

Digitalization, Finance, and Governance for Blue Inclusive Growth in Sulampua

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ABSTRACT

This study aims to analyze the spillover effects of digitalization, financing, and institutional governance on inclusive blue economic growth in SULAMPUA. By applying aggregated crosstabulation (PODES) to a panel data model of 144 regencies/cities during 2019–2022 in the Sulawesi, Maluku, and Papua regions. This study employs three analytical techniques, namely cluster analysis: k-means and location quotient to determine blue economic centers; efficiency analysis: Luenberger productivity index to determine inclusive blue growth; and static panel regression to determine digitalization, financing, and governance. The results show that digitalization and banking financing have a significant positive effect on inclusive blue growth.

Keywords: Digitalization, Finance, Good Governance, Inclusive Blue Growth

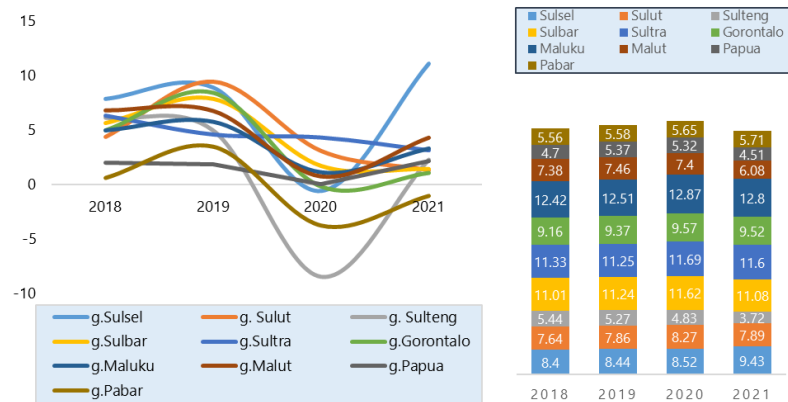
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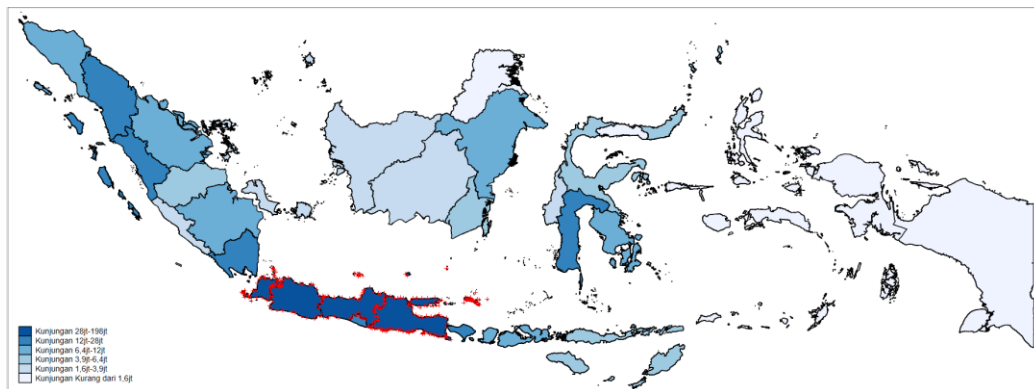
INTRODUCTION

The maritime development potential of Eastern Indonesia, particularly Sulawesi, Maluku, and Papua, is considered to represent one of the breakthroughs in economic growth. The vast marine area in Eastern Indonesia makes this multi-sector potential increasingly promising; for instance, strengthening the fisheries sector, marine tourism, and the creative economy will drive the transition to new growth, allowing the shift of focus from extraction in mining and non-renewable energy industries to be realized as soon as possible. A detailed review, based on KKP (2022) data, shows that economic growth from fisheries has reached 2.89%, with the highest growth achieved by South Sulawesi. Meanwhile, in the tourism sector, data indicate that visitation in the SULAMPUA region has remained relatively lagging compared to other areas. Statistically, domestic tourist visits to the region in 2023 accounted for only 6.7% of the total national visits. In line with this, the creative economy is also still considered low. Therefore, strong synergy is needed to achieve increasingly inclusive economic growth by navigating and improving qualifications in these sectors.



Source: BPS (2022), data processed

Figure 1. Fisheries Economic Growth (Left) and Fisheries Contribution to the Economy (Right) in SULAMPUA



Source: BPS (2022), data processed

Figure 2. Average Penetration of Domestic Tourism Visits 2020-2023

Amid increasingly widespread digitalization, the economy today will be oriented toward this context, thereby driving regional progress. The role of both agents which namely, the community and business actors are certainly essential for achieving the solidification of productivity and an economic leap. Nevertheless, the significant disparity in digital access ownership between coastal and non-coastal areas in the SULAMPUA region becomes both a reinforcement and an effort to eliminate this disparity. Statistically, the average rate of digital access ownership in coastal areas remains around 44%, while in non-coastal areas it reaches 73%. Based on previous research, digitalization is considered capable of gradually increasing productivity (Ren et al., 2023). Nevertheless, digitalization cannot proceed on its own but requires guidance through proper financing and regulation; according to several previous studies, the majority of fishermen and tourism industry promoters indeed still lack sufficient qualifications for access, which further disrupts their business processes. (Sumaila et al., 2021) To that end, complementary measures are needed for the massive development of digitalization, including the penetration of socialization as well

as the strengthening of physical infrastructure development. In addition, support from local governments such as governance and fiscal decentralization is also essential as an effort to streamline business processes while also promoting increasingly conducive economic growth. Accordingly, this research is very important to conduct given that growth is still focused on the extractive sector.

Several previous studies have not extensively addressed the inclusivity of blue growth either globally or in Indonesia. Currently, research related to maritime affairs still focuses on the achievements of the fisheries sector and its efforts to enhance growth. Meanwhile, the need to expand research on digitalization, financing, and governance is more often associated with the green sector. Therefore, this serves as one of the embryos in realizing sustainable inclusive blue growth. Accordingly, the objective of this study is to examine the influence of digitalization, financing, and governance on inclusive blue growth in SULAMPUA. In line with this, the study's locus encompasses regencies/cities with potential in the SULAMPUA region during 2019–2022. It is hoped that, first, this study can provide information related to sectoral hubs so that inclusive blue growth can be achieved. Second, it offers a justification for the influence of digitalization, financing, and governance on inclusive blue growth. Third, it can provide methodological insights, making implementation possible in research and national planning.

Blue Inclusive Growth

The measurement of blue growth and its nomenclature borrow from inclusive green growth, but focus on the characteristics of aquatic environments and causal factors related to the ocean economy. The paradigms of inclusive green and blue growth in fact evaluate inclusive growth that previously focused only on social equity; such as poverty, employment, and income disparity, thus requiring better navigation especially of environmental aspects, as demanded by development and sustainability.

According to several previous studies, Blue Inclusive Growth (BIG) refers to the concept of promoting sustainable development in the marine and maritime sectors while ensuring inclusivity and social progress. Several benchmarks of the European Union Blue Growth strategy aim to support innovation and economic growth in these sectors, emphasizing the importance of involving various stakeholders, including investors, governments, academics, and businesses. (Aguiar Machado, 2019; van den Burg et al., 2017a). In addition, the Blue Economy model promotes the Quadruple Helix approach, which integrates government, academia, businesses, and users to drive sustainable and inclusive development in coastal and marine areas (Sampaolo et al., 2021). Inclusive growth is crucial for restoring public trust in democratic institutions and international economic integration, by highlighting the importance of social progress and well-being for all (Cordemans, 2019). By strengthening economic ties, reducing economic leakage, and promoting international partnerships, Inclusive Blue Economic Growth aims to create a more sustainable and inclusive future for ocean-dependent economies (Hampton & Jeyacheya, 2020; Sampaolo et al., 2021).

In more detail, inclusive blue growth represents the success of blue development efficiency in a region. In general, blue development efficiency refers to the optimal utilization of fisheries and marine resources to maximize economic benefits and minimize environmental damage. Blue development efficiency refers to benchmarking that focuses on the utilization of resources, technological innovation, and sustainable practices. (Cisneros-Montemayor, 2019; Sarwat, 2022).

The Role of Digitalization in Blue Inclusive Growth

Several previous studies have not revealed much about the impact of digitalization on inclusive blue growth. Thus, inclusive blue growth is approached or borrows the nomenclature of inclusive green growth. Digitalization plays an important role in driving positive impacts on inclusive green economic growth by enhancing various aspects of sustainable development. Studies show that the agglomeration of the digital economy positively influences inclusive green economic growth through energy consumption, environmental pollution, economic growth, human resources, industrial structure, and technological advancement (S. Ren et al., 2022a). In addition, digital financial inclusion significantly increases green agricultural total factor productivity, with an important "structural growth effect" from the optimization of the agricultural industry structure (Hong et al., 2022). In addition, digital financial inclusion reduces capital misallocation and increases financial efficiency, thereby driving environmentally friendly innovation and contributing to sustainable development (Li et al., 2023). Bank digitalization has also been found to have a significant positive impact on sustainable financial inclusion, providing benefits for vulnerable groups and promoting sustainable development through risk avoidance and gain mechanisms (Chu et al., 2023). Overall, the synergy between digitalization and inclusive green economic growth is evident, highlighting the importance of digital initiatives in driving positive outcomes for a sustainable and inclusive economy.

Digitalization has a negative impact on Blue Inclusive Economic Growth by offering solutions to various challenges. The study highlights that the digitalization of government services can play an important role in addressing issues related to the transition to renewable energy, ensuring responsible energy consumption, and improving energy infrastructure to achieve inclusive economic growth (Kwilinski et al., 2023). In addition, studies in China highlight the positive impact of digital economy agglomeration on inclusive green economic growth, indicating that digitalization can contribute to inclusive growth by influencing energy consumption, environmental pollution, economic growth, human resources, industrial structure, and technological progress (S. Ren et al., 2022a). In addition, an analysis of digital financial inclusion in China reveals that digital financial inclusion can reduce the negative impact of climate variability on rural income growth, indicating how digitalization can promote income growth and poverty alleviation in rural areas. (Cao et al., 2022; Chunyan He et al., 2022).

The Role of Financing in Blue Inclusive Growth

Bank financing plays an important role in promoting inclusive growth across various sectors, including blue economic growth initiatives. Research shows that women's financial inclusion, as measured by access to bank accounts and credit cards, has a positive impact on economic development by reducing income inequality (Cabeza-García et al., 2019). In addition, digital financial inclusion has been shown to significantly increase the total green factor productivity of agriculture, with part of this effect attributed to the optimization of the agricultural industry structure (Hong et al., 2022). In addition, digital financial inclusion has been shown to promote green economic efficiency, although interactions with regional competition may have varying impacts on overall green economic development (Song et al., 2023a). Understanding investor behavior and engaging private investors is crucial for the sustainable growth of the blue sector, as investors play a key role in mitigating the risks associated with scaling up promising technologies in the blue growth sector (van den Burg et al., 2017b). Overall, bank financing, particularly through inclusive finance mechanisms, plays an important role in driving positive outcomes for blue inclusive growth initiatives.

On the other hand, research Chen et al (2018) emphasizes that the promotion of financial inclusion can have a negative impact on non-performing loans of commercial banks, which ultimately affects the asset quality of the banking sector. In addition, research by van den Burg et al (2017) underlines the importance of government support in attracting private investors to drive sustainable growth in Blue Economy Growth sectors, indicating the need for stable and effective financial support schemes to mitigate risks and encourage investment in these sectors. Therefore, by aligning financial inclusion efforts with sustainable economic policies and providing the necessary support, banks can play a crucial role in promoting Inclusive Blue Growth and ensuring financial stability and asset quality in the banking sector.

The Role of Governance in Blue Inclusive Growth

Good governance plays an important role in driving positive outcomes for Blue Inclusive Growth by interacting with various factors such as economic globalization, the renewable energy transition, and institutional quality. Research shows that good governance, particularly government effectiveness, interacts with economic globalization to promote Green Inclusive Growth (Ofori & Figari, 2023). In addition, government digitalization is highlighted as a key instrument in achieving inclusive economic growth, which is crucial for Inclusive Blue Growth (Kwilinski et al., 2023). In addition, the development of institutional frameworks and new governance structures is crucial for the success of blue economy initiatives, leading to significant changes in marine policy and governance that support Inclusive Blue Growth (Guerreiro, 2021). In addition, studies in developing Islamic countries show a significant positive correlation between indicators of good governance such as rule of law and control of corruption and economic growth, which are key components of Blue Inclusive Growth (Setayesh & Daryaei, 2017).

Government governance also has an influence on the negative impact on Blue Inclusive Growth by interacting with various factors. Research shows that good governance is essential for promoting inclusive green economic growth by moderating the negative impact of urbanization on sustainability (Wang et al., 2022). In addition, in the context of economic globalization (EG) in Africa, good governance, which particularly government effectiveness, interacts with EG to promote Green Inclusive Growth, highlighting the importance of governance frameworks for environmental and social sustainability (Ofori & Figari, 2023) In addition, the quality of governance is crucial for achieving inclusive growth, which requires structural reforms, anti-corruption measures, and transparent political institutions to limit policy errors and incentivize decisions that prioritize the public interest (Ivanyna & Salerno, 2021). Therefore, improving good governance practices is essential to mitigate negative impacts on Blue Inclusive Growth and to promote sustainable and inclusive growth across various sectors and regions.

RESEARCH METHODS

Research Stage Framework

In this section, the stages of the research are explained to establish their interrelation, so that inclusive blue growth can be properly confirmed using various approaches. In this study, there are three qualification stages: data collection, data processing and modeling, and spatial model evaluation. More specifically, these can be described as follows:

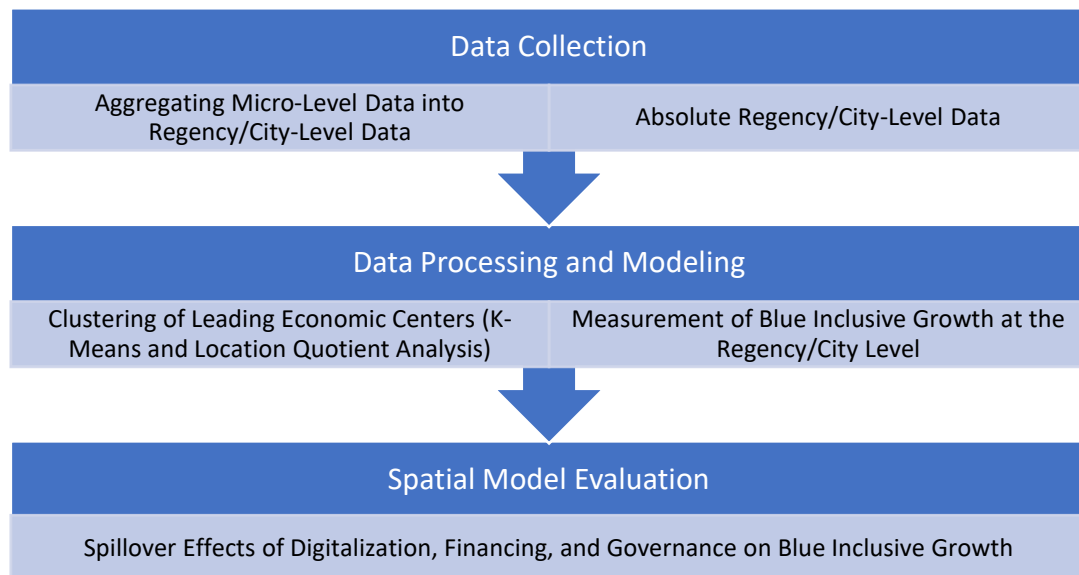


Figure 3. Research Stage

Research Data

This study uses secondary panel data consisting of 144 regencies/municipalities during 2019–2022 across all provinces in the Sulawesi,

Maluku, and Papua regions. These data were compiled from Marine and Fisheries Statistics of KKP, Tourism Statistics of Kemenparekraf and BPS, Macroeconomic Indicators of BPS, primary data from the National Socio-Economic Survey (susenas), primary data from the National Labor Force Survey (SAKERNAS), Regional Financial Statistics from Bank Indonesia, energy and electricity use data, Village Potential Data Collection (PODES), and other Environmental Indicators.

Analysis Techniques

Clustering of Centers of Excellence (K-Means and Location Quotient)

The process of measuring and determining the clustering of blue economy centers of excellence uses two techniques, namely unsupervised with k-means and supervised using Location Quotient (LQ). This refers to several previous studies, for example (Alnaji & Ashour, 2011; He & Liu, 2022; Huang et al., 2021; Pham, 2020). Clustering techniques such as K-Means play an important role in analyzing patterns of economic growth, especially in regions with disparities such as China (Pham, 2020). Traditional K-Means methods may struggle with elongated or irregularly shaped clusters, resulting in inaccurate outcomes. To address this, researchers have proposed modifications such as the KMSR and CUK algorithms, which enhance the clustering process by incorporating advanced data similarity measures and additional centroids for more accurate and efficient data point clustering. (Alnaji & Ashour, 2011; Huang et al., 2021). The results indicate that this clustering technique can convey more accurate information by moderating various factors.

Location Quotient (LQ) is an index widely used in geography and economics to measure the relative concentration of activities. This index helps identify industrial clusters and economic strengths in a region. On the other hand, K-means clustering is a popular unsupervised machine learning algorithm used for data clustering and pattern recognition (Jagwani & Kaushik, 2014). While LQ focuses on the concentration of activity in a particular location, K-means clustering groups data points based on similarity, aiming to uncover patterns and relationships within the data. By combining insights from LQ analysis with the clustering capabilities of K-means, researchers and policymakers can gain a deeper understanding of economic structure, identify key sectors, and make informed decisions for regional development and resource allocation.

K-Means Formulation Model applies the Euclidean Distance principle as follows:

$$d_{x,y} = \sqrt{\sum_{i=1}^n (x_{ik} - x_{jk})^2} \quad (1)$$

$d_{x,y}$ is the distance between objects i and j, x_{ik} is the i-th data object in data k. x_{jk} Represents the j-th data object in the k-th data, or what is often referred to as the centroid (midpoint value).

Meanwhile, LQ measurement can be expressed as follows:

$$LQ = \frac{\frac{x_{ik}}{X_{ik}}}{\frac{x_i}{X_i}} \quad (2)$$

Where x_{ik} is the number of villages utilizing one activity/with a marine characteristic at the district level, X_{ik} is the number of villages utilizing one activity/with a marine characteristic at the provincial level, x_i is all villages utilizing activities/with marine characteristics at the district level, X_i is all villages utilizing activities/with marine characteristics at the provincial level.

Table 1. Reference Attributes for K-Means and LQ Cluster Utilization

Number of Villages with Marine Characteristics	Utilization of Seawater	Creative Economy Supplement
Villages that have/are near the coast	Village that utilizes seawater as: fishpond Village that utilizes seawater for aquaculture Village that utilizes seawater for maritime activities Village that utilizes seawater for other activities	The Presence of Mangroves in the VillageCondition of the Mangrove Ecosystem

Measurement of Blue Inclusive Growth and Its Convergence

The measurement of inclusive blue growth refers to an analysis using the slack based measurement of efficiency, considering the very close interregional proximity. In addition, the use of Luenberger productivity measurement also serves as a reference in determining inclusive growth that prioritizes environmental aspects. The formulation can be stated as follows: Based on the results of the DDF-SBM calculation, this is then followed by using the Luenberger index as a comprehensive measure of blue inclusive growth as a form of technical change. This process requires information related to annual changes so it can be expressed as follows:

$$LI_t(X_t, X_{t+1}, Y_t^d, Y_{t+1}^d, Y_t^u, Y_{t+1}^u) = \bar{D}^t(X_t, Y_t^d, Y_t^u) - \bar{D}^t(X_{t+1}, Y_{t+1}^d, Y_{t+1}^u) \quad (3)$$

Where $\bar{D}^t(X_t, Y_t^d, Y_t^u) < \bar{D}^t(X_{t+1}, Y_{t+1}^d, Y_{t+1}^u)$, $LI_t(X_t, X_{t+1}, Y_t^d, Y_{t+1}^d, Y_t^u, Y_{t+1}^u) > 0$

indicates the inclusiveness of blue growth and vice versa. Meanwhile, to define the future time t+1, it can be expressed as follows:

$$LI_{t+1}(X_t, X_{t+1}, Y_t^d, Y_{t+1}^d, Y_t^u, Y_{t+1}^u) = \overline{D^{t+1}}(X_t, Y_t^d, Y_t^u) - \overline{D^{t+1}}(X_{t+1}, Y_{t+1}^d, Y_{t+1}^u) \quad (4)$$

Next, to analyze the technology cycle in inclusive green growth, the arithmetic mean of the Luenberger Productivity indicator for t and t+1 is more finely used to measure the average effect arbitrated across the two periods to calculate productivity growth, known as efficiency change as follows:

$$LI = \frac{1}{2} [LI_t(X_t, X_{t+1}, Y_t^d, Y_{t+1}^d, Y_t^u, Y_{t+1}^u) - LI_{t+1}(X_t, X_{t+1}, Y_t^d, Y_{t+1}^d, Y_t^u, Y_{t+1}^u)] = \frac{1}{2} [\overline{D^t}(X_t, Y_t^d, Y_t^u) - \overline{D^{t+1}}(X_{t+1}, Y_{t+1}^d, Y_{t+1}^u) + \overline{D^t}(X_{t+1}, Y_{t+1}^d, Y_{t+1}^u) - \overline{D^{t+1}}(X_t, Y_t^d, Y_t^u)] \quad (5)$$

Based on the information above, it is stated that there is a possibility of input and output bias, so the process needs to be expanded to output-biased technical change (OBTC), input-biased technical change (IBTC), and magnitude of technical change (MATC) structured as follows:

$$TC = OBTC + IBTC + MATC \quad (6)$$

Then, to interpret the information symmetrically, each parser is separated as follows:

$$OBTC = \frac{1}{2} [\overline{D^t}(X_{t+1}, Y_{t+1}^d, Y_{t+1}^u) - \overline{D^{t+1}}(X_{t+1}, Y_{t+1}^d, Y_{t+1}^u) + \overline{D^{t+1}}(X_t, Y_{t+1}^d, Y_{t+1}^u) - \overline{D^{t+1}}(X_{t+1}, Y_t^d, Y_t^u)] \quad (7)$$

In addition, input-biased technical change (IBTC) is defined as follows:

$$IBTC = \frac{1}{2} [\overline{D^{t+1}}(X_t, Y_t^d, Y_t^u) - \overline{D^t}(X_t, Y_t^d, Y_t^u) + \overline{D^t}(X_{t+1}, Y_t^d, Y_{t+1}^u) - \overline{D^{t+1}}(X_{t+1}, Y_{t+1}^d, Y_{t+1}^u)] \quad (8)$$

Lastly, MATC is calculated as follows:

$$MATC = \overline{D^t}(X_t, Y_t^d, Y_t^u) - \overline{D^{t+1}}(X_t, Y_t^d, Y_t^u) \quad (9)$$

Table 2. Components of Blue Inclusive Growth

Index	Variables	Description	Obs	Mean	SD
Input	Labor including fishermen	Number of people over 15 years old working (soul)	576	139855.18	133221.68
	Investment	Gross Capital Formation (current US\$)	576	3985711.7	8835081
	Water Area	Water Area including rivers, lakes, reservoirs, and sea	576	13933.383	50188.563
	Electricity Consumption	Electric power consumption (KWH percapita)	576	10159.697	12584.634
Output	PDRB	Gross Regional Domestic Product of Fisheries	576	2239032.2	2533036.8
	Fish	Fisheries Production	576	17223.193	226125.579
Undesirable Output	Inverse of IKLH	Level inverse of the Environmental Quality Index as a representation of environmental degradation	576	24.102	4.131

Next, the convergence measurement stage β to ensure blue inclusive growth acceleration areas in regions with low but potential blue economy levels, the following can be done:

$$\frac{LI_{it} - LI_{i0}}{t} = \alpha + \beta LI_0 + \varepsilon_{it} \quad (10)$$

Where LI is inclusive blue growth, β is the convergence coefficient, dan ε is error term.

The Impact of the Spillover from Digitalization, Financing, and Governance on Inclusive Blue Growth

Based on previous studies, the compilation of variables was carried out in order to provide the most accurate information possible (Hong et al., 2022b; Li et al., 2023; Ofori & Figari, 2023; S. Ren et al., 2022b; Song et al., 2023b; Wang et al., 2022). This

model uses a static panel regression fixed effect approach. The empirical equation can be expressed as follows:

$$\begin{aligned}
 BIG_{it} = & \alpha_0 + \rho W * BIG_{it-1} + \alpha_1 Dig_{it}^2 + \alpha_2 dig_{it} + \alpha_3 \ln loans_{it} + \alpha_4 rb_{it} \\
 & + \alpha_5 \ln govspend_{it} + \alpha_6 ahh_{it} + \alpha_7 rls_{it} + \alpha_8 road_{it} \\
 & + \beta \sum_{k=1}^3 \ln orientasi + u_{it}
 \end{aligned}
 \tag{11}$$

Where *BIG* is blue inclusive growth, *dig* is the level of digitization, *loans* constitutes bank financing, *rb* constitutes government governance, *govspend* is government expenditure, *ahh* is the life expectancy figure, *rls* average years of schooling, *road* is the length of the road, *ln orientasi* is the natural logarithm of additional main sectors such as industry and mining.

Table 3. Components Constituting the Determinants of Blue Inclusive Growth

Label	Variable	Description	Obs	Mean	SD
BIG	Inclusive Blue Growth	Estimation results	-	-	-
Dig	Digitalization	Rural internet ratio	576	71.53	27.78
<i>ln loans</i>	Bank loans	Natural logarithm of bank loans	572	13.90	1.35
Rb	Institutional governance	Bureaucratic Reform Index	576	30.40	24.62
<i>ln govspend</i>	Regional government expenditure	Natural logarithm of regional government expenditure	576	6.77	0.61
<i>ahh</i>	Life expectancy	-	576	67.50	3.42
<i>rls</i>	Average years of schooling	-	576	8.09	2.02
<i>road</i>	Road length	-	576	550.15	481.80
<i>ln industri</i>	Industrialization	Natural logarithm of GRDP in the Industrial sector	576	11.91	2.45
<i>ln mining</i>	Mining	Natural logarithm of GRDP in the mining sector	576	11.66	2.44

FINDING AND DISCUSSION

Result

Strengthening Blue Economy Centers

Based on the results of K-Means Clustering and LQ calculations, most areas of Sulawesi are dominated by marine tourism potential, Maluku is dominated by the fishing industry, and Papua tends to have less variation compared to the others.

Meanwhile, the results of the LQ calculation indicate that Papua and Maluku are the regions with the highest fisheries competitiveness if in the future they are developed into new growth centers for fisheries and marine sectors. The results of the k-means calculation show densities that correspond to supporting rural networks; for example, regencies/cities in the industrial cluster mostly have advantages in ownership of fishing villages, aquaculture, and good transport development. Meanwhile, the extractive fisheries cluster is supported by proximity to the sea, fishing villages, and transport. On the other hand, the marine tourism cluster is mostly supported by the presence of fishing villages, proximity to the sea, mangrove village ownership, and transport. Finally, the creative economy is supported by the existence of transport, villages with mangroves, villages close to the coast, and fishing.

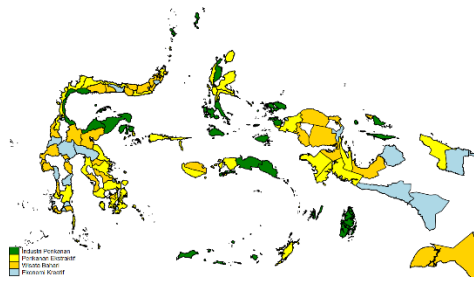


Figure 4. K-Means Clustering Results

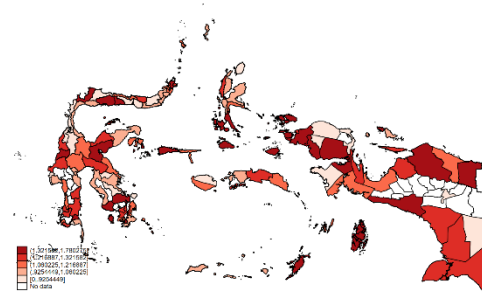


Figure 5. LQ Calculation

Based on these findings, it shows that the LQ tends to be concentrated in areas that have complete qualifications, for example being near the coast, having both capture and aquaculture areas, possessing tourism attractions, and the potential for developing ponds for tourism. This phenomenon suggests that, going forward, new growth can only be realized if the infrastructure and sea transport accommodations in coastal areas become increasingly adequate.

Results of Blue Inclusive Growth Calculation

Based on the results of the LI calculation, during 2019–2022 regions that achieved inclusive blue growth included the province of South Sulawesi. An accurate review shows a correlation indicating that South Sulawesi is the largest fish producer in Indonesia. Meanwhile, a historical overview indicates that since 2021 inclusive blue growth has begun to be experienced by various regions of SULAMPUIA in general. However, these results need to be cross-tabulated using panel convergence regression to confirm whether simultaneous growth occurred in these regions.

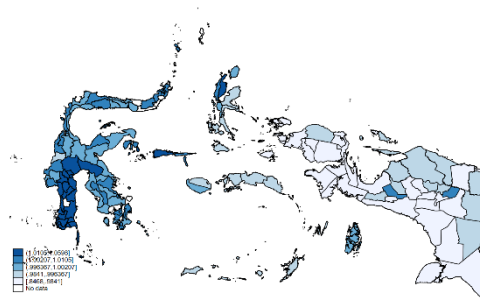
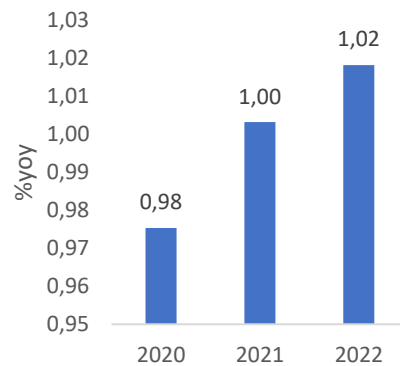


Figure 6. Results of Blue Inclusive Growth Calculation



Gambar 7. Blue Inclusive Growth 2020-2022

Based on the results of the absolute beta convergence calculation, it shows that regions producing fish other than SULSEL have not experienced significant growth, as indicated by a beta coefficient greater than zero. This means that only SULSEL has a statistical advantage in fisheries.

Table 4. Absolute Beta Convergence

	(1) dg
big	.835*** (.081)
_cons	-.825*** (.082)
Observations	217
Pseudo R ²	.z

Standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Impact of Digitalization, Financing, and Governance on Blue Inclusive Growth

Based on the research findings, digitalization and banking finance have a significant positive effect on blue inclusive growth. Meanwhile, this is supported by life expectancy and average length of schooling. On the other hand, government expenditure on capital goods actually has a negative effect on blue inclusive growth. These results were obtained using static panel regression, which was robust to time and regency effects.

Table 5. Regression's Results

	(1) big	(2) big	(3) big
dig	.0005* (.00025)	.0015*** (.00019)	.0015*** (.00015)
lnloans	.0258 (.0175)	.0188*** (.0053)	.0188*** (.0045)
ttk	.00015 (.0004)	-.00016 (.00022)	-.00016 (.00019)
lngovspend	-.0066 (.0077)	-.0269*** (.0071)	-.0269*** (.0068)
ahh	.0372** (.0189)	-.00089 (.0016)	-.00089 (.0013)
rls	.2808*** (.0326)	-.0135*** (.0033)	-.0135*** (.0031)
lnindustri	-.001 (.0072)	-.0033 (.0031)	-.0033 (.0029)
lnmining	.0018 (.0088)	-.0012 (.0023)	-.0012 (.0023)
_cons	-4.219*** (1.187)	.9636*** (.11)	.9636*** (.0923)
Observations	572	572	572
Pseudo R ²	.z	.z	.z

Standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*

Discussion

Based on the results of estimation and clustering, the potential for developing the blue economy ecosystem is highly promising to be navigated in the Sulampua region, considering the vastness of its marine areas alongside the considerable potential for abundant fish production. Nevertheless, mapping equitable development needs to be strengthened by involving various elements, especially local communities. In general, the regression results are consistent with and support the opinions expressed by (S. Ren et al., 2022a); (Hong et al., 2022a); (Li et al., 2023); (Chu et al., 2023); (Cabeza-García et al., 2019); (Hong et al., 2022) (van den Burg et al., 2017b)

Digitalization has had a significant positive impact on inclusive growth across various sectors. First, digitalization enables broader access to information and services, including education and healthcare, which were previously difficult for people in remote areas to reach. In addition, with the development of e-commerce and digital financial services, micro, small, and medium enterprises (MSMEs) have greater opportunities to grow and compete in the global market.

Digital technology also promotes financial inclusion by providing banking services to those who previously had no access to conventional banks. Thus, digitalization not only drives economic growth but also ensures that the benefits of that growth are felt by all segments of society, reducing social and economic disparities. This also applies to coastal communities, if implemented properly and with precision.

Meanwhile, with better access to financing, business actors in this sector can increase production capacity, adopt environmentally friendly technologies, and innovate in marine resource management. Bank financing also enables investment in infrastructure that supports sustainability and marine environmental preservation, such as green ports and waste processing facilities. In addition, financial support from banks can help coastal communities, who often belong to lower economic groups, to start or expand their businesses, thereby improving welfare and reducing poverty. Thus, bank financing not only strengthens the blue economy but also ensures that the benefits of this growth can be felt by all members of society, including the most vulnerable communities.

A high life expectancy and an increasing average length of schooling have a significant positive impact on inclusive blue economy growth. With rising life expectancy, coastal communities engaged in blue economy sectors, such as fisheries and marine tourism, can contribute longer and more productively to economic activities. Better education enhances the skills and knowledge of communities, enabling them to adopt technology and sustainable practices in managing marine resources. Education also opens opportunities for innovation and entrepreneurship in the blue economy sector, strengthening sustainability and competitiveness. Thus, the combination of good health and higher education creates a more competent and healthy workforce, capable of driving inclusive and sustainable economic growth, ensuring that the benefits of the blue economy can be enjoyed by all levels of society. The negative findings on the average length of schooling indicate that most coastal communities' education still lags behind, so increases in the average length of schooling need to be accompanied by adequate skills strengthening.

Lastly, unplanned and poorly targeted capital expenditures can have a negative impact on inclusive blue economy growth. When large investments are focused on projects that disregard marine environmental sustainability or fail to involve local communities, the result can be damage to marine ecosystems and neglect of the needs of coastal populations. For example, large-scale infrastructure development in coastal areas without considering environmental impacts can lead to habitat degradation, reducing the natural resources that are the main source of livelihood for local residents. Furthermore, uneven allocation of capital expenditures can exacerbate economic inequality, with economic benefits being felt only by a small group, while local communities most in need gain no advantage. As a result, the economic growth generated is neither inclusive nor sustainable, and

may threaten the long-term well-being of coastal communities and marine ecosystems that form the foundation of the blue economy.

CONCLUSION

The results show that, in general, the Sulawesi region cluster is dominated by marine tourism potential, Maluku is dominated by the fisheries industry, and Papua tends to have less variation compared to the others. Meanwhile, the measurement results indicate that blue inclusive growth has been achieved in South Sulawesi, while the rest are growing but have not yet reached optimal levels. Overall, the results show that digitalization and banking finance have a significant positive effect on blue inclusive growth. This then implies that progress in digitalization and access to finance are necessary in order to strengthen better growth progress. In line with this, life expectancy and average years of schooling must also be properly managed.

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