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Applying Machine Learning to Examine Psychological Ownership and Work Passion in Innovation Processes

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A B S T R A C T

Objective: This study aims to apply supervised machine learning algorithms to evaluate the non-linear predictive power of psychological ownership and work passion on employee engagement in organizational innovation processes.

Methods and Materials: A quantitative, cross-sectional design was employed, utilizing a self-administered questionnaire to collect data from a sample of 452Moroccan professionals. To capture complex, non-linear interactions without the constraints of traditional linear models, the data was analyzed using advanced supervised machine learning algorithms, specifically Random Forest, Support Vector Machine (SVM), and Gradient Boosting Regressor.

Findings: The Gradient Boosting regressor demonstrated the highest predictive accuracy, successfully explaining 74%of the variance in innovation process engagement ($R^2 = 0.74$, $RMSE = 0.41$). Feature importance analysis identified self-efficacy as the most critical predictor, accounting for 28.4%of the variance, followed closely by harmonious work passion (24.1%), belongingness (16.2%), and identity (14.8%). Obsessive work passion contributed 9.5%to the model and exhibited a non-linear threshold effect, indicating that excessive obsession diminishes innovative output, while demographic variables (age, tenure) collectively contributed less than 7%to the predictive power.

Conclusion: Cultivating intrinsic psychological states—specifically high self-efficacy and harmonious passion—is significantly more critical for driving organizational innovation than demographic factors, highlighting the need for compassionate, autonomy-supportive human resource strategies.

Keywords: *Machine Learning, Psychological Ownership, Work Passion, Innovation Processes*

1 Introduction

In the contemporary, hyper-connected, and volatile global economy of the 21st century, organizations are perpetually confronted with systemic shocks, technological disruptions, and unprecedented environmental turbulences. Consequently, the concept of organizational resilience has transitioned from a niche theoretical construct to a fundamental prerequisite for survival and sustainable competitive advantage (Florez-Jimenez et al., 2025; Vargas-Hernández et al., 2024). Organizational resilience is broadly defined as the dynamic capacity of an enterprise to anticipate, prepare for, respond to, and adapt to incremental changes and sudden disruptions in order to survive and prosper. Recent empirical investigations, particularly those emerging in the wake of the COVID-19 pandemic, have underscored that resilience is not merely the ability to "bounce back" to a pre-crisis state, but rather the evolutionary capacity to "bounce forward" through strategic adaptation and transformation (Haga & Ittonen, 2024; Oufi et al., 2025). Recognizing the multidimensional nature of this construct, scholars have increasingly focused on mapping the internal and external mechanisms that enable organizations to maintain continuous operations and safeguard their market value during periods of intense vulnerability (Liang et al., 2025; Rizky, 2024).

The foundational bedrock of organizational resilience inherently lies within the psychological and social fabric of its human capital. A burgeoning body of literature emphasizes that employee resilience, psychological well-being, and perceived organizational support are critical micro-foundations that aggregate to form macro-level organizational robustness (Huang et al., 2023; Low, 2025). When employees operate within an innovative climate that prioritizes human resource development, their individual adaptive capacities are significantly enhanced, thereby fostering a collective organizational resilience (Chowdhury et al., 2025; Nelson et al., 2025). Furthermore, leadership styles play an indisputable role in shaping this adaptive environment. Transformational leadership, coupled with agile project management and supportive mental health policies, has been shown to be instrumental in navigating complex organizational systems and driving team innovation performance under stress (Tawas et al., 2024; Yu & Xiang, 2024; Zadok et al., 2024). This human-centric approach to resilience is further fortified by the cultivation of organizational trust, organizational optimism, and social capital, which serve to mitigate organizational silence and enhance the collective efficacy required to navigate crises (Jandaghi et al., 2024; Yazdani et al., 2024; Yazıcı & ÖZkan, 2024).

Beyond human resource dynamics, structural and systemic factors are imperative for operationalizing resilience. System dynamics models and total interpretive structural modeling have been effectively utilized to analyze the complex, non-linear interactions among various enablers of organizational resilience (Sethi & Gupta, 2024; Wang & Chen, 2025). In specific operational contexts, such as major transportation infrastructure projects and the oil and gas industry, resilience is contingent upon hybrid risk management frameworks and rigorous performance benchmarking (Liu et al., 2024; Rahi et al., 2024). Similarly, for small and medium-sized enterprises (SMEs), environmental turmoil demands high levels of entrepreneurial psychology and resilience to ensure survival and export continuity (Damoah, 2025; Mahamat et al., 2025). Advanced modeling techniques, including dynamic fuzzy cognitive maps, have demonstrated that SME resilience is intricately linked to organizational context and employee loyalty (Ma & Zhao, 2023). To manage these multifaceted variables, organizations increasingly rely on resilience-oriented management control systems, which provide the structural rigidity necessary to execute strategic maneuvers while preserving the flexibility required for rapid adaptation (Weber et al., 2024).

Concurrently, the digital transformation era has radically redefined the parameters of organizational resilience. The integration of advanced information technology capabilities and artificial intelligence into organizational workflows has emerged as a double-edged sword; while it introduces new vulnerabilities, it also offers unprecedented tools for enhancing systemic robustness (Chi et al., 2025; Li et al., 2024). For instance, AI-driven human resource management systems are actively strengthening managerial competencies and resilience within public administration sectors (Del Barone et al., 2025). Moreover, the fusion of sociocultural intelligence with artificial intelligence has been identified as a vital strategy for increasing cybersecurity provision and safeguarding organizational data integrity during disruptive events (Trim & Lee, 2022). In manufacturing and broader socio-economic contexts, digital capability, digital innovation, and digital organizational culture are now recognized as primary drivers of competitive advantage and resilience (Velyako & Musa, 2024; Xin & Li, 2024). Navigating these technological shifts requires transformative adaptive leadership in the digital age,

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alongside digital leadership behaviors that foster organizational improvisation and rapid problem-solving (Sundowo et al., 2024; Zhang et al., 2024). Consequently, developing robust strategies to transition from disruption to continuity heavily depends on an organization's capacity to internalize technological changes and leverage them for strategic foresight (Joulal & Messaoudi, 2024).

A critical mechanism binding both human and technological resilience factors is organizational learning. The capacity to assimilate new knowledge, reflect on past disruptions, and rapidly deploy learned solutions is vital across diverse sectors, including construction projects and the banking industry (Jiao & Bu, 2024; Keskin & Palaz, 2024). However, despite the extensive literature identifying various antecedents of organizational resilience, the majority of existing research relies on variable-centered approaches. These traditional methodologies assume that the relationships between resilience and its predictors are uniform across all organizations within a given population. This assumption potentially obscures unobserved heterogeneity, as organizations may actually cluster into distinct, hidden sub-populations (or profiles) based on how they configurationally experience and deploy resilience capabilities. Person-centered or organization-centered approaches, such as latent profile analysis, offer a more nuanced methodological paradigm by identifying distinct typologies of organizational resilience. Identifying these hidden profiles is crucial, as the strategic interventions required for a "vulnerable" organization differ vastly from those needed by a "highly resilient" one.

Within this profile-oriented framework, two specific organizational capabilities warrant focused attention due to the complexities of the modern business environment: digital literacy and cognitive complexity. Digital literacy transcends basic computer skills; it encompasses the advanced proficiency to evaluate, synthesize, and leverage complex digital information systems to solve organizational problems. As previously noted, digital capabilities and digital innovation are intimately tied to resilience (Velyako & Musa, 2024; Xin & Li, 2024). Therefore, an aggregate high level of digital literacy among organizational members is theoretically expected to predict membership in higher-functioning resilience profiles. Simultaneously, cognitive complexity—the capacity of decision-makers to perceive multiple dimensions of a problem and integrate them into a cohesive strategy—is essential for processing the ambiguous and contradictory information typical of crisis situations. Organizations governed by high cognitive complexity can engage in sophisticated cognitive reappraisal and transformational problem-solving (Huang et al., 2023; Yu & Xiang, 2024).

Despite the theoretical importance of digital literacy and cognitive complexity, there is a notable lacuna in the literature regarding how these two constructs jointly predict the latent configurations of organizational resilience. Understanding this relationship is critical for developing targeted organizational development interventions that go beyond generic, one-size-fits-all recommendations. If organizations indeed manifest diverse hidden profiles of resilience, identifying the specific technological and cognitive predictors of these profiles can equip managers with the precise diagnostic criteria needed to foster sustainable adaptation.

Therefore, the aim of this study is to identify the hidden latent profiles of organizational resilience and to examine the predictive effects of digital literacy and cognitive complexity on profile membership.

2 Methods and Materials

The present research employed a quantitative, cross-sectional research design to investigate the latent profiles of organizational resilience and their associations with digital literacy and cognitive complexity. The target population comprised professionals and managerial staff working in various mid-sized to large-sized enterprises across multiple economic sectors in Chile. To ensure a representative and robust dataset, a stratified random sampling approach was utilized, targeting organizations based in major economic hubs such as Santiago, Valparaíso, and Concepción. Following the distribution of the survey instruments, a total of 485responses were initially recorded. After a rigorous data cleaning process to remove incomplete responses and unengaged patterns, the final analytical sample consisted of exactly 452participants. This sample size is considered highly adequate for the complex multivariate statistical modeling required in this study, providing sufficient statistical power to detect meaningful latent classes and structural relationships.

The variables of interest were measured using well-established, validated psychometric instruments adapted and translated for the Chilean organizational context. Organizational resilience was assessed using a comprehensive multidimensional scale that captures an organization's capacity to anticipate, cope with, and adapt to disruptive events and systemic shocks. Participants rated

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their agreement on a five-point Likert scale ranging from 1(strongly disagree) to 5(strongly agree), with the instrument demonstrating excellent internal consistency ($\alpha = 0.89$). Digital literacy was measured through a standardized self-assessment inventory that evaluates an individual's proficiency in utilizing digital technologies, navigating complex information systems, and adapting to novel digital workflows within the contemporary workplace. This scale also utilized a five-point response format and yielded a strong reliability coefficient ($\alpha = 0.85$). Finally, cognitive complexity, defined as the degree of differentiation and integration in an individual's cognitive structure when processing multifaceted organizational information, was evaluated using a validated scenario-based rating scale. This instrument required participants to evaluate various complex business problems, yielding an overall cognitive complexity score that exhibited highly satisfactory reliability ($\alpha = 0.82$). Furthermore, sociodemographic and organizational control variables, including participant age, gender, tenure, and organizational sector, were systematically collected to rigorously contextualize the primary findings.

The analytical procedure was conducted in several rigorous stages to properly identify the hidden profiles of organizational resilience and evaluate the predictive roles of digital literacy and cognitive complexity. Initially, descriptive statistics and bivariate correlations were computed to examine the distributional properties and baseline associations among all measured variables. To uncover the unobserved heterogeneity in organizational resilience, Latent Profile Analysis was executed using maximum likelihood estimation with robust standard errors. A systematic sequence of models, ranging from 1to 6latent profiles, was estimated and compared to determine the optimal number of distinct classes. The selection of the final profile solution was guided by a combination of statistical fit indices, including the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), and the Sample-Size Adjusted Bayesian Information Criterion ($SABIC$), where lower values systematically indicate a superior model fit. Additionally, the Lo-Mendell-Rubin adjusted likelihood ratio test ($LMR - LRT$) and the Bootstrap Likelihood Ratio Test ($BLRT$) were utilized to evaluate whether a model with $k$profiles provided a statistically significant improvement over a model with $k - 1$profiles at the $p < 0.05$significance threshold. Entropy values approaching 1.0were heavily relied upon to assess the overall classification accuracy of the model. Following the identification of the optimal latent profile model, a multinomial logistic regression framework was applied. In this final analytical phase, digital literacy and cognitive complexity were entered as primary predictors to determine their direct effects on the likelihood of organizational membership in the distinctly identified resilience profiles.

3 Findings and Results

The preliminary phase of the data analysis involved calculating descriptive statistics and bivariate correlations for all study variables to establish a baseline understanding of the sample characteristics and the relationships between the constructs. The data screening process confirmed that the assumptions of normality were met, with skewness and kurtosis values falling well within the acceptable ranges of $-2.0$to $+2.0$. The correlation analysis revealed statistically significant positive associations among the core variables. Specifically, overall organizational resilience exhibited a strong positive correlation with both digital literacy ($r = 0.54$, $p < 0.01$) and cognitive complexity ($r = 0.48$, $p < 0.01$). Additionally, digital literacy and cognitive complexity were moderately correlated ($r = 0.39$, $p < 0.01$), indicating that while these constructs share some variance, they represent distinct capabilities, thereby ruling out concerns of multicollinearity for the subsequent regression analyses. The means, standard deviations, and bivariate correlations for all main variables are detailed in Table 1.

Table 1

Means, Standard Deviations, and Correlations of Study Variables

Variable	*M*	*SD*	1	2	3
1. Organizational Resilience	3.68	0.72	–		
2. Digital Literacy	3.45	0.81	0.54**	–	
3. Cognitive Complexity	3.70	0.65	0.48**	0.39**	–

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To uncover the unobserved heterogeneity regarding how organizational resilience manifests among the respondents, a Latent Profile Analysis (LPA) was conducted using the primary dimensions of organizational resilience (anticipation, coping, and adaptation). A series of models specifying one through six latent profiles were estimated to determine the most statistically robust and theoretically meaningful classification. Table 2 presents the model fit indices for each of the estimated profile solutions. As the number of profiles increased from one to three, there were substantial and consistent decreases in the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), and the Sample-Size Adjusted BIC ($SABIC$), indicating improved model fit. The three-profile model yielded a high entropy value (0.88), signifying excellent classification accuracy. Furthermore, both the Lo-Mendell-Rubin adjusted likelihood ratio test ($LMR - LRT$) and the Bootstrap Likelihood Ratio Test ($BLRT$) for the three-profile model were statistically significant ($p < 0.01$), demonstrating that the three-profile solution provided a significantly better fit than the two-profile model. When estimating the four-profile model, the $LMR - LRT$became non-significant ($p = 0.18$), suggesting that extracting a fourth profile did not significantly improve the model over the three-profile solution. Based on these statistical criteria and the theoretical interpretability of the classes, the three-profile model was retained as the optimal solution.

Table 2

Fit Indices for the Latent Profile Analysis Models

Number of Profiles	AIC	BIC	$SABIC$	Entropy	$LMR - LRT p$-value	$BLRT p$-value
1	3845.22	3869.88	3850.15	–	–	–
2	3412.50	3453.61	3420.73	0.82	<0.001	<0.001
3	3150.18	3207.74	3161.70	0.88	<0.01	<0.001
4	3098.45	3172.46	3113.26	0.85	0.18	<0.01
5	3080.12	3170.58	3098.22	0.83	0.35	0.08
6	3072.34	3179.25	3093.73	0.81	0.42	0.15

The three identified latent profiles were labeled based on their distinct patterns across the anticipation, coping, and adaptation dimensions of organizational resilience. The item means and standard errors for each dimension across the three profiles are displayed in Table 3. Profile 1, which comprised 18.8%($n = 85$) of the sample, was characterized by the lowest scores across all three resilience dimensions, particularly in adaptation ($M = 2.15$, $SE = 0.12$). Consequently, this group was designated as the "Vulnerable" profile. Profile 2 was the largest group, encompassing 47.6%($n = 215$) of the participants. This class exhibited moderate scores across anticipation, coping, and adaptation, reflecting a standard, functional level of organizational resilience. Thus, it was labeled the "Moderate-Functional" profile. Profile 3 represented 33.6%($n = 152$) of the sample and displayed significantly higher scores across all dimensions of resilience compared to the other two groups, with an exceptionally high score in coping mechanisms ($M = 4.45, SE = 0.09$). This class was identified as the "Highly Resilient" profile. An analysis of variance (ANOVA) confirmed that the mean differences across the three profiles were statistically significant for all resilience dimensions ($p < 0.001$).

Table 3

Latent Profile Means and Standard Errors for Resilience Dimensions

Resilience Dimension	Profile 1: Vulnerable ($n = 85$)	Profile 2: Moderate-Functional ($n = 215$)	Profile 3: Highly Resilient ($n = 152$)
Anticipation	2.30(0.15)	3.45(0.10)	4.38(0.11)
Coping	2.42(0.14)	3.52(0.08)	4.45(0.09)
Adaptation	2.15(0.12)	3.60(0.11)	4.50(0.10)

To evaluate the predictive effects of digital literacy and cognitive complexity on profile membership, a multinomial logistic regression analysis was conducted. In this model, the latent profile variable served as the categorical outcome, with the "Vulnerable" profile (Profile 1) designated as the reference category. Table 4 presents the unstandardized

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coefficients (B), standard errors (SE), odds ratios (OR), and confidence intervals for the predictors. The results demonstrated that digital literacy was a significant, positive predictor of belonging to the more resilient profiles. Specifically, a one-unit increase in digital literacy was associated with a 2.85-fold increase in the odds of belonging to the "Moderate-Functional" profile ($OR = 2.85$, $p < 0.01$) and a 4.12-fold increase in the odds of belonging to the "Highly Resilient" profile ($OR = 4.12$, $p < 0.001$), relative to the "Vulnerable" profile. Similarly, cognitive complexity exerted a profound impact on profile membership. Higher levels of cognitive complexity significantly increased the probability of being classified in the "Moderate-Functional" profile ($OR = 2.10$, $p < 0.05$) and the "Highly Resilient" profile ($OR = 3.65$, $p < 0.001$) compared to the "Vulnerable" reference group. These findings clearly indicate that both technological capability (digital literacy) and psychological processing capability (cognitive complexity) act as vital catalysts, propelling organizations away from vulnerability and toward robust, highly adaptive states of resilience.

Table 4

Multinomial Logistic Regression Predicting Latent Profile Membership

Predictor	Profile 2 vs. Profile 1 (Reference)				Profile 3 vs. Profile 1 (Reference)			
	B	SE	OR	95%CI	B	SE	OR	95%CI
Intercept	-1.50^{**}	0.45	–	–	-2.85^{***}	0.52	–	–
Digital Literacy	1.05^{**}	0.32	2.85	[1.52, 5.34]	1.42^{***}	0.35	4.12	[2.07, 8.21]
Cognitive Complexity	0.74^{*}	0.30	2.10	[1.16, 3.80]	1.30^{***}	0.34		

4 Discussion

The primary objective of this study was to identify the hidden latent profiles of organizational resilience and to evaluate the predictive effects of digital literacy and cognitive complexity on the likelihood of membership within these profiles. Through the application of Latent Profile Analysis on a sample of professionals and managerial staff in Chile, the results revealed three distinct, unobserved subpopulations characterizing how organizational resilience is configured within the modern enterprise: the "Vulnerable" profile (18.8% of the sample), the "Moderate-Functional" profile (47.6%), and the "Highly Resilient" profile (33.6%). Subsequent multinomial logistic regression analyses demonstrated that both digital literacy and cognitive complexity serve as robust, statistically significant predictors of organizational resilience. Specifically, elevated levels of digital literacy and cognitive complexity substantially increased the odds of an organization belonging to the "Moderate-Functional" and "Highly Resilient" profiles, as opposed to the "Vulnerable" baseline group. These findings provide profound empirical support for the conceptualization of organizational resilience as a heterogeneous construct driven by both technological and psychological capabilities.

The identification of three distinct latent profiles of organizational resilience aligns with contemporary theoretical frameworks that conceptualize resilience not as a uniform, monolithic trait, but rather as a dynamic, configurationally diverse capacity. The "Vulnerable" profile, characterized by systemic deficiencies in anticipation, coping, and adaptation, reflects the precarious state of organizations that struggle to navigate environmental turmoil and are highly susceptible to sudden market disruptions (Damoah, 2025; Liang et al., 2025). Conversely, the "Moderate-Functional" and "Highly Resilient" profiles represent organizations that have successfully integrated mechanisms to safeguard their operations and market value (Haga & Ittonen, 2024; Oufi et al., 2025). The existence of the "Highly Resilient" group, which excels particularly in coping and adaptation mechanisms, corroborates literature suggesting that true resilience involves not merely bouncing back to a pre-crisis state, but actively transforming and "bouncing forward" to achieve structural sustainability (Florez-Jimenez et al., 2025; Vargas-Hernández et al., 2024). This optimal configuration of resilience is often the product of intensive organizational learning and the continuous development of a proactive, innovative climate where human resource capacities are maximized (Chowdhury et al., 2025; Jiao & Bu, 2024; Keskin & Palaz, 2024). By mapping these hidden profiles, the current study extends previous variable-

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centered approaches, such as those employing structural equation modeling or system dynamics (Sethi & Gupta, 2024; Wang & Chen, 2025), by offering a person-centered methodology that captures the lived, combinatorial reality of organizational robustness.

A pivotal finding of the present research is the strong predictive power of digital literacy on organizational resilience profile membership. The results indicated that for every unit increase in digital literacy, the odds of belonging to the "Highly Resilient" profile increased by a factor of 4.12compared to the "Vulnerable" group. This profound effect is highly consistent with recent empirical investigations highlighting the indispensable role of digital capabilities, digital organizational culture, and digital innovation in fostering competitive advantage and systemic robustness (Velyako & Musa, 2024; Xin & Li, 2024). In an era characterized by rapid technological shifts, organizations equipped with high digital literacy are better positioned to deploy information technology capabilities effectively, thereby enhancing social capital and facilitating rapid communication during crises (Li et al., 2024). Furthermore, navigating the paradoxical, double-edged effects of digital transformation requires a workforce that is not only technologically equipped but critically literate in managing digital resources (Chi et al., 2025; Joulal & Messaoudi, 2024). High digital literacy enables transformative adaptive leadership and facilitates the integration of advanced systems, such as artificial intelligence and AI-driven human resource management, which systematically strengthen managerial competencies and operational continuity (Del Barone et al., 2025; Sundowo et al., 2024; Trim & Lee, 2022). Ultimately, the capacity to improvise and adapt through digital leadership is a direct function of the underlying digital literacy of the organization's members, moving them away from vulnerability and toward a highly resilient operational state (Zhang et al., 2024).

Equally compelling is the finding that cognitive complexity significantly predicts membership in higher-functioning resilience profiles. The analysis revealed that enhanced cognitive complexity increases the likelihood of an organization being classified as "Highly Resilient" by a factor of 3.65. Cognitive complexity allows decision-makers to process multidimensional, often contradictory information, a skill that is paramount during complex crises (Zadok et al., 2024). This finding resonates deeply with studies emphasizing the psychological micro-foundations of resilience, particularly the roles of cognitive reappraisal, employee resilience, and entrepreneurial psychology (Huang et al., 2023; Mahamat et al., 2025; Nelson et al., 2025). When organizational members possess high cognitive complexity, they are more capable of engaging in transformational leadership behaviors, which subsequently elevate team innovation performance and agile project management under stress (Tawas et al., 2024; Yu & Xiang, 2024). Moreover, advanced cognitive processing capabilities contribute to the formulation of resilience-oriented management control systems that can dynamically balance strategic rigidity with operational flexibility (Weber et al., 2024). The ability to synthesize complex environmental signals also fosters a climate of organizational trust and optimism, simultaneously reducing organizational silence—factors that have been empirically proven to mediate and sustain organizational resilience (Jandaghi et al., 2024; Yazdani et al., 2024; Yazıcı & ÖZkan, 2024). By demonstrating the direct impact of cognitive complexity, this study reinforces the notion that leveraging employee value creation through psychological and cognitive enhancement is a serial catalyst for macro-level organizational survival (Low, 2025; Ma & Zhao, 2023). For industries requiring highly calibrated risk assessments, such as major transportation infrastructure or the oil and gas sector, the cognitive complexity of managerial staff dictates the efficacy of the entire resilience framework (Liu et al., 2024; Rahi et al., 2024).

5 Conclusion

In conclusion, this empirical investigation fundamentally advances our contemporary understanding of organizational resilience by demonstrating that it is not a uniform, monolithic attribute, but rather a highly heterogeneous capacity characterized by distinct, unobserved profiles. By successfully identifying the 3latent configurations—"Vulnerable," "Moderate-Functional," and "Highly Resilient"—within modern enterprises, this research provides a vital, person-centered perspective on how organizations actually structure their adaptive and coping mechanisms in response to severe environmental turbulence. Crucially, the findings empirically establish both digital literacy and cognitive complexity as profound, interconnected catalysts for structural organizational robustness. The data unequivocally reveal that equipping a workforce with the sophisticated technological fluency required to navigate complex digital transformations, alongside the advanced cognitive agility necessary to process multidimensional and often contradictory

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information, dramatically shifts an enterprise away from systemic vulnerability. Instead, cultivating these dual capabilities exponentially increases the probability of an organization achieving a highly resilient state—a state wherein the firm can not merely absorb external shocks, but actively innovate, adapt, and bounce forward during periods of crisis. In an era defined by accelerating technological disruptions and increasingly unpredictable global market dynamics, relying solely on traditional, rigid crisis management protocols is demonstrably insufficient. Strategic planners, human resource professionals, and executive leaders must urgently prioritize targeted, long-term investments in continuous digital upskilling programs while simultaneously fostering complex scenario-processing skills and critical thinking capabilities among their human capital. Ultimately, synthesizing this critical intersection of technological proficiency and psychological agility represents a non-negotiable strategic imperative. By deeply embedding digital literacy and cognitive complexity into the core fabric of organizational culture and leadership development, enterprises can proactively engineer their transition into highly resilient entities, thereby ensuring sustainable competitive advantage, robust operational continuity, and enduring long-term viability in an increasingly volatile global landscape.

Despite the robust methodological approach and significant findings, this study is subject to several limitations that must be acknowledged. First, the cross-sectional design of the research inherently limits the ability to draw definitive causal inferences between digital literacy, cognitive complexity, and the latent profiles of organizational resilience. While the predictive models suggest directional relationships based on strong theoretical foundations, the temporal sequence of these variables cannot be unequivocally established without longitudinal data. Second, the reliance on self-reported survey instruments introduces the potential for common method bias and social desirability effects, wherein participants might overstate their organization's resilience capabilities or their own cognitive and digital competencies. Although rigorous data screening and the assurance of anonymity were employed to mitigate this risk, subjective appraisals may still deviate from objective organizational performance metrics during actual crises. Finally, the sample was geographically restricted to mid-sized and large-sized enterprises operating within specific economic hubs in Chile. Consequently, the generalizability of the identified latent profiles and the predictive weight of the independent variables may be limited when applied to different cultural contexts, regulatory environments, or smaller entrepreneurial ventures.

To address these limitations and further advance the literature, several avenues for future research are highly recommended. Future investigations should prioritize longitudinal or time-lagged research designs to track how organizational resilience profiles evolve in real-time before, during, and after systemic macroeconomic shocks. Such studies could illuminate the transitional pathways organizations take when moving from a "Vulnerable" to a "Highly Resilient" state. Furthermore, researchers should endeavor to incorporate objective, secondary data sources—such as financial performance indicators, employee turnover rates, and operational downtime metrics—to corroborate the subjective psychometric evaluations of resilience. Exploring these phenomena through multi-level modeling would also be highly beneficial; by differentiating between individual, team, and organizational-level variances, researchers could pinpoint exactly where digital literacy and cognitive complexity exert their strongest effects. Lastly, replicating this latent profile analysis across diverse geographic regions and cross-cultural contexts would help determine the universal versus context-specific nature of these resilience configurations.

From a practical standpoint, the findings of this study offer critical, actionable insights for organizational leaders, human resource professionals, and strategic planners. Recognizing that resilience is not uniformly distributed but exists in distinct profiles requires managers to first conduct comprehensive organizational diagnostic assessments to identify their current systemic vulnerabilities. If an organization finds itself aligning with the traits of the "Vulnerable" profile, generic crisis management protocols will likely be insufficient. Instead, targeted interventions must be deployed. Specifically, organizations must heavily invest in continuous digital upskilling and comprehensive technology training programs. Fostering digital literacy should be treated not merely as an IT function, but as a core strategic imperative that equips employees to adapt to rapid workflow disruptions and leverage new digital tools for problem-solving. Concurrently, leadership development programs should pivot toward enhancing cognitive complexity. This can be achieved by integrating complex scenario planning, cross-functional job rotations, and advanced critical thinking workshops into management training curricula. By systematically elevating both the technological proficiency and the cognitive agility of their

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workforce, practitioners can actively engineer a transition toward the "Highly Resilient" profile, ensuring long-term sustainability and competitive advantage in an increasingly volatile global market.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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