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Analysis of Tropical Coastal City Development toward the Sustainable Development Goals in Bengkulu City, Indonesia

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ABSTRACT

Coastal cities like Bengkulu, in tropical coastal areas, possess natural potential and human resources for sustainable development. Despite this, they face climate change impacts and socio-economic vulnerabilities. This study employs regional analysis techniques to comprehensively understand the multidimensional aspects of developing diverse tropical coastal cities like Bengkulu. The method involves analyzing economic, social, and geographical factors. The research findings reveal a distinct regional typology within Bengkulu Province, with Bengkulu City emerging as an advanced and rapidly growing area. Economic sectors in Bengkulu City, particularly in the coastal region, exhibit advanced and fast-growing characteristics. Ratu Samban Sub-district stands out as a critical growth hub, while Kampung Melayu and Sungai Serut Sub-districts face lower hierarchy levels based on the scalogram index. This concentration of growth aligns with urbanization and economic development theories. The study emphasizes the urgency of inclusive development to ensure every area is included in achieving sustainable and equitable progress, contributing to the broader global agenda of the SDGs.

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Introduction

Indonesia, located near the equator, boasts a tropical climate and rich biodiversity in flora and fauna, including tropical rainforests, small islands, and diverse marine species. The tropical climate significantly influences Indonesia's agriculture, fisheries, and tourism, contributing to the country's unique ecological landscape (Eka Suranny et al., 2022; Kurniawan et al., 2016). Additionally, being the fourth most populous country globally, with a majority residing in coastal areas, has increased demand for housing, healthcare, education, and facilities, prompting the development of coastal cities.

Indonesia's tropical climate and coastal city development present an intriguing phenomenon, particularly in the context of sustainable and environmentally conscious

management and development (Maes et al., 2019). Coastal tropical cities play a crucial role in national and regional development, acting as economic and business hubs (Ren et al., 2018). For instance, Jakarta, Indonesia's capital, serves as the national economic and business hub, strategically connecting the surrounding land and coastal regions, while other areas nearby provide abundant resources, such as fisheries, agriculture, forestry, and tourism.

As part of the global commitment to achieving a more sustainable future, Indonesia has adopted the Sustainable Development Goals (SDGs) established by the United Nations in 2015 (Johnston, 2016). The SDGs provide a comprehensive framework for addressing major global challenges, including poverty, inequality, climate change, environmental degradation, and peace and justice. In the context of developing tropical coastal cities such as Bengkulu, several goals are particularly relevant, especially SDG 8 (Decent Work and Economic Growth) and SDG 11 (Sustainable Cities and Communities). Recent studies also show that the SDGs – and SDG 11 in particular – are increasingly used as a guiding framework for sustainable urban development and for monitoring progress at the city level (Nabiyeva et al., 2023). Applying the SDGs to the development of coastal cities is expected to enhance resilience to climate change impacts, improve the quality of life for residents, and promote more sustainable management of natural resources. By aligning local development plans with the SDGs, cities like Bengkulu can support inclusive and sustainable regional development while at the same time contributing to the achievement of global sustainability targets.

Cities like Bengkulu, situated in tropical coastal areas, possess the natural potential and human resources to enhance the quality of life and contribute to sustainable development goals (Schipper et al., 2021). However, they also face significant challenges, including climate change impacts like increased storm frequency, coastal erosion, floods, declining seawater quality, and environmental pollution (Hasan et al., 2021; Pollard et al., 2019). Social-economic vulnerabilities, such as high poverty rates and susceptibility to climate change and natural disasters, further complicate the situation.

A holistic approach to planning and management is crucial to address these challenges and ensure sustainable and environmentally conscious coastal city development (Burt & Bartholomew, 2019). Various analytical instruments, including regional analysis techniques, are essential for comprehensively understanding the multidimensional social, economic, and geographical aspects of developing diverse and complex tropical coastal cities (Ye et al., 2019).

While there has been limited research on developing tropical coastal cities, some studies have touched upon related aspects (Drosou et al., 2019; Meerow, 2019; Zheng et al., 2020). For example, (Drosou et al., 2019) proposed a blue-green city model for tropical coastal city development; (Meerow, 2019) evaluated and developed the principles of coastal green cities, and (Zheng et al., 2020) explored the environmental changes and disasters in coastal zone city. This research builds upon these studies, focusing on developing the tropical coastal city of Bengkulu as a unique case study, incorporating regional analysis techniques that have yet to be explored in previous research.

This research aims to analyze the development of the tropical coastal city of Bengkulu in achieving sustainable development goals. Given the crucial role that tropical coastal cities play in sustainable development, this research aims to provide valuable insights for the planning and development of other coastal cities. The results are expected to enhance the capacity of tropical coastal cities to achieve inclusive and sustainable development goals.

Methodology

This study mainly uses a quantitative approach and is supported by field-based qualitative observation (Grzeszczyk, 2018; Shantha Nair & S Prem, 2020). The quantitative part works with numbers and indicators to compare conditions between sub-districts, while

the qualitative part helps to explain these results through direct observation of the city and its service facilities in each sub-district, such as their location, condition, and how they are used in daily life (Keyimu et al., 2024). This study employs primary and secondary data gathered through field surveys and data acquisition from relevant government institutions, serving as input for the research data processing.

In this study, the qualitative data are obtained mainly from field surveys, including on-site observations and photographic documentation of key service facilities (such as schools, health centres, ports, and commercial areas) in each sub-district. These qualitative observations are then used to verify, complement, and interpret the quantitative indicators derived from secondary datasets, especially when assessing the completeness and functional hierarchy of service centres in Bengkulu City.

The data is sourced from various outlets, including Map of the Earth of Indonesia (RBI Maps), Google Earth City of Bengkulu imagery, and District in Figures documents covering the 9 districts in Bengkulu City. This data encompasses population figures, educational facilities, healthcare facilities, economic infrastructure, and social amenities. Secondary data from the central statistical agency is also utilized to obtain the Gross Regional Domestic Product at Constant Prices (GRDP CP) for both Bengkulu City and Bengkulu Province.

The research employs regional analysis techniques, incorporating geospatial analysis and regional analysis. Geospatial analysis utilizes spatial data such as RBI Maps and field surveys, visualizing the development of Bengkulu City as a tropical coastal city through thematic maps. The regional analysis utilizes secondary data, including population figures, educational and healthcare facilities, economic infrastructure, and social amenities for each district in Bengkulu City in 2022, employing a scalogram analysis. The completeness of service facilities indicates the potential concentration of activities in a given region due to its high service reach (Bruno et al., 2020).

$$LF(\%) = \left(\frac{AF}{TF}\right) * 100$$

where AF is the number of available facility types in the sub-district and TF is the total number of facility types considered. This formulation follows the scalogram-based approach to facility completeness commonly used in regional analysis and service center studies (Ancok & Nurhadi, 2018; Sadik et al., 2021).

The expected output is determining the developmental level in Bengkulu City's various regions based on the analysis of service facility availability. The regional analysis also utilizes GRDP CP data for Bengkulu City and Bengkulu Province from 2012 to 2022, using a class typology analysis to generate two typologies: spatial (regional) and sectoral (economic). The first typology assesses the regional development to understand the developmental level of Bengkulu City and make comparisons with other districts within Bengkulu Province. The second typology assesses the development of economic sectors within the region to understand the developmental level of various economic sectors in Bengkulu City.

Table 1. Typology of Regional Development in Regencies/Cities in Bengkulu Province

GRDP per Capita (b) *GRDP Growth Rate (a)*	*Bi > b*	*Bi < b*
Ai > a	*Quadrant I: Advanced and Rapidly Growing Region*	*Quadrant II: Quickly Developing Region*
Ai < a	*Quadrant III: Advanced but Pressured Area*	*Quadrant IV: The Region with Relative Backwardness*

Source: Darius et al. (2021); Maulidah & Arisanti (2025)
Information:
Ai =GRDP in Bengkulu Province
Bi = GRDP per capita in Bengkulu Province

a = Growth rate of GRDP in regencies/cities in Bengkulu Province
b = Average per capita income in regencies/cities in Bengkulu Province.

Table 2. Typology of Economic Sector Development in Bengkulu City

Sectoral Growth (t) *Sectoral Contribution (s)*	*Ti > t*	*Ti < t*
Si > s	*Quadrant I: Advanced and Rapidly Growing Sector*	*Quadrant II: Quickly Developing Sector*
Si < s	*Quadrant III: Advanced but Pressured Sector*	*Quadrant IV: The Sector with Relative Backwardness*

Source: Darius et al. (2021); Yudha et al. (2025)
Information:
Si = Sectoral contribution to GRDP in Bengkulu Province
Ti = Sectoral growth of GRDP in Bengkulu Province
s = Sectoral contribution to GRDP in Bengkulu City
t = Sectoral growth of GRDP in Bengkulu City.

Result and Discussion

Result

1. Results of Regional Typology Classes

The typology of regional classes was derived from the processing of secondary data, namely documents from the City of Bengkulu and Bengkulu Province, spanning 2013 to 2023. These documents were sourced from the publications of the Central Statistics Agency. The data was analyzed using class typology analysis to obtain the average growth and Gross Regional Domestic Product (GRDP) growth rate of both the City of Bengkulu and Bengkulu Province from 2012 to 2022.

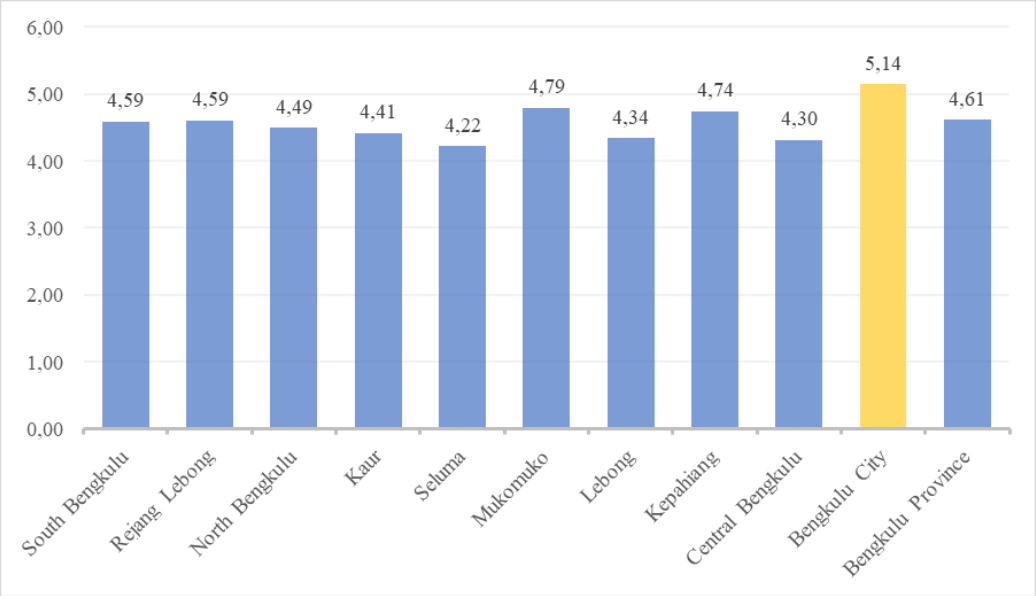

Figure 1. The average GRDP growth rate from 2012 to 2022 in Bengkulu
source: processed from central statistics agency data

The average growth rates of Gross Regional Domestic Product (GRDP) for each regency/city in Bengkulu Province varied relative to the overall provincial average of 4.61% from 2012 to 2022. The City of Bengkulu exhibited a higher average growth rate than the provincial average, at 5.14%. Other regencies that experienced higher GRDP growth rates than the provincial average were Mukomuko Regency (4.79%) and Kepahiang Regency

(4.74%). On the other hand, seven regencies had average growth rates lower than the provincial average, namely South Bengkulu Regency (4.59%), Rejang Lebong Regency (4.59%), North Bengkulu Regency (4.49%), Kaur Regency (4.41%), Lebong Regency (4.34%), Central Bengkulu Regency (4.30%), and Seluma Regency (4.22%).

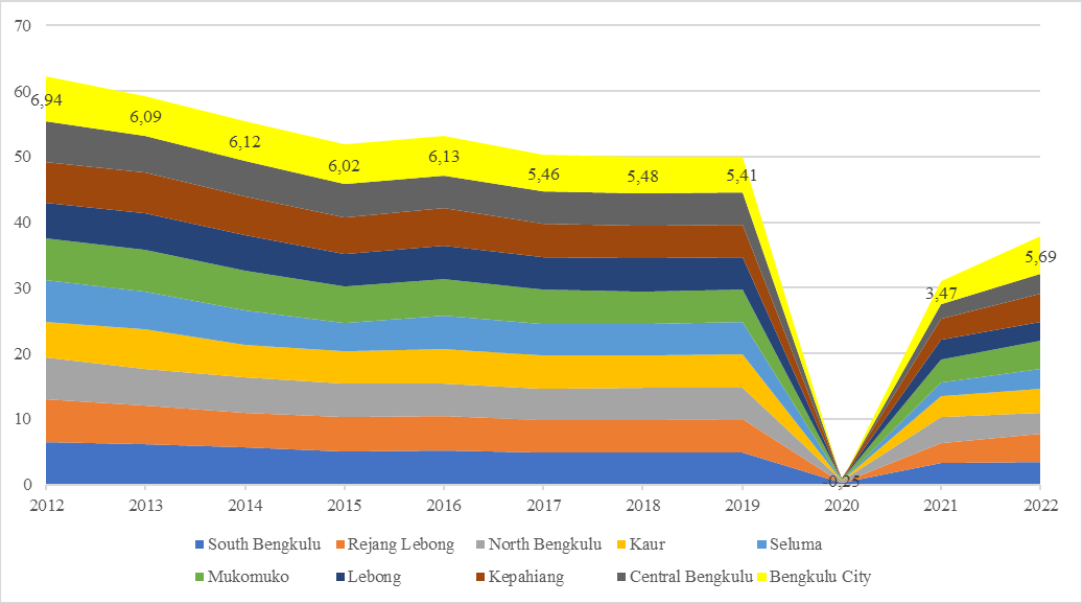

Figure 2. The GRDP growth rate for regencies/cities in Bengkulu Province from 2012 to 2022
source: processed from central statistics agency data

The Gross Regional Domestic Product (GRDP) growth rate in the City of Bengkulu between 2012 and 2022 experienced a declining trend, with the highest growth rate recorded in 2012 at 6.94%. The downward trend persisted from 2012 to 2022, showing gradual and relatively extreme decreases. An extreme decline occurred in 2020, with a growth rate of 0.25%, partly attributed to the impact of the global COVID-19 pandemic, affecting not only Bengkulu City but almost all regencies/cities in Bengkulu Province. In 2020, the pattern of GRDP decline was observed in nearly all regencies/cities in the province, with growth rates below 1% and some even experiencing negative growth. The growth rate of GRDP in Bengkulu City began to rebound in 2021 and 2022, with growth rates of 3.47% and 5.69%, respectively. However, these growth rates have yet to reach the levels observed from 2012 to 2016, which were consistently above 6%.

Table 3. Regional Classification Typology of Bengkulu Province

Regency/City	*Average GRDP growth per capita 2012-2022 (billion rupiah)*	*Average GRDP growth rate 2012-2022 (percent)*	*Regional Classification Typology*
South Bengkulu	*20447,37*	*4,59*	*Quickly Developing Region*
Rejang Lebong	*20736,86*	*4,59*	*Quickly Developing Region*
North Bengkulu	*15989,64*	*4,49*	*The region with Relative Backwardness*
Kaur	*16979,83*	*4,41*	*The region with Relative Backwardness*
Seluma	*13396,16*	*4,22*	*The region with Relative Backwardness*
Mukomuko	*16282,35*	*4,79*	*Advanced but Pressured Area*
Lebong	*17347,25*	*4,34*	*The region with Relative*

Kepahiang	*18221,45*	*4,74*	*Backwardness* *Advanced but Pressured Area*
Central Bengkulu	*23276,29*	*4,30*	*Quickly Developing Region*
Bengkulu City	*37699,19*	*5,14*	*Advanced and Rapidly Growing Region*
Bengkulu Province	*20037,64*	*4,61*	

Source: analysis results

As presented in Table 3, Bengkulu City records the highest GRDP per capita (37,699.19 thousand rupiah) and the highest GRDP growth index (5.14) among all regencies/cities, so it is classified as an "Advanced and Rapidly Growing Region". This typology is consistent with its performance over the last decade (2012–2022), during which the average growth rate of GRDP per capita in Bengkulu City was 43% higher than the Bengkulu Province average, while its GRDP growth rate was 10% higher than that of the province. Table 3 also shows that Rejang Lebong (20,736.86 thousand rupiah; 4.59) and South Bengkulu (20,447.37 thousand rupiah; 4.59) are categorized as "Quickly Developing Regions". Both regencies already have GRDP per capita values that exceed the provincial average (20,037.64 thousand rupiah), and their GRDP growth indices are only slightly lower (around 0.5%) than the provincial index (4.61). These characteristics indicate that, if the current trends continue, Rejang Lebong and South Bengkulu have the potential to converge towards the same typology as Bengkulu City in the future

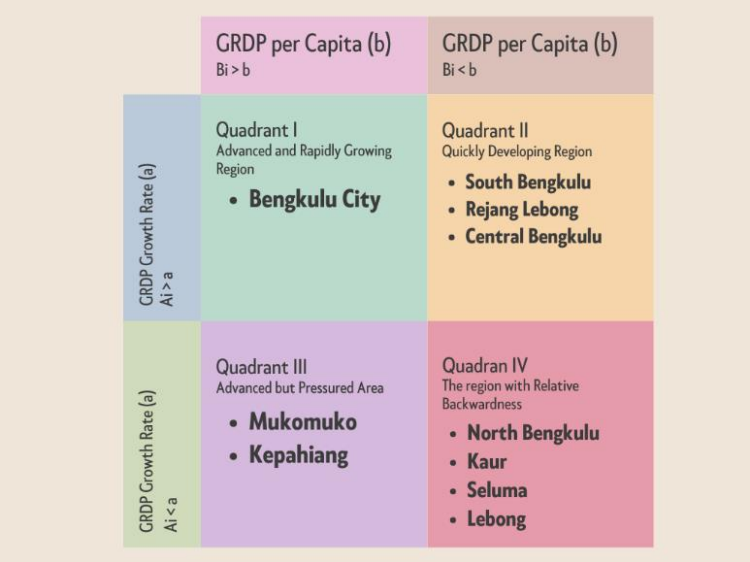

Figure 3. Distribution of Regional Typology in Bengkulu Province
source: analysis results

The results of the regional typology class indicate that Bengkulu City is the sole area in Bengkulu Province located in quadrant I, namely, the advanced and rapidly growing region. Bengkulu City has had a position as an economic growth centre and the central administrative hub in Bengkulu Province. The depiction of regional typology in Bengkulu Province reveals that underdeveloped areas are still greater than advanced and developing regions because 4 out of 10 regions in Bengkulu Province fall into Quadrant IV, "the region with relative backwardness." These regions include North Bengkulu Regency, Kaur Regency, Seluma Regency, and Lebong Regency

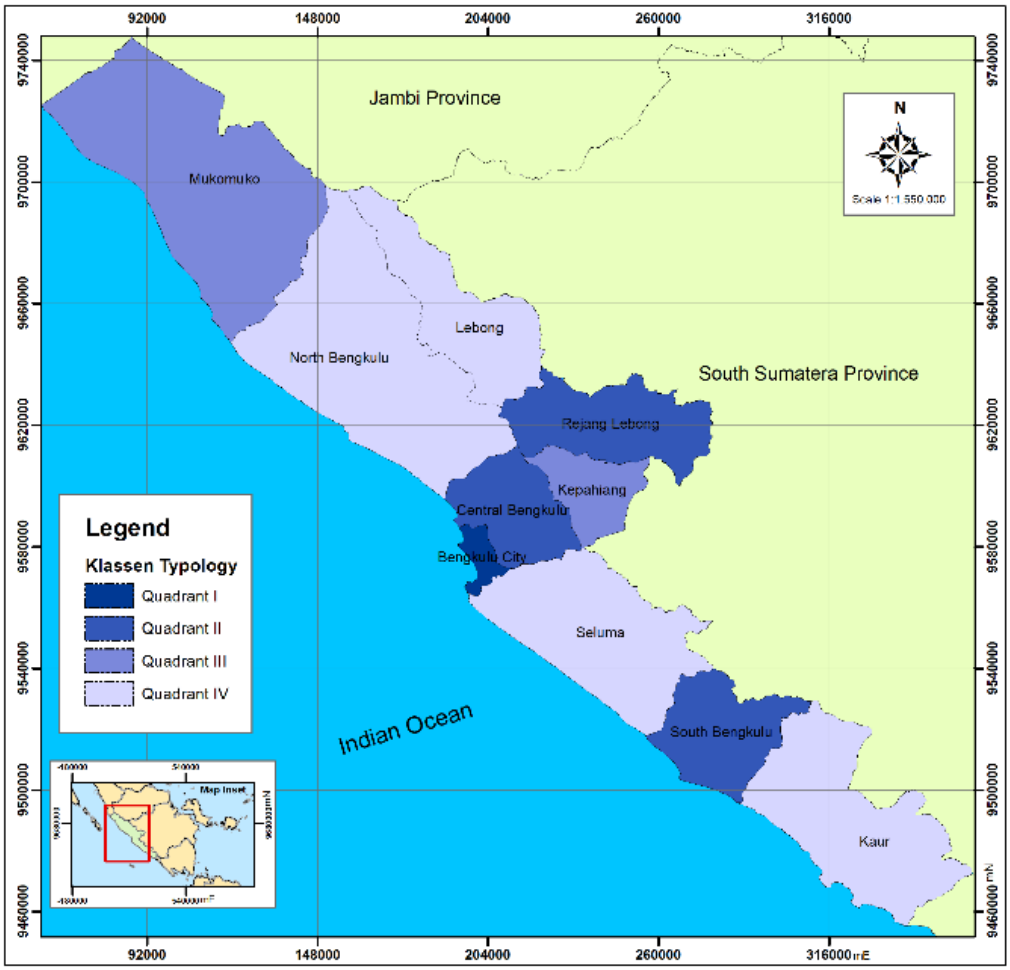

Figure 4. Map of the Typology Classifications of Regencies/Cities in Bengkulu Province source: analysis results

Geographically, Bengkulu City is adjacent to three other regencies: North Bengkulu Regency, Central Bengkulu Regency, and Seluma Regency. The spatial distribution based on the results of the typology class indicates that Bengkulu City serves as the economic growth centre (quadrant I). Its development direction tends to be towards Central Bengkulu Regency, classified as a quickly developing region (quadrant II), compared to North Bengkulu Regency and Seluma Regency, which fall into The Region with Relative Backwardness (quadrant IV). It is also interesting to note that the development direction of several other regencies is associated with inter-regional connectivity between Bengkulu Province and South Sumatra Province. Bengkulu City, along with Central Bengkulu Regency and Rejang Lebong Regency, is a region traversed by the primary road access from and to South Sumatra Province, characterized by quadrants I and II in the typology class.

2. Results of Economic Typology Classes

Based on the results of the regional typology class, Bengkulu City falls into the category of Quadrant I or an Advanced and Rapidly Growing Region. To delve more specifically into the economic sectors contributing to the progress of Bengkulu City, an analysis of economic typology classes is also conducted using data on the sectoral contributions to the Gross Regional Domestic Product (GRDP) of Bengkulu City and the growth of GRDP in Bengkulu City from 2012 to 2022.

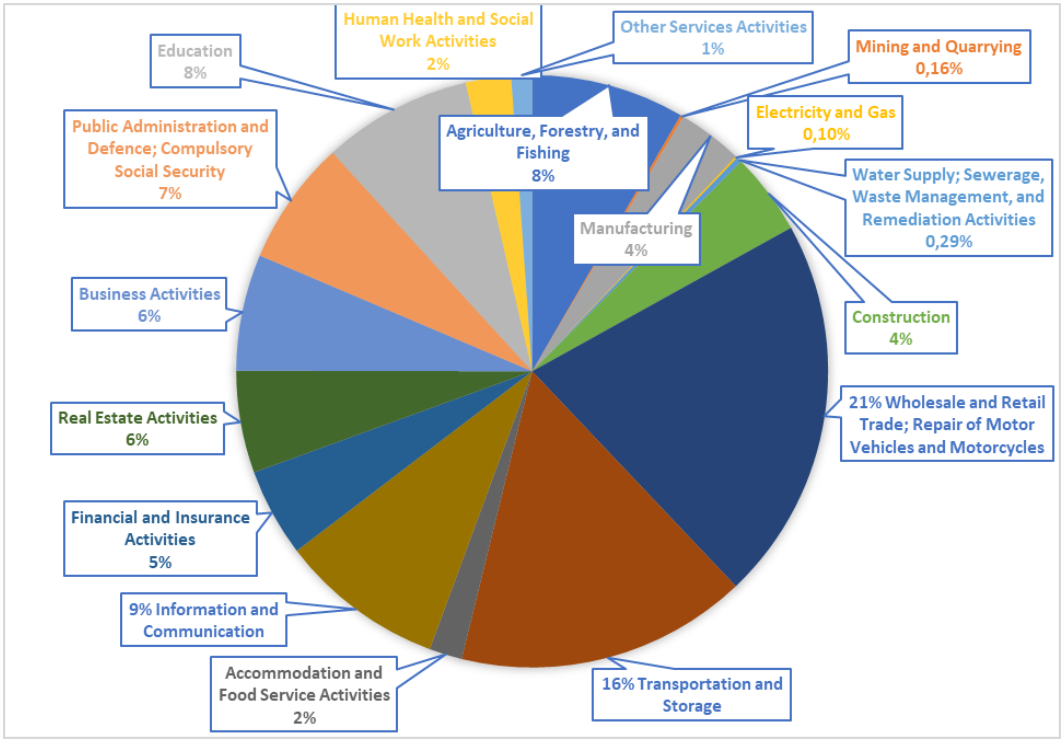

Figure 5. Average Contribution of Sectors to the GRDP of Bengkulu City 2012-2022
source: processed from central statistics agency data

The average contribution of sectors to the Gross Regional Domestic Product (GRDP) of Bengkulu City over the past 10 years (2012-2022) reveals that the trade sector accounted for 21%, while the transportation sector contributed 16%. Both sectors significantly exceeded other sectors, which ranged below 10%. Even other sectors in mining, industry, and water supply contributed less than 1% to the total contribution of the sectors to the GRDP of Bengkulu City. The dominant contributions of the trade and transportation sectors in Bengkulu City indicate that the region serves as a central hub for the flow of goods and services from both within and outside Bengkulu City and its surroundings. Contrary to the coastal city characteristics and maritime potential, Bengkulu City's contribution to the GRDP is not dominant. The fisheries sectors, agriculture, and forestry had an average value from 2012-2022 of 8%.

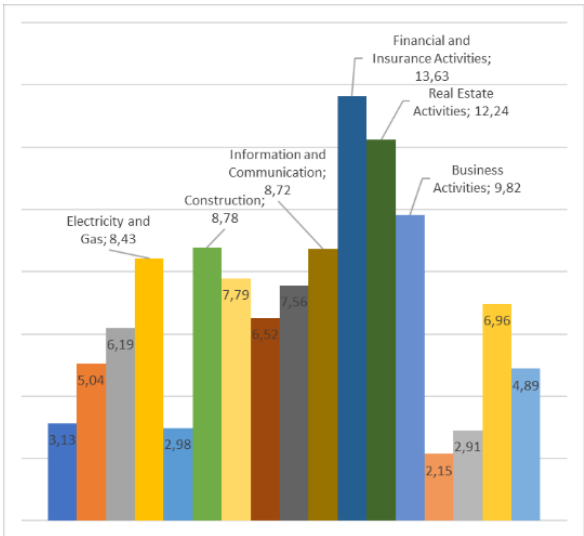

Figure 6. Average Growth of the GRDP of Bengkulu City 2012-2022
source: processed from central statistics agency data

The average growth of the Gross Regional Domestic Product (GRDP) of Bengkulu City from 2012 to 2022 indicates that there are sectors with higher growth rates than others. These include the financial and insurance services sector (13.63%), real estate (12.24%), corporate services (9.82%), information and communication (8.72%), construction (8.78%), and electricity and gas supply (8.43%). These sectors relate to the service sector, whether in infrastructure or finance, and an increase in the population and the community's purchasing power leads to a growing demand for infrastructure sectors such as telecommunications, electricity supply, construction, and housing. However, compared to the contribution of sectors to the GRDP, the trade and transportation sectors, with contributions of 21% and 16%, respectively, have average growth rates of only about 7.79% and 6.52%. The information and communication sector is one of the economic sectors in Bengkulu City, with both contribution and growth rate figures relatively consistent at 9.01% and 8.72%, respectively.

Figure 7. Distribution of Regional Typology in Bengkulu Province
source: analysis results

The results of the economic typology classes indicate that 8 out of 17 economic sectors in Bengkulu City belonged to quadrant I, namely, the advanced and rapidly growing sector. These sectors are associated with trade, transportation, accommodation, communication, real estate, corporate, educational, and other services. The trade sector is related to the exchange of goods and services in Bengkulu City, serving as the governmental and economic center of Bengkulu Province. Infrastructure sectors, including transportation, accommodation, and telecommunications, also play a significant role. As the primary service center in Bengkulu Province, Bengkulu City has contributed to and experienced rapid growth in advanced sectors, particularly in corporate services and educational services. Various educational facilities have contributed to the city's development, from elementary to tertiary education and other services.

3. Results of the analysis of the service center region in Bengkulu City

The development of Bengkulu City can be observed by analyzing the service centre system in Bengkulu City using data on the availability of functions and types of service facilities with a scalogram analysis approach. This method is employed to examine the

tendency of growth concentration in various regions within Bengkulu City, observed based on administrative regions at the sub-district level, totalling 9 sub-districts. The scalogram analysis divides each sub-district into four hierarchies, where a higher hierarchy indicates a higher tendency of growth concentration due to the increasing completeness of service facility types in that sub-district.

The service facilities in Bengkulu City exhibit varied completeness in each sub-district. The availability of types of service facilities found in Bengkulu City is related to economic sectors such as the trade sector, education ranging from elementary to higher education, and health facilities owned by the public and private sectors. Despite its vast area, Bengkulu City has a low population density, resulting in the concentration of service facilities in a centralized manner in specific areas or zones. The field survey results indicate that service facilities such as airports, hospitals, universities, and ports are part of a concentrated area with other service facilities in Bengkulu City

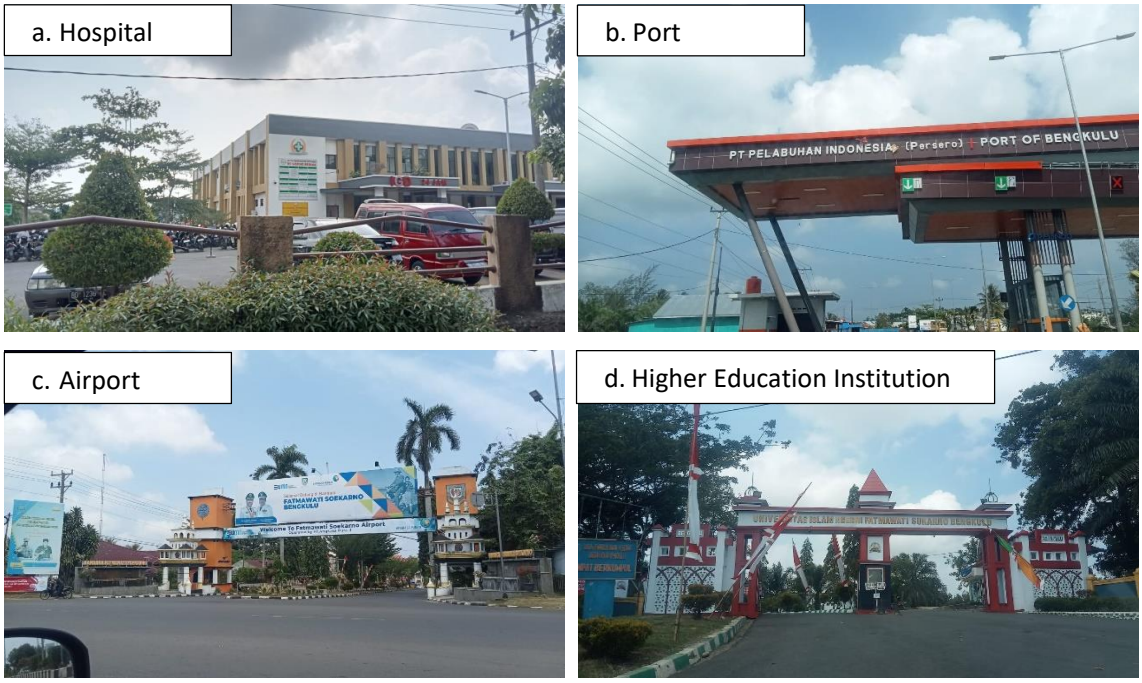

Figure 8. Health, Education, and Transportation Service Facilities in Bengkulu City
source: research documentation (2023)

To support the results of the scalogram analysis and field observations, these key facilities are illustrated in Figure 8. The photographs show examples of a hospital, port, airport, and higher education institution that represent higher-order services in Bengkulu City. These facilities are located in sub-districts that were classified in the upper hierarchies of the scalogram, where the completeness of service facility types is highest and the tendency for growth concentration is strongest. Thus, Figure 8 provides visual evidence of the spatial concentration of strategic health, education, and transportation services, reinforcing the analytical finding that urban development in Bengkulu City is centred around specific sub-districts that function as the main service centres for the city.

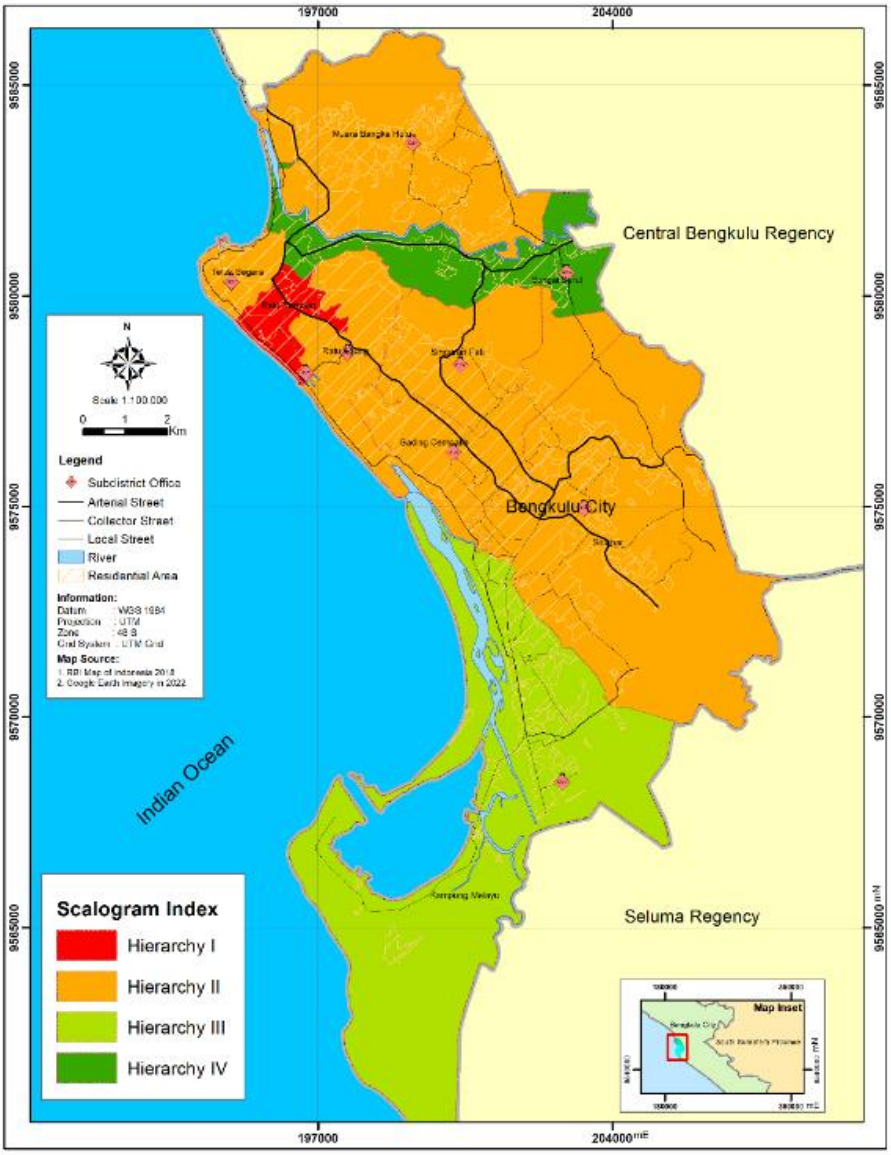

Figure 9. Scalogram Index Map of Bengkulu City
source: analysis results

Figure 9 maps the scalogram index for all nine sub-districts in Bengkulu City. The red area on the central-west coast shows Ratu Samban Sub-district, which is classified as Hierarchy I and appears as the main service centre of the city. Around Ratu Samban, the coastal and inner-city sub-districts of Teluk Segara, Gading Cempaka, Ratu Agung, and Singaran Pati are coloured orange (Hierarchy II), indicating that they also have a relatively high completeness of service facilities, although not as high as Ratu Samban. Further from the coastal core, the map shows light-green areas in Selebar and Kampung Melayu (Hierarchy III) and dark-green areas in Muara Bangkahulu and Sungai Serut (Hierarchy IV), where fewer types of facilities are available and residential land use is more dominant. Overall, the map illustrates a clear pattern in which the most complete service facilities are concentrated in the coastal urban core, while the level of completeness gradually decreases toward the northern and southern edges of Bengkulu City and near the borders with Central Bengkulu and Seluma Regencies.

Based on the scalogram index results, Bengkulu City indicates that the Ratu Samban Sub-district falls into the hierarchy category, with a percentage of 79% completeness of types of service facilities in this sub-district. Ratu Samban Sub-district has various service facilities

due to the centralized government offices in this area, followed by the presence of three hospitals, primary to upper-level educational facilities, and trade facilities such as shops and the largest shopping centres in Bengkulu City concentrated in this area. Spatially, it can be observed that the centre of Bengkulu City's development is in the coastal area centred in Ratu Samban Sub-district, followed by surrounding sub-districts such as Selebar, Muara Bangkahulu, Ratu Agung, and Singaran Pati, with completeness percentages of service facility types above 70%.

Kampung Melayu and Sungai Serut Sub-districts have the lowest completeness levels of types of service facilities, namely, 65% and 53%, respectively, or in hierarchies III and IV. The relatively low availability of service facility types in Kampung Melayu Sub-district can be identified due to the area's characteristics dominated by swamps and mangrove forests compared to residential areas, which is a primary factor influencing the need for service facilities. A similar situation occurs in the Sungai Serut Sub-district with similar geographical conditions, consisting of swamp areas and mangrove forests, and partly utilized for agriculture (rice fields and plantations). This concentration of non-residential land use contributes to the lower availability of types of service facilities compared to other sub-districts.

Discussion

The research findings reveal a distinct regional typology within Bengkulu Province, with Bengkulu City emerging as the sole region in the first quadrant, characterized as an advanced and rapidly growing area. In the Klassen typology framework, regions in quadrant I are those whose economic growth rate and GRDP per capita are both higher than the reference region, so they are interpreted as advanced and rapidly growing “prime movers” of regional development (Izza & Purnomo, 2024; Munandar & Wardoyo, 2015; Pangow et al., 2021; Wijaya et al., 2020). The province, depicted through the regional class typology, had positions in four out of ten regions in quadrant IV, indicating the region with relative backwardness, such as North Bengkulu, Kaur, Seluma, and Lebong Regency. The coexistence of a single quadrant-I region and several quadrant-IV regions is in line with growth-pole and core–periphery theories, which explain how economic activities tend to agglomerate in a limited number of urban centres that act as growth poles or cores, while surrounding areas remain relatively lagging peripheries due to weaker access to capital, infrastructure, and innovation (Chen et al., 2023; Klimczuk & Klimczuk-Kochańska, 2019; Zeng et al., 2023). The spatial distribution based on regional class typology highlights Bengkulu City as the focal point of economic growth (quadrant I), with developmental trends leaning towards Central Bengkulu Regency, identified as a quickly developing region (quadrant II), in contrast to North Bengkulu and Seluma Regency, categorized as the region with relative backwardness (quadrant IV). Similar quadrant patterns are also reported in other Indonesian provinces, where major cities such as Surabaya or East Kutai consistently occupy quadrant I, while several rural regencies remain in quadrant IV, indicating that spillover effects from urban growth centres to their hinterlands are still limited and spatial inequality persists (Aditya Pratama et al., 2025; Wijaya et al., 2020).

The economic class typology outcomes illustrate that eight out of seventeen economic sectors in Bengkulu City fall into quadrant I, which is characterized as advanced and fast-growing sectors. These sectors encompass trade, transportation, accommodation, communication, real estate, corporate, education, and other services. Spatially, the developmental hub of Bengkulu City is situated in the coastal region, centred around Ratu Samban sub-district, followed by surrounding areas such as Muara Bangkahulu, Ratu Agung, and Singaran Pati sub-district, each exhibiting a completeness percentage of service facilities above 70%. The clustering of higher-order trade, transport, education, and other service

facilities in these sub-districts is consistent with central place theory and growth-pole perspectives, which argue that advanced services tend to agglomerate in the most accessible urban nodes and form service centres that supply and stimulate growth in their surrounding hinterlands (Frick & Rodríguez-Pose, 2025; Giuliano et al., 2019; Shi et al., 2020; Xie et al., 2019). Conversely, Kampung Melayu and Sungai Serut sub-districts display the lowest completeness percentages at 65% and 53%, respectively, falling within hierarchical levels III and IV. This pattern of lower service completeness in peripheral sub-districts reflects a core–periphery structure commonly observed in Indonesian cities, where fringe areas have relatively limited access to public service facilities compared with the urban core (Muhaimin et al., 2022; Wijaya et al., 2020).

The concentration of economic growth in Bengkulu City aligns with urbanization and economic development theories, emphasizing the pivotal role of central urban areas as growth engines. Scholars such as (Mewes & Broekel, 2022) have argued that the spatial distribution of economic activities influences regional development trajectories. The findings regarding Central Bengkulu Regency rapid development resonate with (van Aswegen & Retief, 2021) theories on emerging economic centres in peripheral regions. Additionally, the underdevelopment in North Bengkulu and Seluma Regency mirrors discussions by (Panzera & Postiglione, 2022) on the challenges lagging regions face in achieving economic progress.

Furthermore, the economic typology aligns with the literature on sectoral development, with trade, transportation, and communication often identified as critical drivers of economic growth. Studies by (Adeleye et al., 2021) have highlighted the significance of these sectors in fostering regional development. The spatial analysis of service facility completeness supports (Mitrică et al., 2020) theories on the uneven distribution of infrastructure and services, contributing to regional disparities.

In sum, the Bengkulu case shows that coastal city growth in Indonesia is strongly driven by advanced, fast-growing service sectors and a high completeness of facilities in the coastal core. In Bengkulu City, more than 70% completeness of key services in the central coastal sub-districts helps advance SDG 8 (Decent Work and Economic Growth) and SDG 11 (Sustainable Cities and Communities), while quadrant-IV areas such as North Bengkulu and Seluma still risk uneven urbanisation outcomes. This research, therefore, provides both conceptual and practical contributions to the study of regional development in coastal provinces. Conceptually, it demonstrates how Klassen's economic typology, sectoral class analysis, and scalogram-based service-facility hierarchies can be combined in a single spatial framework to identify growth poles, emerging centres, and lagging peripheries within one province. Empirically, the study offers one of the first district- and sector-level mappings of Bengkulu Province, revealing the coastal core of Bengkulu City as a service-based growth engine and documenting the persistence of quadrant-IV lag in several hinterland regencies and low-completeness sub-districts. Methodologically, the indicators and thresholds used here are transparent and replicable so that the approach can be applied by local governments or researchers in other Indonesian regions facing similar coastal–inland disparities. From a policy perspective, the findings provide an evidence base for prioritising infrastructure and public-service investments, designing more place-sensitive SDG 8 and SDG 11 interventions, and monitoring whether development policies actually reduce spatial inequality between Bengkulu City and its surrounding regencies.

Despite these contributions, the study has several limitations. It relies on a cross-sectional snapshot and on secondary data, so it cannot fully capture temporal change or short-term shocks in Bengkulu's development trajectory. The results are also sensitive to the choice of typology thresholds and the spatial aggregation of data, which may hide variation at the neighbourhood or village scale. Key challenges that follow from these limitations include extending basic services and job opportunities to low-completeness sub-districts such as

Kampung Melayu and Sungai Serut and coordinating investments to strengthen coastal and hinterland infrastructure. Future research should therefore track shifts across typology quadrants over time and test light, targeted interventions—such as improving public transport links and essential service coverage in lagging sub-districts—to see whether better connectivity and services can accelerate more inclusive growth toward SDGs 8 and 11.

Conclusion

In conclusion, this study shows that Bengkulu City has become the main growth centre in Bengkulu Province. The city stands alone in quadrant I, supported by eight leading service-based sectors and a high completeness of health, education, trade, and transport facilities in its coastal sub-districts. At the same time, several hinterland regencies (North Bengkulu, Kaur, Seluma, Lebong) and peripheral urban areas (Kampung Melayu, Sungai Serut) remain in lower quadrants, with fewer service facilities and weaker development, so a clear core–periphery pattern is still visible and progress toward SDGs 8 and 11 is uneven. By combining Klassen typology, sectoral analysis, and a scalogram of service facilities, this research offers a simple framework that local governments can reuse to read spatial inequality and to spot new growth areas such as Central Bengkulu Regency. The results point to the need for more focused policies that improve basic services, transport links, and job opportunities in lagging areas, and future studies should follow these regions over time to see whether such interventions can truly support more inclusive and sustainable regional development.

For Bengkulu City and its surrounding regencies, the findings tell a clear story: development policies now need to pay more attention to basic services, everyday mobility, and decent jobs in the sub-districts and regencies that are still left behind. Bengkulu city's pattern of a strong urban core and slower-growing hinterland is likely to appear in many other Indonesian regions. Following Bengkulu and similar areas over time will help show whether targeted improvements in services and connectivity can really narrow these gaps and support more inclusive regional growth and sustainable regional development.

Funding Declaration

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Competing Interests

The author(s) declare no competing interests.

Data Availability

The datasets generated during and/or analysed during the current study are not publicly available due ethics related to protecting the privacy and confidentiality of research participants but are available from the corresponding author on reasonable request.

Author Contributions

Akbar Abdurrahman Mahfudz led the overall study, including research design, data analysis, interpretation of results, preparation of figures and tables, and writing of the first draft of the manuscript (corresponding author). Ana Ariasari contributed to the study design, field data collection, data processing, and critical revision of the manuscript. Ali Muqsit contributed to field surveys, data curation, and review and editing of the text. Nur Lina Maratana Nabiu assisted with fieldwork, spatial data processing, validation of results, and revision of the manuscript. An Nisa Nurul Suci provided conceptual input on the research framework, supervised the analysis and interpretation in the context of marine and coastal studies, and contributed to the critical review and refinement of the manuscript. All authors read and approved the final version of the manuscript.

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