding to Disruptive Change for Digital Innovation framework (Figure 3), which provides guidance on the complexities of digital innovation in the public sector. Additionally, the study recommends that public sector organizations must simultaneously develop innovative capabilities and mitigate core rigidities to effectively respond to disruptive change. The study supports Chan et al.'s (2019) framework proposition that an effective response to disruptive change is enabled by the development of capabilities and the mitigation of core rigidities. Therefore, the study highlights the importance of considering both aspects of digital innovation that can help public sector organizations achieve sustainable development. By highlighting the importance of both aspects, the study provides practical guidance on how to adapt to and align with the emerging digital world, thereby contributing to the attainment of the SDGs.

Further, this study provides specific details on organizational elements promoting digital innovation to explain what the public sector is currently doing to achieve sustainable development. The study highlights that for public sector organizations to effectively innovate digitally, they must holistically adapt their organizational alignment to incorporate newer digital models while preserving their unique contextual priorities and processes. To assist in this process, the Organizational Alignment and Enabling Digital Innovation model (Figure 4), which provides practical guidance on how to align organizational elements to support digital innovation, is presented. The study emphasizes that this is a complex process that requires multiple interventions and provides examples in section 5.2 to demonstrate feasibility.

These contributions provide actionable guidance to overcome the complex challenges of digital innovation in the public sector, emphasizing the importance of a comprehensive approach that addresses all relevant organizational components. This study provides valuable insight into the challenges and complexities of digital innovation in the public sector and offers practical guidance to help public sector organizations adapt and align their organizational elements to promote digital innovation and contribute to the achievement of the SDGs.

6.3 Research Limitations and Future Work

Limitations are inevitable in any research study. In this case, the generalizability of the study's findings to other sectors, such as the private or non-profit sectors, may be limited due to the specific research objectives focused on investigating digital innovation in the public sector. Public sector organizations have distinct contextual priorities and values which may impact the characteristics of digital innovation in this sector. As a result, it is possible that the findings may not be entirely applicable to other sectors, and additional research is needed to understand the unique challenges and opportunities in those contexts. A second limitation of this study is the restricted timeframe and resources. This limitation affected the range of public sector employees who were interviewed. Although theoretical saturation was achieved through these interviews, the sample consisted mainly of public sector employees in leadership positions. While this provided valuable insight and experience to contribute to the findings, a more diverse range of industry professionals could have been engaged. A longer timeframe for the study would have allowed for engagement with professionals at all levels of the public sector hierarchy, including business analysts, project leads, service designers, and application developers. This could have provided further insight into the phenomenon of digital innovation in the public sector in practice.

A clear gap was identified in the approach taken by the NSW government which failed to align the wide range of NSW Government strategies and priorities with the digital transformation agenda. Further research across NSW government portfolio priorities, policies and strategies, and the alignment of digital innovation investment could identify potential opportunities to maximize benefits in areas including

environmental sustainability. Examining the specific outcomes sought through strategies such as those identified in this research (see section 4.1.6) might reveal where joint initiatives could deliver more customer-focused services aligned to broader socio-economic outcomes. This would also allow for a more in-depth comparative analysis across other jurisdictions where digital technologies have been entwined with portfolio responsibilities, rather than isolated as a separate priority.

This study has contributed to the public sector management research agenda, but there remain many opportunities for future research. First, the study's findings on how digital innovation for sustainability is enabled and promoted in the public sector could be confirmed or advanced by investigating other public sector organizations at different levels, such as local and federal levels of government, to develop a deeper understanding and further test the study's findings. Second, the study has identified eight organizational elements enabling digital innovation in the NSW government and recommends that future studies can further refine and develop these elements to provide more theoretical and practical contributions. Furthermore, the study's focus was predominantly internal, with less attention given to external socioeconomic and technological factors. Future studies can extend the findings by examining how these factors interact with strategic organizational alignment.

7 Conclusion

Digital innovation is a complex and emerging phenomenon that requires further research attention, particularly to achieve sustainable development in the public sector. The objective of this study is to address the underexplored gaps in digital innovation management, specifically related to its enablement to support sustainable development. By enhancing our understanding of the challenges faced by public sector organizations in implementing digital innovation and their responses to enable it, this research aims to contribute to the digital innovation and sustainable development literature.

First, we studied the challenges to digital innovation unique to the government. These challenges may be found to varying degrees in the private sector. Approaching these challenges in the public sector is different from approaching them in the private sector. As discussed, public sector digital innovation involves collaboration between multiple government agencies, which can lead to complex governance arrangements and decision-making processes. This complexity can make it challenging to achieve consensus and alignment among the governance agencies involved. Secondly, public sector digital innovation typically involves collaboration with external partners, such as private sector or non-profit organizations, to access external capabilities and resources. However, the public sector operates within a regulatory framework that may be different from that of the private sector, requiring additional considerations and approvals before collaboration can occur. Thirdly, the public sector often has unique requirements for data privacy, security, and accessibility that may not be present at the same level in the private sector. Collaboration between both sectors on digital innovation must take these requirements into account to ensure that data is handled appropriately and securely. From studying these challenges, we found that there are core rigidities that could align better with digital ways of working. However, the case shows clearly why they exist and are so powerful in the NSW government, which is a large, diverse organization of over 431,000 employees[12]. Further, we argued that agencies need more digital capability to enable digital innovation. We found an interplay between rigidities and capabilities, where some rigidities make it hard for the public sector to build capabilities and vice versa.

Second, we adapted a practical alignment framework to guide alignment to digital-era governance so that innovation improves. The insight here is that enabling digital innovation is complex because many organizational components need to work cohesively, but this is possible.

Overall, this study contributes to research by investigating the underexplored topic of how digital innovation is enabled and promoted within the public sector to facilitate sustainable development. It finds that its enablement is a complex phenomenon in practice, requiring holistic organizational change. This research provides a practical framework that demonstrates how holistic change via organizational alignment enables public sector organizations to progress with digital innovation and contribute to SDGs. In conclusion, public sector agencies must adapt digital technologies to fit their context to enable digital innovation as a channel which may not be appropriate for all customers and for services that do not

[12] https://www.psc.nsw.gov.au/reports-and-data/workforce-profile/workforce-profile-reports/workforce-profile-report-2021/size-and-composition

generate a financial return on investment but rather rely on customer satisfaction as a measure of success and accelerate progress towards a more sustainable future. Although a complex process, making multiple simultaneous interventions helps promote new ways of thinking and doing and results in continuous improvement for digital innovation in a public sector context.

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Appendix A: List of Secondary Material

Secondary Material	Source	Imported to NVIVO
Department of Customer Service – About Us	Department of Customer Service Website	Y
NSW Digital Government Strategy	NSW Government Website	Y
Human-centred Design Communities of Practice	Digital NSW Community Website	N
Data Analytics Centre – About Us	Data.NSW Website	Y
Transport Accelerator Hub – About Us	Transport for NSW Website	N
Digital.NSW – About Us	Digital.NSW Website	Y
Service NSW – About Us	Service NSW Website	Y
NSW Cloud Strategy	Digital.NSW Website	Y
Digital Design Standards	Digital.NSW Website	N
Privacy by Design Standard	Information & Privacy Commission Website	N
Digital Capabilities Uplift Framework	Public Service Commission Website	Y
Future Transport 2056 Strategy	Transport for NSW Website	Y
2018 State Infrastructure Strategy	Infrastructure NSW Website	N
Human Services Outcomes Framework	Communities & Justice Website	N
Beyond Digital Strategy	Digital.NSW Website	Y
NSW Premier's Priorities	NSW Government Website	Y
Digital Restart Fund	Digital.NSW Website	Y
Outcomes Budgeting	NSW Treasury Website	Y
Privacy and Personal Information Protection Act	Information & Privacy Commission NSW Website	N
Open Data Policy	Data.NSW Website	N
Infrastructure Information Management Framework	Data.NSW Website	N
Customer Sentiments Check	Digital.NSW Website	Y
Department of Customer Service Annual Report (2019)	Department of Customer Service Website	N

Appendix B. Overall Data Structure

Open Codes & Examples	Axial Codes	Selective Codes	Aggregate Dimension
Pressure to deliver extant deliverables	Insufficient innovation capacity	Slow mobilization	**Challenges of Digital Innovation**
Constrained resource availability to dedicate to innovation			
Yearly investment cycles mean acquiring money is a slow process Yearly investment cycles induce conservative spending behaviors by investment decision makers	Securing funding is challenging		
Different agencies compete for a limited budget Agencies must search for alternative funding sources due to limited budget			
Procurement policies constrain industry partner involvement	Engaging with industry is challenging		
There is insufficient capability to identify the right partnering			
Reporting processes to ensure transparency and efficient spending slows digital transformation	Reporting & governance take time		
Traditional waterfall funding models require solution specificity	Prescriptive funding processes	Premature solutioning	
Funding models encourage a phased approach, preventing continuous and iterative innovation			
Agencies must engage with market with a pre-specified solution	Prescriptive procurement processes		
Procurement models prevent collaborative ideation with industry			
Agencies have differing swim lanes and program logics	Collaborating on shared outcomes is difficult	Customer journey reform is hindered by service-based silos	
It is difficult to distribute problem and attribution ownership across agencies when collaborating			
Agencies have differing levels of focus at different times			
Insufficient inter & intra-organizational collaboration			
Disparate systems exist in a large digital government environment	Technological integration is complex		
Prevalence of both legacy and modern technologies complicate integration			
Some agencies do not adopt a multidisciplinary team approach	Digital delivery inexperience	Inconsistent digital maturity	
Lack of digital skills to deliver projects			
Lack incentives to compete with industry for digital talent	Difficulty in retaining and attracting digital talent		
Recruitment rules			
Inconsistent digital & non-digital ways of working challenge collaboration	Inconsistent levels of digital capabilities		
Intangibility of digital technologies contributes to its perceived complexity	Unfamiliarity with the complexity of ‘digital’	Non-digital mindset	

There is unfamiliarity and misunderstanding with how 'digital' works			
Desire to avoid potential negative consequences of 'digital'	Uncertainty of consequences brought about by 'digital'		
Uncertainty of unintended consequences of 'digital'			
Insufficient assurance that digital approaches are secure			

• Multi-agency collaboration (development & ideation) • Sharing learning and knowledge across government agencies • Build interdisciplinary teams centred on products • Technological integration & interoperability	Intra & inter-organizational connectivity & sharing	Integrated & collaborative government structures	Organizational elements enabling digital innovation
• Centralize delivery of digital customer services • Accelerate digital capability and strategies across government agencies • Allocate organizational units to accelerate digital innovation	Implement central structures for digital innovation		
• Leverage available commercial technologies • Leverage industry methodologies & ways of thinking • Leverage & tapping into commercial ideas • Leverage industry data & models	Leverage industry partner resources	External ecosystem collaboration	
• Leverage research capability to incorporate new ways of looking at something	Leverage R&D problem solving skills		
• Building an ecosystem of information and data exchange • Role of government is to collect and protect data • Role of government is to stimulate innovation in the market	Stimulate open innovation in the market		
• Implement cloud infrastructures • Utilize modern Web development tools	Leverage new functional ways of service development	Digital technologies & infrastructure	
• Emerging digital technologies, (e.g., artificial intelligence, infrared flash cameras, digital twins, 4D data & modelling)	Leverage new functional capabilities for new service outcomes		
• Manuals, systems, and procedures to ensure consistent replication and best practice	Formalize digital standards and frameworks		
• Digital strategies • Customer outcomes strategies • Digital & customer strategies	Digital and customer-first strategies	Digital & customer strategies and digital innovation skills	
• Dedicated political leadership to drive digital & customer • Senior leadership digital maturity &	Drive digital & customer priorities through political and		

mindsets	senior leadership		
• Leverage existing internal digital skills • Build an agile workforce • Develop project delivery maturity • Train people to recruit the right resources	Build agile digital delivery skills		
• Senior leadership driving a culture of cautious risk acceptance • Senior leadership encouraging exploration of ideas outside boundaries • Senior leadership endorsement for trialing ideas	Empower internal staff through senior leadership accountability & advocacy	Passionate & entrepreneurial mindsets	
• Develop internal passion to solve a problem space • Provide opportunities for staff to voice new ideas	Build an environment enabling organization-led innovation		
• Execute on citizen life journeys • Unpack & define a specific customer problem (rather than solution-first) • Reframe understandings of complex problems using data • Human-centered design	Understand and frame customer problems & life journeys	Customer-centric management processes	
• Product management practices for digital products • Establish portfolio view of projects and programs	Customer-centric program/project management		
• Drive funding by customer value & impact • Centralized funding mechanisms for citizen life journeys	Establish outcomes-based investment/funding models		
• Fail safe and fail fast through agile experimentation (i.e., developing and testing hypotheses, proof of concepts) • Start small through agile development (pilot & scaling, developing MVP, iterative development) • Deliver quick benefits through agile rapid development (continuous improvement, alpha & beta prototypes)	Establish agile ways of working	Agile management processes	
• Seed funding to enable testing ideas and assumptions • Fund discovery and proof of concepts rather than a defined solution first • Fund iteratively small packages to deliver quick benefits and wins • Fund iteratively for due diligence and risk reduction	Establish agile investment		
• Abide by existing data frameworks, policies & models • Develop, amend, and adapt data legislation to enable information exchange	Establish data government & legislation	Management processes for retaining trust and transparency	
• Data management • Cybersecurity	Protect data		

About the Authors

George Joukhadar is a Senior Lecturer at UNSW's School of Information Systems and Technology Management. His research delves into the evolving landscape of technology, focusing on exploring novel ways for organizations to enhance their efficiency and productivity through the utilization of emerging digital tools. Recognizing the need for digital sustainability, George balances the benefits of digital transformation with environmental and social responsibility. His research aims to shape a future where technology and sustainability coexist, transforming society for the better.

Rachel Jiang is a digital analyst at the Commonwealth Bank of Australia, and formerly an Honours Student Researcher at UNSW's School of Information Systems and Technology Management. Her research primarily focuses on digital innovation within public sector organizations. She has held roles in digital innovation to build digital customer experiences with the Commonwealth Bank of Australia, PwC, Digital Transformation Agency and Insurance Australia Group

Kate Harrington is Head of Strategic Digital Initiatives at the NSW Department of Customer Service. With over 25 years of service in the NSW public sector, she has worked across operational, corporate service, policy and strategy areas, and was awarded the Premier's Innovation Award for her leadership of open data across the NSW Government. Kate's PhD is from UNSW which focused on the effectiveness of public sector reform through ICT and she has published several articles on digital transformation by government.

Alan Thorogood manages research and engagement for MIT Sloan's Center for Information Systems Research in Asia-Pac and is a senior visiting fellow at UNSW. His research explores how organizations partner effectively with others of various sizes or types and how they can build their own digital capability. Drawing on in-depth qualitative data from start-ups, SMEs, banks, corporations, and government agencies, he works with successful large organizations that manage innovative relationships. The proper guardrails allow managers and entrepreneurs to move quickly with executive support. With a background as an executive in financial services, the public sector, and multinational consulting companies. He set up Accenture's digital strategy group in Asia-Pac, Westpac's digital ecosystem approach, and was the Head of Digital Strategy in Australia's Turnbull administration.