

Resilience Beyond Regions: Cluster-Based Trajectories of Resistance and Recovery in Indonesia

Abstract

This paper examines regional economic resilience in Indonesia during the COVID-19 crisis through the lens of spatial inequality and perceived left-behindness. Rather than conceptualising resilience as a uniform benchmark of regional performance, the study adopts an economic geography perspective that treats resilience as a phase-specific and spatially uneven process. From this perspective, resilience outcomes are shaped by long-term patterns of uneven development, differentiated exposure to shocks, and the accumulation of institutional, cognitive, and relational capacities over time. The paper argues that regional differences in crisis performance cannot be adequately understood without accounting for these structural conditions, particularly in a context such as Indonesia where territorial inequality and decentralised governance are deeply entrenched.

Much of the existing literature on regional economic resilience evaluates regions based on their ability to absorb shocks or return quickly to pre-crisis levels of economic activity. While such approaches offer valuable insights, they often risk flattening structural heterogeneity across regions and implicitly framing resilience as a matter of success or failure. This framing can be problematic in unequal national systems, where observed outcomes during crises may reflect differences in exposure rather than differences in adaptive capacity. Regions that experience limited economic contraction may appear resilient even when this outcome is driven by structural insulation from the shock, while regions that suffer large downturns may be interpreted as vulnerable despite possessing strong long-term recovery potential.

This paper addresses these limitations by distinguishing analytically between resistance to the initial shock and subsequent recovery. Resistance refers to the ability to limit immediate economic decline at the onset of the crisis, while recovery captures the capacity to regain economic activity in the period following disruption. These two phases are related but not interchangeable, and they are shaped by different underlying mechanisms. Resistance is influenced primarily by exposure, which is determined by sectoral composition, degree of global integration, and functional position within national and international economic systems. Recovery, by contrast, depends more strongly on accumulated institutional capacity, learning capability, coordination mechanisms, and infrastructural foundations that enable regions to adapt and reconfigure after a shock.

By separating resistance and recovery, the analysis allows for a more nuanced understanding of how regional inequalities manifest during crises. In particular, it enables an examination of how regions commonly perceived as left behind may exhibit relatively strong resistance due to limited exposure, yet struggle to recover due to weak endogenous capacity. Conversely, it highlights how highly developed and globally connected regions may experience severe initial shocks but recover rapidly because of strong institutional and organisational foundations. In this sense, resilience is not treated as a singular attribute of regions but as an outcome of the interaction between exposure, accumulated capacity, and institutional context.

Empirically, the study employs a cluster-based analytical strategy using Kml3d, a longitudinal clustering technique designed to identify groups of regions that share similar multidimensional

trajectories over time. This approach is particularly suited to resilience analysis because it captures temporal dynamics and heterogeneity without imposing strong assumptions about linear relationships or causal direction. Rather than ranking regions along a single resilience index, the clustering framework groups regions according to shared resistance and recovery paths combined with evolving capacity profiles.

The analysis integrates two types of indicators. The first consists of resilience outcomes measured through resistance and recovery indices that capture, respectively, the magnitude of the initial economic contraction during the COVID-19 shock and the pace and extent of post-shock rebound. The second consists of a set of Resilio capacity indicators covering six dimensions of regional capacity: insight capacity, government capacity, knowledge and innovation capacity, learning capacity, networking and cooperation capacity, and infrastructure capacity. Together, these indicators capture the institutional, cognitive, relational, and material foundations that shape regional adaptive potential.

All indicators are observed annually over the period 2020 to 2023. This temporal coverage is a central feature of the analysis. By incorporating indicators that evolve during and after the crisis, the study moves beyond static notions of pre-crisis capacity and recognises that institutions and organisations adapt in real time. At the same time, the clustering results reveal a high degree of persistence in regional trajectories. Robustness checks across multiple specifications show stable cluster membership over time, suggesting that resilience paths are strongly shaped by deep-rooted structural characteristics rather than short-term policy responses alone.

The clustering procedure identifies four distinct groups of regions that can be interpreted as unequal regional resilience regimes, each characterised by a specific resistance and recovery profile and a corresponding configuration of capacities. These clusters do not represent simple gradations from low to high resilience. Instead, they reflect qualitatively different ways in which regions experience crisis and adjust over time.

The first cluster exhibits the highest resistance to the initial COVID-19 shock but also the slowest recovery. Regions in this group display consistently low scores across all capacity dimensions, including institutional capability, learning, innovation, networking, and infrastructure. Their relatively strong resistance reflects limited exposure to the sectors most affected by pandemic-related restrictions, such as tourism, high-value services, and globally integrated manufacturing. Many of these regions are peripheral and resource dependent, with economic structures that insulate them from immediate shocks but also constrain their ability to reorient economic activity. Recovery in this cluster is slow and heavily reliant on external support, reflecting weak endogenous capacity for adjustment. From the perspective of spatial inequality, this cluster illustrates how limited exposure can produce an appearance of resilience during the shock phase, while slow recovery reinforces longer-term patterns of marginalisation.

The second cluster experiences weaker resistance than the first but achieves the strongest recovery among all groups. Regions in this cluster are characterised by modest yet broadly balanced capacity profiles, particularly in government capacity, learning, innovation, and infrastructure. These regions are more exposed to the initial shock but benefit from functional institutions and administrative coherence that support cumulative and path-dependent recovery. Rather than undergoing rapid transformation, their recovery unfolds through incremental adjustment, institutional learning, and policy continuity. This trajectory demonstrates that

strong recovery does not require high resistance and that effective institutional functioning can compensate for initial vulnerability over time.

The third cluster represents institutionally thick regions with high levels of knowledge and innovation capacity, dense networks of cooperation, and strong administrative capability. These regions tend to be economically complex and deeply integrated into national and global markets. As a result, they experience relatively weak resistance due to high exposure to mobility restrictions, supply chain disruptions, and demand shocks. However, recovery is rapid and consistent. Strong cognitive, relational, and organisational capacities enable coordinated responses, policy experimentation, and adaptive reorientation of economic activity. The persistence of this cluster underscores the role of cumulative advantage and path dependence in shaping resilience outcomes, as regions with strong pre-existing capacities are better positioned to adapt following disruption.

The fourth cluster exhibits the lowest resistance to the initial shock but a moderate and stable recovery trajectory. This cluster consists entirely of cities in the DKI Jakarta province, together with Badung in Bali. These regions combine very strong government capacity and learning capacity with improving innovation and infrastructure profiles. Their low resistance reflects extreme exposure to mobility restrictions, the collapse of tourism, and the concentration of service-sector activities rather than institutional weakness. Recovery is shaped by active institutional upgrading, experimentation, and post-shock reconfiguration. This cluster demonstrates that low resistance does not imply fragility in highly connected metropolitan and tourism-dependent regions, where exposure is the dominant driver of initial decline.

Across all clusters, the analysis shows that policy responses tend to operate within existing structural conditions rather than overriding them. While crisis interventions vary in form and intensity, they do not fundamentally alter underlying resilience regimes in the short term. Instead, resistance and recovery trajectories reflect the interaction between exposure, accumulated capacity, and institutional thickness.

By clustering resilience trajectories rather than ranking regions on a single metric, the paper contributes to the regional economic resilience literature in several ways. First, it advances a phase-specific interpretation of resilience that clarifies why resistance and recovery should not be conflated, particularly in unequal and decentralised settings. Second, it demonstrates the analytical value of cluster-based approaches, which remain relatively underutilised in regional economic resilience research, especially in decentralised developing countries where subnational heterogeneity is pronounced and governance capacity varies widely across regions. By applying longitudinal clustering to a large set of local governments, the study shows how resilience regimes emerge from shared structural conditions rather than isolated regional characteristics. Third, the paper contributes to debates on perceived left-behindness by showing that slow recovery is often rooted in long-term capacity constraints rather than immediate shock impacts or short-term policy choices. Together, these contributions highlight the importance of phase-sensitive, place-based, and structurally informed approaches to understanding resilience in developing and highly decentralised regional systems.

Keywords: cluster, longitudinal, resistance, recovery, path-dependence