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Resilience Under Turbulence: A Complex Adaptive Systems Perspective on SMEs in Developing Economies

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Abstract**:** *Small and medium-sized enterprises in developing economies increasingly operate under persistent turbulence marked by institutional instability, regulatory inconsistency, inflationary pressures, geopolitical disruptions, and resource constraints. Existing research often treats resilience as a predefined organizational capability activated during episodic crises, offering limited explanation of how firms adapt under prolonged instability. Drawing on Complex Adaptive Systems Theory, this paper develops a conceptual framework explaining SME resilience as an emergent phenomenon produced through continuous adaptation. We argue that resilience emerges through nonlinear interactions among distributed agency, adaptive learning, feedback processes, self-organization, and network reconfiguration. By repositioning resilience as a dynamic, system-level outcome rather than a static capability, the paper contributes to resilience and SME scholarship in three ways: it advances a processual understanding of resilience, extends CAS theory to SMEs in developing economies, and offers implications for managers and policymakers supporting firms under persistent uncertainty. Future empirical research directions are outlined*

Keywords: *Resilience, Turbulence, Complex Adaptive System Perspective, SMEs, Developing Economies*

1. Introduction

SMALL and medium-sized enterprises (SMEs) operating in developing economies increasingly face conditions of persistent turbulence rather than episodic disruption. Political instability, inflationary pressures, institutional fragility, regulatory inconsistency, disrupted supply chains, and limited access to capital often coexist and reinforce one another, transforming uncertainty into a normal feature of organizational life rather than an exceptional event [1], [2]. In many developing economies, SMEs must operate under conditions where crises overlap, recur, and evolve before firms fully recover from previous disruptions. Under such circumstances, resilience becomes a central organizational concern—not simply the ability to survive shocks, but the capacity to sustain operations, adapt organizationally, and remain viable despite prolonged instability [3].

The resilience of SMEs has therefore attracted increasing scholarly attention. Existing research highlights mechanisms such as strategic flexibility, learning, network embeddedness, improvisation, and resource reconfiguration as critical for helping firms absorb shocks and maintain continuity during crises [1], [3]. Studies have further emphasized the importance of informal social ties, entrepreneurial agility, and organizational learning in enabling SMEs to navigate adverse environments [4], [5]. Yet much of this literature continues to conceptualize resilience as an organizational capability or attribute that firms possess and activate when disruption occurs [6]. Implicit in such perspectives is the assumption that crises represent temporary interruptions to relatively stable organizational environments.

This assumption becomes problematic in contexts characterized by chronic turbulence. In many developing economies, SMEs do not merely respond to isolated shocks but continuously confront instability generated by shifting regulations, bureaucratic inefficiencies, weak institutional coordination, inflation, and geopolitical uncertainty [7], [8]. In some cases, international sanctions intensify turbulence by disrupting supply chains, limiting access to financial systems, restricting imported technologies, and increasing market unpredictability [9], [10], [11]. Under such conditions, resilience is unlikely to function as a static capability that organizations mobilize after disruption. Rather, it appears to emerge through ongoing adaptation to continuously evolving circumstances.

This raises an important theoretical question: How does resilience emerge in SMEs operating under persistent turbulence? Existing resilience frameworks provide important insights into organizational preparedness, recovery, and adaptation, yet they often privilege relatively linear and capability-based explanations of organizational response [6]. Such perspectives are less suited to explaining organizational adaptation under conditions where uncertainty is nonlinear, feedback is continuous, and equilibrium is rarely restored [12].

To address this gap, this paper argues that Complex Adaptive Systems Theory offers a useful lens for understanding SME resilience in turbulent environments. CAS theory conceptualizes organizations as systems of interacting and interdependent agents whose adaptive behaviors, feedback loops, learning processes, and localized interactions collectively generate emergent outcomes [13], [14]. Rather than assuming predictability or centralized control, CAS emphasizes adaptation, self-organization, emergence, and nonlinear interactions among organizational and environmental elements [15], [16]. This perspective aligns closely with the realities of SMEs in developing economies, where firms often rely on informal coordination, iterative experimentation, and adaptive responses to uncertain institutional and market conditions.

Applying a CAS lens suggests an important reconceptualization of resilience. Instead of viewing resilience as a stable organizational capability, resilience can be understood as an emergent organizational property produced through ongoing interactions among actors, routines, networks, resources, and environmental feedback [17], [18]. SMEs do not simply possess resilience; resilience emerges through distributed adaptation, learning, self-organization, and the dynamic reconfiguration of relationships under turbulent conditions.

Accordingly, this paper develops a conceptual framework explaining SME resilience under turbulence through a CAS perspective. We argue that persistent turbulence intensifies adaptive interactions within and around SMEs and that resilience emerges through mechanisms such as distributed agency, feedback processes, adaptive learning, self-organization, and network reconfiguration. In doing so, the paper contributes to resilience and SME research by reconceptualizing resilience as an emergent phenomenon, introducing CAS as an integrative explanatory lens, and offering implications for managers and policymakers operating in environments characterized by prolonged instability.

2. Persistent Turbulence in Developing Economies

SMEs operating in developing economies frequently function in environments characterized by persistent turbulence rather than temporary disruption. Unlike firms in relatively stable institutional settings, where crises are often episodic and followed by periods of recovery, SMEs in many developing economies encounter overlapping economic, political, and institutional disruptions that continuously reshape organizational conditions [1], [12]. Inflationary pressures, unstable regulatory systems, inconsistent government policies, labor market volatility, bureaucratic inefficiencies, and recurrent geopolitical disruptions often coexist, producing an environment in which uncertainty becomes a permanent organizational condition rather than an exceptional event [2], [7]. Under such circumstances, firms cannot rely on assumptions of equilibrium or predictable recovery trajectories because turbulence itself becomes embedded in the organizational context.

Government institutions play a particularly important role in shaping the operating environment of SMEs in developing economies. Public policy may stimulate entrepreneurial activity through investments, incentives, or entrepreneurship-support initiatives, yet inconsistent implementation, weak coordination, and bureaucratic inefficiencies may simultaneously constrain organizational growth and adaptation [8], [19]. For example, research on SMEs in developing economies demonstrates that policies intended to support entrepreneurship frequently suffer from implementation gaps, unclear communication, or institutional inconsistency, reducing their effectiveness and increasing uncertainty for firms [7]. Consequently, SMEs often operate in institutional environments where formal structures simultaneously support and constrain organizational resilience.

Beyond domestic institutional conditions, many SMEs in developing economies face turbulence generated by global political and economic dynamics. International sanctions, trade restrictions, and disruptions to global financial systems can significantly intensify organizational vulnerability by limiting access to imported technologies, restricting participation in international markets, disrupting supply chains, and constraining financial transactions [2], [11]. Such disruptions frequently generate second-order consequences, including inflationary pressures, resource scarcity, declining investment, and heightened market unpredictability, all of which increase pressure on SMEs with limited financial and organizational slack [9], [20].

Yet turbulence does not necessarily imply organizational collapse. Research increasingly shows that SMEs often develop adaptive responses that allow them to survive and, in some cases, grow despite prolonged adversity [1]. Firms operating under unstable institutional conditions frequently rely on informal social networks, improvisation, adaptive learning, and flexible resource allocation to navigate uncertainty [4]. Evidence from sanction-affected and institutionally constrained environments further suggests that SMEs often reconfigure business models, reduce nonessential expenditures, strengthen informal coordination mechanisms, and intensify environmental scanning to remain operational under pressure [9], [10]. Recent work also highlights how resilience emerges through dynamic interactions among formal and informal networks, managerial characteristics, and continuous feedback from stakeholders and institutional actors [5], [21].

These observations suggest an important conceptual implication. Under persistent turbulence, SME resilience cannot be understood solely as a predefined organizational capability activated after disruption occurs. Rather, resilience appears to evolve through continuous adaptation to shifting institutional and environmental conditions. The challenge for theory, therefore, is not simply to explain why some SMEs survive disruption, but to understand how adaptive organizational responses emerge under conditions of chronic uncertainty, interdependence, and institutional instability. This challenge points toward the need for theoretical perspectives capable of explaining resilience as a dynamic and emergent organizational process rather than a static attribute. In the next section, we argue that Complex Adaptive Systems Theory provides such a lens.

3. Complex Adaptive Systems as a Lens for SME Resilience

Understanding SME resilience under persistent turbulence requires a theoretical lens capable of explaining adaptation under uncertainty, interdependence, and continual change. Traditional perspectives often conceptualize organizational adaptation as a planned managerial response or the deployment of predefined capabilities. However, SMEs in turbulent developing economies frequently face nonlinear uncertainty in which adaptation emerges incrementally rather than through centralized planning [16]. Under such conditions, resilience is unlikely to be fully explained by static organizational attributes alone. Instead, it emerges through continuous interactions among organizational actors, routines, networks, and environmental conditions. In this regard, Complex Adaptive Systems Theory provides a useful explanatory perspective.

CAS theory conceptualizes organizations as systems of interacting and interdependent agents whose localized actions collectively generate system-level outcomes through adaptation, feedback, and self-organization [13], [14]. Rather than assuming stable structures or linear cause–effect relationships, CAS emphasizes emergence, nonlinear interactions, and continuous adaptation under changing conditions [15], [16]. For SMEs operating under turbulence, these assumptions closely reflect organizational realities in which firms continuously adjust routines, priorities, and resource allocations in response to shifting environmental conditions [1].

Three CAS principles are particularly relevant for understanding SME resilience. First, adaptive learning through feedback enables firms to continuously interpret signals from customers, markets, institutions, and stakeholders and recalibrate decisions accordingly [5], [14]. Second, self-organization allows coordination to emerge through informal structures, flexible roles, and decentralized decision-making, particularly when formal institutional systems are weak or unstable [4], [22]. Third, emergence suggests that resilience cannot be reduced to individual organizational characteristics but instead arises from interactions among actors, routines, networks, and environmental conditions [16], [23].

Taken together, CAS theory reconceptualizes resilience as an emergent organizational property rather than a static capability possessed by firms. Resilience develops through ongoing adaptation, feedback, coordination, and relational reconfiguration under turbulent conditions [17], [18]. This perspective provides a useful foundation for explaining how SMEs sustain continuity and adapt under persistent instability in developing economies

4. A CAS Framework of Resilience Under Turbulence

Building on the preceding discussion, this paper proposes a conceptual framework explaining how resilience emerges in SMEs operating under persistent turbulence. Rather than conceptualizing resilience as a predefined organizational capability or a managerial asset activated during periods of disruption, we argue that resilience emerges through adaptive interactions among organizational actors, routines, networks, and environmental conditions. From a Complex Adaptive Systems (CAS) perspective, resilience is not possessed by firms; it is continuously produced through nonlinear organizational adaptation under conditions of instability [14], [16].

Figure 1 conceptualizes resilience under turbulence as an emergent outcome of interactions between environmental turbulence and a set of interdependent adaptive mechanisms within SMEs. Persistent turbulence, including regulatory inconsistency, institutional fragility, economic volatility, sanctions, and market disruption—intensifies organizational uncertainty and continuously reshapes organizational constraints and opportunities [1], [11]. Under such conditions, SMEs engage in adaptive processes that collectively generate resilience over time.

Distributed Adaptive Agency

CAS theory assumes that organizational adaptation emerges from the actions and interactions of multiple heterogeneous agents rather than centralized managerial control alone [15]. In SMEs operating under turbulence, adaptive responses frequently emerge through decentralized decision-making among founders, employees, suppliers, and informal collaborators who respond dynamically to environmental disruptions. Employees may assume flexible responsibilities, founders may reconfigure priorities, and informal partners may provide critical information or resources that support continuity [4]. Particularly under institutional instability, distributed agencies become important because centralized planning alone rarely provides sufficient responsiveness to rapidly changing conditions.

Proposition 1: *Persistent turbulence increases distributed adaptive agencies within SMEs, enabling decentralized organizational responses that contribute to resilience.*

Adaptive Learning Through Continuous Feedback

A second mechanism concerns organizational learning through continuous feedback. CAS emphasizes that adaptive systems evolve through ongoing interaction with environmental signals and feedback loops [13], [14]. SMEs operating under turbulence continuously encounter changing customer demands, supply chain disruptions, regulatory shifts, inflationary pressures, and stakeholder expectations. Firms capable of actively interpreting and responding to environmental signals may improve organizational flexibility and reduce vulnerability [5]. Rather than relying on static strategic planning, resilient SMEs often learn iteratively through experimentation, adjustment, and environmental scanning.

Proposition 2: *Continuous feedback-seeking and adaptive learning positively contributes to the emergence of SME resilience under turbulent conditions.*

Self-Organization and Flexible Coordination

CAS further suggests that adaptive systems maintain continuity through self-organization, whereby coordination emerges through localized interactions rather than formal managerial direction [14]. In turbulent environments, SMEs frequently rely on informal structures, fluid team arrangements, and spontaneous role reconfiguration to sustain operations [22]. Formal organizational systems may prove insufficient when institutions are unstable or environmental conditions rapidly evolve. Consequently, informal coordination mechanisms become critical for maintaining flexibility and responsiveness.

For example, SMEs may temporarily restructure workflows, redistribute responsibilities, or form ad hoc teams in response to operational disruptions without formal restructuring processes. Such organizational flexibility enables firms to continue functioning despite environmental volatility.

Proposition 3: *Self-organizing coordination mechanisms enhance SME resilience by increasing organizational flexibility during persistent turbulence.*

Network Reconfiguration and Resource Access

SMEs in developing economies frequently operate under severe resource constraints. CAS highlights the importance of interdependence among organizational actors and external systems, implying that adaptation frequently depends on dynamic relational reconfiguration [24]. Under turbulence, SMEs often intensify reliance on informal relationships, business networks, suppliers, customers, and social ties to access information, financial support, and operational resources [4]. Evidence from sanction-affected and institutionally constrained contexts suggests that firms frequently modify supply chains, strengthen trusted partnerships, and rely on informal exchanges to compensate for institutional voids and resource scarcity [9].

Rather than static network dependence, resilience appears linked to the organization’s ability to dynamically reconfigure relationships in response to shifting environmental conditions.

Proposition 4: *Dynamic network reconfiguration strengthens SME resilience by improving access to information, resources, and adaptive support during turbulence.*

Resilience as an Emergent Organizational Outcome

The central proposition of this framework is that resilience emerges through the interaction of these adaptive mechanisms rather than from any isolated organizational capability. Distributed agencies, adaptive learning, self-organization, and network reconfiguration do not operate independently; instead, they interact recursively and reinforce one another through feedback processes. Organizational actors interpret signals, reorganize routines, activate relational resources, and continuously adapt responses to changing conditions. Through these interactions, resilience emerges as a system-level property that cannot be reduced to individual organizational components [16], [23].

This perspective shifts resilience research away from static and capability-centered explanations toward a processual understanding of organizational adaptation under chronic turbulence. SMEs survive not because they possess resilience in advance, but because resilience continuously emerges through adaptive organizational responses under persistent instability.

Proposition 5: *SME resilience emerges from the nonlinear interaction of distributed agency, adaptive learning, self-organization, and network reconfiguration under persistent turbulence*

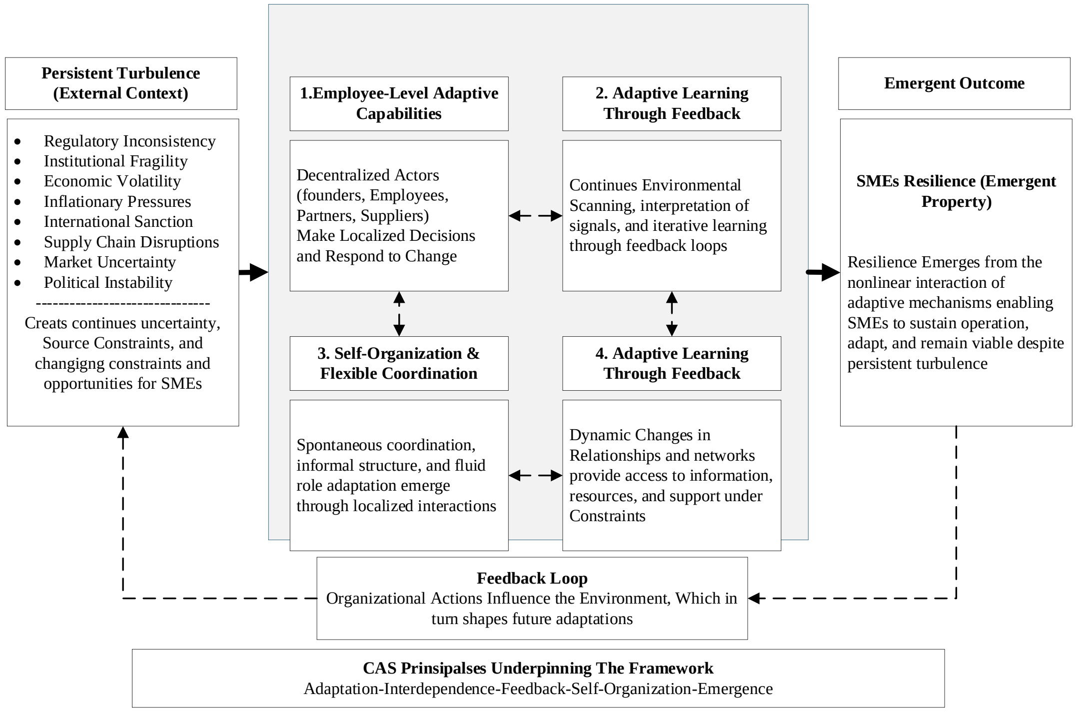

Fig. 1 Proposed Conceptual Framework

The proposed framework contributes to resilience scholarship by offering a dynamic explanation of organizational adaptation under prolonged instability and provides the foundation for future empirical investigation of resilience processes in SMEs operating in developing economies.

5. Discussion and Implications

This paper sought to explain how resilience emerges in SMEs operating under persistent turbulence in developing economies. Existing resilience scholarship has generated important insights regarding organizational preparedness, recovery, and adaptation during crises, yet much of this work implicitly assumes relatively bounded disruptions that interrupt otherwise stable organizational conditions [3], [6]. Such assumptions become increasingly difficult to sustain in environments characterized by chronic instability, where inflationary pressures, institutional fragility, sanctions, regulatory inconsistency, and political uncertainty continuously reshape organizational realities [1], [7]. In these contexts, SMEs often operate without clear periods of equilibrium or recovery, making resilience less a matter of recovery from crisis and more a process of adaptation within turbulence.

Drawing on Complex Adaptive Systems Theory, this paper advances a processual understanding of resilience by conceptualizing it as an emergent organizational property rather than a predefined capability. The proposed framework suggests that resilience develops through dynamic interactions among distributed agencies, adaptive learning, self-organization, and network reconfiguration under conditions of persistent turbulence. Rather than being centrally designed or statically possessed, resilience emerges through continuous adaptation to environmental feedback, institutional uncertainty, and changing organizational constraints [14], [16]. This shift in perspective offers several theoretical and practical implications.

5.1. Theoretical Implications

This paper contributes to resilience theory by reconceptualizing resilience as an emergent and adaptive organizational process rather than a static capability activated during disruption [6]. Instead of viewing resilience as organizational preparedness, the framework emphasizes continuous adaptation through interaction, learning, and adjustment under persistent turbulence. The paper also contributes to SME research in developing economies by positioning chronic turbulence—shaped by sanctions, institutional instability, and policy inconsistency—as a defining organizational condition [9], [11]. Finally, it extends the application of Complex

Adaptive Systems Theory to SME resilience by conceptualizing resilience as a system-level outcome emerging from interactions among organizational actors, networks, and environmental conditions [17], [23].

5.2. Managerial and Policy Implications

The framework suggests that SME resilience under turbulence depends less on rigid crisis planning and more on adaptive organizational capabilities. Managers may strengthen resilience by encouraging decentralized decision-making, continuous feedback-seeking, informal coordination, experimentation, and trusted business networks that improve access to information and resources during disruption [4], [5]. For policymakers, the findings highlight the importance of enabling adaptive entrepreneurial ecosystems. In institutionally unstable environments, rigid or inconsistently implemented policies may increase uncertainty and undermine SME resilience [7], [8]. Policies supporting access to finance, coordination, and network development may better facilitate adaptation under turbulence.

5.3. Future Research

Future studies may empirically examine how adaptive mechanisms interact across different forms of turbulence, sectors, and institutional environments. Comparative research could further investigate how resilience emerges under varying crisis configurations, helping advance understanding of resilience as continuous adaptation rather than post-crisis recovery.

6. Conclusion

SMEs operating in developing economies increasingly face environments characterized by persistent turbulence rather than discrete and recoverable crises. Under conditions shaped by institutional fragility, policy inconsistency, sanctions, inflationary pressures, and market uncertainty, resilience cannot be fully understood through conventional capability-based perspectives that assume stable environments and episodic disruption [1], [7]. Instead, organizational continuity often depends on firms' ability to adapt continuously to evolving constraints and opportunities.

Drawing on Complex Adaptive Systems Theory, this paper reconceptualized SME resilience as an emergent organizational phenomenon arising through adaptive interactions among organizational actors, routines, networks, and environmental conditions. We argued that resilience is dynamically generated through distributed agency, adaptive learning, self-organization, feedback processes, and network reconfiguration rather than being statically possessed by firms [14], [16]. In doing so, the paper advances a processual understanding of resilience that better reflects the realities of SMEs operating under chronic instability.

By positioning resilience as an emergent property of adaptation under turbulence, this study contributes to resilience and SME scholarship while extending the application of CAS theory to entrepreneurship in developing economies. More broadly, the paper suggests that understanding how SMEs survive and adapt under turbulence requires moving beyond static explanations toward perspectives capable of explaining resilience as an evolving organizational process under persistent uncertainty.

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