# BLUE ECONOMY DEVELOPMENT AS GOVERNMENT POLICY AND COMMUNITY INCOME: THE MEDIATION EFFECT OF DIGITAL TECHNOLOGY

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## Abstract

The Indonesian government's economic policy tends to rely on the green economy rather than the blue economy, despite the latter's great potential to increase income (Rizky et al., 2025). The purpose of this study is to test the influence of the development of the blue economy and digital technology on community income. Additionally, it examines whether digital technology mediates the impact of the blue economy on community income. This study uses a quantitative survey. This research collects data by distributing questionnaires directly to participants. The respondents in this research are blue economy actors based in Indonesia, including businesses in four districts on Madura Island: Bangkalan, Sampang, Pamekasan, and Sumenep. There were 150 questionnaires from actors, including fishermen, salt farmers, and scrap iron collectors. This study found that: 1) the development of the blue economy had no effect on community income, 2) the development of the blue economy had a significant effect on digital technology, 3) digital technology had a significant effect on community income, and 4) digital technology played a role in mediating the significant influence of the blue economy on community income.

**Keywords:** Digital Technology, Blue Economy, Community Income, Indonesia, Sea

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## 1. INTRODUCTION

As a maritime nation with approximately 70% of its territory bordered by the sea, Indonesia possesses exceptional marine resources, including seawater, fish, salt, mangroves, and natural beauty. Optimizing the utilization of these vast marine resources still requires careful attention to resource sustainability. The use of marine resource potential to improve community welfare and economic prosperity is known as the blue economy (Wenhai et al., 2019). The implementation of this blue economic activity is highly aligned with Indonesia's geographical conditions, where its territory is largely dominated by numerous oceans and bodies of water (Sutardjo, 2014).

The blue economy approach in marine development will help overcome the existing dependency between the economy and the ecosystem. The success of the blue economy is closely tied to that of the maritime industry, which is highly dependent on community participation and requires reliable labor and advanced technology (D'Ambrosio, 2024; Phang et al., 2023; Pauli, 2010). Marine economic development, according to the blue economy model, must ensure the sustainability of available resources, maintain ecosystem balance, and promote efficient use and management of resources. This is part of preventing the threat of global warming, such as carbon emissions and energy, so that sustainable development and integrated poverty alleviation efforts can be achieved.

Furthermore, Pauli (2010) stated that a blue economic system is necessary to overcome an economic system that tends to exploit and damage the environment. The blue economy is an economic concept or idea that improves the welfare and social justice of society, reduces the risk of significant environmental damage, and uses natural resources (sea) efficiently, effectively, without disposing of waste, so as to have a positive impact on the economy, the environment, and create added value for the remaining processed raw materials.

So far, Indonesia's economic policy has tended to rely more on the concept of a green economy (Ulya et al., 2023; Martawardaya et al., 2022; Pangarso et al., 2022; Law et al., 2016; Endriana et al., 2016). This concept is an economic concept that focuses on land yields and resources, including plantations, agriculture, and forestry. The green economy emphasizes the protection, health, and security of marine ecosystems and the communities that depend on them (Manioudis & Angelakis, 2023). In fact, the results of agricultural and cultivation activities still have many shortcomings that need to be addressed to ensure future environmental sustainability (Symons, 2024).

This blue economy program is a concept that can be applied in archipelagic countries such as Indonesia. For Indonesia, this can be a strength to become a pioneer in implementing blue economy-based projects to improve the economic welfare of local communities (Sutrisno, 2022). The blue economy program for Indonesia is the primary development initiative implemented. In various international forums, Indonesia has conveyed and formulated that the dominance of blue economy policies has enabled a shift in orientation from land to the enormous marine potential.

On the other hand, in the era of Industrial Revolution 4.0, digitalization is very important. Digital transformation is more broadly interpreted as not just moving from offline to online, but also about integrating by driving changes in business processes that create value tailored to users. The United Nations, through the 2022 e-government survey, reported the level of e-government adoption across countries, with Indonesia ranked 88th out of 193 (United Nations Department of Economic and Social Affairs [UNDESA], 2022). This means that digitalization in Indonesia is still relatively low, at around 21%.

The demands of the blue economy and digitalization must be responded to positively. Business actors must dare to implement reforms, starting with green and blue products, transactions, and marketing, among others, that should already be heading towards the blue economy and digitalization. Given the urgency of the two global issues related to the Sustainable Development Goals, this study focuses on the blue and digital economy in the marine sector towards achieving a smart blue village. Post-pandemic, Indonesia, as a maritime country whose territory is largely ocean-dominated, has the potential to reach $1.33 billion and absorb 45 million jobs, necessitating a digitally based blue economy recovery for sustainability (Ministry of National Development Planning/National Development Planning Agency [BAPPENAS], 2021). This development aims to restore marine health and promote a sustainable marine economy, encompassing strategies to maintain long-term marine health and resilience, as well as create jobs and attract environmentally friendly, digital-based business investment. This initiative is designed to improve the welfare of coastal communities, including salt farmers and scrap metal businesses, and further strengthen the economy and national sovereignty.

The realization of the digital blue economy ecosystem varies across countries, depending on each country's policy. Each country has different societal characteristics. Not all parts of a country's cultural values can be implemented in the Indonesian setting. The social capital and local wisdom of the Indonesian people, characterized by strong family values, cooperation, and high religiosity, differ in their approach to realizing the digital blue economy model compared to other countries. Based on the urgency and phenomena outlined above, this study aims to investigate the impact of blue economy development and digital technology on individuals' income and to examine the role of digital technology in mediating the influence of blue economy development on individuals' income.

Research on the blue economy has largely remained descriptive or project-based, with very few studies examining its direct quantitative effects on household income at the community level. In addition, only a limited number of studies explicitly position digital technology as a mediator between blue economy interventions and community economic outcomes. This creates a need for rigorous, quantitative empirical research that measures the relative contributions of blue economy components to community income and positions digital technology as a mediating factor linking blue economy development to community income.

The structure of this article is as follows. Section 2 covers the literature review and develops

the hypotheses. Section 3 describes research methods. Section 4 provides the results, and Section 5 discusses them. Section 6 ends the paper with a conclusion.

## 2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

### 2.1. Blue economy concept

The blue economy is a refinement of the second generation of the green economy (Phang et al., 2023; Pauli, 2010). Suppose the green economy is conceived as an economic concept intended to improve economic welfare and social equality while reducing environmental risks. In that case, the blue economy is built as an idea for developing economic activities on a wider scale, while producing minimal waste and minimizing the excessive use of natural resources, thereby creating more effective and efficient economic activities (Sapriani et al., 2024). Additionally, further efforts are made to process waste into a useful product with added value for future use. Therefore, the green economy concept, as Sharma and Verma (2025) primarily aim to mitigate pollution that has already occurred. In that case, the blue economy concept seeks to prevent waste from occurring from the outset of economic activity.

The effective application of the blue economy concept to current economic activities aims to develop a more creative and innovative economy, while also utilizing marine natural resources more effectively and efficiently. The most important thing is to minimize waste while also providing business opportunities and creating jobs for all parties. With more creative economic activities, routine operations can be carried out without harming the environment and existing ecosystems. In fact, with this concept, in addition to continuing economic activities, it will also help save the environment and ecosystem from the damage caused by excessive and irresponsible resource exploitation (Chen et al., 2024; Anshari & Afriansyah, 2022).

In the context of the blue economy, several fundamental principles of economic development can be identified, including creativity, innovation, the utilization of local resources, and the use of tools or facilities that minimize waste, thereby maintaining the sustainability of the ecosystem (Manioudis & Angelakis, 2023). Thus, in the blue economy, the roles of entrepreneurs and the industrial world are crucial in collaborating with the state to provide innovative facilities and infrastructure that support effective and efficient management of natural resources. There is a concept of mutual integration between economic and environmental activities, production systems, and government policies.

The concept of the blue economy involves controlling and managing marine and aquatic resources while also maintaining ecosystems in waters, seas, and coastal areas (Ghalidza, 2020). The Blue Economy Program is an initiative designed to address various challenges, including environmental sustainability issues and energy crises (Sitorus & Simanjuntak, 2023). Even the blue economy can solve economic problems and waste problems. Economic and waste problems.

### 2.2. Digital technology in the blue economy

The development of the blue economy, which focuses on the sustainable use of marine resources, is greatly influenced by advances in digital technology. This technology not only provides efficiency and innovation but also supports the creation of new jobs and increases competitiveness in the maritime sector. Digital technology, including blockchain, plays a significant role in improving connectivity among tourist destinations, especially in remote areas (Incio Chavesta et al., 2025). By integrating products and services into digital platforms, this technology enables better access to global markets.

Digitalization enables better management of marine resources. With integrated and systematic data, Indonesia can project global supply and demand for marine-based products. This creates opportunities for sustainable industrialization and conservation of marine ecosystems. Blockchain technology, for example, can ensure transparency and traceability in resource management practices (Ahokangas & Aagaard, 2024). To support this transformation, coastal communities need adequate digital literacy. This will facilitate the adoption of new and innovative technologies in the development of the blue economy. Training and education on digital technology must be a priority to ensure that human resources are ready to face the challenges of the digital era.

Ease of use is one of the main advantages of digital technology. It enables users from diverse backgrounds to access and utilize technology with fewer barriers (Ajina et al., 2024; World Economic Forum, 2020). Digital technology offers a range of media options for conveying information or communicating. This allows users to choose the media type that best suits their needs. Some options include text, visual, audio, video, and interactive media. Digital technology also plays a crucial role in advancing sustainability, particularly through initiatives that mitigate negative environmental impacts.

Digital technologies offer numerous benefits, including increased productivity, flexibility, and innovation; however, they also require attention to sustainability and security. The aspects of benefits, convenience, media variety, sustainability, and security provide broader guidance in assessing the impact of digital technologies on the lives of individuals and society. By understanding and managing these aspects, we can use digital technologies more effectively and responsibly.

### 2.3. Community income

Community income is a key indicator of a community's economic well-being. Income measurement can be viewed from several dimensions, including income diversity, income sufficiency, and potential for income growth (Bilan et al., 2020; Nham & Ha, 2023). Income diversity refers to the various sources of income that an individual or household has. Communities with diverse sources of income are better able to cope with economic uncertainty because they do not rely on a single source of income. Income sufficiency measures the extent to which the income earned by an individual or household is sufficient to meet their

basic needs. This sufficiency is typically measured relative to the cost of living, encompassing necessities such as food, housing, education, and healthcare.

These three dimensions are interrelated, providing a more comprehensive picture of a society's economic well-being (Chen et al., 2024; Nham & Ha, 2023). Here is how they interact:

1) Income diversity contributes to income adequacy by providing households with alternative sources of income that can help meet their needs. If one source of income is disrupted, diversity allows compensation from other sources.

2) Income adequacy determines how well households are able to meet their immediate basic needs. With opportunities to improve skills, expand businesses, or access technology, people cannot only maintain their income but also increase it, thereby improving their economic stability.

## 2.4. Blue economy development affects community income

Previous studies (Erwin et al., 2025; Agnishwaran et al., 2024; Fudge et al., 2023; Balsmeier & Woerter, 2019; Pauli, 2010) on the blue economy and community income have shown that the blue economy plays a crucial role in enhancing community income and welfare, particularly when managed sustainably. Pauli (2010) shows how this approach can increase community income and welfare through environmentally friendly innovation. Symons (2024) emphasizes the importance of sustainability in marine resource management. Montes Ninaquispe et al. (2025) examine the relationship between the fisheries sector (part of the blue economy) and community income in Sub-Saharan Africa.

Fudge et al. (2023) studied the maritime sector (such as fisheries and tourism). They found that it affects the income of coastal communities and that effective management of marine resources can enhance their economic well-being. Agnishwaran et al. (2024) stated that the impact of climate change on fisheries within the blue economy has implications for the income and economic resilience of coastal communities.

*H1: The development of the blue economy has an impact on community income.*

## 2.5. Development of the blue economy affects digital technology

Studies on the influence of blue economy development on digital technology have shown that digital technology plays a crucial role in supporting the blue economy, particularly in enhancing resource management efficiency, promoting environmental sustainability, and driving innovation in the maritime sector. Few studies have examined the influence of the blue economy on digital technology, especially in how digital technology supports or integrates with blue economy principles.

Tijan et al. (2021) found that digital technology plays a crucial role in collecting and analyzing data on marine ecosystems, enabling more effective and sustainable management of blue economy sectors, such as fisheries and tourism. The European Commission (2019) found that technologies such as smart ocean sensors, underwater drones, and remote sensing satellites help monitor ocean conditions in real time, enabling better decision-making for conservation and resource use.

Annisa and Indriyani (2024) and the Organisation for Economic Co-operation and Development (OECD) (2016) found that the application of digital technologies in the marine and coastal sectors, such as blockchain for fisheries supply chains, big data for ecosystem monitoring, and artificial intelligence (AI) for ocean weather prediction, is instrumental in improving the productivity and sustainability of these industries. The digital twin concept is explored in the context of the blue economy, where digital models of marine ecosystems are created to enhance the monitoring, simulation, and management of ecosystem health more effectively (Rafael et al., 2024; Das, 2023).

Vecchio et al. (2024), Rowan (2023), Ayan et al. (2022), and Martínez-Vázquez et al. (2021) examine the role of digital innovation in the fisheries and aquaculture sector within the blue economy. Technologies such as smart sensors, big data analytics, and AI are used to monitor water quality, fish health, and farm productivity, thereby reducing environmental impact and improving production efficiency. It also helps in monitoring wild fish stocks to prevent overfishing and maintain the sustainability of the marine ecosystem.

*H2: The development of the blue economy has an impact on digital technology.*

## 2.6. Digital technology development affects community income

Ayan et al. (2022) and Acemoglu and Restrepo (2020) examine the impact of automation and robotization on labor markets and earnings in the US. Doblas et al. (2025) and Acemoglu and Restrepo (2020) find that while digital technology increases productivity, it also leads to job losses in some sectors and lower earnings for low-skilled jobs. Okur et al. (2025) and Belesis et al. (2024) conclude that digital technology creates new opportunities for increased income but also widens the gap between individuals with digital access and skills and those without. Xue et al. (2026) found that higher levels of digital technology adoption are associated with increased income.

*H3: The development of digital technology affects community income.*

## 2.7. Digital technology mediates the influence of the blue economy on community income

Previous studies have shown that digital technology serves as a mediator, helping to optimize marine-based economic activities, increase efficiency, shorten distribution chains, and enhance market access. Nham and Ha (2023) examined the influence of the blue economy, technology, and community income. Nham and Ha (2023) found that digitalization in sectors such as fisheries, marine tourism, and marine energy can increase the income of coastal communities. Qi (2022) and Germond-Duret (2022) found that digital technology affects the income of coastal communities in the context of the blue economy. The use of these applications shortens the distribution chain, enabling fishermen to sell directly to consumers and thereby increase their income.

Verma et al. (2024) found that digital technology improves the efficiency of the fisheries sector through applications that provide real-time weather information and fish location maps. Dwinafiah and Hasan (2023) demonstrated that the application of digital technology in the fisheries sector, including logistics tracking and fish stock monitoring, facilitates waste reduction and enhances product quality. Saumena and Kamila (2024) demonstrated that digital technologies, such as drones and underwater sensors, aid in conserving marine resources and ultimately have a long-term impact on the sustainability of the blue economy. In the long term, this increases the income of coastal communities by sustainably managing the natural resources that underpin their economy.

*H4: Digital technology mediates the influence of the blue economy on community income.*

## 3. RESEARCH METHODOLOGY

This research is quantitative. This research collects data by distributing questionnaires directly to participants. The respondents in this research are blue economy actors based in Indonesia, including businesses in four districts on Madura Island: Bangkalan, Sampang, Pamekasan, and Sumenep. A total of 150 questionnaires have been collected from actors, including fishermen, salt farmers, and scrap metal businesses. In this study, the questionnaires were distributed directly to the respondents at their workplaces as blue economy actors. The respondents completed the questionnaires on the spot and returned them. In addition, the researcher interviewed the respondents and recorded their responses using the prepared questionnaire. The number of questionnaires distributed directly was 200, and 50 respondents did not return them due to their busy schedules and lack of time to answer.

The community income variable (see Table 3) is measured using income diversity (three questions), income sufficiency (three questions), and potential for income growth (three questions) (Abate et al., 2025). The blue economy development variable (see Table 4) is measured through the utilization of marine resources (four questions) that support economic welfare (four questions) and sustainable conservation (four questions) (Pauli, 2010; Phang et al., 2023; Ding & Tabeta, 2024; De Fontaubert & Vierros, 2017). The digital technology variable (see Table 5) is measured using indicators of benefits (three questions), convenience (three questions), media type selection (three questions), sustainability (three questions), and security (three questions) (Ajina et al., 2024; Okur et al., 2025). Measurement of variables using a five-point Likert scale.

The analytical method used is partial least squares structural equation modelling (PLS-SEM) with SmartPLS 3.0 (Ghozali, 2021). PLS-SEM is a statistical method used to analyze relationships among latent variables (constructs) that are measured by multiple indicators. PLS-SEM helps ensure that indicators are valid and that relationships between concepts can be tested within a single, comprehensive model. Another advantage lies in its predictive orientation. Many social models are often better approached from a predictive rather than purely explanatory perspective. PLS-SEM follows this principle, making it well-suited for complex field data while still producing relationship patterns that can be used to project policy impacts with reasonable accuracy.

## 4. RESEARCH RESULTS

### 4.1. Respondent characteristics

The characteristics of businesses in the four regencies of Madura Island based on business characteristics are illustrated in Table 1. Respondents' characteristics by work type are grouped into nine categories. All nine categories of work of these respondents are marine business actors who have used digital technology.

**Table 1.** Descriptive statistics

| *No.* | *Business type* | *Total* | *Percentage (%)* |
|---|---|---|---|
| 1 | Scrap iron owner | 15 | 10 |
| 2 | Salt workers | 36 | 24 |
| 3 | Fisherman workers | 30 | 20 |
| 4 | Scrap iron worker | 15 | 10 |
| 5 | Boat owner | 33 | 22 |
| 6 | Scrap metal trader | 7 | 5 |
| 7 | Fish trader | 4 | 3 |
| 8 | Salt trader | 1 | 1 |
| 9 | Salt capital owner | 9 | 6 |

### 4.2. Respondent demographic characteristics

Table 2 shows the demographic characteristics of the respondents. The majority of respondents came from Sumenep regency (40%) and Pamekasan regency (38%). The majority of respondents (73%) have run their businesses for more than 10 years. The majority of respondents (63%) have between one and five employees, and the majority (51%) have between four and seven dependents.

**Table 2.** Respondent Demographic Characteristics

| *No.* | *Respondent demographic characteristics* | *Total* | *Percentage (%)* |
|---|---|---|---|
| 1 | ***Area demographics*** | | |
| | Bangkalan | 20 | 13 |
| | Sampang | 13 | 9 |
| | Pamekasan | 57 | 38 |
| | Sumenep | 60 | 40 |
| 2 | ***Length of time running a business*** | | |
| | 1–5 years | 16 | 11 |
| | 6–10 years | 24 | 16 |
| | ≥ 11 years | 110 | 73 |
| 3 | ***Number of employees*** | | |
| | 1–5 | 94 | 63 |
| | 6–10 | 40 | 27 |
| | ≥ 11 | 16 | 11 |
| 4 | ***Number of family members*** | | |
| | 1–3 members | 73 | 49 |
| | 4–7 members | 76 | 51 |

### 4.3. Confirmatory factor analysis results

#### *4.3.1. Community income*

Table 3 shows the average score for the community income variable and the respondent's community income variable answer index, both of which are valid for use in data analysis.

**Table 3.** Statistical description: Community income variables

| No. | Statement | Min | Max | Mean | Index |
|---|---|---|---|---|---|
| ***Income diversity*** | | | | | |
| 1 | The types of income that I have are increasingly diverse, not just from one type of goods/services. | 2 | 5 | 4.06 | 122 |
| 2 | My income increases every year. | 2 | 5 | 3.987 | 119 |
| 3 | The income I earn is balanced with the work I do. | 2 | 5 | 3.953 | 118 |
| ***Income sufficiency*** | | | | | |
| 1 | The income I receive is sufficient to cover my daily needs. | 2 | 5 | 4.1 | 123 |
| 2 | The income I receive is able to ensure the welfare of my family. | 1 | 5 | 3.94 | 118 |
| 3 | The income received satisfies every family member. | 2 | 5 | 4.033 | 121 |
| ***Potential increase in income*** | | | | | |
| 1 | The income I receive can expand my business. | 2 | 5 | 3.987 | 119 |
| 2 | Over time, income will increase. | 2 | 5 | 4.173 | 124 |
| 3 | Your belief that this business is promising in the future. | 2 | 5 | 4.127 | 124 |

### *4.3.2. Blue economy development*

Table 4 presents the average scores of the blue economic development variables and the respondent answer index and is valid for use in data analysis.

The blue economy development variable is measured through three main dimensions: utilization of marine resources, supporting economic welfare, and conservation and sustainability. Overall, respondents' perceptions showed a very positive trend across all measured indicators.

**Table 4.** Statistical description: Blue economy development variable

| No. | Statement | Min | Max | Mean | Index |
|---|---|---|---|---|---|
| ***Utilization of marine resources*** | | | | | |
| 1 | Your business is related to marine resources. | 3 | 5 | 4.093 | 121 |
| 2 | Communities around the coast have long carried out efforts to utilize marine resources. | 1 | 5 | 4.1 | 120 |
| 3 | There are still marine resources that the community has not utilized. | 2 | 5 | 3.893 | 116 |
| 4 | The nature of marine resources is never exhausted. | 3 | 5 | 4.26 | 127 |
| ***Supporting economic welfare*** | | | | | |
| 1 | Marine resources come in many forms and varieties, serving as a source of livelihood. | 2 | 5 | 4.187 | 123 |
| 2 | Marine resources create jobs. | 3 | 5 | 4.173 | 123 |
| 3 | Able to provide sufficient economic prosperity. | 3 | 5 | 4.1 | 121 |
| 4 | Giving rise to many marine cultivation businesses. | 3 | 5 | 4.08 | 121 |
| ***Conservation and sustainability*** | | | | | |
| 1 | Utilization of marine natural resources must be sufficient. | 2 | 5 | 4.04 | 119 |
| 2 | In utilizing marine resources, marine conservation is prioritized. | 2 | 5 | 4.067 | 120 |
| 3 | Utilization of marine resources with local traditional tools. | 2 | 5 | 4 | 120 |
| 4 | If using better tools, still prioritize being environmentally friendly. | 3 | 5 | 4.113 | 123 |

### *4.3.3. Digital technology*

Table 5 presents the average scores for the digital technology variables and the digital technology variable response index for respondents, which are valid for use in data analysis. The digital technology variable is evaluated through five main aspects: benefits, convenience, media type selection, sustainability, and security.

**Table 5.** Statistical description: Digital technology variables

| No. | Statement | Min | Max | Mean | Index |
|---|---|---|---|---|---|
| ***Benefits aspect*** | | | | | |
| 1 | I always use the internet and digital technology as a source of information. | 3 | 5 | 4.147 | 125 |
| 2 | Digital technology helps expand the reach of my business. | 3 | 5 | 4.153 | 125 |
| 3 | The use of digital technology is beneficial for business development. | 3 | 5 | 4.113 | 122 |
| ***Convenience aspect*** | | | | | |
| 1 | You can easily and conveniently use digital technology to help smooth your business. | 2 | 5 | 4.133 | 123 |
| 2 | You can use digital technology at a low price. | 1 | 5 | 3.987 | 119 |
| 3 | Digital media tools can be used anywhere, anytime. | 3 | 5 | 4.153 | 124 |
| ***Media type selection aspects*** | | | | | |
| 1 | I have replaced paper with files a lot in storing documents. | 2 | 5 | 4.047 | 121 |
| 2 | I utilize social media to promote my products and services. | 3 | 5 | 4.213 | 125 |
| 3 | I use digital applications for business transactions. | 3 | 5 | 4.187 | 124 |
| ***Sustainability aspects*** | | | | | |
| 1 | You will continuously utilize digital technology to develop your business. | 2 | 5 | 4.207 | 124 |
| 2 | You are willing to spend any amount of money to continue utilizing digital technology. | 2 | 5 | 3.98 | 119 |
| 3 | You believe that technology will continue to develop and be useful. | 3 | 5 | 4.173 | 124 |
| ***Security aspects*** | | | | | |
| 1 | You already understand the risks of using digital technology. | 2 | 5 | 3.98 | 119 |
| 2 | You have anticipated all the risks of using digital technology. | 2 | 5 | 4.113 | 124 |
| 3 | The technology you use is very safe, and all your privacy matters are protected. | 2 | 5 | 4.1 | 123 |

### 4.4. Hypothesis test results

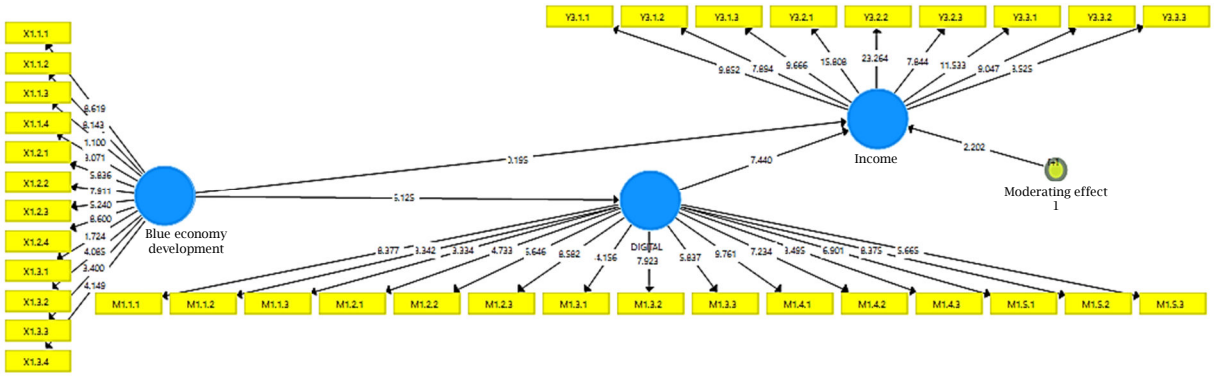
The results of the hypothesis test are presented in Table 6. The economic development variable on income presents the results of the economic development test on income, with a calculated t-value of 0.195 and a significance value of 0.846. This indicates that *H1* is rejected, suggesting that economic development has no significant impact on income.

The variable of blue economy development in relation to digitalization technology, where the calculated t-value is 6.125, and the significance value is 0.000. This indicates that *H2*, the variable related to the blue economy and digitalization technology, has a significant effect. The variable showing the influence of digitalization technology on community income, with a t-value of 7.440 and a significance value of 0.000. This indicates that *H3*, the digital technology variable, affects community income. The relationship between blue economy development and income, as well as digitalization technology, has a calculated t-value of 4.350 and a significance value of 0.000. This indicates that *H4*, the variable related to digitalization technology, mediates the significant influence of blue economy development on community income.

**Table 6.** Hypothesis test results

| *Hypothesis* | *Relationship* | *Original sample (O)* | *Sample mean (M)* | *Std. dev. (STDEV)* | *T-statistics (O/STDEV)* | *p-value* | *Decision* |
|---|---|---|---|---|---|---|---|
| *H1* | *Blue economic development → Income* | 0.029 | -0.009 | 0.147 | 0.195 | 0.846 | Not significant |
| *H2* | *Blue economic development → Digital technology* | 0.507 | 0.556 | 0.083 | 6.125 | 0.000 | Significant |
| *H3* | *Digital technology → Income* | 0.707 | 0.718 | 0.095 | 7.440 | 0.000 | Significant |
| *H4* | *Blue economic development → Digital technology → Income* | 0.358 | 0.400 | 0.082 | 4.350 | 0.000 | Significant |

**Figure 1.** Structural model of the influence of blue economy development on income through digital technology




*Source: Authors' elaboration.*

## 5. DISCUSSION

### 5.1. Development of the blue economy and community income

The first hypothesis, *H1,* test indicates that blue economy development does not affect community income. This means that the growth of the marine and fisheries sector cannot improve economic welfare, especially for people living in coastal areas. This result aligns with Cohen et al. (2019), who suggest that implementing blue economy initiatives is more beneficial to large industries and foreign investment than to a sustainable local economy. Furthermore, Cohen et al. (2019) stated that the blue economy agenda often prioritizes economic growth and profit from investments without considering its impact on the incomes of coastal communities.

Evans et al. (2023) found that the development of the blue economy does not necessarily affect community income. They discovered that many blue economy initiatives prioritize macroeconomic benefits without accounting for their distribution to local communities. Nurhayati (2013) found that although blue and green economic policies are expected to improve community welfare, their impact on increasing the income of communities that depend on the fisheries and marine sectors is not significant.

De Fontaubert and Vierros (2017) emphasize that the blue economy can increase community income by developing sectors such as fisheries, maritime tourism, and marine renewable energy, creating new jobs and enhancing the income of coastal communities. Food and Agriculture Organization of the United Nations (FAO, 2022) acknowledges that the fisheries sector, a crucial part of the blue economy, plays a significant role in enhancing the income and food security of coastal communities. United Nations Conference on Trade and Development (UNCTAD, 2024) highlights that sectors such as fisheries, marine-based tourism, and the maritime industry can serve as primary economic pillars for countries with extensive coastlines, playing a crucial role in increasing local communities' incomes. World Resources Institute (WRI, 2019) also demonstrates that the development of the blue economy plays a crucial role in enhancing

community income. WRI (2019) emphasized that investments in marine infrastructure, sustainable fisheries management, and ecotourism can directly strengthen local economies and provide significant benefits to coastal communities.

### 5.2. Development of blue economy and digital technology

The second hypothesis, *H2*, test indicates a positive relationship between blue economy development and digital technology. The significant influence of blue economy development on digital technology demonstrates that these two sectors mutually support each other in creating sustainability and efficiency.

This aligns with UNCTAD (2024), which states that the need to efficiently manage marine resources, ensure environmental sustainability, and expand global markets has driven the adoption of digital technologies in sectors such as fisheries, shipping, and marine environmental management. Some key studies that review this relationship include the OECD (2016) report, which emphasizes the importance of digital transformation in supporting the development of the blue economy. Evans et al. (2023) state that digital technologies play an important role in supporting the growth of blue economy sectors.

The European Commission (2019) study found that digital innovations in shipping and marine data processing could improve transparency and traceability in global fisheries supply chains. Rafael et al. (2024), Annisa and Indriyani (2024), Das (2023), Ayan et al. (2022), Tijan et al. (2021), Martínez-Vázquez et al. (2021) and European Commission (2019) supported the hypothesis. They found that the application of digital technologies in the marine and coastal sectors, such as blockchain for fisheries supply chains, big data for ecosystem monitoring, and AI for ocean weather prediction, is instrumental in improving the productivity and sustainability of these industries.

### 5.3. Digital technology and community income

The third hypothesis, *H3*, test indicates a positive relationship between digital technology and community income. This result is a perspective widely supported by research and studies on the digital economy. Digital technology, including the internet, cloud computing, and digital platforms, has transformed the way people work, conduct business, and access markets. These results are supported by Jangjarat and Jewjinda (2023) and Verma et al. (2024). The second machine age argues that digital technology, including automation and AI, significantly increases productivity and creates new income opportunities.

Withupassakan et al. (2022) examine how the sharing economy enabled by digital technology provides economic flexibility, allowing individuals to increase their income outside of traditional employment. The research results that support Saumena and Kamila (2024) showed that digital technology contributes to changes in the composition of jobs, driving higher income for high-skills jobs, while low-skills jobs experience stagnation or decline in income. Furthermore, Acemoglu and Restrepo (2020) and Czernich et al. (2011) found that although digital technology increases productivity, it also causes job losses in some sectors and decreases in income for low-skilled jobs.

Balsmeier and Woerter (2019) and the World Bank (2016) concluded that digital technology creates new opportunities for income generation, but also widens the gap between individuals with digital access and skills and those without. Higher levels of digital technology adoption are associated with increased incomes, especially in developed countries.

### 5.4. Digital technology mediates the influence of blue economy development on community income

The fourth hypothesis, *H4*, test shows that blue economy development through digital technology can have a significant impact on community income. This means that blue economy development refers to the sustainable use of marine and aquatic resources to improve economic welfare, maintain ecosystem sustainability, and support community income. With the development of digital technology, the blue economy has significant potential to increase community income substantially.

De Fontaubert and Vierros (2017) concluded that, in reality, exploring the potential of the blue economy to increase income through digital technology and innovation. The OECD (2016) report demonstrates how digital technologies, including satellite-based monitoring and big data, can facilitate the development of the blue economy and deliver benefits to coastal communities. FAO (2022) reports on the role of digital technology in sustainable fisheries management and the well-being of communities dependent on the fisheries sector. UNCTAD (2024) reports on how digitalization in the blue economy can increase local community incomes and support sustainable development.

The research results supporting this finding include Nham and Ha (2023), who found that digitalization in sectors such as fisheries, marine tourism, and marine energy can increase the income of coastal communities. Qi (2022) and Germond-Duret (2022) found that digital technology affects the income of coastal communities in the context of the blue economy. Verma et al. (2024), Febryanti and Utami (2023), and Dwinafiah and Hasan (2023) suggest that digital technology, such as e-commerce platforms and marketing applications, serves as a link between fishery products and global consumers, thereby increasing the income of local fishermen. The use of these applications shortens the distribution chain, enabling fishermen to sell directly to consumers and thereby increase their income.

## 6. CONCLUSION

The purpose of this study was to examine the role of digital technology in mediating the influence of blue economy development on community income. This study concludes that the blue economy in Indonesia has not yet had a direct impact on increasing income. The development of the blue economy has driven the adoption and diversity of digital

technology. The diversity and innovation of digital technology drive increased community income. In other words, digital technology is a crucial link that optimizes the blue economy's role in increasing community income.

The findings of this study indicate that blue economy actors must increase their use of digital technology to improve their business income. They must also balance this with responsible behavior when seeking effective sources of income at sea. The limitation of this study lies in the unbalanced distribution of respondents by demographic characteristics, which does not fully reflect the actual conditions in the four regions of Madura, Indonesia, examined.

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