
RESILIENCE AT THE LOCAL LEVEL: LINKING DIGITAL GOVERNANCE MATURITY TO MUNICIPAL RESILIENCE EMPIRICAL INSIGHTS FROM LITHUANIA

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Abstract:

Digital governance is increasingly viewed as a key driver of municipal resilience, enabling municipalities to modernize operations, streamline service delivery, and strengthen citizen engagement through e-government and participatory tools, thereby enhancing transparency and public value and catalyzing innovative outcomes. Accordingly, this study examines how digital governance maturity (digital consistency, adaptation, transformation) interacts with resilience strategies (bounce back, bounce forward, bounce beyond) to shape municipalities' capacity to cope with disruptions, and how alignment of strategy, people, and processes domains enables this relationship. Drawing on prior research, this study proposes and tests a model linking different levels of digital governance maturity to distinct municipal resilience strategies. The model is empirically examined using CB-SEM, based on survey responses collected from all sixty municipalities in Lithuania. The results indicate that digital governance maturity at the digital consistency stage is not significantly associated with municipal resilience strategies. In contrast, digital adaptation has a strong, positive, and significant effect across all three resilience strategies, while digital transformation has a negative but significant effect, suggesting that overly ambitious digital reforms may undermine resilience if institutional readiness and governance integration are insufficient.

Key words: *bounce back, bounce beyond, bounce forward, digital governance, municipal resilience*

1. Introduction

Faced with ongoing uncertainty and frequent disruptions, municipalities are under increasing pressure to strengthen their resilience, prompting local governance officials and researchers to seek effective ways to support local stability and adaptability. Recent studies have demonstrated that digital governance is a crucial area for enhancing municipal resilience (Perney & D'Angelo, 2023; Choi & Park, 2023; Horák & Špaček, 2024). Crises such as COVID-19, the ongoing global geopolitical instability, and natural disasters have already shown that digitally induced decisions can act as a catalyst for municipal resilience, enabling municipalities to respond to a crisis more efficiently while addressing citizens' needs as much as possible (Nolte & Lindenmeier, 2023; Ansell et al., 2024). For example, municipalities that implemented advanced digital solutions were better equipped to manage the COVID-19 pandemic's multifaceted challenges, utilizing data-driven decision-making, integrated information systems, and remote working capabilities to sustain essential services and uphold public trust (Spicer et al., 2023; Josipovic & Viergutz, 2023).

However, the level of digital maturity across municipalities is often uneven, leading to equity challenges in the distribution of public services (Shen et al., 2023; Radovic-Markovic, 2025). This is particularly important because, as Riveros-Gavilanes et al. (2025) emphasize, the increased adoption of digital solutions within municipalities also encourages citizens to adopt digital services. Digitally advanced municipalities leverage integrated platforms and innovative solutions, such as digital twins and real-time analytics. They are well prepared to mobilize resources, streamline coordination, and maintain uninterrupted service delivery even in the face of disruptive conditions (Josipovic & Viergutz, 2023; Eom & Lee, 2022). Interestingly, a study by Brici and Achim (2023) shows that the digitalization of government services reduces economic and financial crime, influenced by transparency among institutions and increased trust. Conversely, municipalities with lower levels of digital maturity face various barriers, including in terms of communication, coordination, and resource allocation, which can expose vulnerabilities during turbulent events (Uster, 2024).

Nevertheless, despite an increasing number of studies demonstrating a clear link between digitalization and municipal capacity to cope with disruptions, knowledge remains limited regarding how various levels of digital maturity influence the emergence of municipal resilience strategies. Therefore, in this study, we aimed to explore the interconnections between different levels of digital governance maturity and resilience strategies within municipalities. By assessing digital governance maturity through the lens of digital consistency, adaptation, and transformation – and analyzing resilience through Clement's (2023) framework of 'bounce-back,' 'bounce-forward,' and 'bounce-beyond' approaches – we sought to contribute to the argument proposed by Ansell et al. (2024) regarding the need to balance these distanced approaches. The authors argue that balancing these strategies is inherently complex and requires municipalities to build structural and operational readiness to explore, exploit, and shape emerging opportunities. Accordingly, by moving beyond a general understanding of the relationship between digitalization and resilience, this study provides novel insights into how varying levels of

digital governance maturity influence municipalities' capacity not only to withstand adversity but also to adapt and transform in the face of unexpected challenges.

Additionally, this study aims to explore the enablers of digitally enhanced municipal resilience. Some studies indicate that a municipality's ability to cope with adversity is embedded in its strategic frameworks (Choi & Park, 2023; Clement et al., 2023). In contrast, Carlsson et al. (2023) argue that it is all about the people and their capacity to respond effectively to disruptions. Drawing on the theoretical frameworks proposed by Lafioune et al. (2023), Gangneux and Joss (2022), and Haug et al. (2024), this study conceptualizes strategy, people, and processes as the core enablers of digitally enhanced municipal resilience. The novelty of the study lies in exploring how these enablers interact and vary across municipalities with different levels of digital maturity and resilience. Finally, the Lithuanian context also represents an important dimension of this study, given the country's rapid digitalization in the public sector and its complex geopolitical environment, which requires constant preparedness to address emerging security, economic, and political uncertainties.

Given the range of existing academic viewpoints and the identified research gaps, this study offers a novel perspective on digitally induced municipal resilience by focusing on the interplay of its key enablers: strategy, people, and processes. To the best of our knowledge, no prior research has systematically addressed this perspective, making this study a valuable contribution to the academic discourse on municipal capacity to cope with adversity through digital governance. At the same time, the research has strong practical relevance, offering policymakers insights into how digital governance can be leveraged to enhance municipal resilience.

This study is structured into five main parts. Following the introduction, it presents the literature review, outlines the methodology, reports the results, discusses the main findings, and concludes with the concluding remarks and implications.

2. Literature review

During crisis-induced turbulence, leaders of local government institutions must take action and make choices under intense time pressure, often with only fragmentary knowledge about the situation and any potential solutions (Malicka et al., 2024). However, decisions must still be taken swiftly and efficiently if public trust is to be preserved (Aristovnik et al., 2023). To achieve this, Roztocki et al. (2024) demonstrate that proactive leadership, paired with relevant, timely, and reliable communication, can reduce citizens' anxiety and distrust. At the same time, they emphasize that reaching this standard is much more difficult without digital processes, platforms, and tools. In a related insight, Daub et al. (2020) argue that digital processes enable municipalities to respond rapidly and meet increasing public expectations even with limited resources. Moreover, the ability to integrate digital technologies enables institutions to stay aligned with broader technological advances, ensuring that public services not only remain functional and continuous during crises but are also adaptive and transformative in response to changing environments (Sfounis et al., 2024). For instance, Clement et al. (2023) found that municipalities that encountered greater disruptions due to the COVID-19 pandemic were more proactive in

introducing technology-based solutions than their less affected counterparts, which tended to make fewer digital adjustments. However, it remains unclear whether the latter category of municipalities genuinely lacked a pressing need to increase their level of digital governance or were primarily held back by a shortfall in organizational capacity. The literature suggests a common theme, i.e., that the pandemic accelerated digitalization trends far more rapidly than earlier shocks, serving to catalyze a critical breakthrough for digital innovation across local governance institutions (Gangneux & Joss, 2022; Carlsson et al., 2023).

Notably, Nolte and Lindenmeier (2023) demonstrate that municipalities that had already established information and communications technology (ICT)-supported processes before the pandemic proved markedly more resilient than less digitally mature institutions. These findings suggest that digital maturity should not be developed in the heat of a crisis; instead, it must be cultivated methodically during calmer times. However, Spicer et al. (2023) argue that the public sector's unique constraints, most notably a shortage of qualified talent, make that task anything but straightforward. Therefore, although embedding discrete digital processes is a helpful first step, without a strategic, system-wide vision for strengthening municipal resilience through digital governance, the gap between digitally advanced and lagging municipalities will only widen. In turn, this divergence becomes a barrier to collaboration, specifically in sharing scarce resources and critical information, which becomes crucial for the effective management of a crisis (Dragomir et al., 2023). This is why researchers are calling for innovative strategies that integrate digital transformation into every aspect of municipal resilience (Choi & Park, 2023). However, Ansell et al. (2024) caution that even the best-laid strategies can falter when an unfamiliar shock arrives; thus, at times, 'good-enough' improvisation is the only sensible course. In such moments, the spotlight shifts to frontline staff, particularly individuals who can improvise and deploy technology creatively, or, as Ansell et al. (2024) observe, can spark innovative outcomes during disruptions at multiple scales. In addition, Carlsson et al. (2023) suggest that municipalities with higher levels of digital literacy pull their local communities along with them, strengthening not only their organizational resilience but also the collective ability of citizens to navigate whatever crisis comes next. Hence, building these capabilities during calm periods so that municipalities can continue to cope successfully with disruptions beyond their established strategies is not a luxury but a prerequisite for resilient, digitally enabled local governance (Haug et al., 2024).

Although there is a large consensus in the literature that digital governance enhances municipal resilience, we must also recognize the need to analyze this phenomenon in greater detail, as differences in levels of digital maturity, chosen resilience strategies, and sector-specific constraints all impose important limitations. Previous studies indicate that the research exploring the impact of digitalization on municipal resilience often adopts a generalized approach to both digital governance and resilience. For instance, Choi & Park (2023) highlight the interconnections between crises and digital solutions, Daub et al. (2020) focus on the relationship between digital technology and resilience, and Profirou and Nastaca (2021) examine digital capacity in relation to resilience. While these studies are highly valuable and make meaningful contributions to advancing scholarly understanding of the interaction between these two phenomena, there remains a need to

examine how digitalization influences resilience across different levels of digital maturity and resilience. Therefore, to develop a more nuanced understanding of these interconnections, it is important to assess digital governance through the lens of digital consistency, adaptation, and transformation, while analyzing resilience through Clement's (2023) framework of bounce-back, bounce-forward, and bounce-beyond approaches. From this perspective, resilience in the municipal context should be approached as a multidimensional phenomenon encompassing several distinct but interrelated responses to disruption. One of the core mandates of local government is to guarantee the uninterrupted delivery of public services; therefore, many scholars argue that municipalities must first reinforce static or 'bounce-back' resilience, i.e., the capacity to restore critical functions to their pre-crisis state as quickly as possible (Clement et al., 2023; Nolte & Lindenmeier, 2023; Perney & D'Angelo, 2023). By this logic, the shorter the time needed to return to the pre-crisis equilibrium, the more resilient an organization is deemed to be. Although a bounce-back strategy is undeniably vital for safeguarding essential operations, it has notable downsides. Nolte and Lindenmeier (2023) find that municipalities committed to a bounce-back mindset collaborate less with external stakeholders, whereas Ansell et al. (2021) warn that restoring the old equilibrium may be neither feasible nor desirable. This is because crises bring forth novel information, opening the door to innovative outcomes. However, Shen et al.'s (2023) study reveals that many innovative outcomes that emerge during a crisis tend to fade once the emergency subsides. Hence, municipalities should view a bounce-back resilience strategy as a minimum safety net, not a ceiling, and ensure that emergency strategies are designed for easy expansion rather than mere restoration. A study by Bartuseviciene et al. (2022) highlights the importance of a bounce-forward resilience strategy, which Lafioune et al. (2023) also acknowledge as being a form of progressive adaptability. A bounce-forward mindset ensures that novel insights, gained during crisis, are deliberately integrated into organizational routines to establish a new equilibrium. Taking this path is slower and often hindered by resistance from employees (Choi & Park, 2023) and the risk that, for example, any newly designed services might misalign with citizen expectations (Haug et al., 2024). To avoid this, Esposito et al. (2024) suggest that digital governance integration should become indispensable, provided that effective digital channels are in place before any crisis, employees know how to use them, and municipalities can transmit real-time, data-driven information and adapt rapidly.

To extend this concept further, Clement et al. (2023) outline a bounce-beyond strategy, which seeks radical transformation rather than mere adjustment. Such 'positive disruption' is aimed at resolving complex problems through entirely new solutions and practices; hence, adopting digital governance becomes critical as it paves the way for citizen-oriented and more decentralized public service delivery, rather than a relapse into a monocentric, control-style model (Horák & Špaček, 2024).

Returning to the conceptual approaches to digital governance, it can be observed that in relation to resilience, it is conceptualized in general terms (Choi & Park, 2023; Perney & D'Angelo, 2023; Lekkas & Souitaris, 2023; Irajifar & Vu, 2022; Villani et al., 2023), rarely distinguishing between different levels of digital maturity. However, as Debeljak and Dečman's (2022) study shows, the level of maturity matters. As an illustration, one may refer to the results reported in Levesque et al.'s (2024) study, which showed that well-

designed digital services can even lead to an expansion of municipal capacity during crises. A similar finding was reported by Zwolinska-Ligaj and Guzal-Dec (2025), who revealed that higher levels of e-service delivery correlate with greater community resilience.

Therefore, given the existing research gaps and the current scholarly discourse, in this study we distinguish three levels of digital maturity to illuminate the resilience gains that can be achieved through improved digital governance.. The first refers to digital consistency, which leads to the uniform and stable application of digital processes (Levesque et al., 2024). The second recognizes the level of digital adaptation, which refers to the ability to roll out new digital solutions as needs evolve (Haug et al., 2024). Lastly, the third level, digital transformation, refers to profound structural changes that encompass the overall transformation of an organization, followed by technological advances and interaction with communities, as well as the implementation of e-training (Bartuseviciene & Butkus, 2024).

Overall, our review of the scholarly literature sharpened our conception of two key nuances. First, although researchers distinguish between the three strategies, i.e., bounce back, bounce forward, and bounce beyond, Ansell et al. (2024) argue that they must be held in careful balance because the fundamental mission of local governments is to safeguard essential functions while adapting to and responding to shifting conditions. Second, while the research discourse exhibits consensus that digitalization fosters resilience, there appears to be a limited understanding of how digital governance functions across the various resilience pathways, or of the impact different levels of digital maturity may ultimately have on those pathways. Determining the level of digital governance maturity of municipalities would equip local leaders with a clearer understanding of their current digital capabilities, concrete approaches for further improvement, and how these capacities intersect with their resilience strategies. Building on this premise, we propose the following hypothesis:

H1: Digital governance maturity (D), conceptualized through interrelated dimensions of consistency (Con), adaptation (Ada), and transformation (Tra), positively affects municipal resilience (R), reflected in the dimensions of bounce-back (Bbac), bounce-forward (Bfor), and bounce-beyond (Bbey).

At the same time, and in line with the scholarly debate around the principal enablers of municipal resilience, we examine how strategies, processes, and people operate at each level of maturity and whether discernible differences emerge across the intersecting levels of resilience and digital governance maturity.

3. Methodology

3.1 Measurement instrument

Understanding the effect of digital governance on municipalities' resilience requires a robust measurement instrument based on established research frameworks. Thus, we designed a research instrument consisting of a questionnaire developed following our literature review. The questionnaire comprised 54 questions, covering digital governance

and resilience, their three levels of maturity (consistency, adaptation, and transformation for digital governance; bounce back, bounce forward, and bounce beyond for resilience), and three dimensions for each level of maturity, i.e., strategy (S), employees (E), and processes (P) (see **Eroare! Fără sursă de referință.** and Appendix 2 for further details).

This quantitative study, conducted across all 60 municipalities in Lithuania, is situated in a particularly relevant context due to the country's rapid public-sector digitalization and its complex geopolitical environment, which necessitates constant preparedness to respond to emerging security, economic, and political uncertainties. According to the latest Digital Economy and Society Index (DESI, 2025) report, Lithuania ranks among Europe's most rapidly digitalizing nations, demonstrating substantial progress in connectivity and digital public services. Digital public services for citizens increased by 20.9% between 2020 and 2024, while the European Union average increased by 9.9% over the same period. Nevertheless, considerable disparities remain at the municipal level, with smaller and more rural municipalities frequently lagging behind major urban centers such as Vilnius and Kaunas, highlighting critical gaps in digital infrastructure and competencies.

Prior to data collection, all participants were presented with an informed consent form outlining the purpose of the study, voluntary participation, confidentiality, and data protection in line with the EU General Data Protection Regulation (GDPR). The informed consent document was attached to the online survey, and participants were required to review it before proceeding to complete the questionnaire. Formal ethics approval was not applicable, as participation was anonymous and posed no risk.

The target sample included at least three representatives per municipality, specifically mayors, deputy mayors, administrative directors, or delegated officials, as well as opposition leaders and members. In total, 204 respondents, representing all municipalities, completed the online questionnaire. Data were collected via the online questionnaire, capturing respondents' assessments of their organizations' digital governance and resilience. A link to the questionnaire was emailed to targeted municipal representatives. Follow-up calls were made to encourage participation. Descriptive statistics for the items related to digital governance and resilience are shown in Table 1 and Table 2, respectively.

Table 1. Summary statistics of items relating to digital governance.

Component		Abbreviation	Mean	95% CI	SD	Skewness	Kurtosis
Consistency	Strategy	DConS1	7.48	(7.17, 7.78)	2.08	-1.04	0.94
		DConS2	7.64	(7.35, 7.92)	1.91	-1.11	1.13
		DConS3	7.58	(7.30, 7.86)	1.91	-1.08	0.90
	Employees	DConE1	7.88	(7.63, 8.13)	1.69	-0.84	0.64
		DConE2	7.63	(7.30, 7.95)	2.21	-1.28	1.31
		DConE3	7.17	(6.83, 7.52)	2.35	-1.02	0.44
	Processes	DConP1	7.15	(6.84, 7.46)	2.12	-1.06	0.51
		DConP2	7.75	(7.46, 8.03)	1.92	-1.15	1.07
		DConP3	7.58	(7.29, 7.86)	1.94	-1.17	1.28
Adaptation	Strategy	DAdaS1	7.42	(7.11, 7.74)	2.13	-1.20	1.46

		DAdaS2	7.15	(6.81, 7.48)	2.26	-1.04	0.69
		DAdaS3	7.35	(7.01, 7.69)	2.30	-1.23	1.26
		DAdaE1	7.07	(6.79, 7.35)	1.89	-0.70	0.41
	Employees	DAdaE2	7.42	(7.06, 7.78)	2.44	-1.27	1.03
		DAdaE3	7.38	(7.05, 7.71)	2.24	-1.25	1.24
		DAdaP1	7.02	(6.70, 7.34)	2.20	-0.82	0.13
	Processes	DAdaP2	7.02	(6.69, 7.34)	2.23	-0.91	0.38
		DAdaP3	7.44	(7.12, 7.75)	2.16	-0.87	0.20
Transformation	Strategy	DTraS1	7.70	(7.41, 7.99)	1.98	-1.13	1.20
		DTraS2	7.32	(7.00, 7.64)	2.17	-1.16	1.26
		DTraS3	7.43	(7.12, 7.74)	2.13	-1.11	1.24
	Employees	DTraE1	7.35	(7.08, 7.62)	1.83	-0.91	0.87
		DTraE2	6.81	(6.49, 7.13)	2.17	-0.88	0.44
		DTraE3	7.17	(6.82, 7.52)	2.38	-1.07	0.54
	Processes	DTraP1	6.59	(6.21, 6.96)	2.54	-0.79	-0.04
		DTraP2	6.82	(6.48, 7.15)	2.30	-0.88	0.23
		DTraP3	7.33	(6.98, 7.67)	2.34	-1.00	0.34

Note: CI, confidence interval; SD, standard deviation.

Source: own elaboration

Table 2. Summary statistics of items relating to resilience.

Component		Abbreviation	Mean	95% CI	SD	Skewness	Kurtosis
Bounce-back	Strategy	RBbacS1	8.43	(8.16, 8.71)	1.85	-1.9	4.6
		RBbacS2	7.8	(7.50, 8.10)	2.03	-1.22	1.18
		RBbacS3	7.63	(7.31, 7.95)	2.17	-1.23	1.37
	Employees	RBbacE1	7.81	(7.56, 8.06)	1.71	-1.15	1.66
		RBbacE2	7.8	(7.54, 8.06)	1.79	-1.24	2.5
		RBbacE3	7.62	(7.35, 7.90)	1.86	-1.4	2.79
	Processes	RBbacP1	7.62	(7.34, 7.89)	1.86	-1.1	1.46
		RBbacP2	7.27	(6.96, 7.58)	2.11	-1.04	1.16
		RBbacP3	8.04	(7.75, 8.32)	1.94	-1.38	2.27
Bounce-forward	Strategy	RBforS1	8.27	(8.02, 8.52)	1.68	-1.21	1.62
		RBforS2	7.69	(7.38, 7.99)	2.07	-1.17	1.38
		RBforS3	6.83	(6.49, 7.18)	2.35	-1.1	0.85
	Employees	RBforE1	7.64	(7.38, 7.90)	1.79	-1.22	2.02
		RBforE2	7.78	(7.46, 8.11)	2.22	-1.21	0.98
		RBforE3	7.79	(7.47, 8.11)	2.18	-1.25	1.2
	Processes	RBforP1	7.38	(7.09, 7.67)	1.98	-1.02	1.18
		RBforP2	7.69	(7.35, 8.03)	2.33	-1.34	1.15
		RBforP3	8.21	(7.93, 8.50)	1.96	-1.53	2.46
Bounce-beyond	Strategy	RBbeyS1	7.62	(7.31, 7.93)	2.12	-1.05	0.52
		RBbeyS2	7.8	(7.52, 8.07)	1.88	-1.27	1.37
		RBbeyS3	6.81	(6.47, 7.15)	2.33	-0.9	0.27
	Employees	RBbeyE1	7.75	(7.50, 8.00)	1.67	-1.14	1.76
		RBbeyE2	6.58	(6.24, 6.92)	2.31	-0.82	0.19

		RBbeyE3	6.66	(6.30, 7.01)	2.4	-0.84	0.21
	Processes	RBbeyP1	4.91	(4.54, 5.29)	2.55	-0.26	-0.86
		RBbeyP2	6.09	(5.75, 6.43)	2.34	-0.6	-0.27
		RBbeyP3	7.28	(6.96, 7.60)	2.17	-0.91	0.34

Note: CI, confidence interval; SD, standard deviation.

Source: own elaboration

To assess whether the items used in the analysis were approximately normally distributed – a key assumption for selecting the appropriate SEM estimator – we evaluated the skewness and kurtosis of each item. We relied on distributional shape indicators. Following established thresholds from the literature, we considered a distribution to be approximately normal if skewness fell within the range of $(-2, 2)$ and kurtosis within $(-7, 7)$ (Byrne, 2010; West et al., 1995).

Based on these criteria, all 54 items used to measure digital governance and resilience exhibited acceptable levels of skewness and kurtosis. Skewness values ranged from -1.90 to -0.26 , while kurtosis values ranged from -0.86 to 4.60 , indicating that none of the items substantially deviated from univariate normality. Therefore, the data were deemed sufficiently normal to proceed with SEM estimation using maximum likelihood (ML), which is robust to minor deviations from normality.

Table 3. Cronbach's alpha measures for latent variables

Cronbach's alpha for the maturity levels of digital governance and their dimensions		Group of items of (number of items)	Cronbach's alpha for the maturity levels of resilience and their dimensions	
Consistency	0.935	Strategy (3)	0.860	Bounce back
	0.880	Employees (3)	0.884	
	0.934	Processes (3)	0.901	
	0.965	All (9)	0.943	
Adaptations	0.940	Strategy (3)	0.907	Bounce forward
	0.926	Employees (3)	0.907	
	0.948	Processes (3)	0.922	
	0.975	All (9)	0.964	
Transformation	0.930	Strategy (3)	0.933	Bounce beyond
	0.929	Employees (3)	0.873	
	0.931	Processes (3)	0.848	
	0.968	All (9)	0.950	
All	0.988	Overall (27)	0.982	All

Source: own elaboration

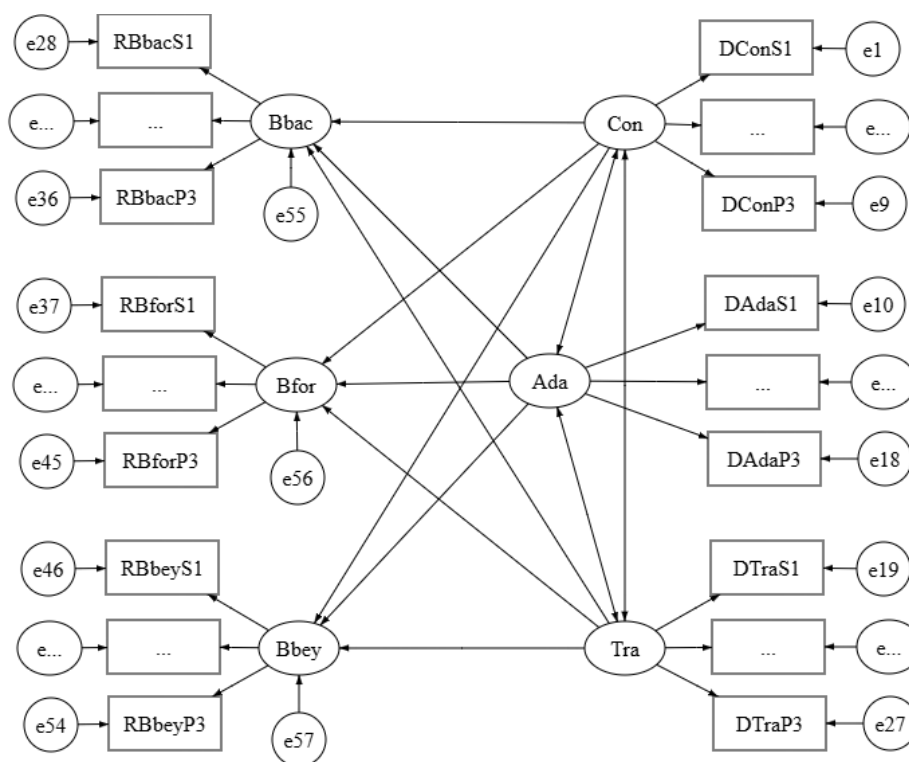
To evaluate the internal consistency and reliability of the scales used to measure the maturity levels of digital governance and resilience, Cronbach's alpha coefficients were calculated for each dimension (strategy, employees, and processes). The results indicated high to excellent reliability across all dimensions and maturity levels (Table 3), as

Cronbach's alpha values above 0.7, 0.8, and 0.9 are generally considered acceptable, good, and excellent, respectively. These findings provide strong empirical support for the instrument's reliability, indicating that the items within each latent construct were highly correlated and effectively captured the underlying theoretical dimensions of both digital governance and resilience.

3.2 Model

To test our hypothesis, we used an SEM (Figure 1). Specifically, we employed Covariance-Based Structural Equation Modeling (CB-SEM) using Maximum Likelihood (ML) estimation. CB-SEM is a statistical technique used to confirm theoretical models by comparing the implied covariance matrix of the hypothesized model against the empirical covariance matrix of the data. This approach was selected because it allows for rigorous testing of theory-driven hypotheses and provides comprehensive goodness-of-fit indices (such as CFI, TLI, and RMSEA) to evaluate how well the theoretical model fits the observed data.

Figure 1. Structural equation model (SEM) linking digital governance and resilience in Lithuanian municipalities.



Source: own elaboration

Our results revealed that across all three enablers, i.e., strategy, employees, and processes, the highest scores were consistently observed within the bounce-back component (Table 1 and Table 2). This result suggests that the municipalities were most confident and capable when it came to immediate crisis response and short-term recovery actions. Strategy, in particular, stands out, indicating that initial planning and direction-setting were well established in these contexts. The employee and organizational processes components also strongly support the bounce-back stage, reflecting a practical readiness to restore operations following a disruption. Digital consistency appeared to be particularly solid in terms of strategy and employee-related components, suggesting that foundational digital tools and structures were in place. Digital adaptation, representing a mid-stage level of maturity, reflects municipalities' increasing ability to respond dynamically and to learn from challenges, with processes slightly lagging, possibly due to limited institutional agility or resources.

However, digital transformation, particularly its process-related component, emerged as the comparatively weakest component, yielding the lowest overall values. The most notable weakness was observed in the digital transformation component, particularly in processes, which yielded the lowest overall values. This signaled that, while strategic intentions for digital transformation may have been clear and employees somewhat engaged, operationalizing such change through concrete processes remained a challenge. This gap implies that advanced digital ambitions often outpace the actual structural and procedural capacities of municipalities. Finally, when examining bounce-forward and bounce-beyond strategies, we observed that while these resilience strategies scored reasonably well in terms of strategy and employee dimensions, bounce-beyond processes were notably weak, suggesting a difficulty in institutionalizing long-term, anticipatory resilience practices.

Taken together, the data revealed the following meaningful pathway: municipalities were more prepared for immediate reaction, i.e., bounce back, than for transformative adaptation, i.e., bounce beyond. Digital maturity must evolve in tandem across the strategy, people, and particularly the process domains to fully support resilience at a higher level.

The estimated SEM demonstrated a moderate and acceptable fit, supported by several key indicators, especially considering its complexity (Table 4 and Table 5). The overall model fit was reasonable, with the chi-square/degrees of freedom ratio (3.062) falling within the commonly accepted threshold of ≤ 3 , suggesting tolerable misfit given the sample size and number of estimated parameters. The incremental fit indices showed marginal but acceptable performance: CFI = 0.810, TLI = 0.801, and IFI = 0.811. While less than the ideal 0.90, they exceed the 0.80 threshold often accepted for complex models, indicating that the model substantially improved upon the null model. The parsimony-adjusted measures (PNFI = 0.708 and PCFI = 0.773) confirmed the model's efficiency in balancing fit and complexity, with values above the commonly accepted threshold of 0.60. The RMSEA was 0.107 (90% confidence interval 0.104–0.111), slightly above acceptable levels, yet still within a tolerable range for complex models. The empirical cross-validation index ECVI was 24.693, indicating that the model had acceptable predictive potential for new samples. In summary, while not perfect, the model

showed acceptable reliability and structural validity based on key fit indices, justifying its use in hypothesis testing within a complex SEM framework.

The measurement model exhibited strong support for the adequacy of the observed indicators in capturing the intended latent constructs. All factor loadings were statistically significant at the $p < 0.001$ level and substantively high, with standardized coefficients generally exceeding 0.80. For instance, indicators of the latent construct consistency, such as DConP1 ($\lambda = 1.089$, $SE = 0.055$, $p < 0.001$) and DConE3 ($\lambda = 1.159$, $SE = 0.065$, $p < 0.001$), loaded strongly. Similarly, adaptation was robustly measured with items such as DAdaP2 ($\lambda = 1.097$, $SE = 0.053$, $p < 0.001$), while transformation showed even higher loadings, e.g., DTraP1 ($\lambda = 1.521$, $SE = 0.111$, $p < 0.001$). The three resilience maturity levels were also well-defined, with all respective indicators demonstrating significant and substantial loadings (e.g., RBforE2 on bounce forward: $\lambda = 1.110$, $SE = 0.055$, $p < 0.001$). These results confirm the construct validity of the latent dimensions and indicate that the selected items adequately capture the underlying theoretical constructs.

Table 4. Estimated covariances

Relationship	Estimate (standard error)	Significance
Consistency ↔ adaptation	3.260 (0.400)	$p < 0.01$
Consistency ↔ transformation	2.561 (0.342)	$p < 0.01$
Adaptation ↔ transformation	2.852 (0.369)	$p < 0.01$

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: own elaboration

As hypothesized, the maturity stages of digital governance were found to be significantly interrelated. Covariances among consistency, adaptation, and transformation were all positive and statistically significant at the $p < 0.001$ level. These results suggest that municipalities exhibiting strength in one maturity level of digital governance tend to demonstrate parallel development in the others, supporting the conceptualization of digital governance as an integrated and sequentially reinforcing process.

Table 5. Estimated regression weights

Predictor	Outcome	Estimate	SE	Significance	Interpretation
Consistency	Bounce back	0.107	0.398	NS	Not significant
	Bounce forward	-1.075	0.987	NS	Not significant
	Bounce beyond	-0.074	0.334	NS	Not significant
Adaptation	Bounce back	5.698	2.040	***	Positive, significant

	Bounce forward	13.332	5.807	**	Positive, significant
	Bounce beyond	4.919	1.726	**	Positive, significant
Transformation	Bounce back	-6.226	2.338	***	Negative, significant
	Bounce forward	-14.427	6.605	**	Negative, significant
	Bounce beyond	-4.966	1.974	**	Negative, significant

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; NS, not significant; SE, standard error.

Source: own elaboration

Overall, the findings offer partial support for the hypothesized relationship between digital governance maturity and municipal resilience. The adaptation stage emerges as the most robust and reliable predictor of resilience enhancement, aligning with theories that emphasize flexibility, experimentation, and learning as key enablers of resilience. Consistency appears insufficient on its own to drive resilience, while transformation, although anticipated to be the pinnacle of maturity, may inadvertently reduce resilience capacity unless carefully aligned with local capabilities and implementation resources.

4. Discussions

We explored the maturity of digital governance through the lens of digital consistency, adaptation, and transformation; we also analyzed municipal resilience through the strategies of bounce back, bounce forward, and bounce beyond. Our findings highlight the understudied role of the emergence of distinct resilience strategies enabled through differing levels of digital governance maturity.

Following the debate by Ansell et al. (2024), which posits that achieving sustainable municipal resilience requires a balance of distinct strategies that equip municipalities with unique capacities to cope with disruptions, we found that digital governance and resilience structures, when analyzed separately, exhibited a positive endogenous relationship among their components. Although this finding does not directly address our main research question, it provides an important outcome, confirming that the stimulus of stability can enhance a municipality's ability to both adapt and transform in the face of disruption and vice versa. The same conclusion is drawn in Nolte and Lindenmeier's (2023) study, which emphasizes the need for strategic alignment and balance among stability, adaptability, and transformative capacities. The same conclusion applies to the digital governance framework. A positive endogenous interconnection suggests that transformation is gradual, and if municipalities succeed in ensuring digital stability, this will, in turn, lead to positive outcomes in digital adaptation and transformation.

Although these results are both promising and important, further analysis of the interconnection between these two phenomena revealed a differentiated pattern of effects across the maturity stages of digital governance on distinct resilience strategies.

The first key point is that digital consistency did not exert any statistically significant effect on the three levels of resilience strategies. Its influence on bounce-back, bounce-

forward, and bounce-beyond strategies was negligible and statistically indistinguishable from zero. This contrasts somewhat with Josipovic and Viergutz's (2023) view that small-scale digital solutions can effectively mitigate crises. Nevertheless, our findings align with those of Carlsson et al. (2023) and indicate that digital governance initiatives oriented solely toward digital consistency may be insufficient for enhancing meaningful resilience due to limited financial investment and technological adoption in municipalities. One of the reasons for this is discussed by Bartuseviciene et al. (2025), who conclude that, in general, municipalities tend to be late adopters of digital technologies and allocate insufficient financial resources to increase digital intensity. As a result, their ability to enhance resilience remains limited.

The second consideration involves the prospects of digital adaptation for enhancing municipal resilience readiness to cope with disruptions. Our results revealed that digital adaptation consistently demonstrated positive and statistically significant effects across all resilience strategies, thereby reinforcing the hypothesis that digital adaptation is vital for enhancing municipal capacity to absorb, adapt to, and transform in the face of shocks. These findings are consistent with the results of two empirical studies conducted in different public sector contexts. Spicer et al. (2023), in the case of Canadian municipalities, showed that stronger digital readiness and intentional cross-functional modernization enabled a smoother organizational response during the COVID-19 crisis. Similarly, Horák and Špaček (2024), examining public sector organizations in the Czech Republic, found that higher levels of digitization improved organizations' ability to respond to unexpected and uncertain events. Taken together, these studies suggest that digital maturity enhances organizational resilience, although it should be viewed as an important enabling condition rather than the sole source of resilience.

The third aspect of our results indicates the impact of digital transformation on municipal resilience strategies. Most strikingly, digital transformation unexpectedly showed adverse effects across all resilience dimensions. These findings suggest that although advanced digital initiatives signify a high level of digital maturity, they may also introduce complexities, organizational constraints, and resource misalignment, ultimately undermining resilience outcomes in the short to medium term. In this regard, our findings resonate with Nematollahi (2024), who, in the context of Tehran, emphasized that digital transformation without an embedded digital culture is likely to fail. A similar caution emerges from Lekkas and Souitaris (2023), whose study of municipalities in Munich, Lyon, Vienna, Rotterdam, Stockholm, Santiago de Compostela, and Barcelona found that data-sharing practices were constrained by privacy compliance concerns, thereby limiting the practical value of advanced digital solutions. Likewise, Carlson (2023) noted in the Swedish context that rising digital intensity may widen inequalities in access to digital services across municipalities, suggesting that digital transformation can produce uneven resilience effects when resources and capabilities are distributed asymmetrically.

These results further emphasize the importance of having a clear strategy for what digitally induced resilience should look like, the competencies of the individuals implementing the plan, and, crucially, the processes that enable the implementation of such strategies. As our results demonstrate, the mere adoption of digital transformation does not, in itself, guarantee that the change will positively contribute to strengthening

resilience. This concern is echoed by Eom and Lee (2022), who argued that digital government transformation is not a “silver bullet” for crisis management, but instead may generate additional challenges due to the distinctive institutional and operational characteristics of the public sector. In sum, our findings partially support the hypothesized relationship between digital governance maturity and resilience, identifying adaptation as the most robust predictor of resilience enhancement, while highlighting limitations with regards to consistency and the risks inherent in transformative initiatives.

5. Conclusions

Our results indicated a differentiated pattern of effects across the maturity stages of digital governance on distinct resilience strategies. Digital governance at the stage of digital consistency showed no significant link to resilience outcomes. In contrast, digital adaptation had a strong, positive, and significant effect, strengthening municipal capacities across all three resilience strategies (bounce back, bounce forward, and bounce beyond). However, digital transformation revealed a significant but negative relationship, suggesting that overly complex or ambitious digital reforms may undermine resilience if institutional readiness and governance integration are insufficient.

Policy implications. From a policy perspective, these findings underscore several key considerations for municipal authorities and policymakers. First, municipalities should prioritize the adaptation stage of digital governance, as it consistently and positively contributes to resilience capacities that enable them to bounce back, bounce forward, and bounce beyond. Thus, policies that foster institutional flexibility, responsiveness, and learning mechanisms must be supported by adequate financial resources and continuous capacity-building initiatives, ensuring municipalities are prepared to respond effectively to crises. Second, policymakers need to recognize that foundational digital capabilities, represented by digital consistency, are necessary but insufficient on their own for fostering resilience. Efforts must extend beyond the mere implementation of digital technologies toward deeper institutional integration and capacity enhancement. Investments in digital tools must be complemented by targeted training programs and cross-functional coordination efforts, enhancing municipalities’ ability to transition smoothly through increasingly sophisticated stages of digital maturity.

Third, the unexpected adverse effects associated with digital transformation underscore a crucial cautionary point for policymakers. Transformational digital initiatives must be carefully aligned with municipalities’ actual operational capacities and institutional readiness. Policies should therefore include comprehensive assessments before any advanced digital projects are initiated, identifying potential organizational strains, complexities, and resource misalignments. Policymakers must facilitate incremental transformation stages, supported by sufficient procedural groundwork, clear objectives, and realistic expectations, to prevent short- to medium-term setbacks in resilience outcomes. Furthermore, effective data governance and inter-institutional trust should become a policy priority. Ensuring clarity and consensus around data-sharing protocols and digital interoperability standards can mitigate the fragmentation and mistrust issues highlighted in existing studies. Establishing clear governance frameworks for data usage

and ensuring transparency in digital collaborations will be essential for sustainable digital resilience.

Lastly, long-term policy development should emphasize institutionalizing bounce-forward and bounce-beyond strategies within municipalities. Policies must explicitly promote anticipatory and innovative resilience practices, embedding them into municipal processes, techniques, and organizational cultures. Encouraging forward-looking resilience planning through scenario-based training, simulations, and cross-sector collaboration can build long-lasting adaptive capacities and innovative solutions to future disruptions. Overall, municipal resilience strategies must move beyond technological sophistication to encompass holistic approaches that emphasize practical adaptability, institutional readiness, and integrated governance structures, thereby equipping municipalities to manage both present and future disruptions effectively.

Our study had some limitations. Although Lithuania provides an appropriate context for exploring the potential of digitally induced resilience, given its rapid digitalization, we acknowledge that relying on a single-country sample limits the generalizability of our findings. Therefore, future research could have a greater scope by incorporating a broader, cross-national sample to reflect diverse regional contexts better. Another limitation relates to the sample size of the study. While the sample was appropriate to ensure the overall representativeness of the data, we were unable to provide municipality-specific insights. This limitation stems from the sampling strategy, which prioritized gathering perspectives from key municipal actors, i.e., mayors, administrative directors, and opposition leaders. Although this approach was essential for capturing accurate strategic-level information about municipal resilience and digital governance, it did not allow for in-depth analysis at the individual municipality level.

Further research avenues should include seeking causal explanations for the identified relationships. Additionally, policy-relevant case studies of municipalities that have demonstrated high levels of digitalization and resilience would be valuable in helping to identify the underlying factors that enable some municipalities, despite existing constraints, to advance digitally induced resilience more successfully than others.

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Appendix 1: Structure of the digital governance measurement instrument

Component		Item		Abbreviation
Consistency	Strategy	1.	Digital governance is implemented gradually according to planned schedules, and during crises, existing resources are utilized to the maximum extent.	DConS1
		2.	Digital governance helps prepare for crisis prevention, ensures control, and preserves existing abilities (e.g., operational quality levels).	DConS2
		3.	In our organization, digital governance is implemented using existing information and communication technology (ICT) tools to ensure business continuity and stability, while reducing risks and vulnerabilities.	DConS3
	Employees	1.	Our employees can use digital tools and official municipal ICT channels.	DConE1
		2.	The stability and support of digital activities are essential for managers who use official municipal ICT channels to exercise control, as well as for monitoring how employees use them	DConE2
		3.	In response to crises, training is provided to update employees' knowledge and skills on digitalization.	DConE3
	Processes	1.	Digital governance is developed through precise planning, action design, and employee supervision.	DConP1
		2.	In times of crisis, we use existing ICT channels and tools to ensure the stability and continuity of our operations.	DConP2
		3.	Using digital tools ensures high-quality process management in times of crisis	DConP3
Adaptation	Strategy	1.	In our organization, digital governance is novel, continually developed in a search for new resources and opportunities.	DAdaS1
		2.	We view crises as an opportunity to introduce alternative digital tools or channels that enhance the quality of activities (such as speed, accessibility, and transparency).	DAdaS2
		3.	Our organization emphasizes the importance of digital governance and collaboration in developing innovative digital solutions that address emerging situations and needs.	DAdaS3
	Employees	1.	Employees possess good skills in using digital tools, can quickly adapt to new ICT tools and channels, and start using other digital tools themselves to achieve operational efficiency.	DAdaE1
		2.	Managers are at the forefront of digital advancement, driving change through digitalization, seeking new opportunities, and enabling employees to utilize a wide range of ICT channels and tools.	DAdaE2
		3.	To adapt to the changing environment, we encourage employees to constantly update their digitalization knowledge and skills and develop and implement new ICT systems, channels, and tools necessary for operational efficiency.	DAdaE3
	Processes	1.	We involve employees in defining the goals and aims of the organization's digital governance development and discussing the implemented activities.	DAdaP1
		2.	While standard ICT tools and channels dominate our organization, we encourage employee digitalization initiatives that help to adapt to changing conditions and needs in times of crisis.	DAdaP2
		3.	In times of crisis, we remain optimistic and creative, work in teams, and adopt new digital practices, testing them and learning from our mistakes.	DAdaP3
Transformation	Strategy	1.	One of the most important goals for the development of digital governance in times of crisis is an organization's ability to focus on digital innovation, anticipate the future, exhibit dynamism, drive digital change, and achieve progress.	DTraS1
		2.	In times of crisis, we seek opportunities to ensure continuity, quality, and digital accessibility by becoming the frontrunners of digital change.	DTraS2
		3.	Our organization's digital governance development goals are to introduce new administrative service delivery models based on digital technologies, increase operational efficiency through ICT	DTraS3

Component		Item		Abbreviation
	Employees		tools, and respond to the latest digital trends.	
		1.	Employees make decisions based on their prior digitalization experiences. They trust the team and pool collective knowledge to solve problems using digital tools.	DTraE1
		2.	During the work process, we consider changes in the environment, which we view as an opportunity for growth. We are ready to think and act non-traditionally in the digital space (e.g., using artificial intelligence tools).	DTraE2
		3.	Our organization's managers and ICT specialists work together as partners, discussing, encouraging, and supporting new digitalization initiatives. They provide employees with greater autonomy and offer guidance in good faith, both on these initiatives and on any issues that arise	DTraE3
	Processes	1.	Our organization continually discusses digital transformation to be prepared to react, act, and propose innovative solutions in times of crisis.	DTraP1
		2.	Our organization's digital governance processes are transforming its structure and culture, changing leadership practices (e.g., guided by ICT tools and channels), and providing flexibility in work forms and places.	DTraP2
		3.	We focus on the citizen as a customer by updating digital technologies. We provide e-services through the e-government gateway, install user-friendly tools, and adapt digital tools to provide personalized services.	DTraP3

Appendix 2: Structure of the resilience measurement instrument

Component		Item		Abbreviation
Bounce back	Strategy	1.	One of our organization's aims is to use our resources to ensure operational stability and reliability in times of crisis.	RBbacS1
		2.	We set out the rules for ensuring the performance of functions, issuing orders, and providing instructions for performing essential tasks. We also set out the expected results, how to manage them, and the imposition of incentives or penalties.	RBbacS2
		3.	Hearing words such as stability and continuity are customary in our organization.	RBbacS3
	Employees	1.	Our employees adhere to strategic goals and are consistent in their activities.	RBbacE1
		2.	Employees are making efforts to avoid diverse types of crises.	RBbacE2
		3.	The staff shall update their knowledge with the plan drawn up by the management.	RBbacE3
	Processes	1.	We implement the strategy by planning and implementing employee control, with each employee individually reporting on the work they perform to their line manager?"	RBbacP1
		2.	Quality management of activities is ensured through a hierarchical structure, continuous control and audit, and the identification of deviations from the standard.	RBbacP2
		3.	In times of crisis, we are in a hurry to manage the situation and restore the normal routine we worked on before the crisis as soon as possible.	RBbacP3
Bounce forward	Strategy	1.	One of our organization's goals in times of crisis is to adapt to a changing environment and ensure continuous activity.	RBforS1
		2.	We view crises as an opportunity to enhance the quality of our activities by adapting to changing circumstances.	RBforS2
		3.	Hearing words such as adaptation, transformation, and learning organization is customary in our organization.	RBforS3
	Employees	1.	Employees learn from the experience gained, integrate it into everyday activities, and respond to changing situations. Decisions are made based on updated knowledge.	RBforE1
		2.	Employees are encouraged (annual appraisals, promotions, awards, gratitude) to analyze what they do well, what can be done differently, and how lessons learned and knowledge can be integrated into follow-up activities.	RBforE2
		3.	When employees inform line managers about what skills they lack,	RBforE3

Component		Item		Abbreviation
	Processes		training is provided.	
		1.	Staff make suggestions on how to improve the implementation of the measures set out in the strategy as part of the strategy's implementation.	RBforP1
		2.	Although formal management procedures prevail in our organization, most projects are implemented in teams that include employees with the required competencies from different departments/units.	RBforP2
		3.	In times of crisis, we look for solutions to manage the situation and adapt to the changed circumstances.	RBforP3
Bounce beyond	Strategy	1.	One of our organization's aims is to encourage innovation by exploring new opportunities, methods, and tools for action.	RBbeyS1
		2.	In times of crisis, we seek opportunities to perform activities differently than before.	RBbeyS2
		3.	In our organization, it is customary to hear words such as scenario testing, experiment, fault tolerance, diversity, and inclusion.	RBbeyS3
	Employees	1.	Employees make decisions based on experience and intuition.	RBbeyE1
		2.	Employees are not afraid to make mistakes, as they are aware that mistakes are valuable sources of knowledge, opening opportunities to perform activities differently from before	RBbeyE2
		3.	Employees work in self-management teams.	RBbeyE3
	Processes	1.	Stress testing is regularly simulated within our organization to develop the staff's ability to act in times of crisis (e.g., tasks are performed with less-than-normal resources, staff are rotated to perform functions other than their usual ones).	RBbeyP1
		2.	Although our organization has a formal management structure, we seek to separate the activities of different departments so that a crisis in one unit does not affect the others.	RBbeyP2
		3.	We cooperate with other organizations on crisis management issues. We know where and what kind of help we can get and what kind of help we can provide ourselves.	RBbeyP3