DEVELOPMENT DISPARITY, INCOME INEQUALITY, AND SOCIAL VULNERABILITY IN COASTAL RIAU: A COMPARATIVE ANALYSIS OF THE MALACCA STRAIT STRATEGIC CORRIDOR

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Abstract: This study examines development disparities, expenditure inequality, and social vulnerability across five coastal regions of Riau Province, Indonesia: Dumai Municipality, Siak, Bengkalis, Rokan Hilir, and Kepulauan Meranti. Using a quantitative descriptive-comparative approach, the study analyzes secondary data from Statistics Indonesia and regional planning documents. Indicators include the Human Development Index (HDI), poverty, open unemployment, Gross Regional Domestic Product (GRDP), and the Gini Ratio. Pearson correlation analysis is employed to examine relationships among 2024 regional indicators. The findings reveal substantial spatial disparities. HDI ranges from 69.64 in Kepulauan Meranti to 77.03 in Dumai, while poverty rates vary from 3.14% to 23.15%. Bengkalis records the highest GRDP at IDR 175.71 trillion. HDI is strongly and negatively correlated with poverty ($r = -0.886$; $p = 0.045$), whereas GRDP's relationship with poverty is statistically insignificant. These findings highlight the importance of human capital, economic structure, labor markets, fiscal capacity, and geographical conditions. Therefore, coastal development requires integrated, inclusive, and region-specific policies.

Keywords: *Development Disparity; Human Development; Income Inequality; Poverty; Coastal Regions*

Regional inequality remains one of the most persistent challenges facing emerging economies. Economic growth can lift aggregate welfare, but its benefits rarely spread evenly, because regions differ in productive capacity, infrastructure, human capital, institutional quality, and market access. A growing strand of development research argues that spatial inequality is not simply a residue of unequal output; it also reflects unequal opportunity for households and communities to take part in economic transformation in the first place (Kanbur & Venables, 2005; Lessmann & Seidel, 2017). In the Indonesian context, Azim et al. (2022) similarly find that interprovincial disparities in economic development are shaped less by output alone than by differences in infrastructure, human-capital investment, and government fiscal capacity, a pattern this study revisits at the intraregional, coastal scale.

The relationship between growth and welfare is especially complex in resource-dependent regions. Areas with abundant natural resources can post large economic numbers while undergoing limited social transformation, particularly when activity is dominated by capital-intensive sectors with weak local linkages and under-investment in human development. Recent evidence shows that resource-based economies often struggle to convert resource rents into inclusive outcomes, because employment creation, local value chains, and public-service

delivery do not necessarily expand in step with output (Sharma & Paramati, 2022)
Human development is therefore a necessary companion indicator to economic size. Gains in education, health, and living standards widen people's capabilities and their ability to convert economic opportunity into actual welfare. The human development perspective insists that progress be judged not only by income accumulation but also by the expansion of capability and opportunity more broadly (UNDP, 2022).

Coastal regions hold a strategic place in global economic systems: they concentrate trade infrastructure, industry, fisheries, and population. At the same time, they carry a distinct bundle of vulnerabilities, climate exposure, environmental degradation, geographic isolation, and socioeconomic inequality, that inland regions rarely face in combination.

Recent coastal-vulnerability research shows that exposure to environmental hazard is only part of the story; vulnerability is equally a function of income, education, livelihood diversification, institutional support, and adaptive capacity (Lu et al., 2022; Putiamini et al., 2022). Coastal households with limited economic resources typically have fewer adaptation options when they face erosion, flooding, or ecosystem degradation, and the social dimension of vulnerability can therefore widen or narrow a community's exposure to the same physical hazard.

Small islands and remote coastal settlements face an additional, compounding constraint: physical connectivity, transport cost, and access to public services are structurally thinner than on the mainland. Micro-spatial evidence from the neighboring Riau Islands Province illustrates how severe this penalty can be, geographic barriers there are positively and significantly associated with the depth of extreme poverty, with isolated sub-districts recording poverty-depth values several times higher than the provincial average (Fatmasari et al., 2026). This confirms that geography itself can harden into a structural determinant of persistent poverty and unequal development trajectories, not merely a backdrop to it. A similar pattern of tourism-dependent, infrastructure-constrained vulnerability is documented for the Anambas Islands, where village sustainability under tourism development is closely tied to socioeconomic exposure rather than natural-hazard exposure alone (Hidayat et al., 2021).

These dynamics matter directly for Indonesia, an archipelagic nation where thousands of coastal villages and island communities depend on marine resources while simultaneously absorbing economic and ecological pressure. The policy challenge is therefore twofold: raising economic productivity, and ensuring that the resulting gains actually reach the populations most exposed to structural disadvantage.

Riau Province sits on the eastern coast of Sumatra, directly facing the Malacca Strait, one of the world's busiest maritime trade routes. The province carries substantial economic weight from oil and gas, plantations, manufacturing, logistics, and marine resources, yet that weight has not produced uniform welfare across its coastal districts.

Prior work already points to significant intraregional inequality within Riau. Manurung et al. (2025), applying the Williamson Index, the Theil Index, panel regression, and dynamic analysis, show that disparities among Riau's regions trace back to differences in natural-resource distribution, infrastructure, geography, and the intensity of government intervention.
The pattern is clearly visible among the coastal districts examined here. Dumai has grown into an industrial and logistics hub anchored by its port. Siak and Bengkalis carry strong resource-based economies built on plantations and extraction. Rokan Hilir blends agriculture, fisheries,

plantations, and resource industries. Kepulauan Meranti, by contrast, is defined by island geography, limited connectivity, dependence on local commodities, and a structurally higher vulnerability profile than its mainland neighbors.

These differences surface directly in the 2024 development indicators. Dumai records the highest HDI among the five regions (77.03), while Kepulauan Meranti records the lowest (69.64). Poverty follows the same gradient, from 3.14% in Dumai to 23.15% in Kepulauan Meranti. Bengkalis, meanwhile, generates the highest GRDP (IDR 175.71 trillion), more than six times the economic scale of Kepulauan Meranti. Economic capacity, in other words, does not automatically determine welfare performance: a region can sustain high production while still struggling to convert that output into human development gains, which is consistent with the broader claim that inclusive development rests on economic structure, institutions, and distribution mechanisms rather than sheer economic size (Barca et al., 2012).

Poverty and inequality are related but distinct dimensions of welfare. Poverty counts the share of people who fall short of a minimum standard of living; inequality describes how resources are spread across the population as a whole. A region can therefore combine low poverty with high inequality, or a fairly equal distribution in which most households are nonetheless economically fragile.

The Gini Ratio captures how expenditure is distributed, but it needs context to be read correctly. A low Gini Ratio can reflect genuinely equitable welfare, or it can simply mean that most households share a similarly low level of expenditure. Inequality indicators, in short, only make sense alongside poverty and human-development indicators, not in isolation (OECD, 2021).

Coastal Riau illustrates the point well. Dumai has historically carried a higher Gini Ratio than its neighbors despite recording the lowest poverty rate in the corridor. Kepulauan Meranti shows the opposite combination: comparatively low inequality alongside the highest poverty rate. Equal distribution, in other words, cannot be treated as a proxy for successful development on its own.

Earlier work on Kepulauan Meranti attributes its poverty to structural factors geographic isolation, limited economic diversification, and weak connectivity (Sari et al., 2023). Complementary evidence on education and population pressure elsewhere in Indonesia reinforces the point that infrastructure and human-capital gaps, not output alone, drive uneven regional welfare (Ningsih et al., 2024), while multidimensional poverty analysis specific to Riau confirms that education and health indicators remain decisive levers for welfare improvement in the province (Syapsan et al., 2020).

Existing studies on Riau tend to isolate a single dimension of development, regional inequality, poverty determinants, fiscal decentralization, or environmental vulnerability, rather than examining how these dimensions interact. Few integrate economic capacity, human development, expenditure inequality, labor-market conditions, and coastal vulnerability within one comparative framework, and fewer still do so at the scale of a single, strategically connected coastal corridor.

METHOD

Research Design and Study Area

This study uses a quantitative descriptive-comparative design to examine spatial disparities in development outcomes among the coastal regions of Riau Province. The design was chosen deliberately rather than by default: Creswell and Creswell (2023) note that a descriptive-comparative quantitative approach is well suited to research that seeks to characterize differences across predefined groups using standardized indicators, which matches this study's aim of comparing five administratively distinct but geographically

connected regions rather than estimating a causal model.

The study area comprises five coastal administrative units along the eastern coast of Sumatra, each connected to the Malacca Strait corridor: Dumai Municipality, Siak Regency, Bengkalis Regency, Rokan Hilir Regency, and Kepulauan Meranti Regency. These regions were selected purposively because they represent contrasting coastal development trajectories, industrial-port growth, resource-based economies, mixed agricultural and fisheries systems, and island-dependent livelihoods, within a single, strategically unified corridor.

The Malacca Strait corridor is analytically useful precisely because it is both an opportunity space and a vulnerability space at once. It opens access to international trade networks, logistics systems, and industrial activity, yet its coastal and island communities simultaneously carry structural constraints from geographic isolation, environmental risk, and unequal access to development resources. Comparing regions that share this same strategic positioning, but diverge sharply in outcomes, helps isolate what is driving the divergence beyond geography alone.

Data Sources and Data Collection

This research relies on secondary quantitative data drawn from official statistical publications and regional government documents. The primary sources are Statistics Indonesia (Badan Pusat Statistik/BPS), specifically Provinsi Riau Dalam Angka 2025, district and municipality statistical publications, and official HDI, poverty, employment, GRDP, and regional-inequality statistics, together with regional development planning documents and socioeconomic reports published by the Government of Riau Province.

Three criteria guided the selection of data sources. First, comparability: indicators had to use consistent definitions across all five regions. Second, temporal consistency: the primary quantitative analysis centers on 2024 indicators. Third, institutional reliability: official statistical sources were prioritized throughout. Standardized official statistics suit comparative regional studies precisely because they allow administrative units to be compared despite real differences in economic structure and geography.

Variables and Measurement Framework

The study analyzes five development indicators spanning different dimensions of regional welfare, summarized in Table 1.

Table 1. Research Variables and Measurement Indicators

Dimension	Variable	Measurement	Interpretation
Human development	Human Development Index (HDI)	Composite index (0-100)	Achievement in health, education, and living standards
Poverty condition	Poverty rate	Percentage of population below the poverty line	Absolute welfare deprivation
Labor market	Open Unemployment Rate (TPT)	Percentage of unemployed labor force	Labor-market pressure
Economic capacity	Gross Regional Domestic Product (GRDP)	Current-price GRDP (IDR trillion)	Regional economic scale
Distributional inequality	Gini Ratio	Index between 0 and 1	Expenditure-distribution inequality

Analytical Procedures

The analysis proceeds in two complementary stages. The first is a descriptive-comparative stage that examines differences among the five coastal regions across HDI, poverty, unemployment, GRDP, and expenditure inequality, producing a regional development profile for each area and highlighting contrasting trajectories. The second stage applies Pearson correlation analysis to examine the relationships among these indicators.

The Pearson correlation coefficient is calculated as:

$$r = \frac{n\left(\sum XY - (\sum X)(\sum Y)\right)}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2]}}$$

where r_{xy} is the correlation coefficient, x_i and y_i are observed values, and $\bar{x}$ and $\bar{y}$ are their means. The coefficient ranges from −1 to +1: positive values indicate a direct relationship, negative values an inverse relationship, and values closer to ±1 a stronger relationship. Six pairwise relationships are examined: HDI–poverty, HDI–TPT, HDI–ln GRDP, poverty–TPT, poverty–ln GRDP, and TPT–ln GRDP.

Statistical Interpretation and Research Limitations

Because the analysis rests on only five regional observations, correlation results are read as exploratory signals of association rather than as causal inference. The aim is to establish the direction of each association, its approximate magnitude, and its consistency with theoretical expectations and prior empirical findings. p-values are reported to flag statistical uncertainty, but they are interpreted cautiously given how small samples reduce statistical power, and this small-N constraint is also why more complex econometric models, such as panel regression, are not attempted here: they require longer time-series observations and consistent measurement across units than five cross-sectional points can support.

Justification of Analytical Approach

Previous studies of regional inequality in Riau have used more advanced techniques, including the Williamson Index, the Theil Index, and panel regression (Manurung et al., 2025). This study nonetheless adopts a comparative descriptive framework for three reasons. First, the goal here is not to estimate a causal effect but to map development patterns among strategically connected coastal regions. Second, several indicators, district-level Gini Ratio data in particular, are not consistently available for all five regions over a sufficiently long period. Third, forcing incomplete longitudinal data into an econometric model risks introducing measurement bias rather than resolving it. The approach adopted here prioritizes analytical transparency and indicator comparability over methodological complexity that the data cannot yet support.

RESULTS

Spatial Development Disparity in Coastal Riau

The comparative analysis shows that Coastal Riau is not a homogeneous development region. The five areas studied share geographic proximity along the eastern coast of Sumatra and the same strategic exposure to the Malacca Strait, yet their socioeconomic conditions diverge sharply, as Table 2 shows for 2024.

Table 2. Development Indicators of Coastal Riau Regions, 2024

Region	HDI	Poverty Rate (%)	Open Unemployment Rate (%)	GRDP (Current Price, IDR trillion)
Dumai	77.03	3.14	4.66	52.67
Siak	76.52	5.08	4.53	121.12
Bengkalis	76.37	6.36	5.88	175.71
Rokan Hilir	72.46	7.01	4.31	102.49
Kepulauan Meranti	69.64	23.15	4.51	27.47

Source: BPS, Provinsi Riau Dalam Angka 2025.

The results reveal a clear development gradient. Dumai records the highest HDI and the lowest poverty rate, while Kepulauan Meranti sits at the opposite end on both measures. The 7.39-point HDI gap between the two, within a relatively well-connected coastal corridor, is a substantial gap in human development

achievement to find among neighbors who share a coastline.

Economic Capacity and Human Development

Comparing GRDP against HDI exposes an important finding: regional economic size does not translate directly into human development achievement. Bengkalis is the clearest case. It recorded the highest GRDP among the five regions, IDR 175.71 trillion in 2024, yet its HDI (76.37) trails both Dumai (77.03) and Siak (76.52). Rokan Hilir shows the same disconnect at a different scale: more than IDR 100 trillion in GRDP, but an HDI of only 72.46. Economic production capacity and social development, in other words, are different dimensions of regional progress, not two readings of the same thing.

Human Development and Poverty

The strongest statistical relationship in this study is the one between HDI and poverty, summarized together with the other five pairwise correlations in Table 3.

Table 3. Pearson Correlation among Development Indicators

Relationship	Pearson *r*	*p*-value	Interpretation
HDI - Poverty	-0.886	0.045	Strong negative relationship
HDI - TPT	0.433	0.466	Moderate positive relationship
HDI - ln GRDP	0.624	0.260	Strong positive relationship
Poverty - TPT	-0.202	0.744	Weak negative relationship
Poverty - ln GRDP	0.709	0.180	Strong negative relationship
TPT - ln GRDP	0.531	0.357	Moderate positive relationship

Source: BPS regional data (n = 5 regions).

The correlation between HDI and poverty is −0.886 and statistically significant at the 5% level (p = 0.045): regions with higher human development tend to record lower poverty. The spatial pattern bears this out directly, Dumai, with the highest HDI, has the lowest poverty rate, while Kepulauan Meranti, with the lowest HDI, has the highest. This is consistent with the human-development view that education, health, and living standards expand people's capabilities and their ability to access productive economic opportunity (UNDP, 2022).

Poverty and Inequality

The Gini Ratio adds a more complicated layer to the welfare picture, summarized in Table 4 for 2020 and 2021, the most recent years for which comparable district-level figures are available across all five regions.

Table 4. Gini Ratio of Coastal Riau Regions, 2020–2021

Region	Gini Ratio 2020	Gini Ratio 2021
Dumai	0.360	0.345
Siak	0.279	0.295
Bengkalis	0.280	0.273
Rokan Hilir	0.281	0.257
Kep.Meranti	0.271	0.278

Source: Government of Riau Province, 2026

Poverty and inequality clearly behave as separate dimensions of welfare here. Dumai has historically carried the highest Gini Ratio among the five regions, yet it simultaneously has the lowest poverty rate, economic inequality coexisting with relatively higher average welfare. Kepulauan Meranti shows the mirror image: comparatively low expenditure inequality alongside very high poverty incidence, which is consistent with low inequality arising because households share a similarly low level of expenditure rather than because welfare is broadly and fairly distributed.

Labor Market Indicators

The relationship between unemployment and poverty is markedly weaker than the ones discussed so far. The correlation between TPT and poverty is −0.202, which should not be read as unemployment being irrelevant to poverty, but rather as a signal about the character of coastal labor markets themselves. Many coastal communities rely on informal

activity, seasonal employment, fisheries, agriculture, and family-based livelihoods, where individuals can be formally "employed" while still facing low productivity and insufficient income, which is to say, employment quantity and employment quality are not the same thing.

Development Typology of Coastal Riau

Reading the indicators together, the five regions resolve into distinct development profiles rather than a single shared pattern, as summarized in Table 5.

Table 5. Coastal Riau Development Typology

Region	Development Characteristics
Dumai	Urban-industrial growth center; high HDI; low poverty; higher expenditure inequality
Siak	Strong economic capacity; relatively balanced human development
Bengkalis	Very high economic output; resource-based economy; difficulty converting output into welfare
Rokan Hilir	Moderate-to-high economic capacity; human development lower than its economic scale would suggest
Kepulauan Meranti	High multidimensional vulnerability; low HDI; high poverty; strong geographic constraints

DISCUSSION

Interpreting Spatial Development Disparity

This pattern confirms that development differences are not determined by geographic proximity alone. They emerge instead from differences in economic structure, infrastructure accessibility, institutional capacity, and each local economy's ability to generate inclusive opportunity. Recent regional development research emphasizes that spatial inequality tends to persist when economic activity concentrates in specific locations while peripheral areas remain weakly integrated into regional production systems (Lessmann & Seidel, 2017); in coastal settings, that persistence can sharpen further, because transport barriers and environmental risk raise the cost of delivering infrastructure and public services to the periphery.

Economic Capacity Does Not Automatically Translate into Human Development

This pattern is consistent with evidence from other resource-dependent regions, where large-scale extractive activity generates substantial economic value but limited spillover when local economic linkages stay weak; resource-intensive economies frequently struggle with employment absorption, value-chain integration, and equitable distribution of the gains (Sharma & Paramati (2022). In Coastal Riau, the gap between Bengkalis and Dumai suggests that converting economic output into welfare depends on several additional factors: the quality of public services, the degree of economic diversification, labor absorption, investment in education and health, and institutional effectiveness. GRDP, read this way, is best treated as a measure of economic capacity rather than a direct indicator of development success.

Human Development and Poverty Reduction

The relationship should not, however, be read as a simple one-way causal chain. Human development and poverty are mutually reinforcing: higher human capital can reduce poverty, but lower poverty can equally improve a household's ability to invest in education and health in the first place. Prior research in Riau supports this multidimensional reading, Syapsan et al. (2020) find that poverty reduction in the province depends on more than income growth alone, and particularly on gains in education participation and basic health conditions.

The Poverty Inequality Paradox

This distinction matters for how regional inequality indicators get used. As the spatial-inequality literature argues, distributional indicators need to be read together with absolute welfare indicators, because equality at a low welfare floor is not the same thing as inclusive development (Kanbur & Venables, 2005). Policy

attention, by extension, should not fix on inequality measures alone; it needs to move productivity, income opportunity, and basic services forward at the same time, a point the OECD (2021) makes explicitly in arguing that inclusive-growth strategies must treat distribution and absolute welfare as joint, not substitute, objectives.

Labor Markets and the Quality of Employment

This explains why Rokan Hilir records a comparatively low unemployment rate (4.31%) yet a higher poverty rate than Dumai or Siak, and why Kepulauan Meranti combines relatively low unemployment (4.51%) with the highest poverty incidence in the corridor. The pattern reinforces a policy point that is easy to overlook: reducing poverty here requires improving the productivity and quality of existing employment, not simply pushing more people into any form of work.

Fiscal Capacity and the Challenge of Converting Growth into Welfare

The findings also point to fiscal capacity as a decisive link between economic potential and public welfare. Regions with a larger economic base generally enjoy greater fiscal opportunity, but whether that opportunity becomes welfare depends on how resources are allocated and invested. In resource-rich regions in particular, revenue does not automatically translate into broad welfare gains when fiscal management stays oriented toward short-term expenditure rather than long-term human-capital and infrastructure investment.

Research on fiscal decentralization shows that regional autonomy can narrow inequality when local governments allocate resources effectively toward productive sectors and public services, but that decentralization's impact is limited where fiscal capacity gaps between regions remain large (Farida et al., 2021). In Riau, differences in fiscal independence among districts shape how well local governments can supply infrastructure and services, particularly in geographically demanding coastal areas (Isyandi et al., 2026; Rineliana et al., 2025). For an island region such as Kepulauan Meranti, limited fiscal capacity compounds the problem directly, because infrastructure provision there costs more than it does on the mainland.

Geographic Constraints and Coastal Social Vulnerability

Development disparity in Coastal Riau cannot be separated from geography. Dumai benefits from urban concentration, industrial activity, and stronger logistics connectivity; Kepulauan Meranti, by contrast, faces structural constraints from island fragmentation, transport dependency, and limited market access. These geographic conditions raise development costs through higher transportation expenses, weaker economies of scale in infrastructure, restricted access to education and health services, and greater exposure to environmental hazard.

Recent coastal-vulnerability modeling confirms that social vulnerability emerges from the interaction between environmental exposure and socioeconomic capacity rather than from exposure alone; communities with limited income, education, and institutional support generally have fewer adaptation options when environmental disturbances hit (Lu et al., 2022). Climate-vulnerability mapping of comparable Indonesian coastal settlements reaches a similar conclusion, linking slum-level vulnerability directly to the interaction between hazard exposure and socioeconomic capacity at the neighborhood scale (Astuti et al., 2021), and studies of Indonesian coastal communities more broadly show that vulnerability is shaped by livelihood dependence, adaptive capacity, and access to institutional support (Putiamini et al., 2022).

In Riau itself, coastal erosion and shoreline degradation add a further layer of pressure. Muhardi et al. (2021) document significant coastal damage across several areas, including Bengkalis, Dumai, and

Kepulauan Meranti, underscoring that development planning in this corridor has to integrate economic growth with ecological resilience rather than treat them as separate agendas.

Development Typology and Policy Implications

This typology makes a simple but important point for policy design: Coastal Riau should not be governed by a uniform development template. Each region needs a strategy matched to its own economic structure and vulnerability profile, a conclusion that also resonates with border and frontier development models elsewhere in Indonesia, where sustainable outcomes have likewise depended on aligning human-development interventions with each community's specific structural constraints rather than applying a single national template (Risal et al., 2022).

Implications for the Malacca Strait Coastal Corridor Development

The Malacca Strait offers real opportunity for strengthening trade, logistics, maritime industry, and regional integration, but economic corridors of this kind can just as easily deepen inequality if their benefits stay concentrated in existing growth centers. Corridor development should therefore prioritize connectivity between growth poles and the more vulnerable areas around them, not simply reinforce the poles themselves.

Four policy directions follow directly from the typology above: strengthening Dumai as a logistics and industrial gateway; developing Siak and Bengkalis through downstream processing and local value-chain integration; improving agricultural, fisheries, and maritime productivity in Rokan Hilir; and prioritizing connectivity, education, health, and livelihood diversification in Kepulauan Meranti. This differentiated approach aligns with place-based development principles, under which policy is designed around a territory's actual characteristics rather than applied identically across very different places (Barca et al., 2012).

CONCLUSION

This study reveals substantial spatial disparities in Coastal Riau despite its strategic position along the Malacca Strait. Economic capacity does not necessarily translate into human development, as demonstrated by Bengkalis, whose GRDP exceeds that of other regions, while its HDI remains below Dumai and Siak. Similarly, poverty and inequality represent distinct welfare dimensions, as Kepulauan Meranti combines relatively low inequality with high poverty, whereas Dumai exhibits the opposite pattern. These disparities are further shaped by geographic constraints, coastal vulnerability, transport limitations, and uneven fiscal capacity, highlighting the need to integrate economic growth, human development, environmental resilience, and institutional capacity.

The main contribution of this study lies in integrating economic, social, spatial, and environmental dimensions into a single analytical framework for the Malacca Strait coastal corridor. The findings demonstrate that regional disparities extend beyond differences in economic output, reflecting variations in the capacity to translate economic resources into sustainable improvements in quality of life. Accordingly, Dumai, Siak, and Bengkalis require strategies emphasizing value-chain development, economic diversification, and inclusive industrial linkages, while Kepulauan Meranti requires stronger interventions in connectivity, education, healthcare, livelihood diversification, and coastal resilience.

Several limitations should be considered when interpreting these findings. The analysis covers only five regional units; therefore, Pearson correlations indicate exploratory associations rather than causal relationships. Inconsistent district-level Gini Ratio data also restrict longer-term panel analysis, while macro-level indicators cannot fully capture household vulnerability mechanisms. Future research should develop longer panel datasets incorporating HDI, poverty, fiscal capacity, infrastructure,

investment, sectoral structure, and environmental vulnerability to support more robust econometric and spatial analyses, including GIS applications. Household surveys and comparative studies across Southeast Asian coastal corridors are also needed to examine livelihood diversification, adaptive capacity, access to essential services, and whether trade and logistics networks generate inclusive benefits or reinforce existing growth centers.

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