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The Gendered Dynamics of the Blue Economy: Women's Contribution to Sustainable Development in Coastal Communities

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ABSTRACT

The blue economy, which focuses on the sustainable use of marine resources, has gained increasing attention for its role in promoting economic well-being in coastal communities. Gender equality, as a key factor in the blue economy, is critical for enhancing participation and promoting sustainable development in sectors such as fisheries, marine conservation, and tourism. This study investigates the impact of gender equality and women's involvement on economic well-being in the context of the blue economy, focusing on coastal communities in Langkat Regency, North Sumatera, Indonesia. A quantitative deductive approach was employed, where a cross-sectional survey was conducted with 375 women respondents, utilizing structured questionnaires to assess three key variables: gender equality, women's involvement, and economic well-being. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to analyze the relationships among these constructs. The results indicate that gender equality positively impacts economic well-being and significantly promotes women's involvement in sectors such as fisheries, marine conservation, and sustainable tourism. Additionally, women's involvement mediates the relationship between gender equality and economic well-being, emphasizing the importance of inclusive governance and gender-sensitive policies. These findings highlight the critical role of women in driving sustainable development and economic growth in coastal communities. The study suggests that gender-inclusive policies are essential for achieving both economic and social benefits within the blue economy. Further research is needed to explore strategies for increasing women's representation in leadership and decision-making roles in this sector.

Keywords: Blue Economy, Gender Equality, Women's Involvement, Economic Well-Being, Sustainable Development
JEL Classifications: M14, M21, Q01

1. INTRODUCTION

The concept of the Blue Economy has emerged as a transformative framework for enhancing the economic well-being of coastal communities while promoting sustainable practices. It encompasses various economic activities linked to oceans, seas, and coastal regions, aiming to balance economic growth with environmental sustainability. This dual focus is essential, as the health of marine ecosystems directly influences the livelihoods of millions who rely on these resources for their economic well-being.

Often framed as a pathway to economic development, the Blue Economy is particularly significant in regions where traditional land-based resources are diminishing. First popularized by the United Nations in 2012, the term emphasizes the sustainable management of marine resources to enhance productivity and foster economic growth. This perspective aligns with the idea that healthy marine ecosystems can provide substantial economic benefits, supporting the livelihoods of coastal communities (Cohen et al., 2019). However, the implementation of Blue Economy initiatives faces challenges, particularly related to social equity

and the inclusion of marginalized communities in decision-making processes (Voyer et al., 2022; Su-lan et al., 2020).

The Blue Economy is not only an economic model but also a governance framework that requires careful attention to spatial rationalities and power dynamics (Choi, 2017). According to Satizábal et al. (2020), the discourse around the Blue Economy often prioritizes economic practices that govern access to marine spaces, which can lead to conflicts over resource use and management. This highlights the need for a critical examination of how Blue Economy initiatives are operationalized, ensuring they do not perpetuate existing inequalities or overlook the voices of local communities (Voyer et al., 2022; Gbadegesin and Akintola, 2021).

In this context, integrating traditional knowledge into Blue Economy practices has proven to be highly beneficial for the economic well-being of coastal communities. By leveraging local knowledge, more effective resource management and new economic opportunities can be created (Arzaman et al., 2022). This approach not only fosters community engagement but also promotes sustainable practices that are both culturally relevant and economically viable.

A key component of sustainability and social equity in the Blue Economy is the participation of women, particularly in small-scale fisheries (SSF) management. Chambon (2023) emphasizes the importance of incorporating women's voices into governance structures, arguing that their involvement can lead to more effective management of marine resources and contribute to "blue justice," which seeks to address social inequalities within ocean governance. Moreover, empowering women through targeted training and financial resources can significantly enhance their contributions to the Blue Economy, promoting inclusive growth (Caroline, 2024; Ivanova, 2024).

The Blue Economy is closely aligned with broader Sustainable Development Goals (SDGs), especially SDG 14, which focuses on the conservation and sustainable use of oceans, seas, and marine resources (Liang et al., 2022). Integrating gender perspectives into Blue Economy initiatives not only supports women's economic empowerment but also contributes to the overarching goals of social equity and environmental sustainability. For instance, research by Voyer et al. (2022) suggests that regional agreements like the Blue Charter can facilitate gender-inclusive policies, promoting sustainable practices across Commonwealth countries.

Economically, the Blue Economy has a substantial global impact, with an estimated contribution of between $3 trillion and $5 trillion annually through sectors like fisheries and tourism (Alharthi and Hanif, 2020). This economic potential underscores the necessity of including women in decision-making processes to maximize the benefits derived from marine resources (Ekstedt, 2024).

However, several gaps exist in the research on the economic well-being of the Blue Economy. A major limitation is the insufficient integration of gender perspectives in broader discussions about the Blue Economy. While sectors such as fisheries, aquaculture, and tourism are central to the Blue Economy, critical engagement with social equity—especially gender issues—remains lacking (Voyer et al., 2022; Harris, 2023). This gap limits the understanding of how women's participation can enhance both economic outcomes and social justice within these sectors.

The literature also often overlooks the specific challenges faced by women in emerging economies, where gender roles and economic opportunities differ significantly from those in developed countries. For example, previous studies have shown that women entrepreneurs in emerging economies may display greater self-confidence in their managerial capabilities compared to their counterparts in developed contexts, yet they still face systemic barriers that hinder their economic performance (Welsh et al., 2018; Cardella et al., 2020). This discrepancy highlights the need for more nuanced research that considers the socio-cultural dynamics influencing women's roles in the Blue Economy across different geographical contexts.

Additionally, there is limited empirical evidence on the economic contributions of women within the Blue Economy. While some studies have explored the general benefits of gender equality, they often fail to address how these benefits specifically manifest in the Blue Economy (Diachkova and Kontoboitseva, 2022; Bennett et al., 2021). Existing frameworks for evaluating the Blue Economy tend to prioritize economic growth over social equity, which can marginalize women's contributions and perpetuate inequalities (Heidkamp et al., 2021; Benzaken et al., 2022). This underscores the critical need for research that explicitly links gender equality with economic well-being within the context of the Blue Economy.

Lastly, while the integration of gender into Blue Economy policies has been widely discussed, comprehensive studies assessing the effectiveness of these policies in practice remain scarce (Silver et al., 2015; Engen et al., 2021). This gap highlights the necessity for more rigorous empirical research that can inform policy-making and ensure that women's voices and needs are adequately represented in Blue Economy initiatives.

The primary objective of this study is to examine the impact of gender equality and women's involvement on economic well-being within the context of the Blue Economy. Specifically, it aims to explore how equitable gender practices and the active participation of women in managing marine and coastal resources contribute to the economic prosperity of coastal communities. Additionally, the study seeks to assess the relationships between these variables through an empirical approach to uncover underlying mechanisms and provide actionable insights. Based on these findings, the research will offer evidence-based recommendations to policymakers and stakeholders, fostering a more inclusive and gender-equitable framework for sustainable Blue Economy development.

The remainder of this paper is organized as follows. First, a comprehensive review of the literature on gender equality and women's roles within the Blue Economy is provided, highlighting existing gaps in the research. This is followed by a detailed description of the methodology, including the data collection process and analytical techniques employed. The results are

then presented, offering an in-depth analysis of the findings. The interpretation of these results is discussed in relation to the existing literature, focusing on their implications and potential limitations. Finally, the paper concludes by summarizing key insights, offering policy recommendations, and suggesting directions for future research.

2. LITERATURE REVIEW

2.1. Blue Economy

The blue economy is defined as the sustainable use of ocean resources to foster economic growth, improve livelihoods, and create jobs, all while preserving the health of ocean ecosystems (Liang et al., 2022). This multifaceted approach aligns with the Sustainable Development Goals (SDGs), particularly SDG 14, which focuses on conserving and sustainably using the oceans, seas, and marine resources (Liang et al., 2022; Ivanova, 2024).

A key principle of the blue economy is the integration of ecological sustainability with economic activities, which is essential for achieving a "triple-win" scenario—benefiting the economy, society, and the environment simultaneously (Satizábal et al., 2020; Cohen et al., 2019). This integration is often framed within the context of "blue growth," which seeks to leverage marine resources while ensuring their long-term viability (Satizábal et al., 2020). The blue economy operates on various principles, including drawing inspiration from nature, transforming business practices, and promoting the sustainable utilization of local resources (Duarte, 2023).

The blue economy is also characterized by its adaptability to different contexts, shaped by local socio-economic and environmental conditions (Voyer et al., 2022; Wuwung et al., 2022). This flexibility allows for diverse interpretations and implementations across regions, reflecting the unique challenges and opportunities faced by different countries (Voyer et al., 2022). For instance, in China, the blue economy is viewed as a state-driven initiative focused on modernization and maximizing national benefits, indicating a more centralized approach to its implementation (Fabinyi et al., 2021). In contrast, small-scale fisheries in other regions emphasize community involvement and equitable access to resources, underscoring the importance of social justice within the blue economy framework (Cohen et al., 2019; Germond-Duret et al., 2022).

Moreover, the governance structures of the blue economy are crucial for its success, as they determine how resources are managed and how benefits are distributed among stakeholders (Wuwung et al., 2022; Huang et al., 2022). The concept also promotes innovative financing mechanisms, such as blue bonds, to support sustainable initiatives and investments in marine conservation (March, 2024).

2.2. Women Involvement

The involvement of women in the blue economy is increasingly recognized as a critical factor in achieving the Sustainable Development Goals (SDGs), particularly those related to gender equality (SDG 5) and the sustainable use of oceans (SDG 14). Despite growing acknowledgment of women's roles, there remains a significant gap in the integration of gender perspectives within blue economy policies and practices. Research indicates that while blue economy policies often prioritize economic and environmental outcomes, they frequently overlook equity considerations, including gender equality and food security (Voyer et al., 2022).

Women play vital roles in various sectors of the blue economy, particularly in fisheries and marine conservation. Their contributions are essential for sustainable ocean governance, as they often possess unique knowledge and skills that enhance resource management and conservation efforts (Gissi et al., 2018; Andrade et al., 2021). However, literature suggests that women's participation is often marginalized due to socio-political factors, such as power dynamics and gender biases that limit their agency and decision-making capabilities (Gissi et al., 2018; Bennett et al., 2022). In many coastal communities, for instance, women are primarily involved in small-scale fisheries, yet their contributions are frequently undervalued and underrepresented in policy discussions (Andrade et al., 2021).

Integrating a gender perspective into the blue economy is not just a matter of equity; it is also crucial for the effectiveness of marine resource management. Studies have shown that gender-inclusive approaches can lead to more sustainable outcomes by ensuring diverse perspectives are considered in decision-making processes (Bennett et al., 2021; Verma, 2018). This is particularly relevant in the context of frameworks like the Commonwealth Blue Charter and other international initiatives aiming to promote sustainable ocean governance (Voyer et al., 2022; World Bank, 2022). Furthermore, the call for gender integration in blue economy policies emphasizes the need for targeted measures to address the specific challenges women face in maritime sectors (Verma, 2018; Wuwung et al., 2022).

Despite these insights, the implementation of gender-inclusive policies remains inconsistent. Many national blue economy strategies still lack concrete mechanisms to integrate gender considerations, limiting the potential for achieving equitable and sustainable outcomes (Voyer et al., 2022; Bennett et al., 2022). To address these challenges, it is essential to develop frameworks that not only recognize women's contributions but also empower them through capacity-building initiatives and equitable access to resources (Bennett et al., 2021; Gissi et al., 2018). By fostering an inclusive approach, the blue economy can better align with the overarching goals of sustainable development, ensuring that both women and marine ecosystems thrive.

2.3. Economic Well-being

The blue economy is recognized for its potential to generate economic opportunities, improve livelihoods, and contribute to food security, all while safeguarding marine ecosystems (Voyer et al., 2022; Liang et al., 2022; Mahadiansar, 2023). One of the core principles of the blue economy is its alignment with the Sustainable Development Goals (SDGs), particularly SDG 14, which focuses on the conservation and sustainable use of oceans, seas, and marine resources (Liang et al., 2022; Cisneros-Montemayor et al.,

2021). The blue economy not only aims to stimulate economic growth through sectors such as fisheries, tourism, and renewable energy but also seeks to enhance community resilience against environmental degradation and climate change (Voyer et al., 2022; Duarte, 2023). For instance, implementing sustainable practices in fisheries and aquaculture can significantly improve food security and local economies, promoting a more equitable distribution of resources (Mahadiansar, 2023; Duarte, 2023).

Additionally, the blue economy serves as a strategic framework for poverty alleviation and the promotion of sustainable livelihoods. By prioritizing the sustainable management of marine resources, it creates pathways for job creation and economic diversification, especially in developing nations that rely heavily on marine ecosystems for their livelihoods (Voyer et al., 2022; Fabinyi et al., 2021). The case of China illustrates how the blue economy can be leveraged as a national strategy for modernization and economic advancement, emphasizing the importance of integrating local benefits with broader state goals (Fabinyi et al., 2021).

However, the success of blue economy initiatives depends on effective governance and collaboration among various stakeholders, including governments, local communities, and the private sector (Voyer et al., 2022; Wuwung et al., 2022). Lack of clarity in governance frameworks can lead to inconsistencies and inequities in resource management, potentially undermining the socio-economic benefits that blue economy policies intend to achieve (Wuwung et al., 2022; Heidkamp et al., 2021). Therefore, fostering inclusive governance structures that prioritize community engagement and equitable resource distribution is essential to realizing the full potential of the blue economy (Cisneros-Montemayor et al., 2021; Cohen et al., 2019). In conclusion, the blue economy offers a transformative approach to economic well-being, balancing human development with the imperative of environmental stewardship.

2.4. Gender Equality

Research indicates that economies prioritizing gender equality tend to outperform those that do not, as gender equity fosters productivity and social output (Diachkova and Kontoboitseva, 2022). For example, Damjanovic and Selvaretnam (2019) demonstrate that as societies develop and accumulate both physical and human capital, women's productivity increases, leading to a societal shift toward gender equality that maximizes overall social output. However, the institutionalization of the blue economy often overlooks gender equity objectives. Voyer et al. (2022) highlight that while high-level blue economy policies prioritize economic and environmental goals, they frequently neglect equity considerations, particularly gender equality. This gap is critical, as the marginalization of women, especially in small-scale fisheries, limits their contributions to and benefits from blue economy initiatives. Cohen et al. (2019) emphasize that small-scale fisheries, often managed by women, are frequently excluded from decision-making processes shaping blue economy strategies, thus perpetuating existing inequalities.

The European Union's approach to gender equality reflects a broader trend where economic arguments dominate the discourse, often at the expense of deeper social justice considerations. Elomäki (2015) critiques the EU's gender equality policies, which are primarily framed within a neoliberal economic context, potentially undermining the substantive goals of gender equity. This framing can lead to a depoliticization of gender issues, as seen in the discussions surrounding gender quotas in corporate governance, where the focus shifts to economic benefits rather than justice (Elomäki, 2015).

In the Nordic context, initiatives such as the Salmon and Equality project illustrate efforts to embed gender equality within blue economy frameworks, showcasing the potential for localized strategies to address these disparities (Karlsdóttir, 2024). These projects highlight the importance of integrating gender considerations into blue economy policies to ensure that all stakeholders, particularly women, can equitably participate in the economic benefits derived from marine resources. Integrating gender equity into blue economy initiatives is essential for maximizing social output and ensuring that the benefits of ocean resources are shared fairly across society.

2.5. Hypotheses Development

Previous studies have demonstrated that gender equality contributes positively to economic growth by enhancing labor market participation and productivity. For instance, Kim et al. (2016) show that eliminating gender inequality could increase aggregate income by 6.6% to 14.5% over generations, with per capita income potentially rising by as much as 71.1% in a hypothetical gender-equal economy. This is particularly relevant in the blue economy, where women's participation in sectors such as fisheries is crucial for sustainable development. Harper et al. (2020) emphasize the significant yet often underappreciated contributions of women in small-scale fisheries and advocate for the use of gender-disaggregated data to inform policy and improve economic outcomes.

Moreover, the potential of the blue economy to promote gender equality is reflected in initiatives aimed at including women in decision-making processes and resource management. Voyer et al. (2022) discuss how blue economy policies often prioritize economic and environmental objectives but tend to overlook equity considerations, especially gender equality. This oversight can hinder the full realization of the economic potential that gender-inclusive policies can offer. Ivanova (2024) argues that the blue economy can significantly improve food security and promote gender inclusion, underscoring the importance of regional cooperation for fostering sustainable development.

The intersection of gender equality and the blue economy is also evident in the Sustainable Development Goals (SDGs), particularly SDG 5 (Gender Equality) and SDG 14 (Life Below Water). Andrade et al. (2021) emphasize the interdependence of these goals, advocating for a gender-sensitive approach to fisheries management that acknowledges the critical roles women play in the ocean economy. Such an approach not only promotes gender equality but also enhances the sustainability of marine resources, contributing to overall economic well-being.

The evidence suggests that improving gender equality leads to increased productivity, greater labor market participation, and overall economic growth. In the blue economy, where women's involvement is vital for sustainable development, promoting gender inclusivity can unlock significant economic benefits. Building on these findings, we propose the following hypothesis:
H1: Gender equality positively affects economic well-being in the blue economy.

Research demonstrates that empowering women and providing equal opportunities result in significant economic benefits, including increased productivity and innovation within the blue economy (Diachkova and Kontoboitseva, 2022; Kim et al., 2016; Damjanovic and Selvaretnam, 2019). Addressing systemic barriers that have historically restricted women's participation directly enhances their contributions across various economic sectors, including the blue economy. For example, studies reveal that gender discrimination in labor markets leads to inefficiencies by failing to fully utilize women's potential (Joseph et al., 2020; Damjanovic and Selvaretnam, 2019).

The blue economy, which depends on sustainable practices and innovation, stands to gain considerably from integrating women's perspectives and expertise. Key sectors such as fisheries management, marine conservation, and sustainable tourism are particularly well-positioned to benefit from women's involvement in decision-making and operational roles (Karlsdóttir, 2024). Empirical evidence further indicates that economies prioritizing gender equality consistently outperform those that do not. Eliminating gender inequality has been shown to significantly increase aggregate income and drive overall economic growth (Kim et al., 2016; Damjanovic and Selvaretnam, 2019).

Within the blue economy, the inclusion of women in decision-making processes enhances the sustainability and effectiveness of marine resource management (Karlsdóttir, 2024). Providing women with equal opportunities is not only a matter of social equity but also a critical economic strategy. Gender-inclusive practices foster innovation, boost productivity, and strengthen sustainable resource management. Building on this compelling evidence linking gender equality to economic gains, we propose the following hypothesis:
H2: Gender equality positively affects women's involvement in the blue economy.

The blue economy, which emphasizes the sustainable use of ocean resources, has proven to create opportunities for women, enhancing their economic participation and contributing to overall community development. Ivanova (2024) highlights how the blue economy fosters gender inclusion alongside food security and sustainable fisheries, underscoring the critical role of women in achieving inclusive economic growth, particularly in the Asia-Pacific region.

Women's participation in the labor force is essential for household economies and broader economic growth. Naheed (2024) demonstrates that women's workforce engagement is shaped by various societal factors, including economic and demographic indicators, which influence their participation in sectors such as fisheries and aquaculture. Similarly, Sajjad et al. (2020) emphasize the pivotal role of women entrepreneurs in driving economic development and social well-being, suggesting that their involvement in blue economy sectors can bolster community resilience and economic stability.

Despite these opportunities, women in the blue economy face significant challenges. Satizábal et al. (2020) note that the expansion of blue economy initiatives can sometimes displace coastal communities, including women who depend on marine ecosystems for their livelihoods. This calls for policies that ensure equitable access to resources and inclusive decision-making processes. Voyer et al. (2022) advocate for blue economy strategies that prioritize social equity, emphasizing the importance of integrating women's perspectives into governance frameworks.

Women's involvement in the blue economy is not only crucial for their economic empowerment but also indispensable for the sustainable development of coastal communities. By actively participating in sustainable practices and decision-making, women contribute to economic growth, social resilience, and environmental sustainability. Building on this growing recognition of women's critical role in sectors like fisheries, aquaculture, and marine conservation, we propose the following hypothesis:
H3: Women's involvement positively affects economic well-being in the blue economy.

Women's participation in blue economy sectors has been shown to enhance economic outcomes while simultaneously advancing gender equality. For example, Behera's (2024) systematic literature review reveals a growing recognition of women's contributions in traditional blue economy sectors, which has led to increased community support for women's leadership and employment opportunities. This shift not only empowers women but also improves the economic efficiency of the blue economy. Case studies from the Shandong Peninsula Blue Economic Zone further underscore the importance of inclusive practices for economic development (Bolton, 2021).

The blue economy's emphasis on sustainable resource management aligns with gender equity principles. Ivanova (2024) notes that the blue economy can significantly enhance food security and promote gender inclusion. This alignment is further supported by research showing that women's economic rights and participation are pivotal for sustainable development, leading to improved economic growth and poverty reduction (Naveed et al., 2023). Empowering women in the blue economy not only elevates their economic status but also fosters broader societal changes, as their advancement is closely tied to increased labor productivity and socio-economic progress (Mishra et al., 2020).

Additionally, women's entrepreneurial activities within the blue economy yield significant socio-economic benefits. Research by Sallah and Caesar (2020) highlights the critical role of women entrepreneurs in driving economic growth and social transformation. This is particularly relevant in developing economies, where women's participation in the blue economy can

act as a catalyst for broader economic development and gender equality (Duflo, 2012).

Given the growing body of evidence illustrating the interconnectedness of gender equality, women's involvement in the blue economy, and economic well-being, it is essential to explore how women's participation mediates the relationship between gender equality and economic outcomes. Women's inclusion in the blue economy not only fosters gender equity but also strengthens economic development, making their involvement a vital factor in translating gender equality into tangible economic benefits. Building on these insights, we propose the following hypothesis:

H4: Women's involvement mediates the relationship between gender equality and economic well-being in the context of the blue economy.

The framework presented in Figure 1 illustrates the conceptual model guiding this study, which examines the relationships between gender equality, women's involvement in the blue economy, and economic well-being.

3. RESEARCH METHODOLOGY

This study employed a quantitative research design to examine the impact of gender equality and women's involvement on economic well-being within the context of the blue economy. A cross-sectional survey was conducted to collect data from individuals in coastal communities involved in the management of marine and coastal resources.

3.1. Population and Sample Size

The study focused exclusively on women from the eastern coastal areas of Langkat Regency, North Sumatera, Indonesia. This specific population was selected due to the critical role women play in these communities' blue economy activities, including fisheries, aquaculture, tourism, and other marine resource-based livelihoods. Women's involvement in these sectors is pivotal for sustainable economic development and resource management. Furthermore, these coastal communities presented unique sociocultural dynamics that provided valuable insights into the relationship between gender equality, women's participation, and economic well-being.

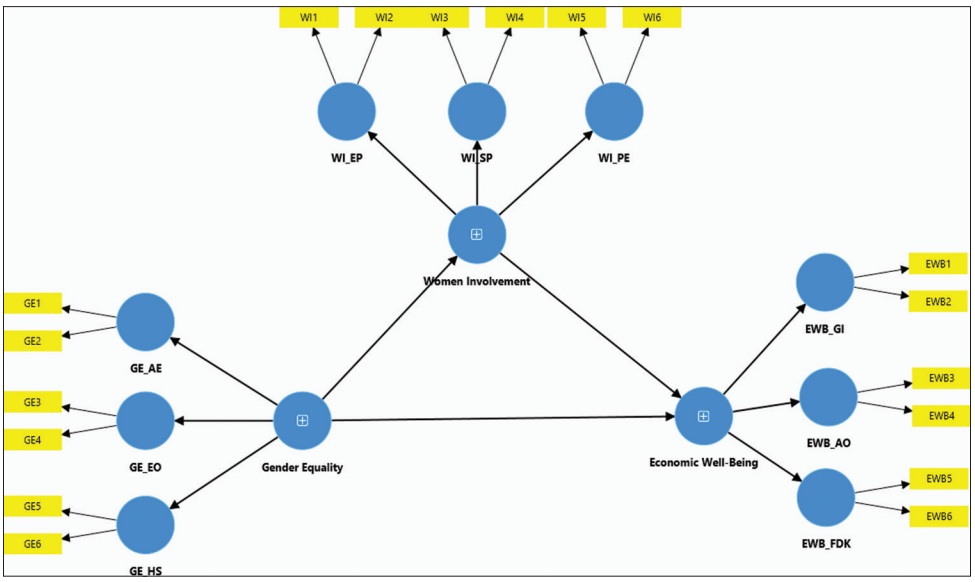
Although the initial target was 500 respondents, 375 valid responses were ultimately obtained, representing a response rate of 75%. This response rate is considered acceptable in social science research, particularly in studies involving field surveys in specific communities. Factors contributing to the lower-than-expected sample size included respondents' limited availability due to their active involvement in economic activities and logistical challenges in accessing certain remote areas. Nevertheless, the sample size of 375 was sufficient for robust data analysis, exceeding the minimum threshold required for Partial Least Squares Structural Equation Modeling (PLS-SEM). The random sampling technique employed further ensured diverse representation across age, education levels, and economic activities, enhancing the validity and reliability of the study's findings.

3.2. Measurement Items

The study investigated three primary constructs: Women's Involvement, Economic Well-Being, and Gender Equality, each assessed through specific dimensions. Women's Involvement was evaluated across three key dimensions: Economic Participation, Social Participation, and Political Engagement. Economic Well-Being was measured through the dimensions of Income Generation, Asset Ownership, and Financial Decision-Making. Finally, Gender Equality was assessed through three dimensions: Access to Education, Employment Opportunities, and Health and Safety.

To measure these constructs, a 5-point Likert scale was employed, allowing respondents to indicate their level of agreement with each statement. The scale ranged from 1 (Strongly Disagree) to 5 (Strongly Agree), providing a range of responses that captured varying degrees of agreement or disagreement. This scale offered

Figure 1: Framework of this study



a nuanced understanding of the participants' perceptions and experiences with regard to the dimensions within each construct.

For example, Economic Participation within the Women's Involvement construct included items such as "I am actively involved in income-generating activities," where participants rated their agreement using the 5-point scale. Similarly, other dimensions such as Social Participation and Political Engagement were assessed with corresponding statements, allowing for a comprehensive evaluation of women's roles in economic, social, and political spheres.

Economic Well-Being was measured through three dimensions: Income Generation, which evaluated participants' financial stability through statements like "I have a stable source of income;" Asset Ownership, assessed with statements like "I own property or land;" and Financial Decision-Making, with items such as "I have control over financial decisions in my household."

Finally, Gender Equality was evaluated through three dimensions: Access to Education, assessed with statements such as "I have equal access to educational opportunities as men"; Employment Opportunities, measured by items like "Women have the same job opportunities as men in my community"; and Health and Safety, with items such as "Women have access to healthcare services without discrimination."

3.3. Data Collection

Data have been gathered using structured questionnaires, which were distributed to a selected group of respondents. The distribution process was conducted offline with the assistance of enumerators to ensure the inclusion of participants who may have limited access to technology. The enumerators were responsible for overseeing the distribution of the questionnaires, clarifying any questions as needed, and ensuring that respondents provided accurate and well-considered answers. Prior to the main data collection, a pilot test was carried out with a small sample to assess the clarity and reliability of the measurement items. This offline method allowed for broad participation, particularly among individuals without reliable internet access, thereby enhancing the representativeness and inclusivity of the sample.

3.4. Data Analysis

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) to investigate the relationships among the key constructs in the study. PLS-SEM was selected due to its ability to handle complex models and its suitability for exploratory research, particularly in cases where theoretical foundations are still evolving.

The analysis proceeded in several stages, beginning with model specification, where the structural model was defined according to the guiding theoretical framework. The measurement model was then evaluated to assess the reliability and validity of the measurement items, utilizing composite reliability, convergent validity, and discriminant validity. Special attention was given to second-order constructs, specifically examining how first-order constructs contributed to these higher-order factors. Subsequently, the structural model was evaluated through path coefficients, R^2 values, and predictive relevance (Q^2) to assess the strength and significance of the relationships among the constructs. Model fitness was assessed using the Standardized Root Mean Square Residual (SRMR), which indicates how well the model fits the data. Bootstrapping procedures were applied to derive significance levels for the path coefficients, ensuring the robustness of the findings. Finally, Variance Accounted For (VAF) was used to assess the mediating effect of Women Involvement (WI) on the relationship between Gender Equality (GE) and Economic Well-Being (EWB), providing insights into the extent of mediation within the proposed model.

4. RESULTS

4.1. Demographic Profile

The demographic profile of the respondents consisted exclusively of women from the eastern coastal areas of Langkat Regency, North Sumatera, Indonesia. It provided a detailed breakdown of key characteristics, such as age, education, marital status, household size, income level, and occupational involvement, which were essential for understanding their socio-economic background. Table 1 summarizes these characteristics.

Table 1 presents the demographic profile of the 375 female respondents from the eastern coastal areas of North Sumatera,

Table 1: Demographic profile (N=375)

Demographic characteristic	Category/Option	Count	Percentage
Age	18-24	41	10.93
	25-34	97	25.87
	35-44	94	25.07
	45-54	73	19.47
	55+	72	19.20
Education Level	No formal education	39	10.40
	Primary school	76	20.27
	Secondary school	149	39.73
	High school	81	21.60
	College or University	32	8.53
Marital Status	Single	72	19.20
	Married	225	60.00
	Divorced	43	11.47
	Widowed	37	9.87
Household Size	1-3	76	20.27
	4-6	189	50.40
	7+	113	30.13
Income Level	Low	150	40.00
	Middle	188	50.13
	High	38	10.13
Occupational Involvement	Fisheries and Marine Resource Management	113	30.13
	Coastal Tourism Services	65	17.33
	Food and Beverage Services	56	14.93
	Handicrafts and Artisanal Products	43	11.47
	Agriculture and Forestry	21	5.60
	Retail and Trade	41	10.93
	Transportation Services	19	5.07
	Other Services	20	5.33

Indonesia. The respondents are categorized by key characteristics such as age, education level, marital status, household size, income level, and occupational involvement.

In terms of age, the majority of respondents are between 25 and 44-years-old, with the largest group being 25-34 years (25.87%), closely followed by the 35-44 years group (25.07%). Regarding education, most respondents have attended secondary school (39.73%), followed by those with primary school education (20.27%) and high school education (21.60%). A smaller proportion of respondents have no formal education (10.40%) or have attended college/university (8.53%).

Concerning marital status, the majority are married (60%), with smaller percentages being single (19.20%), divorced (11.47%), or widowed (9.87%). In terms of household size, the largest group comes from households with 4-6 members (50.40%), followed by households with 7 or more members (30.13%) and 1-3 members (20.27%).

Income levels are primarily distributed between low (40%) and middle (50.13%) income brackets, with a smaller proportion in the high-income category (10.13%). As for occupational involvement, the largest group of respondents work in fisheries and marine resource management (30.13%), followed by those in coastal tourism services (17.33%) and food and beverage services (14.93%). Other occupational categories, such as handicrafts and artisanal products, agriculture and forestry, retail and trade, transportation services, and other services, represent smaller proportions of the sample. This detailed breakdown of the demographic characteristics provides essential context for understanding the socio-economic background of the respondents.

4.2. Common Method Variance

The Common Method Variance (CMV) test in this study was conducted using Harman's Single-Factor Test. The analysis showed that the percentage of variance explained by the single factor was 48.22%, which is below the 50% threshold. Based on this result, it can be concluded that CMV is not a significant concern in this study, suggesting that the findings are not notably influenced by common method bias.

4.3. Assessment of Measurement Model

The assessment of the measurement model evaluates the reliability and validity of the constructs used in the study. Detailed insights into the measurement model's performance, including the various indicators and their respective values, are shown in Figure 2 and Table 2.

The results presented in Table 2 assess the measurement model for both first-order and second-order constructs, including Outer Loadings, Cronbach's Alpha (CA), Composite Reliability (CR), and Average Variance Extracted (AVE), providing insights into the reliability and validity of the model.

For the first-order constructs, the Outer Loadings for all items exceed the recommended threshold of 0.70, indicating that the indicators strongly represent their respective dimensions. For example, GE1 in the GE_AE dimension has an Outer Loading of 0.906, confirming its robust contribution to the Gender Equality construct.

The Cronbach's Alpha (CA) values for all first-order dimensions, such as GE_AE (0.774) and WI_EP (0.807), exceed the threshold of 0.70, suggesting good internal consistency. Similarly, the Composite Reliability (CR) values for all dimensions are above 0.80, indicating high reliability across the first-order constructs. The AVE values, which exceed the threshold of 0.50 for each dimension, further support the convergent validity of the measurement model. For instance, the AVE for GE_AE is 0.815, demonstrating that the items explain a significant portion of the variance in the construct.

For the second-order constructs, which aggregate the first-order dimensions, the Outer Loadings remain strong, with values such as 0.88 for GE_AE, indicating that the second-order constructs are well represented by their dimensions. The Cronbach's Alpha values

Figure 2: Outer loading (second order)

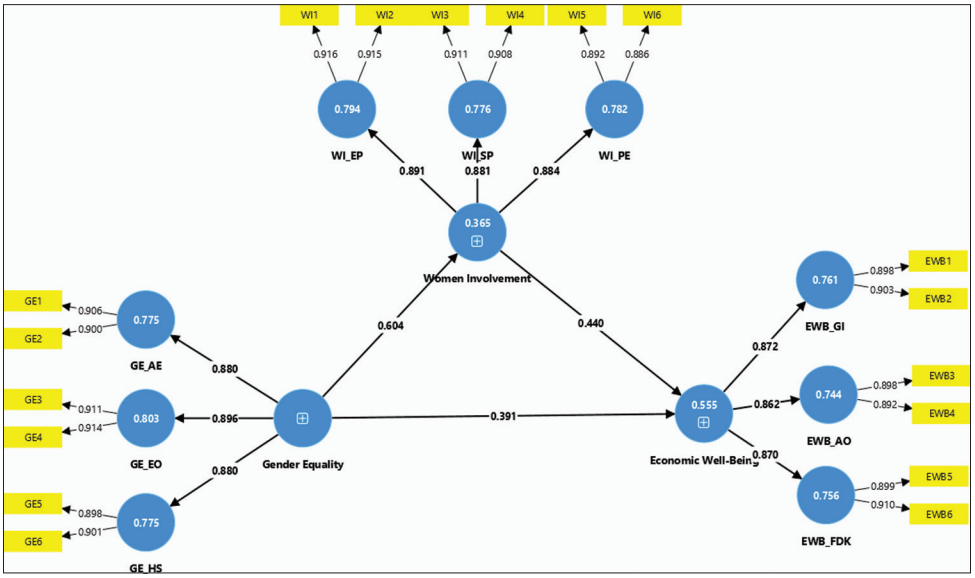


Table 2: Assessment of measurement model (First and second order)

Variable	Dimension	Item	Loading		CA		CR		AVE	
			First order	Second order	First order	Second order	First order	Second order	First order	Second order
GE						0.888		0.915		0.642
	AE			0.880	0.774		0.898		0.815	
		GE1	0.906							
		GE2	0.900							
	EO			0.896	0.799		0.909		0.832	
		GE3	0.911							
		GE4	0.914							
	HS			0.880	0.764		0.894		0.809	
		GE5	0.898							
		GE6	0.901							
WI						0.888		0.915		0.642
	EP			0.891	0.807		0.912		0.838	
		WI1	0.916							
		WI2	0.915							
	SP			0.881	0.791		0.906		0.827	
		WI3	0.911							
		WI4	0.908							
	PE			0.884	0.735		0.883		0.790	
		WI5	0.892							
		WI6	0.886							
EWB						0.872		0.904		0.611
	IG			0.872	0.767		0.895		0.811	
		EWB1	0.898							
		EWB2	0.903							
	AO			0.862	0.752		0.890		0.801	
		EWB3	0.898							
		EWB4	0.892							
	FDM			0.870	0.779		0.900		0.819	
		EWB5	0.899							
		EWB6	0.910							

Loading: > 0.70; CA: > 0.70; CR: > 0.70; AVE: > 0.50. WI: Women Involvement, EP: Economic Participation, SP: Social Participation, PE: Political Engagement, EWB: Economic Well-Being, IG: Income Generation, AO: Asset Ownership, FDM: Financial Decision-Making, GE: Gender Equality, AE: Access to Education, EO: Employment Opportunities, HS: Health and Safety

for the second-order constructs, including Gender Equality (0.888) and Women Involvement (0.888), are above the acceptable level of 0.80, suggesting excellent internal consistency. The Composite Reliability (CR) values for the second-order constructs are also high, further supporting the reliability of the model.

Although the AVE values for the second-order constructs, such as 0.642 for Gender Equality, are slightly lower than those for the first-order constructs, they still exceed the critical value of 0.50, confirming acceptable convergent validity. These findings indicate that the measurement model for both first-order and second-order constructs demonstrates strong reliability, consistency, and validity.

The assessment of discriminant validity for both first-order and second-order constructs is conducted using the Fornell and Larcker criterion, which compares the square root of the Average Variance Extracted (AVE) for each construct with the correlations between constructs, as presented in Table 3.

Table 3 presents the results of the discriminant validity assessment for both first-order and second-order constructs using the Fornell and Larcker criterion. In the first-order constructs, the analysis evaluates the relationships between the dimensions of Economic Well-Being (EWB), Gender Equality (GE), and Women's Involvement (WI), including their respective sub-dimensions such as Income Generation (IG), Access to Education (AE), and Social Participation (SP). For the second-order constructs, the results summarize the discriminant validity of the higher-order constructs: Economic Well-Being (EWB), Gender Equality (GE), and Women's Involvement (WI). These findings provide further support for the conceptual distinction among the constructs within the model.

The diagonal values in parentheses represent the square root of the Average Variance Extracted (AVE) for each construct, while the off-diagonal values indicate the correlations between constructs. To establish discriminant validity, the square root of the AVE for each construct should exceed the correlations between that construct and the others.

Discriminant validity is further evaluated using the Heterotrait-Monotrait Ratio (HTMT), a method that ensures constructs and their dimensions are distinct and measure unique concepts, as presented in Table 4.

Table 4 summarizes the HTMT results for first-order and second-order constructs. All HTMT values fall below the recommended threshold of 0.85, confirming acceptable discriminant validity. These findings highlight the distinctiveness of each construct and

Table 3: Discriminant validity: Fornell and Larcker (First and second order)

	First order								
Construct	**EWB_AO**	**EWB_FDK**	**EWB_GI**	**GE_AE**	**GE_EO**	**GE_HS**	**WI_EP**	**WI_PE**	**WI_SP**
EWB_AO	(0.895)								
EWB_FDK	0.624	(0.905)							
EWB_GI	0.628	0.639	(0.900)						
GE_AE	0.486	0.473	0.504	(0.903)					
GE_EO	0.505	0.493	0.541	0.686	(0.912)				
GE_HS	0.513	0.490	0.540	0.657	0.686	(0.899)			
WI_EP	0.521	0.531	0.545	0.478	0.506	0.457	(0.916)		
WI_PE	0.538	0.508	0.548	0.466	0.504	0.477	0.687	(0.889)	
WI_SP	0.510	0.473	0.505	0.453	0.455	0.466	0.670	0.670	(0.910)
Second order									
Construct	EWB	GE	WI						
EWB	(0.781)								
GE	0.657	(0.801)							
WI	0.676	0.604	(0.801)						

The values in parentheses represent the square root of the AVE. WI: Women Involvement, EP: Economic Participation, SP: Social Participation, PE: Political Engagement, EWB: Economic Well-Being, IG: Income Generation, AO: Asset Ownership, FDM: Financial Decision-Making, GE: Gender Equality, AE: Access to Education, EO: Employment Opportunities, HS: Health and Safety

Table 4: Discriminant validity: HTMT

	First order							
Construct	**EWB_AO**	**EWB_FDK**	**EWB_GI**	**GE_AE**	**GE_EO**	**GE_HS**	**WI_EP**	**WI_PE**
EWB_FDK	0.815							
EWB_GI	0.827	0.826						
GE_AE	0.636	0.609	0.653					
GE_EO	0.651	0.624	0.692	0.872				
GE_HS	0.676	0.635	0.706	0.854	0.878			
WI_EP	0.668	0.669	0.692	0.605	0.630	0.581		
WI_PE,	0.724	0.670	0.730	0.618	0.658	0.637	0.892	
WI_SP	0.661	0.601	0.648	0.579	0.572	0.599	0.838	0.879
Second order								
Construct	EWB	GE						
GE	0.746							
WI	0.768	0.680						

HTMT ratio <0.85 indicates acceptable discriminant validity. WI: Women Involvement, EP: Economic Participation, SP: Social Participation, PE: Political Engagement, EWB: Economic Well-Being, IG: Income Generation, AO: Asset Ownership, FDM: Financial Decision-Making, GE: Gender Equality, AE: Access to Education, EO: Employment Opportunities, HS: Health and Safety

its dimensions, reinforcing their reliability in measuring unique aspects.

4.4. Assessment of Structural Model

The structural analysis results, which provide insights into predictive power, predictive relevance, and overall model fitness, collectively assess the robustness of the proposed model in explaining and predicting the relationships among the constructs, as shown in Table 5.

Table 5: Structural analysis

Variable	Predictive power	Predictive relevance	Model fitness
	R^2	Q^2	
Economic Well-Being	0.555	0.335	
Women Involvement	0.365	0.231	
SRMR			0.081

R^2 (Weak: <0.25; Moderate: 0.25–0.50; Strong: >0.50). Q^2 (Positive: >0 indicates the model has predictive relevance). SRMR (Good fit: < 0.1)

Table 5 presents the results of the structural analysis, indicating that the R^2 values demonstrate moderate predictive power for Economic Well-Being and Women's Involvement, with values of 0.555 and 0.365, respectively. The Q^2 values, both greater than 0, suggest that the model has predictive relevance for these variables. Additionally, the SRMR value of 0.081 indicates a good fit for the model. The results of the significance test for the relationships between the constructs, evaluating whether the proposed hypotheses are supported by the data, are shown in Table 6.

Table 6 shows that all proposed relationships between the constructs are statistically significant, with β values indicating the strength and direction of each path (all P-values < 0.001). The direct effects of Gender Equality (GE) on Economic Well-Being (EWB) (H1) and Women's Involvement (WI) (H2), as well as the effect of WI on EWB (H3), are significant. Additionally, the indirect effect of GE on EWB through WI (H4) is significant, with a variance accounted for (VAF) of 30.56%. These results strongly support the proposed hypotheses and highlight the critical roles of GE and WI in enhancing EWB.

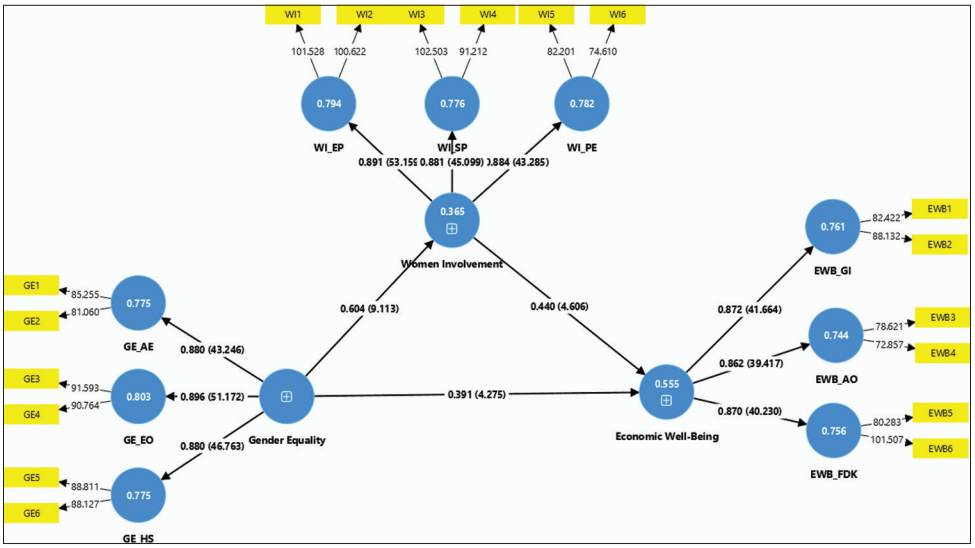
Figure 3 further supports these findings by illustrating the path coefficients (β) and t-statistics. For instance, the path from GE to EWB has a coefficient of 0.391 and a t-statistic of 4.275, indicating

Table 6: Significance test

Hyp.	Path	β	M	SD	t-statistic	P-value	Remarks	VAF
H1	GE→EWB	0.391	0.397	0.092	4.275	0.000	***	
H2	GE→WI	0.604	0.613	0.066	9.113	0.000	***	
H3	WI→EWB	0.440	0.440	0.096	4.606	0.000	***	
H4	GE→WI→EWB	0.266	0.269	0.065	4.108	0.000	***	30.56

*(P<0.10); **(P<0.05); ***(P<0.001). WI: Women Involvement, EWB: Economic Well-Being, GE: Gender Equality

Figure 3: Path coefficient and t-statistics



a significant direct effect (p-value < 0.001). Similarly, the path from GE to WI shows a coefficient of 0.604 with a t-statistic of 9.113, confirming a strong and significant relationship. The path from WI to EWB has a coefficient of 0.440 and a t-statistic of 4.606, also statistically significant. These values confirm the strength and significance of the relationships among the constructs.

5. DISCUSSION

The statistical analysis reveals that Gender Equality (GE) has a positive and significant effect on Economic Well-Being (EWB), with a coefficient of 0.391, a t-value of 4.275, and a significance level of 0.000. This supports the proposed hypothesis and confirms that improving gender equality contributes to economic well-being, particularly within the context of the blue economy. These findings are consistent with existing theories and previous studies, which show that gender equality enhances labor market participation and productivity, directly driving economic growth. In the blue economy, women's involvement in sectors such as fisheries significantly contributes to sustainable development, as highlighted by Harper et al. (2020). Moreover, policies that promote gender inclusivity can unlock substantial economic potential, as discussed by Voyer et al. (2022). This study provides empirical evidence reinforcing the argument that gender equality not only expands economic opportunities but also serves as a critical driver of sustainable marine resource management. These findings align with the Sustainable Development Goals (SDGs), particularly SDG 5 (Gender Equality) and SDG 14 (Life Below Water), which emphasize the importance of gender-inclusive approaches in managing marine resources. Thus, this research significantly contributes by clarifying the relationship between gender equality and economic well-being, while highlighting the importance of gender-based policies in promoting women's participation, enhancing productivity, and supporting sustainable development within the blue economy.

The statistical analysis also demonstrates that Gender Equality (GE) has a strong and significant positive effect on Women's Involvement (WI), with a coefficient of 0.604, a t-value of 9.113, and a significance level of 0.000. These results support the proposed hypothesis and align with prior research highlighting the role of gender equality in empowering women and enhancing their contributions across economic sectors. Studies by Diachkova and Kontoboitseva (2022) and Damjanovic and Selvaretnam (2019) reveal that addressing systemic barriers, such as gender discrimination in labor markets, significantly increases women's participation and unlocks their potential contributions. In the context of the blue economy, the inclusion of women is particularly impactful. Karlsdóttir (2024) underscores that integrating women's perspectives and expertise in areas such as fisheries management, marine conservation, and sustainable tourism enhances innovation and strengthens the sustainability of marine resource management. These insights align with the findings of this study, which highlight the direct impact of gender equality on women's increased involvement in these critical sectors. Additionally, research by Kim et al. (2016) and Joseph et al. (2020) demonstrates that economies prioritizing gender equality tend to achieve higher levels of productivity and economic growth. Removing systemic barriers to women's participation, as seen in the blue economy, leads to better decision-making and more effective resource management, which drives both social equity and economic benefits. Therefore,

this study provides empirical validation for the argument that gender equality is essential for enhancing women's involvement in the blue economy. The findings emphasize the importance of fostering gender inclusivity to achieve sustainable development and improve productivity in this sector.

The statistical analysis demonstrates that Women's Involvement (WI) has a significant positive effect on Economic Well-Being (EWB), with a coefficient of 0.440, a t-value of 4.606, and a significance level of 0.000. These results support the proposed hypothesis and are consistent with previous research emphasizing the critical role of women's involvement in promoting economic and community development. Ivanova (2024) highlights that the blue economy, which focuses on the sustainable use of ocean resources, fosters gender inclusion and strengthens food security and fisheries sustainability. Women's active participation in these sectors is essential for achieving inclusive economic growth, particularly in regions such as the Asia-Pacific. This aligns with the findings of this study, which show that women's engagement in key blue economy sectors, such as fisheries and marine conservation, has a direct and positive impact on economic well-being. Further supporting this, Naheed (2024) demonstrates that women's workforce engagement, influenced by various economic and demographic factors, significantly contributes to household and broader economic growth. Similarly, Sajjad et al. (2020) emphasize the role of women entrepreneurs in driving both economic stability and social well-being, suggesting that women's involvement in the blue economy can similarly enhance community resilience and economic stability.

Additionally, this study supports the research by Satizábal et al. (2020) and Voyer et al. (2022), who argue that equitable governance and inclusive decision-making processes are essential for maximizing women's economic contributions in the blue economy. Policies ensuring equal access to resources and women's involvement in governance structures are crucial for optimizing the benefits of their participation. The findings of this study highlight that integrating women into sustainable practices and resource management in the blue economy can not only foster economic growth but also promote social equity and environmental sustainability. Thus, the results of this study reinforce and extend previous research by providing empirical evidence that women's involvement in the blue economy positively influences economic well-being. The study emphasizes the importance of supporting women's participation in the blue economy, not only to drive economic growth but also to achieve broader social and environmental benefits, particularly in coastal and marine-dependent communities.

The statistical analysis also demonstrates that Gender Equality (GE) positively influences Women's Involvement (WI), which in turn positively impacts Economic Well-Being (EWB), with a coefficient of 0.266, a t-value of 4.108, and a significance level of 0.000. These results support the proposed hypothesis and suggest that women's involvement mediates the relationship between gender equality and economic well-being within the context of the blue economy. These findings align with and extend previous research that emphasizes the mediating role of women's involvement in the relationship between gender equality and economic outcomes in the blue economy. For instance, Behera (2024) highlights how increasing recognition of women's contributions in traditional blue economy sectors, such as fisheries and marine tourism, leads to more inclusive practices, greater community support, and expanded leadership and employment opportunities for women. This shift not only empowers women but also enhances the economic efficiency of the blue economy, as demonstrated by Bolton (2021) in the case study of the Shandong Peninsula Blue Economic Zone, which underscores the importance of inclusive policies for economic development.

Moreover, the blue economy's focus on sustainable resource management aligns with gender equity principles. Ivanova (2024) suggests that gender inclusion in the blue economy contributes significantly to food security and gender equality. This relationship is further supported by Naveed et al. (2023), who argue that women's economic participation and rights are essential for sustainable development, driving economic growth and poverty reduction. The findings of this study reinforce this by showing how gender equality, through women's increased involvement in the blue economy, contributes directly to economic well-being. Additionally, the role of women's entrepreneurship in the blue economy has been widely recognized as a key driver of socio-economic benefits. Sallah and Caesar (2020) emphasize that women's entrepreneurial activities in the blue economy foster both economic growth and social change. This is especially significant in developing economies, where women's participation can serve as a catalyst for broader economic development and gender parity, as argued by Duflo (2012). Our study's findings further support this, showing that women's involvement in the blue economy can drive both social and economic change, benefiting communities at large.

Therefore, this study provides empirical evidence supporting the mediating role of women's involvement in translating gender equality into tangible economic benefits. By enhancing women's participation in the blue economy, gender equality becomes a catalyst for economic development, improving both individual and community economic well-being.

6. CONCLUSION

This study investigates the critical role of gender equality in enhancing economic well-being, particularly within the context of the blue economy. The findings demonstrate that gender equality not only stimulates economic growth but also serves as a catalyst for increasing women's participation in key sectors such as fisheries, marine conservation, and sustainable tourism. By empowering women and ensuring their active involvement, gender equality significantly contributes to broader economic well-being and supports sustainable development.

The results show that gender equality has a direct, positive impact on economic well-being, with women's involvement acting as a crucial mediator between gender equality and economic outcomes. The study emphasizes the importance of inclusive policies that promote gender equality, as they are essential for achieving both

economic and social benefits. These findings align with and expand upon existing literature, reinforcing the idea that gender equality within the blue economy enhances productivity, fosters equitable resource management, and contributes to environmental sustainability.

The implications of these findings are far-reaching. First, they underscore the need for gender-inclusive policies that empower women and ensure their participation in decision-making processes within the blue economy. This approach unlocks greater economic potential and improves overall well-being. Second, the research highlights the central role of women in driving sustainable development, particularly in coastal and marine-dependent communities. As global attention increasingly shifts toward sustainable practices, it is critical for policymakers and stakeholders to prioritize gender equality to unlock the full potential of the blue economy.

Furthermore, this study paves the way for future research focused on strategies to address gender gaps in the blue economy. Future studies should explore ways to more effectively integrate women's contributions into leadership and decision-making roles, offering valuable insights into achieving gender parity within the sector. Thus, this research affirms that gender equality is not only a fundamental issue of social justice but also a key driver of economic prosperity and sustainability. The active inclusion of women in the blue economy is essential for fostering a more equitable, prosperous, and sustainable future for all. As such, gender equality should be recognized as a cornerstone for achieving long-term development goals within the blue economy.

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