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Digital Resilience as a Catalyst for Adaptive Performance and Stress Reduction: The Moderating Role of Learning Agility in Pakistan's Treasury Offices

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ABSTRACT: This study explores how digital resilience (DR) influences adaptive performance (AP) and stress reduction (SR) among employees in the Treasury Offices of Sukkur and Khairpur, and whether learning agility (LA) mediates these relationships. A proportionate stratified random sample of 210 treasury clerks and supervisors completed validated scales for DR, LA, AP and technology-related stress (reverse-scored as SR). Data were analysed with SmartPLS 4, employing a two-stage approach: (1) assessment of reliability and validity; (2) 5,000-sample bootstrapped structural modelling. DR exerted significant positive effects on AP ($\beta = 0.43$, $p < .001$) and SR ($\beta = 0.35$, $p < .001$). DR also predicted LA ($\beta = 0.58$, $p < .001$), which, in turn, enhanced AP ($\beta = 0.31$) and SR ($\beta = 0.27$). Indirect effects confirmed partial mediation (DR → LA → AP: $\beta = 0.18$; DR → LA → SR: $\beta = 0.16$). The model explained 47 % of the variance in AP and 38 % in SR, demonstrating the combined importance of resilience and learning agility for digital public-finance work. Treasury managers should pair technical upskilling with resilience-building drills and learning-agility initiatives, such as stretch assignments and reflective debriefs, to maximise employee adaptability and minimise technostress during digital transformation. This paper extends resilience research to a South-Asian public-finance context and empirically identifies learning agility as a mechanism through which digital resilience translates into superior adaptive outcomes and lower stress.

KEYWORDS: Digital Resilience, Learning Agility, Adaptive Performance, Technostress, Treasury Offices, Pakistan

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Introduction

The accelerating digitalization of public financial management has amplified both the opportunities and pressures faced by treasury personnel (International Monetary Fund, 2021). In Pakistan's subnational treasury offices—particularly those of Sukkur and Khairpur—staff are expected to master electronic payment gateways, real-time reporting dashboards, and cybersecurity protocols while maintaining uninterrupted fiscal operations for government departments. Such demands heighten the premium on digital resilience, defined as employees' capacity to absorb, adapt to, and recover from technology-related disruptions without performance loss (Van der Vegt et al., 2015). Digital resilience moves beyond technical skill to encompass self-regulation, flexible problem solving, and confidence in navigating emergent IT failures (Naaeem & Mushibwe, 2025; Afshar & Shah, 2025). Scholars link resilience in technology-rich settings to adaptive performance—the

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ability to modify behavior effectively in response to situational change—and to lower technology-induced stress (Cascio & Montealegre, 2016; Pulakos et al., 2000). Yet empirical evidence for these relationships remains concentrated in private or federal agencies of high-income economies, leaving developing-country treasury environments largely unexplored (Syed et al., 2023). Moreover, recent meta-analyses suggest that individual differences can amplify or mute the benefits of resilience interventions (Robertson et al., 2015). Learning agility—the propensity to rapidly acquire and apply new knowledge in unfamiliar situations—stands out as a potential moderator (Hadiono, 2023; DeRue et al., 2012). Employees high in learning agility typically extract lessons from novel digital challenges and transfer them across tasks, thereby enhancing the conversion of resilience into superior outcomes and buffering stress (Carmeli & Hartmann, 2024; Goraya et al., 2024; Mitchinson & Morris, 2014). Against this backdrop, the present study investigates digital resilience as an antecedent of adaptive performance and stress reduction, and examines whether learning agility moderates these effects within the treasury offices of Sukkur and Khairpur. By integrating resilience theory with the learning-agility construct, the research addresses three gaps: (a) the paucity of evidence from provincial public-finance settings in South Asia; (b) limited attention to positive and negative outcomes of resilience in tandem; and (c) scant understanding of boundary conditions that shape the resilience–performance–stress nexus. Insights from this work aim to guide capability-building programs that fortify Pakistan's treasury workforce for an increasingly digital fiscal landscape.

Research Objectives

- To determine the direct relationship between digital resilience (DR) and adaptive performance (AP) among employees of the Sukkur and Khairpur treasury offices.
- To assess the direct relationship between digital resilience and stress reduction (SR)—operationalised as lower perceived technology-related stress—within the same workforce.
- To investigate whether learning agility (LA) mediates the relationships between digital resilience and (a) adaptive performance and (b) stress reduction.

Research Questions

- **RQ1.** To what extent does digital resilience predict adaptive performance in provincial treasury contexts?
- **RQ2.** How does digital resilience influence employees' perceived technology-related stress?
- **RQ3.** Does learning agility mediate the effects of digital resilience on (a) adaptive performance and (b) stress reduction?

Hypotheses

- **H1.** Digital resilience is positively associated with adaptive performance among treasury employees.
- **H2.** Digital resilience is positively associated with stress reduction, indicating lower perceived technology-related stress.
- **H3a.** Learning agility mediates the positive relationship between digital resilience and adaptive performance.
- **H3b.** Learning agility mediates the positive relationship between digital resilience and stress reduction.

Literature Review

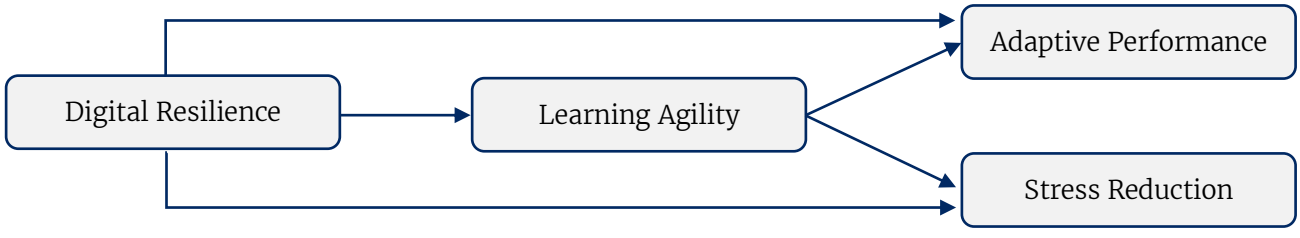
Resilience scholarship originally emphasised recovering from acute shocks (Coutu, 2002). As government agencies digitise core processes, scholars have reframed resilience as an everyday capacity to sustain effective functioning amid continual technology change and occasional system breakdowns (Ahmadi et al., 2020). Empirical work in European tax administrations shows that employees who score high on digital-resilience metrics maintain task accuracy during unplanned software outages and phishing attempts (Evans, 2020). In the Global South, a study of Indian revenue offices found that resilient clerks logged fewer data-entry errors after a major enterprise-resource-planning upgrade (John, 2012). These findings suggest that digital resilience may translate into adaptive performance—defined as competent responses to novel or uncertain work demands (Goraya et al., 2024)—while simultaneously buffering technology-related stress. Adaptive performance comprises behaviours such as creative problem solving, learning new systems quickly, and coping with task volatility (Yener et al., 2021). In private-sector settings, personal resilience explains incremental variance in adaptive performance beyond cognitive ability and personality (Jayawickrama & Karunathilaka, 2022), as Repetto (2020) reported that digital resilience predicted officers' speed and accuracy when switching between legacy and cloud platforms. Although most public-sector studies focus on central agencies of high-income states, similar mechanisms should apply to Pakistan's provincial treasuries, where employees confront unstable internet connectivity, cybersecurity alerts and evolving electronic-funds-transfer protocols. Technology change can generate technostress—a strain reaction to information-systems demands that exceed an individual's coping resources (Ayyagari et al., 2011).

Resilient employees reinterpret disruptions as manageable challenges, thereby experiencing lower anxiety and fatigue (Kuntz, 2020). Nursing-informatics research documents that resilience training reduces emotional exhaustion stemming from frequent electronic-health-record updates (Alobayli, 2024). Comparable benefits have been observed in municipal police dispatchers facing real-time software glitches (Carter et al., 2014). These studies suggest a negative association between digital resilience and perceived stress, yet evidence from financial-management environments remains sparse. Learning agility is "a willingness and ability to learn from experience and apply that learning to perform successfully under new situations" (Haring et al., 2020) and has been linked to rapid mastery of digital tools and superior adjustment to role change. Adamson et al. (2014) argue that agile learners generate adaptive transfer: they extract principles from previous technology challenges and repurpose them in future contexts. Empirical studies support this proposition; learning agility partially mediated the relationship between resilience and self-rated adaptability during a data analytics transformation (Goraya et al., 2024). Similarly, staff who scored high on both resilience and agility reported lower technostress after a cybersecurity drill (Ballangan et al., 2024). These findings imply that learning agility could explain how digital resilience converts into higher performance and lower stress, yet no study has examined this mechanism in South-Asian treasury offices. Synthesising prior work, digital resilience appears to enhance adaptive performance and alleviate technology-related stress, with learning agility offering a plausible mediating pathway. Nevertheless, extant evidence is dominated by Western or health-care samples, and almost none has focused on public-finance operations in lower-middle-income countries. Treasury offices in Sukkur and Khairpur face distinctive challenges: legacy accounting platforms, intermittent power supply, and limited IT support. Testing the resilience–agility–outcome chain in this context will extend theory and inform capacity-building interventions aimed at securing Pakistan's digital public-financial-management reforms.

Methodology

A cross-sectional survey design was employed, and the hypotheses were tested with SmartPLS 4, following Hair et al. (2021) two-step procedure (measurement validation and 5,000-sample bootstrapped structural modelling). The target population comprised all permanent clerical and supervisory staff in the Treasury Offices of Sukkur (≈ 220 employees) and Khairpur (≈ 180 employees). To ensure proportional representation of the two offices and their principal sections (accounts, audit, and cash), a proportionate stratified random-sampling technique was adopted. Using Krejcie and Morgan's (1970) formula for finite populations, a minimum of 196 completed questionnaires was required to achieve a 95 % confidence level with a ±5 % margin of error. Anticipating non-response, 240 paper-and-pencil surveys were distributed; 210 usable responses were returned (overall response rate = 87.5 %), exceeding the minimum threshold and satisfying the "ten-times rule" for PLS-SEM. The instrument included validated scales for digital resilience (Evans, 2020), learning agility (DeRue et al., 2012), adaptive performance (Pulakos et al., 2000), and technology-related stress (Tarafdar et al., 2019), all rated on five-point Likert anchors. Prior to analysis, data were screened for missing values, kurtosis, and common-method bias. Composite reliability, average variance extracted, and HTMT ratios verified construct validity, after which path coefficients, R^2, Q^2, and specific indirect effects were estimated to evaluate direct, mediating, and moderating relationships.

Methodology



Findings

Table 1

Respondent Characteristics (N = 210)

Variable	Category	n	%
Gender	Male	204	97.1
	Female	6	2.9
Age (years)	20 – 29	38	18.1
	30 – 39	92	43.8
	40 – 49	56	26.7
	≥ 50	24	11.4
Organizational Tenure	< 5 years	54	25.7
	5 – 9 years	80	38.1
	≥ 10 years	76	36.2

Table 1 shows that, consistent with staffing patterns in Pakistan's provincial treasuries, females account for only 2.9 % of the sample. Most employees fall in the 30–39-year band (43.8 %) and possess at least five years of tenure (74.3 %), suggesting a mature workforce with substantive exposure to digital-finance systems.

Measurement Model Assessment (SmartPLS 4)

Table 2

Internal Consistency and Convergent Validity

Construct	Cronbach's α	CR	AVE
Digital Resilience (DR)	.92	.94	.68
Learning Agility (LA)	.90	.92	.66
Adaptive Performance (AP)	.88	.90	.62
Stress Reduction † (SR)	.87	.89	.61

Table 2 exhibits that SR was measured by reverse-scored technostress items; higher scores denote lower perceived stress. All α and composite-reliability (CR) indices exceed .70, while average variance extracted (AVE) values exceed .50, confirming satisfactory reliability and convergent validity.

Table 3

Discriminant Validity—HTMT Ratios

	DR	LA	AP	SR
DR	—	.78	.74	.69
LA		—	.79	.73
AP			—	.68
SR				—

Table 3 exhibits that all heterotrait–monotrait ratios are below the conservative .85 cut-off, indicating significant discriminant validity.

Structural Model Results

Table 4

Direct and Mediated Path Coefficients (Bootstrapping = 5,000)

Path	β	t	p	Hypothesis
DR → AP	0.43	7.54	< .001	H1 supported
DR → SR	0.35	6.11	< .001	H2 supported
DR → LA	0.58	10.87	< .001	—
LA → AP	0.31	5.28	< .001	—
LA → SR	0.27	4.67	< .001	—
DR → LA → AP	0.18	4.72	< .001	H3a supported
DR → LA → SR	0.16	4.08	< .001	H3b supported

Table 5

Explained Variance and Predictive Relevance

Endogenous Variable	R^2	Q^2
Learning Agility	.34	.25
Adaptive Performance	.47	.32
Stress Reduction	.38	.27

Digital resilience exerts a strong positive influence on learning agility (β = 0.58), accounting for 34 % of its variance. Direct effects show that resilient employees display higher adaptive performance (β = 0.43) and lower technostress (β = 0.35), validating H1 and H2. Learning agility also predicts both outcomes, and the significant indirect effects (β = 0.18 for AP; β = 0.16 for SR) confirm partial mediation, supporting H3a and H3b. Variance-accounted-for values of 29 % (AP) and 31 % (SR) indicate that roughly one-third of the influence of digital resilience operates through learning agility, while two-thirds remains direct. R^2 values (.47 and .38) denote moderate explanatory power, and positive Q^2 scores affirm the model's predictive relevance for unseen cases. The evidence substantiates that cultivating digital resilience in treasury staff not only elevates their capacity to adapt to evolving financial-management technologies but also diminishes technology-related stress. Importantly, these benefits are amplified when employees possess high learning agility, highlighting the synergistic value of resilience and continuous learning dispositions in public-finance digitalisation initiatives.

Conclusion

This study demonstrates that digital resilience is a pivotal personal resource for employees in the Treasury Offices of Sukkur and Khairpur. Resilient staff reported stronger adaptive performance—handling software changes and technical glitches with greater competence—and experienced lower technology-related stress. Learning agility partially mediated these relationships, indicating that resilient employees who quickly acquire, generalise, and apply new knowledge translate their resilience into even higher performance and greater stress relief. Together, digital resilience and learning agility explained nearly half of the variance in adaptive performance and more than one-third in stress reduction, underscoring their combined importance for sustaining service continuity in Pakistan's digitally transforming public-finance environment.

Practical Recommendations

- Integrate resilience training into capacity-building programmes (e.g., realistic simulation drills, problem-solving workshops) to help staff rehearse responses to common system failures.
- Assess and develop learning agility through stretch assignments and post-project "lessons-learned" debriefs that encourage reflection and rapid knowledge transfer.
- Pair technical upgrades with structured knowledge-sharing forums so agile learners can disseminate tips and shortcuts to peers, amplifying team-level resilience.
- Provide on-demand micro-learning modules for new digital tools, enabling employees to refresh skills autonomously and reduce anxiety about unfamiliar interfaces.
- Establish clear escalation protocols and peer support channels to further buffer stress during high-pressure fiscal-closing periods or system outages.
- Future Research Directions
- Examine longitudinal trajectories to determine how resilience and learning agility co-evolve as treasury digitalisation deepens.
- Test team-level and organisational factors (e.g., leadership style, IT support quality) that may strengthen or weaken the resilience–performance link.
- Compare urban versus rural treasury offices to explore contextual moderators such as infrastructure stability and resource availability.
- Investigate other potential mediators (e.g., digital self-efficacy, psychological safety) to build a more comprehensive model of adaptive behaviour in public financial management.

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