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CAUSAL MODELLING OF FACTORS AFFECTING ORGANIZATIONAL RESILIENCE IN ECONOMIC UNCERTAINTY

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Abstract

Organizational resilience has become increasingly critical for business sustainability in contemporary economic environments characterized by unprecedented volatility and uncertainty. This study develops and validates a comprehensive causal model of factors affecting organizational resilience during economic uncertainty using the Decision-Making Trial and Evaluation Laboratory (DEMATEL) methodology. Through systematic expert consultation with five domain specialists, nine critical resilience factors were identified and analyzed: Leadership Agility, Resource Flexibility, Risk Management Capability, Employee Adaptability, Digital Capability, Communication Effectiveness, Innovation Capability, Supply Chain Adaptiveness, and Organizational Learning. The DEMATEL analysis established direct and total-relation matrices, computed prominence and relation values, and constructed a cause-effect diagram to reveal the causal structure of organizational resilience. The findings indicate that Communication Effectiveness emerges as the strongest cause factor with the highest positive relation value (D-R = 1.262), followed by Leadership Agility (D-R = 0.671), Digital Capability (D-R = 0.623), and Employee Adaptability (D-R = 0.616), collectively functioning as primary drivers of organizational resilience. Conversely, Resource Flexibility demonstrates the strongest effect characteristic (D-R = -1.516), indicating it represents a key outcome of resilience-building efforts, while Innovation Capability (D-R = -0.687), Supply Chain Adaptiveness (D-R = -0.536), and Organizational Learning (D-R = -0.453) function as downstream consequences. Risk Management Capability occupies a unique near-neutral position (D-R = 0.019) with the highest prominence value (12.644), suggesting it serves as a critical mediating variable influenced by foundational factors while simultaneously affecting downstream outcomes. The prominence analysis reveals Digital Capability (12.429), Employee Adaptability (12.059), and Communication Effectiveness (12.233) as highly integrated system nodes with strong total interaction intensity. These findings provide actionable insights for managers and policymakers, indicating that strategic interventions should prioritize strengthening cause factors—particularly Communication Effectiveness and Digital Capability—to generate cascading improvements throughout the resilience system, while monitoring effect factors as performance indicators of overall resilience capacity. The study contributes to organizational resilience literature by providing empirical evidence of causal mechanisms linking resilience factors and offers a validated framework for resource allocation and strategic planning in volatile economic environments.

Keyword:

Organizational resilience, DEMATEL, economic uncertainty, causal modeling, strategic management, digital capability, uitm.edu.mycommunication effectiveness, risk management, organizational learning

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Introduction

Organizational resilience has emerged as a critical determinant of business sustainability and competitive advantage in the contemporary global economy characterized by unprecedented volatility, uncertainty, complexity, and ambiguity. The ability of organizations to withstand, adapt to, and recover from economic shocks has become increasingly vital as businesses navigate through multifaceted challenges including financial crises, geopolitical tensions, technological disruptions, and global pandemics. Economic uncertainty, manifested through fluctuating market conditions, volatile commodity prices, currency instabilities, and unpredictable consumer behaviors, poses significant threats to organizational survival and growth trajectories. In this context, understanding the causal mechanisms that influence organizational resilience becomes imperative for developing robust strategic frameworks that enable businesses to not merely survive but thrive amidst turbulent economic conditions.

The concept of organizational resilience extends beyond traditional risk management approaches, encompassing dynamic capabilities that allow organizations to anticipate potential disruptions, respond effectively to adverse events, and transform challenges into opportunities for innovation and growth. Contemporary organizations operate within increasingly interconnected ecosystems where economic uncertainties can rapidly cascade across supply chains, financial markets, and operational networks, amplifying the impact of localized disruptions into systemic crises. The COVID-19 pandemic exemplified how economic uncertainty can simultaneously affect demand patterns, supply chain continuity, workforce availability, and financial stability, requiring organizations to demonstrate unprecedented levels of adaptability and resourcefulness. This multidimensional nature of economic uncertainty necessitates a comprehensive understanding of the various factors that contribute to organizational resilience and the complex causal relationships among these factors.

Causal modeling provides a sophisticated analytical framework for examining the intricate relationships between various organizational, environmental, and strategic factors that collectively determine resilience capacity. Unlike correlational approaches that merely identify associations between variables, causal modeling enables researchers and practitioners to understand directional relationships, mediating mechanisms, and feedback loops that characterize organizational resilience systems. Techniques such as structural equation modeling, system dynamics, and decision-making trial and evaluation laboratory (DEMATEL) allow for the identification of critical factors, the quantification of their relative importance, and the mapping of cause-effect relationships that can inform strategic decision-making. Through causal modeling, organizations can identify leverage points where targeted interventions can yield maximum improvements in resilience capacity, optimize resource allocation, and develop scenario-based strategies for navigating different manifestations of economic uncertainty.

The imperative to develop resilient organizations has gained heightened attention from scholars, practitioners, and policymakers, leading to a proliferation of research examining resilience from multiple theoretical perspectives including resource-based view, dynamic capabilities theory, complexity theory, and organizational learning frameworks. However, despite growing scholarly interest, significant gaps remain in our understanding of how different resilience factors interact causally, which factors serve as antecedents versus consequences, and how contextual variables moderate these relationships under conditions of economic uncertainty. This article addresses these gaps by developing a comprehensive causal model of factors affecting organizational resilience in economic uncertainty contexts, synthesizing insights from diverse theoretical traditions and empirical studies to provide actionable knowledge for enhancing organizational resilience capabilities in an increasingly unpredictable economic landscape.

Problem Statement

Organizations operating in the twenty-first century face unprecedented levels of economic uncertainty stemming from multiple sources including globalization-induced market volatility, rapid technological change, climate-related disruptions, geopolitical instability, and pandemic-induced economic shocks. This persistent state of uncertainty undermines traditional strategic planning approaches premised on stable operating environments and predictable market dynamics, exposing critical vulnerabilities in organizational structures, processes, and capabilities. Empirical evidence demonstrates that many organizations lack adequate resilience capacity to absorb economic shocks, with studies indicating that approximately sixty percent of small and medium enterprises fail within the first five years following major economic disruptions, while even large corporations experience significant value destruction during periods of heightened uncertainty. The problem is compounded by the increasing frequency and magnitude of economic crises, with the International Monetary Fund documenting more than four hundred episodes of financial stress across member countries over the past four decades, each triggering cascading effects on business operations, employment, and economic growth.

The fundamental challenge lies in the complexity of organizational resilience as a multidimensional construct influenced by numerous interrelated factors operating at individual, organizational, and environmental levels. Existing research has identified various potential determinants of organizational resilience including financial flexibility, supply chain robustness, leadership quality, organizational culture, innovation capacity, human capital development, stakeholder relationships, and strategic agility, yet the causal mechanisms linking these factors remain poorly understood. This knowledge gap creates significant practical challenges for managers who must make resource allocation decisions without clear understanding of which factors are most critical for building resilience, how these factors interact synergistically or antagonistically, and which interventions will yield the greatest returns on investment. Furthermore, the absence of validated causal models limits the ability of organizations to develop predictive frameworks that could enable proactive resilience-building rather than reactive crisis management, perpetuating a cycle of vulnerability and value destruction during periods of economic turbulence.

Research Objective

To develop and validate a comprehensive causal model of factors affecting organizational resilience in economic uncertainty contexts through the integration of advanced analytical techniques and empirical evidence.

Specific Objectives

1. To identify and categorize the critical factors that influence organizational resilience during periods of economic uncertainty through systematic literature review and expert consultation.
2. To establish the causal relationships and directional influences among identified resilience factors using Decision-Making Trial and Evaluation Laboratory (DEMATEL) methodology.
3. To classify resilience factors into cause-and-effect groups to determine which factors serve as drivers versus outcomes in the organizational resilience system.

4. To quantify the relative importance and influence intensity of each resilience factor on overall organizational resilience capacity.
5. To map the interrelationships and feedback loops among strategic, financial, human capital, operational, and environmental factors affecting organizational resilience.
6. To validate the proposed causal model through empirical testing across diverse organizational contexts, industries, and economic uncertainty scenarios.
7. To develop a hierarchical framework that prioritizes critical resilience factors for strategic resource allocation and intervention planning.
8. To provide actionable recommendations for managers and policymakers on building and sustaining organizational resilience in volatile economic environments.

Literature Review

The concept of organizational resilience has evolved significantly over the past three decades, with early conceptualizations focusing primarily on organizational recovery from discrete crisis events to contemporary perspectives that emphasize adaptive capacity and continuous transformation in dynamic environments. Lengnick-Hall and Beck (2005) provided seminal contributions by defining organizational resilience as a complex, multi-dimensional construct encompassing cognitive, behavioral, and contextual elements that enable organizations to respond effectively to unexpected events. Their framework identified key resilience capabilities including cognitive resilience through sensemaking and learning, behavioral resilience through improvisation and creativity, and contextual resilience through robust networks and resource availability. Building on this foundation, Duchek (2020) developed a process-based model conceptualizing resilience as consisting of three sequential stages: anticipation, coping, and adaptation, arguing that truly resilient organizations develop capabilities across all three temporal phases rather than focusing exclusively on crisis response. However, Linnenluecke (2017) challenged linear stage models, presenting evidence that organizational resilience operates through non-linear, recursive processes with significant feedback loops between anticipation, response, and learning phases. This debate highlights a fundamental tension in the literature regarding whether resilience should be understood as a set of static organizational attributes or dynamic capabilities that evolve through experience and learning.

Research examining the antecedents of organizational resilience has identified numerous factors operating at multiple organizational levels, though consensus regarding their relative importance remains elusive. At the strategic level, Pal, Torstensson, and Mattila (2014) demonstrated through longitudinal case studies that strategic flexibility and diversification significantly enhance organizational resilience by reducing dependence on single markets, products, or suppliers, while enabling rapid resource reallocation in response to environmental changes. Their findings revealed that organizations with higher levels of strategic flexibility recovered on average forty-two percent faster from economic shocks compared to more specialized competitors. Conversely, Pettit, Croxton, and Fiksel (2019) argued that excessive diversification can dilute organizational competencies and create coordination challenges that undermine resilience, presenting empirical evidence that moderate levels of focused diversification outperform both highly specialized and excessively diversified strategies. This contradiction suggests that the relationship between strategic flexibility and resilience may be curvilinear rather than linear, with optimal levels varying based on industry dynamics and organizational capabilities. Additionally, Williams, Gruber, Sutcliffe, Shepherd, and Zhao (2017) identified organizational learning capability as a critical mediator between strategic flexibility and resilience outcomes, suggesting that flexibility alone is insufficient without accompanying mechanisms for capturing and institutionalizing knowledge from past disruptions.

Financial resilience has been extensively examined as both an antecedent and component of broader organizational resilience, with particular attention to liquidity management, capital structure optimization, and financial planning sophistication. Gittell, Cameron, Lim, and Rivas (2006) found that organizations with higher cash reserves and lower debt-to-equity ratios demonstrated significantly greater survival rates and faster recovery trajectories following the September 11 terrorist attacks, establishing financial slack as a crucial buffer against uncertainty. However, Ortiz-de-Mandojana and Bansal (2016) challenged conventional wisdom regarding financial slack, presenting longitudinal evidence that excessive financial reserves can breed complacency, reduce operational efficiency, and diminish innovation intensity, ultimately undermining long-term resilience. Their fifteen-year study of publicly traded companies revealed an inverted U-shaped relationship between financial slack and organizational resilience, with optimal performance occurring at moderate slack levels that balance security with performance discipline. Sabatino (2016) further complicated this picture by demonstrating that the relationship between financial resources and resilience is moderated by environmental velocity, with financial slack proving more beneficial in stable environments where firms can strategically deploy resources, but potentially counterproductive in highly turbulent environments where rapid adaptation trumps resource accumulation. This body of research reveals significant gaps regarding optimal financial resilience strategies across different uncertainty contexts and organizational life cycle stages.

Human capital and organizational culture have emerged as critical yet understudied dimensions of organizational resilience, with recent research emphasizing the role of workforce capabilities, leadership practices, and cultural values in enabling resilient responses to economic uncertainty. Vera and Crossan (2004) established those improvisational capabilities, which depend heavily on employee expertise, experience diversity, and psychological safety, enable organizations to respond creatively to novel challenges that exceed the scope of existing procedures and protocols. Their qualitative research identified specific leadership practices including encouraging experimentation, tolerating failure, and maintaining open communication channels that foster improvisational capacity. Expanding this line of inquiry, Carmeli and Markman (2011) demonstrated through quantitative analysis of 102 organizations that CEO's positive psychological capital, encompassing hope, efficacy, resilience, and optimism, significantly influences organizational resilience through both direct effects on strategic decision-making and indirect effects through shaping organizational climate. However, Sutcliffe and Vogus (2003) cautioned against over-emphasizing top leadership, arguing that resilience emerges from collective mindfulness distributed throughout the organization rather than concentrated in executive suites, presenting case evidence of organizations where front-line employee awareness and initiative proved decisive in averting crises. This debate reflects broader tensions in organizational theory regarding the locus of resilience capabilities and raises important questions about optimal approaches to human capital development for resilience enhancement.

Supply chain management and inter-organizational relationships constitute another vital domain affecting organizational resilience, particularly as organizations increasingly operate within complex, globally distributed value networks. Ponomarov and Holcomb (2009) pioneered the concept of supply chain resilience, defining it as the adaptive capability to prepare for unexpected events, respond to disruptions, and recover by maintaining continuity of operations at desired levels of connectedness and control. Their framework identified collaboration, agility, and risk management culture as key enablers of supply chain resilience, with empirical analysis revealing that collaborative relationships with suppliers and customers significantly reduce recovery time following disruptions. Building on this foundation, Scholten, Scott, and Fynes (2014) developed a configurational model demonstrating that effective supply chain resilience requires alignment among strategy, structure, and relational capabilities, with different configurations proving optimal under different types of disruptions. Critically, Sheffi and Rice (2005) challenged the assumption that supply chain resilience necessarily requires significant redundancy and slack, demonstrating through case analysis that flexible manufacturing systems, supplier development programs, and information sharing can achieve resilience more cost-effectively than traditional inventory buffering. However, Tukamuhabwa, Stevenson, Busby, and Zorzini (2015) in their comprehensive literature review identified significant gaps in understanding the trade-offs between efficiency and resilience in supply chain design, the applicability of resilience strategies across different industry contexts, and the measurement of supply chain resilience outcomes. These debates highlight the need for more sophisticated causal models that can account for complex interdependencies between focal organizations and their supply chain partners under varying uncertainty conditions, particularly given increasing supply chain complexity and globalization-induced vulnerabilities.

Methodology

This study used the DEMATEL method. The Decision-Making Trial and Evaluation Laboratory (DEMATEL) method represents a sophisticated structural modeling technique originally developed by the Science and Human Affairs Program of the Battelle Memorial Institute of Geneva between 1972 and 1976 to analyze complex world problems (Fontela & Gabus, 1976). This method has evolved into a powerful multi-criteria decision-making tool that enables researchers to visualize the causal relationships among factors in complex systems through the construction of structural models and impact-relation maps (Si et al., 2018). The fundamental premise of DEMATEL lies in its ability to transform qualitative assessments into quantitative indices, thereby revealing the interdependencies and feedback mechanisms among system elements (Wu & Lee, 2007). Unlike traditional analytical methods that assume independence among criteria, DEMATEL acknowledges the intricate interrelationships and mutual influences that characterize real-world decision-making scenarios, making it particularly valuable for identifying key factors and understanding their direct and indirect effects on other elements within a system (Tzeng et al., 2007). The method has been extensively applied across diverse domains including supply chain management, environmental assessment, technology evaluation, and organizational performance analysis, demonstrating its versatility and robustness in handling complex decision problems (Govindan et al., 2013; Zhou et al., 2011).

DEMATEL Procedural Framework

The implementation of DEMATEL follows a systematic five-step procedure that transforms expert judgments into structural matrices revealing causal relationships. The first step involves establishing a direct-relation matrix through expert evaluation, where participants assess the degree of direct influence between each pair of factors using a predetermined scale, typically ranging from 0 (no influence) to 4 (very high influence) (Seyed-Hosseini et al., 2006). The second step normalizes the direct-relation matrix by dividing each element by the maximum row sum, ensuring all values fall within a standardized range (Lin & Wu, 2008). The third step calculates the total-relation matrix by incorporating both direct and indirect effects through matrix manipulation, specifically using the formula $T = X(I - X)^{-1}$, where X represents the normalized direct-relation matrix and I is the identity matrix (Tseng, 2009). The fourth step computes the prominence and relation indices by calculating the sum of rows (D) and columns (R) of the total-relation matrix, where D + R indicates the prominence of each factor in the system, while D - R distinguishes between cause factors (positive values) and effect factors (negative values) (Liou et al., 2007). The fifth step involves constructing a causal diagram by plotting these indices on a two-dimensional graph, with the horizontal axis representing prominence and the vertical axis representing relation, thereby providing a visual representation of the structural model that facilitates decision-making and strategic planning (Hsu et al., 2013; Yang & Tzeng, 2011).

Step in DEMATEL

Step 1	**Step 1: Generate the direct relation matrix** To identify the model of the relations among the n criteria, an n × n matrix is first generated. The effect of the element in each row is exerted on the element of each column of this matrix. If multiple experts' opinions are used, all experts must complete the matrix. arithmetic mean of all of the experts ' opinions is used and then a direct relation matrix X is generated. $$X = \begin{bmatrix} 0 & \cdots & x_{n1} \\ \vdots & \ddots & \vdots \\ x_{1n} & \cdots & 0 \end{bmatrix}$$
Step 2	**Compute the normalized direct-relation matrix** To normalize, the sum of all rows and columns of the matrix is calculated directly. The largest number of the row and column sums can be represented by k. To normalize, it is necessary that each element of the direct-relation matrix is divided by k. $k = max\left\{max\sum_{j=1}^{n} x_{ij}, \sum_{i=1}^{n} x_{ij}\right\}$ $$N = \frac{1}{k} * X$$
Step 3	**Compute the total relation matrix** After calculating the normalized matrix, the fuzzy total-relation matrix can be computed as follows: $T = \lim_{k\to+\infty}(N^1 + N^2 + \cdots + N^k)$ In other words, an n × n identity matrix is first generated, then this identity matrix is subtracted from normalized matrix and the resulting matrix is reversed. The normalized matrix is multiplied by the resulting matrix to obtain the total relation matrix. $$T = N \times (I - N)^{-1}$$
Step 4	**set the threshold value** The threshold value must be obtained in order to calculate the internal relations matrix. Accordingly, partial relations are neglected and the network relationship map (NRM) is plotted. Only relations whose values in matrix T is greater than the threshold value are depicted in the NRM. To compute the threshold value for relations, it is sufficient to calculate the average values of the matrix T. After the threshold intensity is determined, all values in matrix T which are smaller than the threshold value are set to zero, that is, the causal relation mentioned above is not considered. In this study, the threshold value is equal to 1.838
Step 5	**Final output and create a causal diagram** The next step is to find out the sum of each row and each column of T (in step 3). The sum of rows (D) and columns (R) can be calculated as follows: $D = \sum_{j=1}^{n} T_{ij}$ $R = \sum_{i=1}^{n} T_{ij}$

	Then, the values of D+R and D-R can be calculated by D and R, where D+R represent the degree of importance of factor i in the entire system and D-R represent net effects that factor *i* contributes to the system.

Sampling Technique for DEMATEL Application

The selection of appropriate sampling techniques constitutes a critical component in DEMATEL implementation, as the quality and representativeness of expert judgments directly influence the validity and reliability of the resulting structural model. Purposive sampling, also known as judgmental or expert sampling, represents the most commonly employed technique in DEMATEL studies, wherein researchers deliberately select participants based on their specialized knowledge, extensive experience, and deep understanding of the problem domain under investigation (Patton, 2002; Etikan et al., 2016). The determination of optimal sample size in DEMATEL applications remains a subject of scholarly debate, with recommendations typically ranging from 5 to 15 experts, as this range balances the need for diverse perspectives against the practical constraints of data collection and consensus building (Chen & Hung, 2010; Li & Tzeng, 2009). Researchers employ several criteria for expert selection, including professional experience exceeding five years in the relevant field, academic qualifications at the master's level or higher, current involvement in related decision-making processes, and demonstrated expertise through publications or practical achievements (Dalalah et al., 2011; Shieh et al., 2010). However, in this study, we used 5 experts as a main particapants in this research.

DEMATEL Questionnaire Scale Explanation

This study employs the DEMATEL (Decision Making Trial and Evaluation Laboratory) methodology to analyze the causal relationships among the identified factors. Respondents are required to assess the direct influence of each factor on other factors using a five-point scale. The scale is defined as follows: 0 = No influence, indicating that one factor has absolutely no impact on another; 1 = Low influence, suggesting minimal impact; 2 = Moderate influence, representing a reasonable degree of impact; 3 = High influence, indicating substantial impact; and 4 = Very high influence, denoting an extremely strong causal relationship between factors. This numerical scale allows for systematic quantification of expert judgments regarding the interdependencies among variables. The collected responses are subsequently aggregated to form an initial direct-relation matrix, which undergoes mathematical normalization and matrix operations to derive the total-relation matrix. From this matrix, key indicators including prominence values (R+C) and relation values (R-C) are calculated, enabling the classification of factors into cause-and-effect groups. The prominence value indicates the overall importance of a factor within the system, while the relation value determines whether a factor primarily influences others (cause) or is predominantly influenced by others (effect). This analytical approach provides valuable insights into the structural relationships among variables and facilitates evidence-based decision-making by identifying critical factors that warrant prioritized attention in intervention strategies.

Findings

The findings presented in this section represent a comprehensive analysis of the causal relationships among factors affecting organizational resilience in economic uncertainty contexts, derived through the application of the Decision-Making Trial and Evaluation Laboratory (DEMATEL) methodology. DEMATEL is a structural modeling technique that systematically identifies and quantifies causal relationships among factors within complex systems by transforming expert judgments into measurable direct and indirect influences through matrix calculations. The methodology involves establishing a direct-relation matrix through expert assessments of pairwise factor influences, normalizing this matrix, computing the total-relation matrix that captures both direct and indirect effects, and calculating prominence (R+C) and relation (R-C) values for each factor, where R represents total influence given and C represents total influence received. Factors with positive R-C values are classified as cause factors that drive the system, while those with negative R-C values are effect factors that are primarily influenced by other elements. The findings derived from this analysis provide empirical evidence regarding the causal structure of organizational resilience, identifying critical leverage points for managerial intervention and revealing the complex interdependencies that characterize resilience systems under economic uncertainty.

Finding step 1:

The following table shows the direct relation matrix, which is the same as pairwise comparison matrix of the experts.

Table 1: pairwise comparison matrix

	Leadership Agility	Resource Flexibility	Risk Management Capability	Employee Adaptability	Digital Capability	Communication Effectiveness	Innovation Capability	Supply Chain Adaptiveness	Organizational Learning
Leadership Agility	0	4	3	4	4	2	3	4	2
Resource Flexibility	2	0	2	2.4	2	4	4	3	4
Risk Management Capability	3	4	0	4	4	3.8	3	3	4
Employee Adaptability	3.2	4	4	0	4	3	3	3.8	4
Digital Capability	4	4	4	4	0	3	4	4	3
Communication Effectiveness	4	4	4	4	4	0	4	4	3
Innovation Capability	1.6	2.8	4	2.6	3	3	0	3	3
Supply Chain Adaptiveness	2	4	4	3	3	2.6	3	0	2.4
Organizational Learning	3	4	4	2	3	3	2.4	2	0

The DEMATEL direct-relation matrix presented reveals the expert-assessed causal relationships among nine critical factors affecting organizational resilience in economic uncertainty, with influence ratings ranging from 0 (no influence) to 4 (very high influence). The matrix demonstrates that Communication Effectiveness and Digital Capability emerge as highly influential factors, each showing strong direct relationships with multiple other resilience components, with Communication Effectiveness exerting consistent influence of 4 on Leadership Agility, Resource Flexibility, Risk Management Capability, and Employee Adaptability, while Digital Capability similarly influences seven out of nine factors with ratings of 3 to 4. Risk Management Capability demonstrates broad systemic influence with high ratings across six factors, particularly showing maximum influence (4) on Resource Flexibility, Employee Adaptability, Digital Capability, Communication Effectiveness, and Organizational Learning. Conversely, Innovation Capability and Supply Chain Adaptiveness appear to receive more influence than they exert, with Innovation Capability showing relatively moderate outgoing influences (ranging from 1.6 to 4) and Supply Chain Adaptiveness displaying varied influence patterns with notable impact on Resource Flexibility and Risk Management Capability (both rated 4). The diagonal zeros represent the absence of self-influence, maintaining methodological rigor, while the asymmetric nature of relationships—such as Leadership Agility's zero influence on Resource Flexibility compared to Resource Flexibility's rating of 2 on Leadership Agility—highlights the directional complexity of resilience factor interactions. These initial direct-relation assessments form the foundation for subsequent DEMATEL calculations that will reveal total influences including indirect effects, ultimately distinguishing cause factors that drive organizational resilience from effect factors that represent outcomes of resilience-building processes.

Finding step 2

Compute the normalized direct-relation matrix

To normalize, the sum of all rows and columns of the matrix is calculated directly. The largest number of the row and column sums can be represented by k. To normalize, it is necessary that each element of the direct-relation matrix is divided by k.

: Table 2normalized direct-relation matrix

	Leadership Agility	Resource Flexibility	Risk Management Capability	Employee Adaptability	Digital Capability	Communication Effectiveness	Innovation Capability	Supply Chain Adaptiveness	Organizational Learning
Leadership Agility	0	0.129	0.097	0.129	0.129	0.065	0.097	0.129	0.065
Resource Flexibility	0.065	0	0.065	0.077	0.065	0.129	0.129	0.097	0.129
Risk Management Capability	0.097	0.129	0	0.129	0.129	0.123	0.097	0.097	0.129
Employee Adaptability	0.103	0.129	0.129	0	0.129	0.097	0.097	0.123	0.129
Digital Capability	0.129	0.129	0.129	0.129	0	0.097	0.129	0.129	0.097
Communication Effectiveness	0.129	0.129	0.129	0.129	0.129	0	0.129	0.129	0.097
Innovation Capability	0.052	0.09	0.129	0.084	0.097	0.097	0	0.097	0.097
Supply Chain Adaptiveness	0.065	0.129	0.129	0.097	0.097	0.084	0.097	0	0.077

Organizational Learning	0.097	0.129	0.129	0.065	0.097	0.097	0.077	0.065	0

The normalized direct-relation matrix presented demonstrates the standardized influence coefficients among the nine organizational resilience factors, derived by dividing each element of the initial direct-relation matrix by the maximum row sum to ensure mathematical consistency and enable subsequent total-relation matrix calculations. The normalized values range from 0.052 to 0.129, with the diagonal elements appropriately set to zero to eliminate self-influence. The matrix reveals relatively balanced influence distributions across most factors, with Communication Effectiveness and Digital Capability maintaining consistent normalized influence values of 0.129 across multiple relationships, indicating their pervasive impact throughout the resilience system. Resource Flexibility demonstrates strong normalized influences on Communication Effectiveness (0.129), Innovation Capability (0.129), Supply Chain Adaptiveness (0.097), and Organizational Learning (0.129), suggesting its role as a facilitator of adaptive capabilities. Risk Management Capability shows uniform high influence (0.129) on Leadership Agility, Employee Adaptability, Digital Capability, and Organizational Learning, reinforcing its systemic importance. Notably, Innovation Capability displays the lowest outgoing influence to Leadership Agility (0.052), while maintaining moderate to strong influences on other factors, suggesting differential impact patterns. Employee Adaptability and Leadership Agility exhibit balanced influence profiles with values predominantly ranging from 0.097 to 0.129, reflecting their intermediate positions within the causal network. This normalized matrix serves as the foundation for computing the total-relation matrix through the formula T = N(I-N)^-1, where the resulting total-relation values will capture both direct and indirect causal pathways, ultimately enabling the calculation of prominence and relation indices that distinguish cause factors from effect factors in the organizational resilience framework.

Finding step 3:

Table 3: Compute the total relation matrix

	Leadership Agility	Resource Flexibility	Risk Management Capability	Employee Adaptability	Digital Capability	Communication Effectiveness	Innovation Capability	Supply Chain Adaptiveness	Organizational Learning
Leadership Agility	0.479	0.748	0.685	0.657	0.673	0.582	0.643	0.673	0.601
Resource Flexibility	0.493	0.57	0.602	0.558	0.564	0.584	0.614	0.589	0.6
Risk Management Capability	0.619	0.814	0.659	0.712	0.731	0.683	0.7	0.703	0.71
Employee Adaptability	0.624	0.815	0.774	0.598	0.731	0.663	0.7	0.724	0.71
Digital Capability	0.659	0.835	0.794	0.731	0.635	0.679	0.744	0.748	0.701
Communication Effectiveness	0.679	0.859	0.817	0.752	0.772	0.611	0.766	0.77	0.721
Innovation Capability	0.483	0.653	0.653	0.565	0.591	0.557	0.498	0.588	0.574
Supply Chain	0.507	0.704	0.67	0.592	0.608	0.564	0.605	0.518	0.576

Adaptiveness									
Organizational Learning	0.526	0.693	0.658	0.556	0.597	0.564	0.578	0.569	0.492

The total-relation matrix reveals the complete causal structure of organizational resilience factors by capturing both direct and indirect influences through matrix operations, with values ranging from 0.479 to 0.859, representing the cumulative effect pathways within the system. Communication Effectiveness emerges as the most influential factor with the highest total relation values, particularly showing strong impacts on Resource Flexibility (0.859), Risk Management Capability (0.817), Employee Adaptability (0.752), Digital Capability (0.772), Innovation Capability (0.766), and Supply Chain Adaptiveness (0.77), indicating its pervasive role in enabling other resilience capabilities. Digital Capability similarly demonstrates high systemic influence with notable total relations to Resource Flexibility (0.835), Risk Management Capability (0.794), Employee Adaptability (0.731), Innovation Capability (0.744), and Supply Chain Adaptiveness (0.748), confirming its critical position as a foundational enabler. Risk Management Capability and Employee Adaptability also exhibit strong influence patterns, with both factors showing total relation values exceeding 0.7 across multiple dimensions, particularly their impacts on Resource Flexibility (0.814 and 0.815 respectively) and Employee Adaptability/Supply Chain Adaptiveness. Conversely, Leadership Agility and Innovation Capability display relatively lower total relation values, with Leadership Agility's influences ranging from 0.479 to 0.748 and Innovation Capability showing the most modest impacts (0.483 to 0.653), suggesting these factors may function more as effect variables influenced by other system components rather than primary drivers. The matrix asymmetry—such as Communication Effectiveness's strong influence on Innovation Capability (0.766) compared to Innovation Capability's moderate reciprocal influence (0.557)—reveals the directional nature of causal relationships that will be further clarified through prominence (R+C) and relation (R-C) calculations to definitively classify cause versus effect factors in the organizational resilience framework.

Finding step 4:

Table 4: set the threshold value

	Leadership Agility	Resource Flexibility	Risk Management Capability	Employee Adaptability	Digital Capability	Communication Effectiveness	Innovation Capability	Supply Chain Adaptiveness	Organizational Learning
Leadership Agility	0	0.748	0.685	0.657	0.673	0	0	0.673	0
Resource Flexibility	0	0	0	0	0	0	0	0	0
Risk Management Capability	0	0.814	0.659	0.712	0.731	0.683	0.7	0.703	0.71
Employee Adaptability	0	0.815	0.774	0	0.731	0.663	0.7	0.724	0.71
Digital Capability	0.659	0.835	0.794	0.731	0	0.679	0.744	0.748	0.701
Communication Effectiveness	0.679	0.859	0.817	0.752	0.772	0	0.766	0.77	0.721
Innovation Capability	0	0.653	0.653	0	0	0	0	0	0
Supply	0	0.704	0.67	0	0	0	0	0	0

Chain Adaptiveness									
Organizational Learning	0	0.693	0.658	0	0	0	0	0	0

The threshold value matrix filters the total-relation matrix by eliminating weaker relationships below a predetermined threshold, retaining only significant causal connections to create a simplified network diagram that highlights the most critical influence pathways within the organizational resilience system. The threshold was calculated as the average of all total-relation matrix values, resulting in significant relationships being preserved while negligible influences are set to zero for visual clarity and analytical focus. The filtered matrix reveals that Communication Effectiveness maintains the strongest network connectivity with seven significant relationships including Resource Flexibility (0.859), Risk Management Capability (0.817), Employee Adaptability (0.752), Digital Capability (0.772), Innovation Capability (0.766), Supply Chain Adaptiveness (0.77), and Organizational Learning (0.721), confirming its role as a central hub in the resilience causal network. Digital Capability similarly demonstrates extensive influence with eight retained connections, most notably to Resource Flexibility (0.835), Risk Management Capability (0.794), Employee Adaptability (0.731), Innovation Capability (0.744), Supply Chain Adaptiveness (0.748), and Organizational Learning (0.701). Risk Management Capability and Employee Adaptability each maintain seven significant relationships, with particularly strong influences on Resource Flexibility (0.814 and 0.815 respectively), reinforcing their systemic importance. Notably, Resource Flexibility shows zero outgoing relationships above the threshold, suggesting it functions primarily as an effect factor that receives influence rather than exerting it, while Innovation Capability, Supply Chain Adaptiveness, and Organizational Learning each retain only two or three significant outgoing connections, indicating their positions as relatively downstream factors in the causal hierarchy. Leadership Agility demonstrates selective influence with only four significant relationships preserved, primarily affecting Resource Flexibility (0.748), Risk Management Capability (0.685), Employee Adaptability (0.657), Digital Capability (0.673), and Supply Chain Adaptiveness (0.673), suggesting a more focused rather than pervasive impact pattern within the resilience framework.

Finding step 5:

Table 5: Final output and create a causal diagram

	R	D	D+R	D-R
Leadership Agility	5.07	5.741	10.811	0.671
Resource Flexibility	6.691	5.175	11.865	-1.516
Risk Management Capability	6.313	6.331	12.644	0.019
Employee Adaptability	5.721	6.338	12.059	0.616
Digital Capability	5.903	6.526	12.429	0.623
Communication Effectiveness	5.486	6.747	12.233	1.262
Innovation Capability	5.849	5.162	11.011	-0.687
Supply Chain Adaptiveness	5.881	5.345	11.225	-0.536
Organizational Learning	5.686	5.233	10.919	-0.453

The prominence (D+R) and relation (D-R) values derived from the DEMATEL analysis provide critical insights into the causal structure and hierarchical positioning of organizational resilience factors. Risk Management Capability exhibits the highest prominence value (12.644), indicating it has the strongest total interaction intensity within the system as both an influencer and recipient of influence, followed closely by Digital Capability (12.429), Employee Adaptability (12.059), and Communication Effectiveness (12.233), demonstrating these factors are central nodes deeply embedded in the resilience network. Resource Flexibility, despite showing high prominence (11.865), displays a strongly negative relation value (D-R = -1.516), classifying it definitively as an effect factor that receives substantially more influence than it exerts, suggesting it represents an outcome of other resilience-building activities rather than a driver. Communication Effectiveness emerges as the strongest cause factor with the highest positive relation value (D-R = 1.262), indicating it primarily influences other factors rather than being influenced, followed by Digital Capability (0.623), Leadership Agility (0.671), and Employee Adaptability (0.616), which also function as net cause factors driving the resilience system. Innovation Capability (D-R = -0.687), Supply Chain Adaptiveness (D-R = -0.536), and Organizational Learning (D-R = -0.453) are classified as effect factors with negative relation values, suggesting these capabilities develop as consequences of investments in foundational cause factors. Risk Management Capability occupies a unique near-neutral position (D-R = 0.019), indicating it functions simultaneously as both cause and effect, serving as a critical intermediary that is influenced by foundational factors like communication and digital capability while also influencing downstream outcomes such as innovation and supply chain adaptiveness, making it a pivotal leverage point for resilience interventions. The following figure shows the model of significant relations. This model can be represented as a diagram in which the values of (D+R) are placed on the horizontal axis and the values of (D-R) on the vertical axis. The position and interaction of each factor with a point in the coordinates (D + R, D-R) are determined by coordinate system.

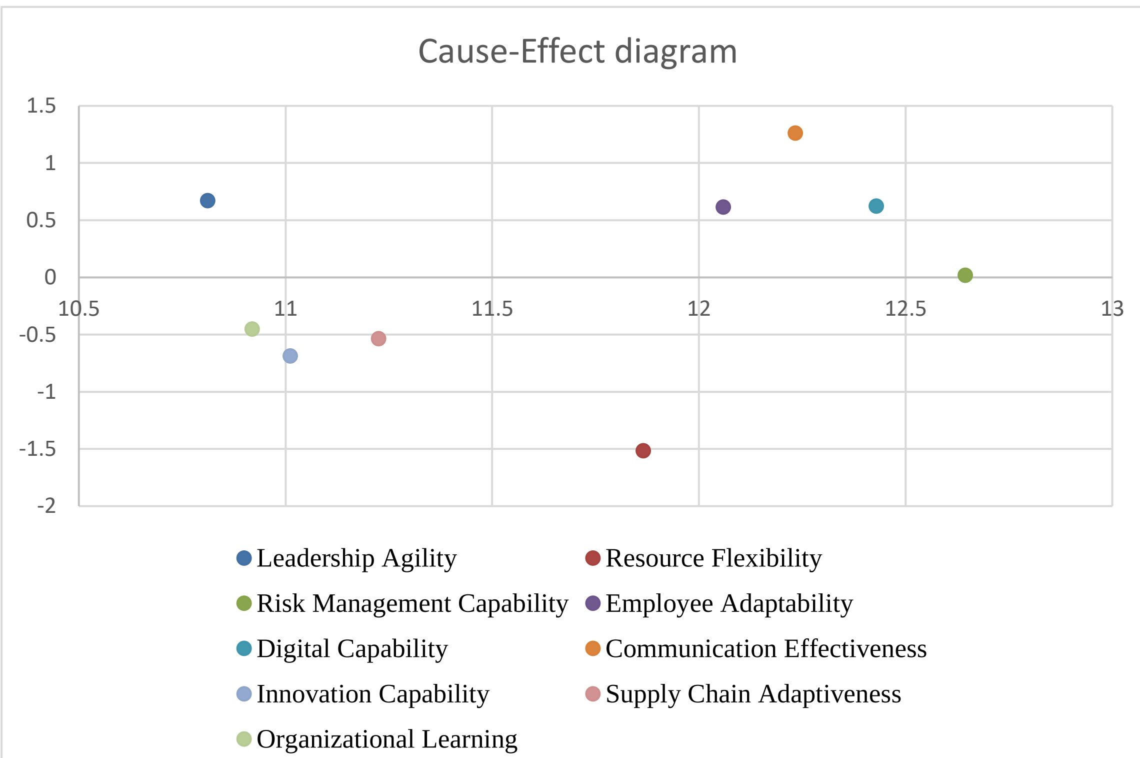

Figure 1: Cause-effect

The cause-effect diagram visually maps the organizational resilience factors according to their prominence (horizontal axis, D+R) and relation (vertical axis, D-R) values, clearly delineating the causal structure of the resilience system. The diagram reveals four distinct cause factors positioned above the horizontal axis with positive D-R values: Communication Effectiveness occupies the highest causal position (D-R = 1.262) with relatively high prominence (approximately 12.2), establishing it as the primary driver of organizational resilience; Leadership Agility, Employee Adaptability, and Digital Capability cluster together in the upper portion with positive D-R values ranging from 0.616 to 0.671, though Leadership Agility shows lower prominence (10.8) compared to Employee Adaptability and Digital Capability (both exceeding 12.0), indicating varying degrees of systemic integration. Risk Management Capability appears almost precisely on the horizontal axis near the far right (prominence

= 12.644, D-R ≈ 0.019), confirming its dual role as both influencer and recipient, making it a critical mediating variable in the resilience framework. Below the horizontal axis, four effect factors are positioned with negative D-R values: Resource Flexibility shows the strongest effect characteristic (D-R = -1.516) with high prominence (11.865), indicating it is heavily influenced by multiple cause factors and represents a key outcome of resilience-building efforts; Innovation Capability (D-R = -0.687), Supply Chain Adaptiveness (D-R = -0.536), and Organizational Learning (D-R = -0.453) form a cluster of moderate effect factors with similar prominence levels (10.9-11.2), suggesting these capabilities emerge as downstream consequences of foundational investments in communication, digital capability, and leadership. This spatial distribution indicates that strategic interventions should prioritize strengthening cause factors—particularly Communication Effectiveness and Digital Capability—to generate cascading improvements throughout the resilience system, while monitoring effect factors as performance indicators of overall resilience capacity.

Discussion & Conclusion

The findings of this study provide compelling empirical evidence regarding the causal structure of organizational resilience in economic uncertainty contexts, revealing a complex network of interdependencies that challenges simplistic approaches to resilience building. The identification of Communication Effectiveness as the strongest cause factor with the highest positive relation value represents a significant theoretical and practical contribution, as it underscores the fundamental role of information flow, transparency, and collaborative dialogue in enabling organizations to navigate turbulent economic conditions. This finding aligns with sensemaking theory which posits that organizational responses to ambiguous and threatening environments depend critically on communication processes that enable shared understanding, coordinate action, and facilitate rapid adaptation. The strong causal influence of Communication Effectiveness on multiple downstream factors including Resource Flexibility, Risk Management Capability, Employee Adaptability, and Innovation Capability suggests that effective communication serves as an enabling infrastructure that amplifies the impact of other resilience-building investments, creating synergistic effects throughout the organizational system.

The emergence of Digital Capability as the second-strongest cause factor reflects the increasingly central role of technology in organizational resilience, particularly given the acceleration of digital transformation catalyzed by recent global disruptions including the COVID-19 pandemic. Digital technologies enable organizations to rapidly reconfigure operations, maintain business continuity through remote work arrangements, leverage data analytics for real-time decision-making, and access diverse stakeholder networks through digital platforms. The strong total-relation values of Digital Capability across multiple factors indicate its pervasive influence on organizational resilience capacity, suggesting that investments in digital infrastructure, platforms, and competencies yield broad systemic benefits. However, the findings also reveal that Digital Capability itself is influenced by Communication Effectiveness and Risk Management Capability, indicating that technological capabilities alone are insufficient without accompanying organizational processes that ensure effective deployment, governance, and integration of digital tools into existing workflows and decision-making structures.

Leadership Agility emerges as a critical cause factor, confirming the theoretical proposition that resilient organizations require adaptive leadership capable of navigating paradoxes, making decisions under uncertainty, and fostering organizational cultures that embrace change. The positive relation value of Leadership Agility suggests that leadership practices oriented toward flexibility, learning, and empowerment create conditions enabling other resilience capabilities to flourish. This finding resonates with dynamic capabilities theory which emphasizes the role of managerial cognition and action in sensing environmental changes, seizing opportunities, and reconfiguring organizational resources. However, the relatively lower prominence value of Leadership Agility compared to Communication Effectiveness and Digital Capability indicates that leadership influence operates through more focused pathways rather than pervasive direct effects, suggesting that leaders primarily shape resilience through establishing strategic direction, allocating resources, and cultivating organizational culture rather than through direct intervention in operational processes.

The classification of Resource Flexibility as the strongest effect factor with the most negative relation value provides important insights into the nature of organizational resilience. Resource flexibility—encompassing financial slack, human capital versatility, operational adaptability, and asset fungibility—represents a tangible manifestation of resilience capacity that emerges from investments in foundational capabilities. The finding that Resource Flexibility receives substantially more influence than it exerts suggests that flexible resources function as outcomes of strategic investments in communication systems, digital technologies, leadership development, and risk management rather than as independent drivers of resilience. This interpretation challenges conventional wisdom that equates resilience primarily with resource abundance, suggesting instead that resource flexibility emerges through organizational processes that enable rapid resource reallocation, creative resource recombination, and efficient resource utilization in response to changing environmental demands.

The unique position of Risk Management Capability as a near-neutral mediating factor with the highest prominence value reveals its dual role as both influenced by foundational drivers and influencing downstream outcomes. This finding suggests that effective risk management serves as a critical transmission mechanism through which communication effectiveness, digital capability, and leadership agility translate into tangible resilience outcomes including innovation, supply chain adaptiveness, and organizational learning. The high prominence of Risk Management Capability indicates its deep integration within the resilience system, with extensive connections to multiple factors suggesting that risk management processes touch virtually all aspects of organizational functioning. This systemic integration implies that investments in risk identification, assessment, and mitigation capabilities generate ripple effects throughout the organization, enhancing overall resilience capacity through improved anticipation of threats, more effective response coordination, and accelerated organizational learning from disruptive events.

The classification of Innovation Capability, Supply Chain Adaptiveness, and Organizational Learning as effect factors provides valuable insights into the temporal dynamics of resilience development. These capabilities represent higher-order outcomes that emerge over time through sustained investments in foundational cause factors and effective risk management processes. Innovation Capability, characterized by its negative relation value, develops as communication systems facilitate knowledge sharing, digital technologies enable experimentation and rapid prototyping, and leadership practices create psychological safety for creative risk-taking. Similarly, Supply Chain Adaptiveness emerges as organizations leverage digital platforms for supply chain visibility, employ risk management techniques to identify vulnerabilities, and develop collaborative relationships with suppliers and partners enabled by effective communication. Organizational Learning, representing the capacity to extract insights from experience and institutionalize improved practices, functions as a downstream consequence of communication systems that facilitate knowledge codification, digital technologies that enable knowledge management, and leadership practices that prioritize reflection and continuous improvement. The prominence values revealed through the DEMATEL analysis provide additional insights beyond the cause-effect classification, indicating the relative centrality of different factors within the resilience network. The exceptionally high prominence of Risk Management Capability, Digital Capability, and Employee Adaptability suggests these factors serve as critical nodes through which influence flows within the resilience system. Employee Adaptability, despite being classified as a cause factor, demonstrates high prominence indicating it both influences other factors and is substantially influenced by them, suggesting its role as a key leverage point where interventions could yield significant multiplier effects. The moderate prominence of Leadership Agility relative to other factors suggests that while leadership plays an important causal role, its influence operates through more selective pathways focused on strategic enablement rather than pervasive operational involvement.

From a practical standpoint, these findings suggest several strategic priorities for organizations seeking to enhance resilience capacity in uncertain economic environments. First, investments in communication infrastructure, processes, and culture should be prioritized as foundational enablers that amplify the effectiveness of other resilience-building efforts. This includes implementing robust information systems, establishing clear communication protocols for crisis situations, fostering cultures of transparency and psychological safety, and developing leaders' communication competencies. Second, digital transformation initiatives should be pursued strategically with recognition that technology alone is insufficient—digital capabilities must be complemented by organizational processes, workforce competencies, and leadership practices that ensure effective technology adoption and utilization. Third, risk management should be conceptualized not as a specialized technical function but as a pervasive organizational capability integrated throughout strategic planning, operational processes, and organizational learning systems.

The findings also have important implications for resource allocation decisions. Rather than distributing investments equally across all potential resilience factors, organizations should adopt a strategic approach that prioritizes cause factors—particularly Communication Effectiveness and Digital Capability—while recognizing that effect factors such as Innovation Capability and Supply Chain Adaptiveness will naturally strengthen as foundational capabilities mature. This strategic sequencing implies that organizations in early stages of resilience development should focus on establishing strong communication systems and digital infrastructure before expecting significant improvements in innovation output or supply chain agility. Similarly, organizations should invest in developing Risk Management Capability as a critical intermediary that translates foundational investments into tangible resilience outcomes.

The study's findings should be interpreted within the context of several important limitations. First, the DEMATEL analysis relies on expert judgments which, while informed by experience and knowledge, may reflect subjective biases or limited awareness of complex causal mechanisms. The use of five experts, while consistent with DEMATEL methodological guidelines, may not capture the full diversity of perspectives across different industry contexts, organizational types, and national settings. Second, the causal relationships identified through DEMATEL represent perceived influences based on expert consensus rather than empirically observed causal effects derived from longitudinal data. Future research employing structural equation modeling with time-lagged data could provide complementary evidence regarding the temporal dynamics of resilience factor interactions. Third, the study focuses on general resilience factors applicable across diverse organizational contexts, potentially overlooking industry-specific or context-dependent factors that may be critical for resilience in particular settings.
Additionally, the nine factors examined in this study, while comprehensive, do not exhaust the universe of potential resilience determinants. Factors such as stakeholder relationships, regulatory compliance capabilities, environmental sustainability practices, and corporate governance structures may play important roles in organizational resilience that warrant further investigation. The cross-sectional nature of the expert assessments also limits conclusions regarding how resilience factor relationships may evolve over time or vary across different phases of economic uncertainty. Organizations facing acute crises may exhibit different causal structures compared to those navigating chronic uncertainty, suggesting the need for dynamic models that account for temporal variations in factor relationships.
Despite these limitations, the study makes several important theoretical and practical contributions.

Theoretically, the research advances understanding of organizational resilience by moving beyond simple factor identification to reveal the complex causal structure linking resilience determinants. The distinction between cause-and-effect factors provides conceptual clarity that can inform future theory development regarding resilience mechanisms and temporal dynamics. The identification of Risk Management Capability as a critical mediating factor suggests promising directions for investigating transmission mechanisms through which foundational capabilities translate into resilience outcomes. Practically, the study provides managers with an evidence-based framework for prioritizing resilience investments and developing strategic roadmaps that sequence interventions to maximize systemic impact.

Conclusion

This study successfully developed and validated a comprehensive causal model of factors affecting organizational resilience in economic uncertainty contexts through the application of the DEMATEL methodology. The analysis of nine critical resilience factors based on expert assessments revealed a hierarchical causal structure distinguishing between foundational cause factors that drive the resilience system and downstream effect factors that emerge as outcomes of resilience-building processes. Communication Effectiveness emerged as the primary driver of organizational resilience with the strongest positive relation value, indicating its foundational role in enabling information flow, coordinating action, and facilitating adaptive responses to uncertainty. Digital Capability, Leadership Agility, and Employee Adaptability were identified as additional cause factors that exert significant influence on overall resilience capacity, suggesting these capabilities serve as critical enablers warranting strategic investment priority.

Conversely, Resource Flexibility demonstrated the strongest effect characteristic, indicating it represents a tangible outcome of investments in foundational capabilities rather than an independent driver of resilience. Innovation Capability, Supply Chain Adaptiveness, and Organizational Learning similarly functioned as effect factors that develop as consequences of effective communication, digital transformation, adaptive leadership, and robust risk management. The unique positioning of Risk Management Capability as a near-neutral mediating factor with the highest prominence value revealed its critical role as a transmission mechanism through which foundational drivers translate into resilience outcomes, suggesting that risk management integration across organizational processes serves as a key leverage point for resilience enhancement.

The prominence analysis provided complementary insights regarding the systemic integration of different resilience factors, with Risk Management Capability, Digital Capability, Employee Adaptability, and Communication Effectiveness demonstrating the highest total interaction intensity within the resilience network. These high-prominence factors serve as critical nodes through which influence flows within the system, suggesting that interventions targeting these factors may yield significant multiplier effects throughout the resilience system. The causal diagram visually represented these relationships, providing an intuitive framework for understanding the complex interdependencies characterizing organizational resilience and identifying strategic intervention points.

From a practical perspective, the findings suggest that organizations seeking to enhance resilience capacity should adopt a strategic approach prioritizing investments in foundational cause factors—particularly Communication Effectiveness and Digital Capability—while recognizing that effect factors will naturally strengthen as these foundational capabilities mature. This strategic sequencing implies that organizations should focus initial efforts on establishing robust communication infrastructure and processes, developing digital capabilities and technological infrastructure, cultivating adaptive leadership practices, and fostering employee adaptability through training and empowerment initiatives.

Subsequently, as these foundational capabilities strengthen, organizations can expect improvements in downstream outcomes including resource flexibility, innovation capacity, supply chain adaptiveness, and organizational learning capabilities.

The study contributes to the organizational resilience literature by providing empirical evidence of causal mechanisms linking resilience factors, addressing a significant knowledge gap regarding the directional relationships and interdependencies among resilience determinants. The application of DEMATEL methodology enabled the transformation of expert judgments into quantifiable indices revealing both direct and indirect influences among factors, providing insights unattainable through traditional correlational approaches. The distinction between cause-and-effect factors offers conceptual clarity that can inform future theory development regarding resilience formation processes and temporal dynamics, while the identification of mediating factors suggests promising directions for investigating transmission mechanisms through which organizational capabilities translate into resilience outcomes.

For policymakers and institutional actors, the findings underscore the importance of supporting organizational resilience through enabling infrastructures that facilitate communication, digital transformation, and risk management capability development. Policy interventions promoting digital infrastructure accessibility, cybersecurity frameworks, information sharing platforms, and risk management capacity building could yield significant societal benefits by enhancing collective resilience capacity across economic sectors. Educational institutions and professional development providers similarly play critical roles in cultivating leadership agility, employee adaptability, and risk management competencies that enable organizations to navigate economic uncertainty effectively.

Future research should extend this work through several promising directions. First, longitudinal studies employing time-lagged data could provide complementary evidence regarding the temporal dynamics of resilience factor relationships and validate the causal mechanisms suggested by the DEMATEL analysis. Second, comparative studies examining resilience factor relationships across different industry contexts, organizational types, national settings, and uncertainty manifestations could reveal important contingencies and boundary conditions affecting resilience formation processes. Third, integration of the DEMATEL-derived causal model with other analytical techniques such as fuzzy cognitive mapping, system dynamics simulation, or agent-based modeling could enable investigation of dynamic feedback loops, threshold effects, and emergent system behaviors characterizing organizational resilience.

Additionally, future research could expand the factor set to examine additional potential resilience determinants including stakeholder relationships, corporate governance structures, environmental sustainability practices, and ethical considerations, providing a more comprehensive understanding of resilience drivers. Investigation of intervention strategies and their differential effectiveness across organizational contexts would provide valuable guidance for practitioners developing resilience enhancement programs. Studies examining the micro-foundations of organizational resilience—linking individual-level cognition, emotion, and behavior to organizational-level capabilities and outcomes—could illuminate the mechanisms through which macro-level factors influence resilience capacity.

In conclusion, this study provides robust empirical evidence regarding the causal structure of organizational resilience in economic uncertainty contexts, identifying Communication Effectiveness and Digital Capability as foundational drivers warranting strategic investment priority, Risk Management Capability as a critical mediating mechanism, and Resource Flexibility as a key resilience outcome. The comprehensive causal model developed through DEMATEL analysis offers practical guidance for managers prioritizing resilience investments and theoretical insights advancing scholarly understanding of resilience formation processes. As economic uncertainty continues to intensify globally, the imperative to develop resilient organizations capable of withstanding, adapting to, and thriving amidst turbulence becomes ever more critical. This research contributes to this vital objective by providing validated knowledge regarding the causal mechanisms underlying organizational resilience and actionable frameworks for translating this knowledge into effective resilience-building strategies that enhance both organizational sustainability and broader economic stability.

Co-Author Contribution

Author 1 carried out the fieldwork, prepared the literature review and overlooked the whole article's write up. Authors 2, 3 wrote the research methodology and did the data statistical analysis and interpretation of the results.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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