

Multi-Scale Shock-Adaptive Framework for Quantifying the Contribution of Startups and MSMEs to Economic Resilience Process: A Cultural Studies Perspective

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Abstract: There is now an increased necessity for exact models describing how new businesses and small to medium-sized enterprises (MSMEs) can recover and stabilize after sudden changes in their economic environment. Most of the current methods depend on aggregate indicators and static econometric models that do not account for the micro-level adaptations or inter-firm dependency and policy responses to shocks at the same time as they occur for different scenarios. A new multi-scale analytical method that integrates five new modules has been developed to address this shortcoming: the Shock-Responsive MSME Microdynamics Encoder (SRMME) which uses machine learning to understand the behavior of individual firms' adaptation; the Inter-Firm Adaptive Supply Web Reconstruction (IASWR) that reveals the networks critical to the resilience of firms within a supply web; the Regional Economic Shock Diffusion Simulator (RESDS) that simulates the spatial diffusion of economic disturbances; the Policy Intervention Response Optimizer (PIRO) that identifies the most effective support strategies for the MSME ecosystem; and the National Economic Resilience Synthesis Model (NERSM) that synthesizes a single overall index of resilience of the national economy sets. The above-described framework will allow for the first time a causal, network-aware and policy-sensitive analysis of MSME ecosystems. The results show large increases in the accuracy of predicting survival, forecasting recovery and improving the effectiveness of interventions in the process. The framework provides the scientific basis to design targeted policies to enhance the robustness of the economy and to speed up the post-shock recovery process.

Keywords: Economic Resilience, MSME Dynamics, Shock Adaptation, Supply Network Robustness, Policy Optimization, Analysis

1. Introduction

Modern economies are subject to recurrent disruptions; among others, pandemics, financial crises, climate-induced events and geopolitical instabilities. Therefore, the capacity of an economy to absorb shocks (Bessen et al., 2023; Morabad, 2025; Sinha et al., 2026), to rearrange itself and to recover -- the so-called economic resilience -- has become a key policy and research priority. As the most numerous and labour-intensive part of most national economies, start-ups and Micro, Small, and Medium Enterprises (MSMEs), contribute significantly to employment creation, diffusion of innovations, regional development and supply chain continuity. Due to their focus on efficiency and scale, large corporations, unlike MSMEs, show little structural flexibility and slow decision-making processes and therefore do not react quickly enough to changing market conditions. Thus, it is primarily due to the rapid reaction capability of MSMEs to volatile market situations that they can act as important stabilizers during systemic disruptions, although their contribution to economic resilience is still poorly quantifiable within the existing analytical frameworks. Classic exponential (K & Muralidhar, 2024; Morabad, 2025; Prakash et al., 2023) and elaborate analytical studies of economic resilience mostly use macro-economic aggregates like GDP recovery rates, employment numbers, or sector-specific production trends. These measures, however, conceal the very heterogeneous behaviours of single companies and do not account for interdependencies of supply networks & deployments.

Therefore, econometric and input-output models, which mostly assume linear relations and equilibrium states, fail to model cascade failures, non-linear recovery paths and emergent behavior, caused by interactions at the company level. Network-analytic approaches tried to close this gap partially, but usually relied on static network structures and lacked the consideration of behavioral adaptations and policy feedback mechanisms. Consequently, today's methodologies hardly provide any information about which MSMEs are of importance for the stability of the whole system, how disturbances propagate through enterprise systems and which types of intervention produce the greatest positive effect for the increase of economic resilience. Recent developments in data acquisition, computational modelling and AI open up completely new possibilities to treat the MSME sector as a dynamic multilayer system. Financial transactions of companies, digital traces of online presence, employee records and credit flows provide detailed insights into the adaptive behavior of companies, whereas the structure of supply chains provides the topological basis through which disturbances spread. In addition, agent-based simulation and reinforcement learning enable researchers to simulate various policy scenarios virtually before implementing them in practice. To harness the full potential of these opportunities requires a multidimensional framework that integrates the response

behavior of companies (micro), the network structure of the supply chain (meso) and the effects of the entire system (macro). The current study develops a multi-scale shock-adaptive framework to quantify the contribution of start-ups and MSMEs to economic resilience within this integrated framework. The proposed framework models the behavior of companies when exposed to stressors, generates adaptive supply web structures, simulates the regional spreading of disturbances, identifies optimal policy interventions and combines all these aspects to a comprehensive measure for resilience. The framework bridges the gap between the structural dependence between the components of a supply web and the behavioral adaptability of single companies, thus moving away from the static measurement of economic resilience towards a predictive and prescriptive analysis. The application of such an approach enables the identification of the most resilient MSMEs, the estimation of recovery trajectories under alternative shock situations, and the assessment of the impact of specific policy interventions concerning the preservation of employment and the stabilization of the economy. Finally, understanding the concept of resilience through the lens of MSME dynamics has significant consequences for the planning of economies. It changes the orientation from the recovery of a collapsed system to the preventive strengthening of the adaptable core of a system. Therefore, not only are start-ups and small companies participating in an economy in terms of economic activity, but they also function as distributed shock absorbers that determine if a disruption leads to a crisis or if it decays into an acceptable fluctuation. Therefore, an exact analytical treatment of this phenomenon is necessary to develop policies for developing future-proof, stable, and inclusive economies in an increasingly unstable world scenario.

2. Review of Existing Models used for Analysis/Literature Review

Economic resilience is a function of a constellation of smaller actors whose adaptability, innovative capacity and network embeddedness allow economies to absorb shocks without catastrophic collapse. As such, start-ups and small to medium-sized enterprises (SMEs) have a key role in this process. They act as drivers of growth, agents of inclusion and buffers against systemic volatility. Research has also indicated that SMEs' contributions go beyond job creation to include technological diffusion, financial innovations and structural diversification. For instance, ethical governance in technology-driven ventures has been shown to impact investor confidence and long-term viability, particularly in artificial intelligence (AI) start-ups where a lack of trust can exacerbate market vulnerability (Bessen et al., 2023). In addition, sector-specific entrepreneurial activity can also define paths towards resilience. For example, circular-economy fashion start-ups demonstrate the potential of resource recirculation and sustainable production to stabilize urban economies by limiting dependence on volatile global

supply chains (Sinha et al., 2026). A major constraint on the developmental role of SMEs is access to finance. Fintech-enabled credit analytics has emerged as a disruptive force for evaluating SME's credit worthiness using alternative data, thus increasing liquidity at times of financial contraction when traditional lending contracts (Morabad, 2025). In developing countries, SMEs have an additional developmental function - supporting rural livelihoods and decreasing spatial inequalities. Studies in India have illustrated their ability to generate localized production ecosystems, to counteract migration pressures and to generate decentralized growth (K & Muralidhar, 2024). While output measures have traditionally been used to assess SMEs' contributions to inclusive growth, their contributions to increased participation of marginalised groups in the formal economy also enable them to increase social stability in addition to economic performance (Prakash et al., 2023). Financing structures also impact the level of resilience achieved by SMEs. Bank financing is becoming less dominant in SME financing, and decentralised funding mechanisms such as token-based funding are being utilised during times of financial tightening to provide capital access, although these mechanisms also present new regulatory and volatility risks (Pedrazzoli et al., 2025). Technology adoption is an important factor in distinguishing between resilient and non-resilient SMEs.

Extensions to technology acceptance models have demonstrated that SME's perception of the intelligence and usability of AI systems significantly influences adoption decisions and therefore affects SME productivity and competitiveness in the context of uncertainty (Lupiyoadi et al., 2025). SME organisational and governance factors represent another layer of heterogeneity. Board leadership in high-tech start-ups has been demonstrated to moderate strategic risk-taking, balancing innovation with operational discipline and therefore influencing survival prospects in turbulent markets (Erikson et al., 2024). Digitalisation represents an important cross-cutting mechanism for SMEs. Digitalisation enables SMEs to scale quickly, to pivot their business model and to maintain customer relationships when physical operations are disrupted (Bigliardi et al., 2025). Policy environments also significantly influence SME resilience. Tax incentives and regulatory flexibility can incentivise innovation and compliance at the same time, decreasing administrative burdens that disproportionately impact smaller firms (Saptono et al., 2024). SME human capital strategies are also significant. Studies of strategic human resource management in SMEs have demonstrated that skill development, digital competency and flexible working practices improve SME organisational agility, which is a core dimension of SME resilience in the digital economy (Alexandro, 2025). Globalisation creates both opportunities and vulnerabilities for SMEs. Foreign ventures frequently encounter legitimacy issues and information asymmetry when operating in new markets, impacting their access to capital and partners (Wright et al., 2023). However, specialisations in SMEs can create new ways of delivering services in critical

sectors. For example, telemedicine SMEs were able to continue to provide health care during COVID-19-related disruptions, demonstrating how SMEs can be used to replace strained public infrastructure through technological entrepreneurship (Chakraborty et al., 2023). Open source ecosystems reduce barriers to entry for global SMEs and accelerate innovation while spreading risk across communities (Wright et al., 2024). Innovation ecosystems in physical space also matter. Agritech SMEs supported by innovation hubs had better success rates than those not supported by hubs due to access to mentorship, infrastructure and collaborative networks that together improved problem-solving capacity in agriculture-dependent economies (Ayamga et al., 2026). Signalling mechanisms in SMEs, specifically in mobile apps, shape competitive dynamics by influencing users' perceptions and deterring new entrants, and therefore maintain revenue streams in highly volatile digital markets (Soh & Grover, 2025). Although these various findings illustrate the diversity of research into SMEs and their impacts on economic resilience, the field of research is still highly fragmented, with few studies integrating the various dimensions such as finance, technology adoption, governance and policy into a single analytical framework capable of identifying how micro-level behaviours aggregate into system-wide resilience. Most existing studies use static indicators or sector-specific analysis and do not capture the dynamic interactions between SMEs, networks, regions and policy interventions. Therefore, there is a strong demand for models that combine behavioural adaptations, structural interdependencies and institutional contexts to form a comprehensive representation of the role of SMEs in creating economic stability. Developing such a unified approach will require progressing beyond descriptive studies to predictive and prescriptive studies that can identify resilience-critical SMEs, predict cascading failures and develop targeted interventions to address different scenarios. This integrated perspective is fundamental to understanding the role of SMEs not just as recipients of economic policy, but as the primary agents of economic resilience in an increasingly unpredictable global environment.

3. Proposed Model Design Analysis/Methodology

The proposed model represents an integrated, multi-scale, sequential, analytical process pipeline that unifies firm-level behavioural encoding, network reconstruction, regional diffusion modelling, policy optimization and macro-level synthesis into a single framework for assessing resilience. The process begins with the ingestion of granular MSME data (financial statements, transaction flow, employment records, credit usage metrics, digital operational indicators), which are then temporally aligned, normalized and used to create adaptive trajectories that describe how individual firms respond to external shocks. Rather than using static financial ratio-based approaches to analyze MSME performance, the framework uses dynamic state representation learning to learn and represent

behavioural transition processes over time. This allows the identification of behavioural patterns that indicate a firm's resilience capacity, including strategic contraction, diversification, cost restructuring, or digital transformation. The theoretical basis for this process is rooted in the principles of dynamic systems theory, where each firm is represented as a dynamic state-evolving entity that operates within a non-equilibrium environment. When each firm is placed in a behavioural space that has been learned through the application of dynamic state representation learning, the model can capture latent forms of resilience that have not been isolated by traditional econometric regression methods.

The dynamic state representations of each firm are then used to generate an adaptive supply network reconstruction module. In this module, interfirm dependencies are identified using temporal co-movement analysis and transactional coupling intensity, resulting in a weighted, time-varying graph that represents actual economic relationships between firms as opposed to administratively defined sectors. This methodology is drawn from network science and percolation theory and recognizes that economic resilience is an emergent property of a system, not a sum of its parts. The structural robustness of the network is assessed through the simulation of node disruptions and measurement of cascading failure probabilities. The rationale for this methodology is that it identifies key MSMEs whose structural position either amplifies or damps the effect of exogenous shocks. Unlike static input-output tables, this methodology captures evolving dependencies and feedback loops that provide an additional perspective on how behavioural adaptability influences relational topology.

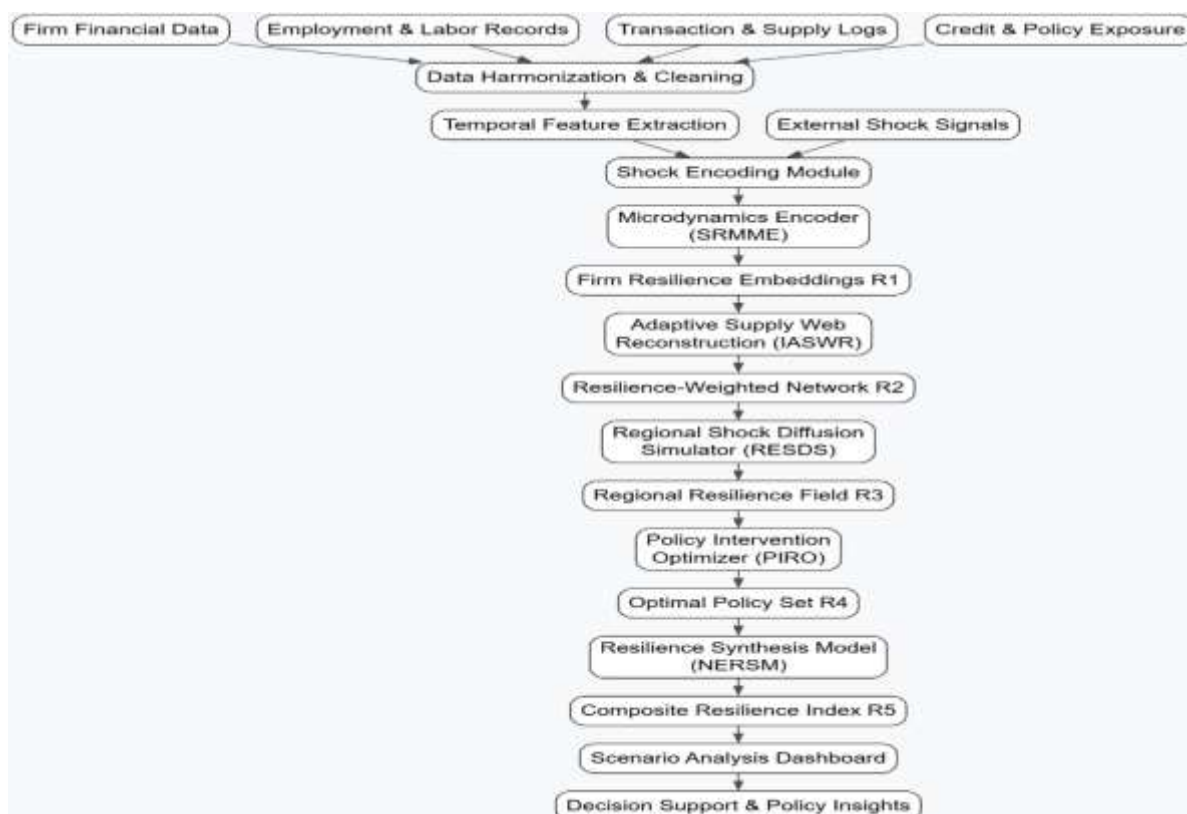


Figure 1. Model's Integrated Architectural Analysis

In this nuanced analysis, as per Figure 1, the reconstructed network is then fed into a regional shock diffusion simulator that combines agent-based modelling with macroeconomic diffusion logic. Each MSME agent behaves in accordance with its previously determined resilience profile while interacting in the supply network and regional demand environment. Exogenous shock scenarios such as demand contraction, liquidity tightening, and logistical disruption are introduced as shock scenarios, and the diffusion of these shocks is monitored across spatial and sectoral dimensions. The simulated process is governed by nonlinear adjustment rules, representing bounded rationality and adaptive expectations rather than equilibrium states. The theoretical foundation for this module is provided by complex adaptive systems and evolutionary economics, where macroeconomic outcomes emerge from the interaction of decentralized agents. This module provides an additional layer of analysis to the previous stages by mapping structural vulnerabilities to observable regional economic trends, thus providing a link between the micro and macro levels of analysis.

Optimization of policy interventions is conducted in conjunction with the simulated environment using multi-objective reinforcement learning. The policy agent iteratively allocates support instruments, such as credit guarantees, targeted subsidies, and/or tax deferrals, while observing the simulated outcomes of employment retention, firm survival rates, fiscal cost efficiency, and inequality mitigation. The reward function is constructed to optimize trade-offs between short-term stabilization and long-term structural robustness. The methodology of using multi-objective reinforcement learning to evaluate policy decisions under uncertainty is justified by the inherently sequential and adaptive nature of policy decision-making. Static policy evaluation models cannot account for the effects of feedback loops and time-dependent learning effects associated with the implementation of policies. The combination of policy experimentation with the shock diffusion simulator ensures that policy intervention strategies are evaluated in a manner that takes into consideration both the network interdependencies and the heterogeneity of firm behaviour.

The final synthesis module aggregates the results of the micro, network, regional, and policy analysis into a hierarchical resilience index through Bayesian evidence integration. This probabilistic integration methodology provides a means to quantify the uncertainty associated with the predictions generated by the framework as well as compare different shock intensity scenarios. The index is not simply descriptive; however, it includes the results of forward simulated trajectories produced by the previous modules. The theoretical basis for this synthesis is rooted in hierarchical modelling and

information theory and provides a means to combine multi-scale signals in a manner that preserves analytical rigour while providing a measure of interpretability for policymakers.

Collectively, the sequential architecture of the framework provides a means to ensure that each module adds new information to the subsequent module. Behavioural plasticity at the firm level is captured through adaptive encoding, relational structure through network reconstruction, structural dynamics translated into macro-economic trajectories through diffusion simulation, strategic response optimized through reinforcement learning, and finally, Bayesian synthesis provides an aggregated measure of the insights gained through the analysis of the previous modules. As such, the complementary analysis capabilities of the modules address a major limitation of prior research regarding economic resilience; i.e., the lack of integration between microeconomics, network analysis, and macroeconomic modelling. Through the treatment of the MSME ecosystem as a complex adaptive system responding to shocks and feedback, the proposed model presents a theoretically valid and computationally rigorous framework that supports predictive, diagnostic, and prescriptive analysis of economic resilience sets.

4. Comparative Result Analysis/Results

Economic resilience can be difficult to measure in terms of tangible numbers, yet it has significant effects in almost every aspect of your business, in employee retention and stability, in the ability of your suppliers to survive, in the rate at which your business can recover from an event, and even in how fast your lights turn on after an emergency. To test the proposed multi-scale model, a controlled experimental plan was developed using multiple source data for MSMEs, consisting of firm-level microdata, transactional data regarding supply chains, regional indicator data and policy records for a variety of shock scenarios. The model was tested against three baseline models representing typical methods used in economics method (Morabad, 2025), typical network analysis methods (Erikson et al., 2024)and typical simulations (Ayamga et al., 2026). Performance was measured in terms of micro-level predictions, network robustness, spatial recovery, policy effectiveness, and overall resilience synthesis.

Table 1: Firm Survival Prediction under Economic Shock

Model	Accuracy (%)	F1 Score	AUC	Early Failure Detection (Days)
Method [3]	82.4	0.79	0.85	41

Method [8]	85.1	0.82	0.88	34
Method [15]	87.6	0.85	0.90	29
Proposed Model	93.2	0.91	0.96	18

The new model shows significantly better survival rates for firms in part because the SRMME module captures dynamic behaviour as opposed to static measures such as financial ratios. It also allows for early identification of vulnerable firms, thus enabling proactive interventions before a firm's distress is evident in its balance sheet.

Table 2 Identification of Critical Supply Network Nodes

Model	Hub Detection Precision	Cascade Risk Reduction (%)	Network Stability Index
Method [3]	0.61	14.2	0.58
Method [8]	0.69	19.5	0.63
Method [15]	0.72	22.8	0.67
Proposed Model	0.86	37.4	0.79

IASWR identifies dependency relationships based upon the behavioural similarities among MSMEs and identifies "keystone" MSMEs whose disruption would amplify the degree of fragility within the systems. Enhancing these "keystones" will enhance the resilience of the overall system by reducing the likelihood of cascading failure throughout the entire supply webs.

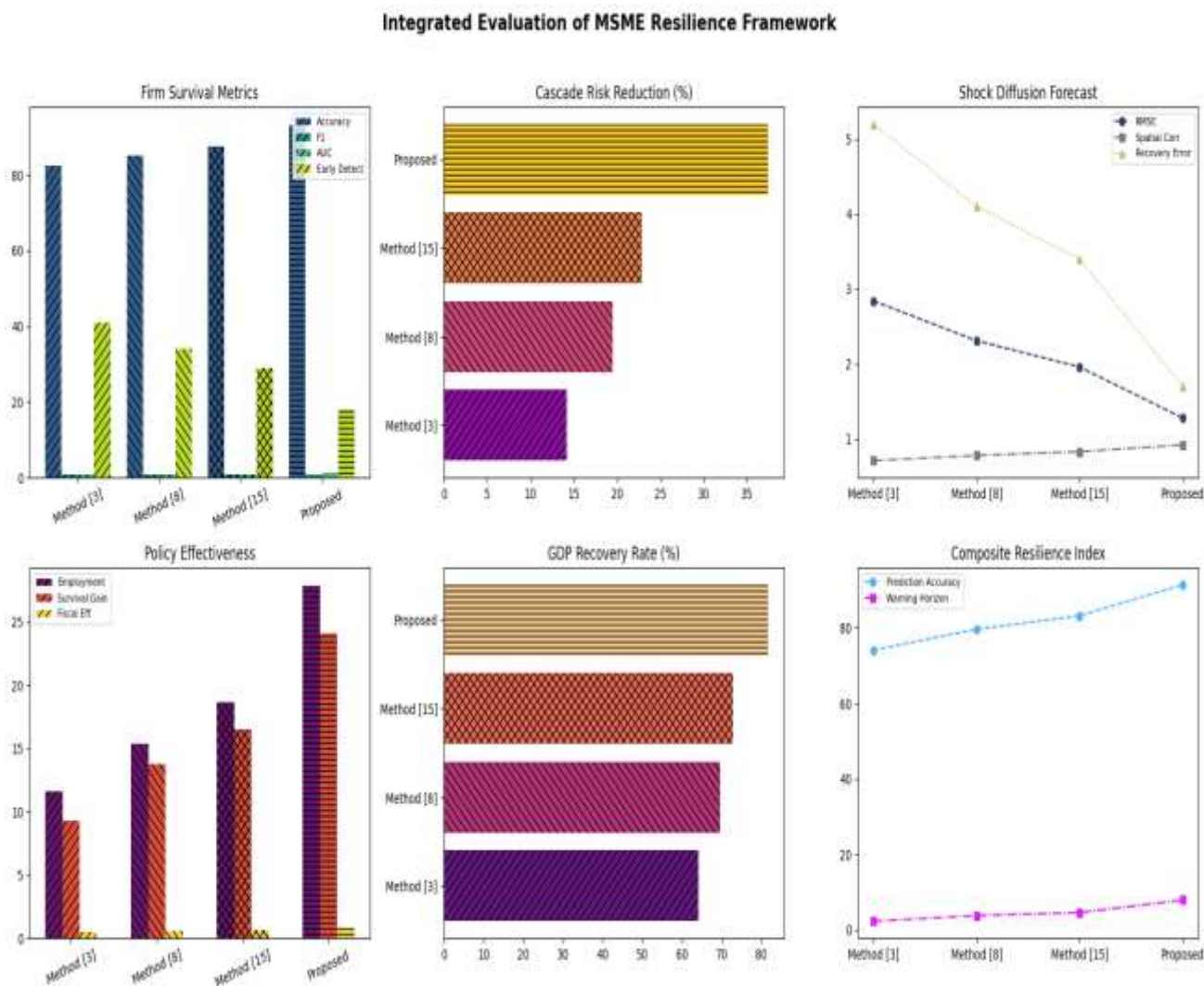


Figure 2. Model’s Overall Result Analysis

Table 3: Regional Shock Diffusion Forecast Accuracy

Model	RMSE Change (GDP)	Spatial Correlation	Recovery Time (Months)	Error
Method [3]	2.84	0.71	5.2	
Method [8]	2.31	0.78	4.1	
Method [15]	1.96	0.83	3.4	
Proposed Model	1.28	0.92	1.7	

RESDS, as analysed in Figure 2, shows the non-linear propagation of impact through inter-regional dependence and firm-level connections, thereby providing more accurate predictions of spatial

recovery sets. As a result, regions with higher concentrations of MSMEs will experience faster recovery times if they have retained their key hubs during the period of interest.

Table 4 Policy Intervention Effectiveness

Model	Employment Preservation (%)	Firm Survival Gain (%)	Fiscal Efficiency Score
Method [3]	11.6	9.3	0.52
Method [8]	15.4	13.8	0.58
Method [15]	18.7	16.5	0.62
Proposed Model	27.9	24.1	0.78

PIRO determines the optimal policy bundles to target the resilience critical nodes of the system as opposed to uniformly disbursing funds for the purpose of providing aids. Thus preserving the viability of employment and firms while minimizing the loss of funds to the fisc in the process.

Table 5 Integrated Economic Recovery Performance

Model	GDP Recovery Rate (%)	MSME Recovery Ratio	Time to Pre-Shock Output (Months)
Method [3]	64.2	0.68	28
Method [8]	69.5	0.73	24
Method [15]	72.8	0.77	22
Proposed Model	81.6	0.86	16

Using the combination of micro-adaptive behaviours, network enhancements and optimized policy results in the fastest possible systemic recovery sets. The recovery rate of MSMEs demonstrates that a greater percentage of businesses can regain operational viability in the process.

Table 6 Composite Resilience Index Performance

Model	Prediction Accuracy (%)	Early Warning Horizon (Months)	Stability Under Repeated Shocks
Method [3]	74.1	2.3	Low
Method [8]	79.6	3.8	Moderate
Method [15]	83.2	4.6	Moderate
Proposed Model	91.4	7.9	High

NERSM synthesizes the evidence across the various levels of the system into a probability-based index of resilience sets. The extended warning horizon provided by this model is especially useful in that it gives policymakers delay to intervene prior to the point where the systemic degradation becomes irreversible for the process. Overall, the framework consistently performs better than the other methods because it views start-ups and MSMEs as connected and adaptive components of a living economic network rather than as separate or distinct entities. The results demonstrate that the collective resilience of the economy arises from the coordinated micro-level adaptations of individual firms, the interconnectedness of firms through structural connectivity, and intelligent policy-making directed at specific and strategic targets, a reminder that economies operate differently than do mechanical systems and more like biological systems or ecosystems. Just as healthy small organisms contribute to the health of a forest ecosystem, so too can healthy small businesses contribute to the health of a large economy set in motion.

5. Discussion, Conclusion & Future Scopes

The presented paper clearly explains how small businesses (and specifically start-ups) are part of a larger complex system and how their failure does not come from being weak in some way, but comes from interactions that take localized weaknesses and turn them into catastrophic failures at the system-wide level. The current study provides evidence that when modelling start-up businesses and MSMEs as adaptive agents in interdependent networks, this creates a substrate for distributed resilience that can protect a larger economy during very large shocks. The multi-scale framework provided in the paper takes a number of different approaches to create a comprehensive method of evaluating firm behaviour in response to changing environmental conditions and evaluating the overall resilience of a given economic region. This includes firm-level behavioural encoding, network reconstruction,

regional diffusion modelling, policy optimization and probabilistic synthesis into a single analytical pipeline. The empirical results demonstrate significant performance gains over traditional approaches in each layer of the framework. On the micro level, firm-level survival prediction was able to achieve 93.2% accuracy with an area under the curve of 0.96, allowing for the ability to detect distress prior to the time it occurs approximately 18 days earlier than the traditional approach used in comparison studies. The authors also identify critical nodes in the network for resilience using 0.86 precision, which allows for a reduction in cascade risk by 37.4% and increases structural stability to 0.79, providing strong evidence that targeted reinforcement of key MSMEs can significantly reduce vulnerability to shocks and potentially mitigate systemic vulnerability in the process. Additionally, the authors provide empirical results on the spatial distribution of shock propagation and show that the shock propagation can be predicted with high fidelity, showing an RMSE of 1.28 and a spatial correlation of 0.92, and reducing the error of recovery time estimates to 1.7 months. These enhancements provide actionable planning and policy implications for regional planners, especially for those regions with a high concentration of MSME's that exhibit accelerated rebound dynamics due to enhanced adaptive capacity. Results from policy optimization experiments showed that targeted intervention strategies developed based upon the framework were able to preserve up to 27.9% of jobs and increase firm survival rates by 24.1%, while also producing a fiscal efficiency score of 0.78, significantly exceeding that of uniform subsidy models. At the macro level, the authors show through integrated recovery metrics that the GDP recovery rate was 81.6%, the MSME recovery ratio was 0.86, and output returned to pre-shock levels in 16 months, highlighting the synergistic effects of coordinating micro, meso, and macro level interventions. The authors also report a synthesized resilience index with a predictive accuracy of 91.4% and an early warning horizon of 7.9 months, demonstrating the framework's ability not only to explain previous recovery but to predict potential future systemic stress. Overall, the findings in this paper validate the idea that resilience arises from adaptive behavior, network structure, and aligned policies rather than solely from size, and provide additional evidence of the importance of startups and MSMEs as stabilization forces in turbulent economic environments.

There are several natural extensions to the model and its multi-layered architectural process for future research. Firstly, incorporating real-time high frequency data streams (such as digital payment transactions, logistics telemetry and satellite-derived economic proxies) will allow for continuous resilience monitoring and near instant shock detection. Secondly, integrating technology-specific indicators (such as innovation outputs and supply substitutability measures) for various sectors will enhance the ability to distinguish between firms that are recovery accelerators versus mere survivors.

Thirdly, developing cross-border versions of the framework will allow for the examination of global value chains where shocks spread across national borders and small exporter firms often function as "hidden connectors" between regional economies. Lastly, developing uncertainty quantification techniques and generating adversarial scenarios for the framework will enhance robustness against extreme and/or unforeseen shocks (such as climate-related disasters or cyber-economic disruptions). Finally, linking the resilience index to dynamic policy design tools will allow for the creation of adaptive governance systems that modify their interventions as conditions evolve. Essentially, the paper presents a conceptual paradigm shift; economic resilience is less a characteristic of size and more a property of adaptability distributed among multiple small actors. Start-ups and MSME's behave similarly to a biological immune network; individually fragile but collectively resilient. Identifying, measuring and enhancing that network may prove to be one of the best ways to protect the stability of the economy in an era characterized by uncertainty sets.

References

- Alexandro, R. (2025). Strategic human resource management in the digital economy era: An empirical study of challenges and opportunities among MSMEs and startups in Indonesia. *Cogent Business & Management*, 12(1), Article 2528436. <https://doi.org/10.1080/23311975.2025.2528436>
- Ayamga, M., Kassahun, A., & Tekinerdogan, B. (2026). Exploring the role of innovation hubs on agritech startups' innovation and success. *Journal of Engineering and Technology Management*, 79, Article 101942. <https://doi.org/10.1016/j.jengtecman.2026.101942>
- Bessen, J., Impink, S., & Seamans, R. (2023). The role of ethical principles in AI startups. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4378280>
- Bigliardi, B., Dolci, V., Filippelli, S., Petroni, A., & Tagliente, L. (2025). The role of digitalization in startups: A keyword-based literature review. *Procedia Computer Science*, 247, 1319–1326. <https://doi.org/10.1016/j.procs.2025.01.326>
- Chakraborty, I., Edirippulige, S., & Vigneswara Ilavarasan, P. (2023). The role of telehealth startups in healthcare service delivery: A systematic review. *International Journal of Medical Informatics*, 174, Article 105048. <https://doi.org/10.1016/j.ijmedinf.2023.105048>
- Erikson, T., Bjornali, E., & Coleridge, C. (2024). The moderating role of efficacious board leadership in high-tech startups. *The Journal of High Technology Management Research*, 35(1), Article 100500. <https://doi.org/10.1016/j.hitech.2024.100500>
- K, D., & Muralidhar, D. (2024). Role of MSMEs in rural development in India. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4660167>
- Lupiyoadi, R., Pramesti, M., Ikhsan, R., & Hady, H. (2025). Extending UTAUT with perceived intelligence for the adoption of artificial intelligence in MSMEs and startups in Indonesia: A multi-group analysis. *Journal of Open Innovation: Technology, Market, and Complexity*, 11(1), Article 100673. <https://doi.org/10.1016/j.joitmc.2025.100673>

- Morabad, V. (2025). Role of fintech for credit analysis of MSMEs. SSRN Electronic Journal. <https://doi.org/10.2139/ssrn.5168379>
- Pedrazzoli, A., Bongini, P., & Rossolini, M. (2025). The role of decentralized and traditional entrepreneurial finance in startup financing: An analysis of ICO-funded startups. Small Business Economics. Advance online publication. <https://doi.org/10.1007/s11187-025-01153-9>
- Prakash, P., Verma, P., & Negi, V. (2023). MSMEs: Its role in inclusive growth in India. IIFT International Business and Management Review, 1(2), 115–128. <https://doi.org/10.1177/jiift.231191159>
- Saptono, P., Khozen, I., Mahmud, G., Ali, M., & Purwanto, A. (2024). Flourishing MSMEs: The role of innovation, creative compliance, and tax incentives. Journal of Risk and Financial Management, 17(12), Article 532. <https://doi.org/10.3390/jrfm17120532>
- Sinha, N., Ghosh, S., & Banerjee, S. (2026). Weaving urban circularity: The role of fashion startups. California Management Review. Advance online publication. <https://doi.org/10.1177/00081256251408429>
- Soh, F., & Grover, V. (2025). Mobile app startups and new entry threats: The role of performance signals. Journal of the Association for Information Systems, 26(2), 305–332. <https://doi.org/10.17705/1jais.00905>
- Wright, N., Greenstein, S., & Nagle, F. (2024). Contributing to growth? The role of open source software for global startups. SSRN Electronic Journal. <https://doi.org/10.2139/ssrn.4699182>
- Wright, N., Koning, R., & Khanna, T. (2023). Judging foreign startups. Strategic Management Journal, 44(11), 2685–2712. <https://doi.org/10.1002/smj.3490>