“Strengthening municipal resilience through digital governance maturity”

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STRENGTHENING MUNICIPAL RESILIENCE THROUGH DIGITAL GOVERNANCE MATURITY

Abstract

As disruptions intensify in frequency and complexity, municipalities face growing pressure from society to strengthen their resilience to navigate these disruptions, maintain critical functions under unstable conditions, recover effectively, adapt, and transform. Hence, this study examines how resilience strategies and digital governance maturity interact to shape municipalities' capacity to cope with disruptions, and how the domains of strategy, people, and processes enable this relationship. Using a systematic literature review, we found that resilience is a multifaceted phenomenon, in which bounce-back, bounce-forward, and bounce-beyond strategies are complementary rather than sequential, requiring municipalities to balance continuity with adaptation and transformation. The synthesis also allowed us to conclude that the feasibility of these strategies varies with digital governance maturity: digital consistency tends to support robust continuity and reliable service delivery, digital adaptation enables learning and flexible reconfiguration, and digital transformation underpins structural change and renewal. Finally, we revealed that these strategy-maturity linkages are enabled by the extent to which strategy, people, and processes are aligned, including leadership and governance arrangements, employee capabilities, and redesigned procedures and routines.

Building on these findings, we propose an integrative synthesis of the literature and derive concluding propositions linking municipal resilience strategies, i.e., bounce back, bounce forward, bounce beyond, with digital governance maturity levels, i.e., digital consistency, digital adaptation, digital transformation, through the alignment of strategy, people, and processes as the enabling mechanism shaping this relationship.

Keywords municipal resilience, digital governance, maturity, strategy, organizational resilience, enablers

JEL Classification H12, D81, O33

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INTRODUCTION

Contemporary economic progress, characterized by a highly dynamic discourse, continuous uncertainty, and a range of unexpected crises, has compelled organizations to undergo profound transformations aimed at strengthening their resilience. In this rapidly shifting environment, they have had to acquire new skills, adapt to new contexts, and manifest leadership approaches that diverge from standard practices, thereby setting new pathways. However, identifying and implementing these pathways is a complex process that requires strategic thinking, adaptability, and the ability to operate under conditions of uncertainty (Nematollahi et al., 2024). This challenge is particularly acute at the municipal level, where the essential role of local governments in everyday public service delivery is often undermined by sector-specific constraints, including hierarchical structures (Aristovnik et al., 2023) and institutional rigidity (Gangneux & Joss, 2022). As a result, disruptions can quickly become stress tests not only of operational capacity, but also of public trust and legitimacy.

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Against this backdrop, digitalization is increasingly positioned as a key driver of municipal resilience in response to structural barriers (Spicer et al., 2023). Digitally enabled operations can streamline service delivery and support citizen engagement through e-government platforms and participatory tools, thereby enhancing transparency and public value, especially when stakeholders seek credible, digitally supported guidance during crises (Ansell et al., 2024). However, the ability to deliver value through digital governance initiatives hinges on more than isolated technologies; it depends on the development of a digital ecosystem integrating processes, services, relationships, structures, and technology (Debeljak & Decman, 2022). This is why municipalities face mounting pressure to digitalize in ways that strengthen public value rather than merely automate existing routines (Lekkas & Souitaris, 2023). However, knowledge remains limited regarding how different levels of digital governance maturity are connected to the strategic approaches municipalities adopt in responding to disruptions. Prior research often discusses resilience through adaptation or crisis management (Lekkas & Souitaris, 2023; Roztocki et al., 2024; Choi & Park, 2023), while paying less attention to differentiated resilience strategies – bounce-back, bounce-forward, and bounce-beyond – that capture how municipalities maintain continuity while also adapting and transforming during disruption. This gap is significant because clarifying the interaction between digital governance maturity and resilience strategies is essential for municipalities seeking to make resilience-building and digital initiatives mutually reinforcing rather than parallel efforts. To address this gap, this study conducts a systematic literature review that examines in greater depth the underlying mechanisms linking digital maturity to strategic resilience responses and the enabling roles of strategy, people, and processes in shaping this relationship.

Thus, the aim of this research is to clarify, based on a review of previous studies, how resilience strategies and digital governance maturity interact to shape municipalities' capacity to cope with disruptions, and how the domains of strategy, people, and processes enable this relationship.

1. LITERATURE REVIEW

The disruptions caused by the COVID-19 pandemic have prompted researchers to scrutinize theoretical perspectives on municipal resilience, in line with other phenomena, such as digitalization (Uster, 2024; Shen et al., 2023; Clement et al., 2023; Levesque et al., 2024). A synthesis of the literature enabled us to identify a wide range of methodologies used to examine the interconnections between municipal resilience and digital governance. Several publications that adopted a quantitative methodology used survey-based statistical analysis. Studies employing qualitative methodologies employed qualitative content analysis and interviews. A large proportion of case studies used surveys and document analysis. Among the reviewed articles, only one was a systematic literature review that explored incremental and transformative digitally induced public-sector change (Haug et al., 2024). While this study is important, it did not explicitly examine how these two approaches influence the development of distinct pathways of resilience.

Using the deductive method, we first identified a predefined set of codes and sub-codes drawn from the existing literature on municipal capacity to cope with disruptions by enhancing distinct resilience strategies through digital governance. We employed a line-by-line coding method to examine how existing knowledge aligns with these pre-established codes. Data coding was performed using MAXQDA for data analysis.

The first coding approach for realizing resilience potential encompasses the capacity to "bounce back," i.e., a municipality's ability to return to its pre-crisis state. This is typically achieved by establishing stable processes and clear lines of responsibility (Clement et al., 2023). While it offers certain advantages, given its focus on securing stability and timely recovery from any disruption, it comes with some constraints, such as recovery to the level present prior to a crisis not always being possible. However, maintaining stability ensures that, during adversity, core functions are preserved and continue to function as usual (Lekkas & Souitaris, 2023). To some extent, this argument supports

the need to implement a bounce-back strategy, as a municipality's primary responsibility is to ensure uninterrupted service provision and social well-being.

However, Ansell et al.'s (2024) seminal work emphasizes that while there is nothing wrong with maintaining stability and preserving functions during any disruption, adjusting to new opportunities during a crisis is essential. Moreover, the aim of restoring the equilibrium of performance to that seen before a crisis is not always possible. Thus, local administrative units should be prepared to establish stable conditions based on the newly available information. This perspective leads to the second "bounce forward" sub-code, which addresses an organization's ability to respond to changing circumstances and recover by adjusting its equilibrium to the new normal rather than returning to the state prior to the crisis. The bounce-forward situation requires organizations to implement the necessary modifications and respond with greater adaptability to unforeseen disruptions (Nolte & Lindenmeier, 2023). Adapting to new environments during disruptive events requires adaptive capacity, which can be safeguarded by a "bounce-forward" strategy. According to Horák and Špaček (2024), a bounce-forward strategy is oriented to enhance an organization's ability to reorganize and adapt to changed circumstances, such as working from home during a pandemic. Adaptive capacity equips local governance institutions with the capacity to adjust their everyday routines to meet future challenges. Lastly, a third research stream emerged in the literature, enabling us to refine a third analytical sub-code that reveals how municipalities can strengthen their resilience through a "bounce beyond" strategy, which involves the organizational capacity to transform, resulting in innovative solutions to operate without looking back (Ansell et al., 2024). "Bounce-beyond" strategy can help maintain dynamic resilience (Ansel et al., 2024) or transformative resilience (Shen, 2023). This concept, first addressed in Clement et al.'s (2023) seminal work, is associated with the ability of an organization to reconfigure and change in the face of adversity. Local governance institutions that develop bounce-beyond strategies maintain agility, collaboration, and networking, and respond flexibly to complex situations (Nolte & Lindenmeier, 2023). Shen (2023) also proposes the conditions crucial to securing transformative capacity: public entrepreneurship, inter-organizational coordination, and citizen co-production of public services. Their study revealed that those organizations that integrated digital solutions during the pandemic were able to secure more decentralized public service provision and create collaborative value with stakeholders, leading to transformative resilience. Local governance institutions that adopt the bounce-beyond strategy position themselves to experience a positive disruption effect related to innovative outcomes and positive change (Clement et al., 2023).

To assess whether municipalities are better equipped to cope with disruptions when resilience-building efforts are strengthened through digitally enabled governance, we used predefined codes that elucidate the levels of digital governance maturity within local governance organizations. The initial level was delineated by a sub-code on digital consistency, which pertains to the uniformity and stability of digital processes within organizations (Levesque et al., 2024). The second recognizes the capacity for digital adaptation, defined as the organizational ability to develop new digital solutions that respond to new situations and needs arising from both external and internal environments (Haug et al., 2024). Finally, the third level of digital governance maturity, identified by a sub-code on digital transformation, refers to major transformations within an organization and its engagement with citizens, enterprises, and external stakeholders (Clement et al., 2023).

The review revealed that different crisis-response strategies shaped municipalities' capacity to adopt digital technologies, highlighting that the effectiveness of digital government innovations depends largely on organizations' strategies and their readiness to embrace change, and emphasizing that one size does not fit all. Clement et al. (2023) demonstrate that the pandemic accelerated digitalization trajectories more rapidly than previously anticipated, serving as a catalyst for transformation. Extending this discussion, Gangneux and Joss (2022) argue that crises can serve as powerful drivers of digital government transformation. Their findings suggest that the experience of crisis heightened an awareness of the value of data, leading to changes in how data are collected and

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governed, including the introduction of new reporting requirements. Moreover, they stress that digital transformation must be sustained beyond the immediate response phase, with a shift toward more permanent, future-oriented solutions. One such avenue involves fostering citizen inclusion. In this regard, Irajifar and Vu (2022) found that local administrations in Australia have adopted a human-centric approach, leveraging innovative technologies to enhance public engagement in co-designing and co-creating cities. This approach not only supports higher living standards and economic growth but also contributes to the development of more inclusive urban environments. In practice, it works because citizens collaborate closely with local governance institutions in designing, developing, and testing solutions that shape how they live, work, and interact.

Furthermore, Shen et al. (2023) elucidated that digital platforms serve as facilitators in the transition from recovery resilience to transformative resilience. This occurs through the adoption of and experimentation with digital platforms alongside public entrepreneurship, the achievement of a critical mass of users, and the incentivization of public service co-production, as well as the establishment of accountability mechanisms for government responsiveness. These findings align with those of Nolte and Lindenmeier (2023), who argue that digitalization often functions as a tool for stakeholder participation. Their research revealed that organizations relying on static resilience strategies demonstrate less willingness to collaborate with stakeholders than those with dynamic resilience strategies and tend to remain within closed system structures. In contrast, public sector institutions that implement alternative processes supported by information and communication technology (ICT) appear to be more resilient when dealing with future crises than their less-digitalized counterparts. This occurs because digital technologies provide a means for sharing data, enabling rapid communication and coordinating activities during crises, which, in turn, leads to increased trust and satisfaction with local institutions among citizens (Profiroiu & Nastacă, 2021). Municipalities that deliver information and services through digital platforms have more flexibility in addressing citizens' needs during disruptions (Levesque et al., 2024). Moreover, by leveraging digital platforms, local governments can enhance operational efficiency through automation and the deployment of new digital services (Carlsson et al., 2023). However, as emphasized by Choi and Park (2023), realizing these benefits depends on the presence of an innovative organizational culture, advanced digital technologies, and empowered employees, which are identified as key conditions for strengthening resilience in the municipalities.

Although Fleron et al. (2021) argue that digital governance strengthens the resilience of society as a whole rather than merely creating resilience within an organization, the implementation of digital initiatives does not automatically guarantee resilient public administration and public service provision (Shen, 2023). This is due to the various constraints encountered at the municipal level, such as top-down policies and centralization (Horák & Špaček, 2024); an inward-oriented working style (Nolte & Lindenmeier, 2023); hierarchy, procedures, formalities, and norms (Profiroiu & Nastacă, 2021); insufficient data-related skills, and gaps in digital capabilities (Gangneux & Joss, 2022). For instance, Lafioune et al. (2023) concluded that digital transformation within Canadian municipalities occurred in a fragmented manner, primarily due to the absence of systematic strategies and a limited understanding that digital transformation entails long-term change encompassing technology, people, processes, and stakeholders. Previous research also suggests that innovative outcomes arise from organizations that share a strong innovation-oriented culture together with the values of openness, flexibility, competence, professionalism, employee responsibility, and risk-taking (Choi & Park, 2023). However, Ansel et al. (2024) argue that government organizations are, first and foremost, responsible for preserving certain essential functions that cannot be sacrificed in the relentless search for new products, forms of operation, or technologies. Nevertheless, they must be prepared to adapt to the evolving conditions that may arise during a crisis. Thus, the primary challenge for public institutions lies in balancing change strategies and the imperative for stability. Choi and Park (2023) demonstrated that public institutions in South Korea felt enormous pressure to overcome the crisis experienced during the pandemic. Staff became more defensive, creating a culture of

anxiety. Moreover, these cultural changes in organizational behavior did not return to the previous state after the pandemic, when the organization's culture was more open, innovative, and empowering. We can infer from this that local institutions in South Korea were not ready to operate in a crisis mode during the pandemic, which could have led to adverse outcomes. This underscores the importance of balancing strategies to maintain stability, adaptation, and the capacity to anticipate and transform in response to disruption.

However, any strategy is only effective when implemented by competent people (Zivanovic et al., 2023). For instance, individuals with greater digital and cross-functional skills can respond more rapidly to changing conditions and integrate digitally induced decisions to recover from a crisis (Haug et al., 2024). Lafioune et al. (2023) found that most municipalities they analyzed did not fully grasp the benefits of digital transformation. A lack of knowledge led to limited interest in digitalization and, consequently, fragmented initiatives, hindering effective change. Thus, a low level of digital maturity leads to larger-scale issues related to resistance to change, including resilience development patterns. This supports Haug et al. (2024), who noted that "adjustment to a new digital environment has behavioral implications when new norms and values are introduced in the workplace, and public sector employees are introduced to new tasks." Nevertheless, enhancing digital maturity in local governance institutions is essential. Additionally, Nkomo and Kalisz (2023) argue that, in terms of value, the most important driver accelerating digital transformation was the pandemic, as the dependence on digital technologies greatly increased during this period. Although there was often no prior knowledge of how to handle the crisis, having adaptable and innovative employees enabled local institutions to improvise and suggest nonstandard digital solutions to manage the pandemic more effectively (Horák & Špaček, 2024). The issue lies in what occurs once a crisis is over. Should people be permitted to continue improvising, or should they revert to strictly structured routines? Ansell et al. (2024) suggest that to maintain the institutional capacity to adapt and transform during unknown situations, coordinated autonomy, which is enhanced through empowering people to accept decisions within a clear scope of responsibility, should always be maintained while preserving the stability of essential functions.

Lastly, given the necessity to enhance the operational efficiency of local governance institutions within systems marked by complexity, continual change, and emerging challenges (Profiroiu & Nastacă, 2021), it becomes imperative to update processes to align with more streamlined and agile approaches that can be swiftly adapted to evolving conditions (Nkomo & Kalisz, 2023). This includes procedural changes, such as the introduction of ICT platforms and data-sharing tools, and changes in routines resulting from increased standardization, automation, and digitalization of files (Haug et al., 2024). Gangneux and Joss (2022) found there was considerable intensification of data engagement by Scottish local governance institutions and also discussed challenges encountered when integrating new datasets, adopting dashboards, and repurposing systems. Changes in processes, social systems, and perceptions related to data sharing and the role of data in decision-making also played an important role. Although Spicer et al. (2023) claim that municipalities lack the processes and experience needed to effectively establish digital platforms that help them operate during critical moments, Nolte and Lindenmeier (2023) found that local governance institutions that established alternative processes, supported by ICT, were more resilient than those that were less digitalized. Although it is challenging to transform or scale up traditional processes, digital technologies greatly reduced the time needed to gather information and collect data during the pandemic; there was also a rapid increase in the development of data visualization tools, which enhanced situational understanding and facilitated rapid data-driven decisions (Josipvic & Viergutz, 2023).

To sum up, the synthesis of the retrieved articles allowed us to conclude that the alignment of all three enabling domains, i.e., strategy, people, and processes, is essential for strengthening municipal resilience; however, the literature does not consistently identify them as equally important for ensuring municipalities' capacity to cope with disruptions.

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2. GENERALIZATION OF MAIN FINDINGS AND DISCUSSION

The results revealed an evident lack of consensus on how resilience is realized and enhanced within local institutions; therefore, based on the conceptualization of resilience in the included articles, we categorized them according to their alignment with distinct resilience strategies (Appendix A). While most studies addressed resilience from a general perspective, such as resilience, capacity to change, or crisis, some explored resilience from the perspective of the distinct strategies acknowledged in this study, including bounce back, bounce forward, and bounce beyond, e.g., Clement et al. (2023), Horák and Špaček (2024), Shen et al. (2023), Ansell et al. (2024), and Nolte and Lindebmeier (2023). Some studies indicate that stable processes and clear lines of responsibility are fundamental to public-sector institutions; thus, focusing on change and flexibility at a large scale may prove risky (Nolte & Lindenmeier, 2023). Nevertheless, the need to increase institutions' awareness and preparedness to cope with a crisis is paramount. Therefore, an adaptive and transformative mode requires different strategies, in which local institutions build the capacity to "preserve key governance functions, goals, and values while adapting and innovating everything else to match shifting conditions" (Ansel et al., 2024, p. 32). In light of this argument, it can be argued that municipal resilience should be preserved through a set of strategies, such as bounce-back, bounce-forward, and bounce-beyond, that secure stability during a crisis and leave room to exploit new ways of operating.

Results demonstrate that balancing these three resilience strategies is inherently complex and requires organizations to build structural and operational readiness to explore, exploit, and shape emerging opportunities (Ansell et al., 2024). Results indicate that digital transformation emerged as a necessity rather than an option for governments aiming to respond effectively to rapidly unfolding disruptions (Carlsson et al., 2023; Eom & Lee, 2022). The empirical findings also show that digital governance is reflected through distinct levels of digital maturity. We found that most articles examining municipal resilience through digital governance capacity approached digital governance from a general perspective or explored it from the perspective of the notion of digital transformation (Appendix A). However, it is important to note that in some cases, digital transformation is used to describe separate elements of digitalization or even small digital initiatives, rather than actual transformation. After synthesizing the reviewed articles and examining how digital governance was addressed in each, the papers were assigned to the corresponding sub-codes identified in this study, i.e., digital consistency, digital adaptation, and digital transformation, based on their alignment with the characteristics of these levels. For example, Toll et al. (2023) and Andersson et al. (2021) discussed automation within a broader spectrum of organizational change, so their work was categorized as digital transformation. Where digitalization was analyzed in a broad sense, it was classified as "general." The same approach was applied to all concepts related to digitalization presented in Annex 1. Our findings also showed that few studies have examined the digital aspects of local institutions from the perspectives of digital consistency and adaptation.

The synthesis of scientific knowledge indicates that the alignment of strategy, people, and processes operates as a key enabling mechanism shaping the relationship between resilience and digital governance. We found that recognition of these enablers is uneven across the reviewed studies. Specifically, while individual studies frequently address one or two enabling domains, only six prior studies (Gangneux & Joss, 2022; Haug et al., 2024; Horák & Spacek, 2024; Lafioune et al., 2023; Lekkas & Souitaris, 2023; Nematollahi et al., 2024) simultaneously acknowledge all three enablers, i.e., strategy, people, and processes, within the context of digitally enabled municipal resilience. Our findings further suggest that resilience development through digital initiatives is most consistently associated with a balanced alignment of all three domains. Where this balance is absent, initiatives tend to remain largely declarative when driven solely by strategy, or to become fragmented and under-resourced when driven primarily by the employee (people) perspective without corresponding strategic direction and process integration.

Taken together, these systematic findings suggest that realizing the characteristics of distinct digital governance maturity levels is not merely descriptive but may be central to understanding why some municipalities strengthen their resilience to tackle turbulence more effectively than others. Hence, we propose an integrative synthesis of the literature and derive concluding contributions to public management theory, linking municipal resilience strategies, i.e., bounce back, bounce forward, bounce beyond, with digital governance maturity levels, i.e., digital consistency, digital adaptation, digital transformation, through the alignment of strategy, people, and processes as the enabling mechanism shaping this relationship.

The first contribution directly responds to the key findings, demonstrating that resilience is influenced by digital governance maturity, shaping whether municipalities respond to disruption primarily through stability-oriented continuity or through more adaptive and transformative action. By examining the balance of different resilience strategies, we found that different levels of digital governance maturity correspond to different resilience behaviors during disruptions. This aligns with Shen (2023), who demonstrates that digital platforms can facilitate movement from recovery resilience toward transformative resilience during crises through active adoption and experimentation. Building on this, our review suggests that such shifts are more likely under higher digital governance maturity, as it helps strengthen adaptive and transformative capacity rather than only maintain continuity.

Synthesizing the retrieved articles enabled us to identify three distinct resilience strategies. The first one involves the municipal capacity to bounce back during disruptions and addresses static resilience, which equips municipalities with the capacity to preserve their main functions during a crisis. The main point is that municipalities must maintain their core functions and foster trust with citizens during any disruption. This supports Janssen and van der Voort's (2020) argument that municipalities cannot focus solely on change and flexibility, as stable processes and clear lines of responsibility are fundamental to local institutions. At the same time, our findings add nuance by showing that stable continuity is not sufficient on its own. Municipalities are expected to remain stable and predictable while also demonstrating flexibility and adaptability, meaning that resilience in practice involves managing this tension between reliability and responsiveness rather than choosing one over the other. This paradox demonstrates that public institutions, first and foremost, must demonstrate stability and routine by providing essential services to citizens. At the same time, they must be ready to operate under conditions of great adversity, which requires them to be agile and flexible. Although our results indicate that balancing strategies to sustain different levels of resilience is important, we found that the interplay between various resilience strategies and digital governance maturity levels, which in our study we concluded as digital consistency, digital adaptation, and digital transformation, remains underexplored. This could explain Lafioune et al. (2023)'s perspective that municipalities often do not fully grasp the benefits of digital transformation, resulting in fragmented initiatives that hinder effective digital transformation. These findings prompt further inquiry. If digital governance in municipalities has already evolved in diverse ways, how might this variation influence their ability to manage adverse events? In this regard, Tangi et al. (2021) found that the full benefits of digital transformation can be realized if institutions transform their social systems. Nevertheless, their study also revealed that while digital technologies enhanced changes in technical systems, social systems remained untransformed.

Our second contribution builds on the key findings by showing how this interaction between resilience and digital governance maturity is enabled through three municipal administration domains: strategy, people, and processes. Our findings indicate that municipalities that align all three domains in a balanced way demonstrate higher resilience than those that do not. For instance, Nkomo and Kalisz (2023) identified people and technology as key drivers for digital transformation, a trend accelerated during the pandemic. Similarly, Haug et al. (2024) contend that employees' roles remain crucial regardless of organizational changes. However, taken together with our results, we argue that to establish comprehensive resilience, aligning all three components is essential. Municipalities are typically good at develop-

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ing strategies to respond to current events; however, our findings suggest they often lack the personnel and talent to implement them effectively, leaving them declaratory rather than operational. To stress further, Uster (2024) emphasizes that paper planning during a crisis exposes municipal weaknesses, which can contribute to citizens' distrust in subsequent decisions to address the crisis.

In conclusion, our findings indicate that municipal resilience is strengthened when resilience-building is enacted through digitally enabled governance and when strategy, people, and processes are aligned rather than addressed in isolation. Synthesizing these insights, our conceptual framework connects resilience strategies (bounce back, bounce forward, bounce beyond) with digital governance maturity (consistency, adaptation, transformation), thereby offering a structured lens for interpreting how municipalities operationalize resilience in practice and for guiding subsequent empirical testing.

CONCLUSION

The objective of this study was to examine how municipal resilience strategies interact with digital governance maturity to shape municipalities' capacity to cope with disruptions, and how this relationship is enabled through the alignment of strategy, people, and processes. Based on a systematic literature review, the findings allowed us to conclude that municipal resilience is a multifaceted phenomenon in which bounce-back, bounce-forward, and bounce-beyond strategies are complementary rather than sequential, requiring a continuous balance between continuity, adaptation, and transformation. The synthesis further reveals that the feasibility and effectiveness of these strategies vary according to digital governance maturity, i.e., digital consistency, which primarily supports stability and reliable service delivery, digital adaptation, which enables learning and adaptation, and digital transformation, which underpins more profound structural change and renewal. Finally, the review demonstrates that these resilience strategy-digital governance maturity linkages are not automatic but are enabled by the degree of alignment between strategy, people, and processes, including leadership and governance arrangements, employee capabilities, and redesigned organizational routines.

Drawing on these results, this study concludes that municipal resilience outcomes emerge from the interplay between specific resilience strategies and corresponding levels of digital governance maturity, mediated by the alignment of strategic intent, personnel capabilities, and operational processes.

AUTHOR CONTRIBUTIONS

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APPENDIX A

Table A1. Synthesis of approaches to resilience strategies and digital governance levels

Digital maturity / Resilience strategies		Digital (general approach)		Digital consistency				Digital adaptation						Digital transformation			
		Digital technology/ digital solutions/ digitalization	Digital maturity	Digital services	Digital connectivity	Digital platforms	Digital infrastructure	Digital capacity/ readiness	Digital citizenship	Digital divide	Digital governance initiatives	Digital era governance	Digital marketing	Digital strategies	Digital automatization	Digital twins	Digital transformation
GENERAL	Resilience	Daub et al. (2020); Irajifar and Vu (2022); Villani et al. (2023)		Levesque et al. (2024)				Profiroiu and Nastaca (2021)		Taylor et al. (2021)						Josipovic and Viergutz (2023)	Nkomo and Kalasz (2023); Florén et al. (2022); Zhang et al. (2021)
	Crisis	Choi and Park (2023)						Spicer et al. (2023)				Aristovnik et al. (2023)					Eom and Lee (2022); Gangneux and Joss (2022)
	Change		Debeijak and Decman (2022)								Tangi et al. (2021)						Haug et al. (2024); van der Hoogen et al. (2024)
BOUNCE-BACK	Static resilience											Nolte and Lindebmeirer (2023)					
	Bounce-back (coping)	Perney and D'Angelo (2023); Clement et al. (2023)	Horák and Spacek (2024)		Marshall et al. (2023)	Shen et al. (2023)	Wahba (2022)										Shen et al. (2023)
BOUNCE FORWARD	Bounce forwards (adapting)	Perney and D'Angelo (2023); Clement et al. (2023)	Horák and Spacek (2024)		Marshall et al. (2023)	Shen et al. (2023)											
	Adapting	Lekkas and Souitaris (2023); Choi and Park (2023); Huby (2024); Mao et al. (2023); Palm (2020); Roztocki et al. (2024); Zaychik et al. (2024)				Uster (2024); Madon et al. (2022)			Suphattanakul et al. (2023)		Esposito et al. (2024)	Nolte and Lindebmeirer (2023)	Valtolina and Fratus (2022)	Munoz et al. (2022)	Toll et al. (2023); Andersson et al. (2021)		Carlsson et al. (2023); Lafontaine et al. (2023)
BOUNCE BEYOND	Bounce-beyond (transforming)	Perney and D'angelo (2023) Clement et al. (2023)	Horák and Spacek (2024)														
	Robustness and agility, antifragility	Ansell et al. (2021)										Ansell et al. (2024)					Bartuseviciene and Butkus (2024)