# EFFECT OF DEEP BLUE ECONOMY ON THE GROWTH OF SELECTED MARITIME COMPANIES IN SOUTH-SOUTH NIGERIA

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**Abstract**
*This study examined the effect of deep blue economy on the growth of selected maritime companies in south-south Nigeria. The study used the survey research design; the target population of this study was 384 senior and mid-level employees from eight (8) selected private maritime firms and expert offices actively operating within the Niger Delta region. This research study utilized a census sampling method to gather data from the entire population. The data for this study were collected with the aid of a well-structured 5-point Likert scale questionnaire and the reliability of this instrument was tested using Cronbach Alpha. Partial Least Square Structural Equation Modelling (PLS-SEM) was employed to test the hypotheses formulated of which the study found that marine biotechnology has a negative insignificant effect on the growth of selected maritime companies in south-south Nigeria. Ocean Tourism does not have a significant effect the growth of the selected maritime companies in South-South Nigeria. The study recommends that Maritime companies should reconsider their investment strategies in marine biotechnology. Instead of allocating substantial resources to this sector, companies should focus on improving the efficiency and innovation of their existing operations. Conducting a detailed cost-benefit analysis can help identify more profitable areas for investment within the blue economy. Maritime companies should collaborate with local governments and tourism boards to develop and promote comprehensive tourism packages. These packages should include infrastructure improvements, marketing campaigns, and partnerships with travel agencies to attract more tourists and increase the economic benefits from this sector.*
**Keywords:** *Deep Blue Economy, Marine Biotechnology, Ocean Tourism, Maritime Companies*

## INTRODUCTION

The maritime industry plays a crucial role in the global economy, facilitating international trade, transportation, and resource extraction. In South-South Nigeria, the maritime sector is a significant contributor to regional and national economic growth, providing employment opportunities, fostering trade, and supporting related industries (Akinyemi, 2020). However, the sector faces numerous challenges, including environmental degradation, regulatory compliance issues, and the need for sustainable development practices. To address these challenges, maritime companies in the region are increasingly adopting deep blue practices, which emphasize sustainable use and conservation of marine resources.

Deep blue economy also known as deep blue practices encompass various strategies aimed at promoting the sustainable use of ocean resources while ensuring environmental protection and economic viability. Two critical proxies for these practices are marine biotechnology and ocean tourism (Hammed, 2018). Marine biotechnology involves the application of scientific and engineering principles to the processing of materials from marine organisms for the development of products and technologies (Leal, 2016). This field has the potential to revolutionize various industries, including pharmaceuticals, agriculture, and environmental management, thereby driving economic growth.

Ocean tourism, on the other hand, capitalizes on the natural beauty and biodiversity of marine environments to attract tourists, generating revenue and promoting local development (Orams, 2019). Sustainable ocean tourism practices aim to minimize environmental impact while maximizing socio-economic benefits for local communities. These practices can enhance the attractiveness of maritime regions, boost local economies, and create job opportunities.

Despite the potential benefits of deep blue practices, their impact on the growth of maritime companies in South-South Nigeria remains underexplored. Understanding this relationship is crucial for policymakers, industry stakeholders, and researchers aiming to promote sustainable development in the maritime sector.

Therefore, this study investigates the effect of deep blue practices, specifically marine biotechnology, and ocean tourism, on the growth of selected maritime companies in South-South Nigeria.

*Statement of the Problem*

The maritime industry in South-South Nigeria is pivotal to the region's economic growth, contributing significantly to trade, employment, and the overall economic landscape (Akinyemi, 2020). Despite its importance, the sector faces numerous challenges that hinder its growth and sustainability. These challenges include environmental degradation, over-exploitation of marine resources, regulatory compliance issues, and the need for sustainable development practices. In response to these issues, maritime companies are increasingly adopting deep blue practices, such as marine biotechnology and ocean tourism, aimed at promoting the sustainable use of ocean resources.

Despite the adoption of these deep blue practices, maritime companies in South-South Nigeria continue to experience slow growth. This raises critical questions about the effectiveness of these practices in enhancing the growth of the maritime industry. There is a need to empirically investigate whether marine biotechnology and ocean tourism significantly impact the growth of maritime companies in the region.

To the author's knowledge, limited research has been conducted on this topic within the Nigerian context. Existing studies examining the effect of the blue economy on maritime industry growth primarily focus on developed nations and emphasize renewable energy and aquaculture, with relatively little consideration for developing countries like Nigeria. Furthermore, most studies exploring the influence of the deep blue economy on maritime industry growth have been restricted in scope and reach. Research by Wenhai et al. (2019), Martínez-Vázquez et al. (2021), Md. Nazrul (2022), Okemwa (2019), and Vázquez et al. (2021) has predominantly been conducted in developed nations and various emerging economies.

**Research Hypotheses**

This research is based on the following null hypotheses:

**$H_{02}$:** Marine biotechnology has no significant effect on the growth of selected maritime companies in south-south Nigeria

**$H_{02}$**: Ocean tourism has no significant effect on the growth of the maritime industry in Nigeria.

## LITERATURE REVIEW

### Concept of Blue Economy

The Blue Economy refers to the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystems (Pauli, 2018). It aims to balance economic development with environmental sustainability, ensuring that marine resources are managed responsibly to support long-term prosperity. This concept emphasizes the integration of economic activities with ocean conservation efforts, promoting practices that reduce pollution, enhance marine biodiversity, and support coastal communities (Barbesgaard, 2018).

Deep blue practices specifically focus on the economic potential of the seas, oceans, and coasts, aiming to foster innovation, sustainability, and growth in marine and maritime sectors (European Commission, 2018). It encompasses a range of activities including marine biotechnology, maritime transport, fisheries, and ocean tourism (Bennett et al., 2018).

### Concept of Marine Biotechnology

Marine biotechnology refers to the use of marine organisms and their derivatives to develop products and processes that benefit various sectors, including healthcare, environmental management, and industry (Arrieta et al., 2015). This field exploits the unique properties of marine life forms, which have adapted to extreme and diverse environments, to discover novel compounds and applications. For instance, marine biotechnology has led to the development of new pharmaceuticals, biofuels, and bioremediation techniques. The harnessing of marine genetic resources is particularly significant for advancing medical research and environmental sustainability.

Marine biotechnology involves the exploration and exploitation of marine organisms to develop products and processes beneficial for various sectors such as medicine, environmental management, and industry (Martins & Custódio, 2015). The unique chemical compounds and genetic materials found in marine species offer potential for innovative solutions to human challenges. Examples include the development of new antibiotics from marine bacteria, biofuels derived from algae, and bioactive compounds from marine sponges that have therapeutic potential (Leal et al., 2016).

**Concept of Ocean Tourism**

Ocean tourism encompasses recreational activities and travel that are directly related to the ocean, including coastal tourism, cruise tourism, and marine sports (Prideaux & Cooper, 2009). This sector is a major contributor to the global economy, providing employment opportunities and fostering regional development. Ocean tourism relies on the sustainable management of marine and coastal resources to ensure that environmental impacts are minimized while enhancing the visitor experience. Sustainable ocean tourism practices include promoting eco-friendly tourism, protecting marine biodiversity, and educating tourists about conservation.

Ocean tourism refers to travel and leisure activities related to the marine environment, such as scuba diving, sailing, and coastal visits (Orams, 2016). This sector significantly contributes to the economy by attracting tourists, generating revenue, and providing employment opportunities. Sustainable ocean tourism practices are essential to balance economic benefits with the conservation of marine ecosystems. These practices include responsible waste management, protecting marine habitats, and promoting eco-tourism activities that minimize environmental impact (Hall, 2016).

**Concept of Business Growth**

Business growth refers to the increase in a company's revenue, market share, or profitability over time. It can be achieved through various strategies such as expanding product lines, entering new markets, or improving operational efficiency (Grewal & Tansuhaj, 2016). Business growth is often measured by metrics such as sales volume, profit margins, and return on investment (ROI) (Barney & Hesterly, 2015).

**Empirical Review**

Wang et al. (2020) used a computable general equilibrium (CGE) model to examine the effect of marine biotechnology in China. A CGE model is a type of economic model that takes into account the interrelationships between different industries in an economy. The study used the CGE model to simulate the impact of different marine biotechnology development scenarios on the Chinese economy. The population of interest for the study was the Chinese economy. The authors selected this population because China is a leading country in marine biotechnology research and development. The study used a census sampling technique to select the sample, which means that they included all industries in the Chinese economy in the CGE model. The study used the CGE model to simulate the effect of different marine biotechnology development scenarios on the following economic indicators: GDP, Employment, Exports, Imports and Welfare. The study found that marine biotechnology has the potential to generate significant economic benefits in China. Under the most optimistic scenario, the study found that marine biotechnology could contribute up to 10% to China's GDP by 2035. The study concluded that marine biotechnology has a positive significant effect on growth. One criticism of the study relates to the disparity in analytical methods, as the present research employs SEM-PLS as opposed to another approach.

Carbone et al. (2019) used a spatial econometric analysis to examine the economic effect of marine biotechnology in the European Union. Spatial econometrics is a statistical method that is used to analyze data that has a spatial dimension. The authors used spatial econometrics to account for the spatial spillover effects of marine biotechnology, which means that the economic effect of marine biotechnology in one region can affect the economic performance of other regions. The population of interest for the study was the European Union. The authors selected this population because the European Union is a leading region in marine biotechnology research and development. The sample size for the study was 28 European Union countries for the period 2008 to 2016. The authors used a census sampling technique to select the sample, which means that they included all 28 European Union countries in the study. The authors used a spatial Durbin model to estimate the economic effect of marine biotechnology in the European Union. The spatial Durbin model takes into account the following factors: The direct effect of marine biotechnology on economic growth, The indirect effect of marine biotechnology on economic growth through its impact on other industries and the spatial spillover effects of marine biotechnology. The study found that marine biotechnology has a positive and significant effect on economic growth in the European Union. Specifically, the authors found that a 1% increase in marine biotechnology output leads to a 0.06% increase in economic growth. The study also found that the indirect effect of marine biotechnology on economic growth is stronger than the direct effect. This study is thorough, yet it diverges in terms of its geographical scope when compared to the current study, which is specifically centered on Nigeria. Therefore, the findings cannot be extended or applied universally.

In Nigeria, Naluba (2020) examined the effect of ocean tourism on growth of Ogoni region. The study covered three local government areas of Ogoni region in Rivers state. Respondents were drawn from 22 randomly sampled communities in the region. The descriptive survey research design was used for the study. Data was collected through copies of questionnaire administered to 400 male and female adults in the region. The data were collected on a 4- point Likert scale and analyzed using descriptive statistics while the Chi-square ($x^2$) statistical tool was used in testing the hypothesis formulated. Findings revealed that: on the positive effect of ocean tourism, out of a total of 400 respondents, 302 respondents representing 75.5% agreed that ocean tourism development will bring about socio- economic growth and development of the region. On the negative effect, out of a total of 400 respondents, 215 respondents representing 53.75% disagreed that ocean tourism development will have negative effect on the region. The result of the first hypothesis tested showed that the Chi-square (x2) value of 7.92 was less than the table value of 32.671 at 21 degree of freedom and 0.05 significant levels. The null hypothesis was therefore accepted. The result of the second hypothesis tested showed that the calculated x2 value of 30.11 was less than 32.671 at the same 0.05 significant level. The null hypothesis which states that ocean tourism development has no significant effect on the socio- economic growth and development of Ogoni region was therefore accepted. A significant criticism of the study is its utilization of a less robust analytical tool, unlike the current study, which employs the advanced SEM-PLS analysis method.

Adongoi (2018) investigated the effect of ocean tourism on the growth of Niger Delta region. In order to achieve this, a multi-stage sampling technique was employed to select respondents from three littoral states in the region. The population of the study comprised maritime business operators in the region, and a sample size of 400 was derived using the Taro Yamane formula. The study adopted the Routine Activity Theory of Lawrence Cohen and Marcus Felson as its theoretical guide. The research design adopted for the study was survey; while the instruments used for data collection were questionnaire and oral interview. The hypothesis formulated for the study was tested using Pearson Product Moment Correlation Coefficient (PPMC) and the result revealed that there is an insignificant positive effect of ocean tourism on growth in the Niger Delta region. While this study is thorough, a significant criticism revolves around its use of the Pearson Product Moment Correlation Coefficient for analysis, in contrast to the current study, which employs a more advanced tool in SEM-PLS.

**Theoretical Framework**

This study adopts the Blue Growth Theory. The Blue Growth Theory was first proposed in 2012 by the European Commission in its communication "Blue Growth: Opportunities for marine and maritime sustainable growth" (Duarte, 2015). The Blue Growth Theory is a holistic approach to the development of the maritime industry that emphasizes the importance of sustainability and environmental protection. It argues that the maritime sector has the potential to contribute significantly to economic growth and job creation, while also protecting the marine environment. The Blue Growth Theory is based on the following assumptions: The maritime sector has a significant untapped potential to contribute to economic growth and job creation. Sustainable maritime development is essential to protect the marine environment and ensure the long-term viability of the maritime sector. Innovation and technological development are key to unlocking the full potential of the maritime sector. Public-private partnerships are essential to achieve sustainable maritime development. The Blue Growth Theory stands for a sustainable and inclusive approach to the development of the maritime sector. It aims to promote economic growth and job creation, while also protecting the marine environment and ensuring the long-term viability of the maritime sector. Examples of Blue Growth: Sustainable fishing, offshore renewable energy, Marine biotechnology, Marine tourism and blue carbon.

The Blue Growth Theory is a relatively new concept, but it has gained traction in recent years as policymakers and businesses recognize the importance of the maritime sector to sustainable development. The European Commission has made Blue Growth a key priority, and other countries around the world are beginning to develop their own Blue Growth strategies. Some of the Benefits of Blue Growth are; Economic growth and job creation, Protection of the marine environment, Long-term viability of the maritime sector, Improved food security, Increased energy security, enhanced coastal resilience, Reduced poverty and inequality and increased social well-being. The Blue Growth Theory offers a promising vision for the future of the maritime sector. By embracing the principles of sustainability and innovation, the maritime sector can play a key role in achieving sustainable development and creating a better future for all. The Blue Growth Theory, through sustainable and holistic approaches to maritime development, can significantly contribute to the growth of the maritime industry in Nigeria by fostering environmentally responsible practices and harnessing the country's marine resources for economic and social progress, aligning with the principles of the deep blue economy.

## METHODOLOGY

The survey research design was used for this study. A survey research design is a research method that involves collecting data from a population using a questionnaire or interview. Survey research is a quantitative research method, which means that it produces numerical data that can be analyzed using statistical methods.

The study's population comprised 384 senior and mid-level employees from eight (8) selected private maritime companies actively operating within the Niger Delta region, chosen due to the region's substantial oil and gas reserves, the firms' well-established nature, their accessibility to publicly available data, which supports more robust research, and their valid registration and licensing by the Nigerian Maritime Administration and Safety Agency (NIMASA), responsible for regulating and overseeing various aspects of Nigeria's maritime sector, as indicated in Table 3.1 based on data obtained from a pilot study conducted with these entities.

**Table 3.1 Number of Private Maritime Firms and Employees**

| S/N | **Name of private maritime firms and Employees** | **Number of Employees** |
|---|---|---|
| 1 | Nigerian Maritime Services (NMS) | 56 |
| 2 | Egina Offshore Field Operators | 59 |
| 3 | Aquatrans Nigeria Limited | 47 |
| 4 | Marine Platforms Limited | 38 |
| 5 | Ocean Marine Solutions | 43 |
| 6 | Nigerian Trawler Owners Company | 57 |
| 7 | Blue Sea Energy Limited | 43 |
| 8 | Cruise and Maritime Services | 41 |
| | **Total** | **384** |

**Source: Field Survey, 2023**

Due to the limited size of the population under investigation, it is both feasible and practical to gather data from every individual within it, and thus, this study employed a census sampling approach to collect data from the entire population, comprising 384 senior and mid-level employees from eight selected private maritime companies, accomplished by distributing a questionnaire to all population members.

The study primarily relied on collecting fresh, specific, and directly relevant information tailored to the research objectives from primary sources, obtained by surveying participants through a closed-ended questionnaire. This questionnaire is structured using a 5-point Likert scale, ranging from "strongly agree" to "strongly disagree," to ensure clarity and reduce the likelihood of ambiguity, confusion, or misinterpretation of the questions.

**Construct Reliability**

To effectively demonstrate the reliability of the notion, it is commonly acknowledged that both Cronbach's alpha and composite reliability (CR) should ideally surpass the threshold of 0.7, as this value is widely recognized as the rule of thumb for ensuring a high level of internal consistency. The results of the Cronbach's Alpha, rho_A, composite reliability and average variance extracted are presented in Table 3.2

**Table 3.2: Construct Reliability and Validity of the Indicators**

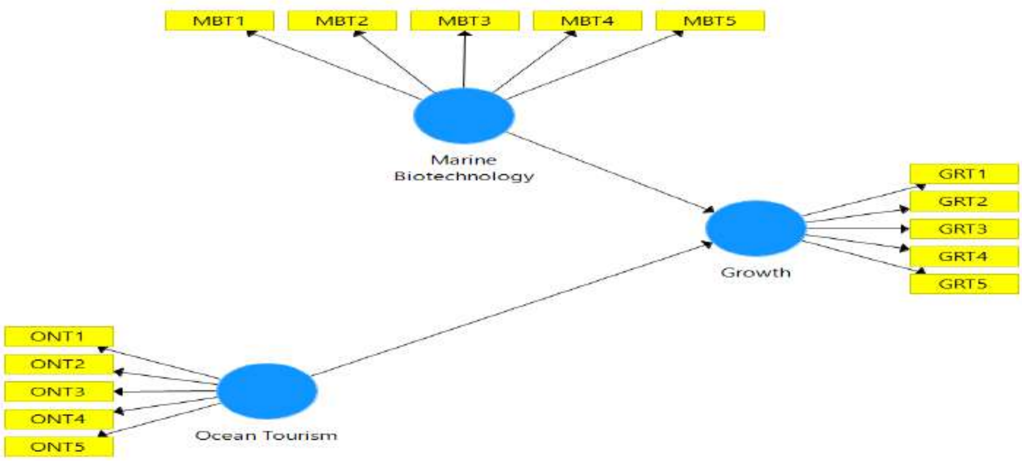
| Variables | Cronbach's Alpha | rho_A | Composite Reliability | Average Variance Extracted (AVE) |
|---|---|---|---|---|
| Maritime Biotechnology | 0.856 | 0.743 | 0.862 | 0.654 |
| Ocean Tourism | 0.897 | 0.741 | 0.799 | 0.668 |
| Growth | 0.901 | 0.762 | 0.899 | 0.676 |

**Source: Researcher's Compilation using SMART PLS.**

The Cronbach's Alpha of 0.897 and Composite Reliability of 0.799 are both above the 0.70 threshold, demonstrating strong internal consistency and reliability of the Ocean Tourism construct (Nunnally & Bernstein, 1994). The rho_A value of 0.741 also supports reliability above the threshold (Dijkstra & Henseler, 2015). With an AVE of 0.668, Ocean Tourism exceeds the 0.50 threshold, indicating good convergent validity (Fornell & Larcker, 1981). This shows that the indicators effectively capture the construct's variance.

The Cronbach's Alpha of 0.901 and Composite Reliability of 0.899 are well above the recommended 0.70 threshold, indicating excellent internal consistency and reliability of the Growth construct (Nunnally & Bernstein, 1994). The rho_A value of 0.762 also suggests robust reliability (Dijkstra & Henseler, 2015). An AVE of 0.676 for Growth indicates that the construct has good convergent validity, as it exceeds the threshold of 0.50 (Fornell & Larcker, 1981). This means the indicators collectively capture a significant amount of the construct's variance.

The study employed partial least square – structural equation modeling (PLS-SEM) to examine the effect of each independent variable on the dependent variable. Smart PLS was used to code and analyze the data for this study to achieve all the set objectives.



## RESULT AND DISCUSSIONS

### Data Presentation

**Table 4.1: Distribution and Retrieval of Questionnaire**

| S/No | Name of Airline | Number Distributed | Number Retrieved | Number not Retrieved |
|---|---|---|---|---|
| 1. | Nigerian Maritime Services (NMS) | 56 | 53 | 3 |
| 2. | Egina Offshore Field Operators | 59 | 57 | 2 |
| 3. | Aquatrans Nigeria Limited | 47 | 47 | 0 |
| 4. | Marine Platforms Limited | 38 | 36 | 2 |
| 5. | Ocean Marine Solutions | 43 | 40 | 3 |
| 6. | Nigerian Trawler Owners Company | 57 | 55 | 2 |
| 7. | Blue Sea Energy Limited | 43 | 43 | 0 |
| 8. | Cruise and Maritime Services | 41 | 40 | 1 |
| | **Total** | **384(100%)** | **371(96.61%)** | **13(3.39%)** |

**Source: Field Survey, 2023.**

Table 4.1 provides details on the distribution and collection of questionnaires sent to private maritime companies in the South-South region of Nigeria. It shows the distribution of questionnaires to companies including Nigerian Maritime Services (NMS), Egina Offshore Field Operators, Aquatrans Nigeria Limited, Marine Platforms Limited, Ocean Marine Solutions, Nigerian Trawler Owners Association, Blue Sea Energy Limited, and Cruise and Maritime Services. A total of 384 questionnaires were distributed, and 371 were returned. The breakdown of responses per company was as follows: Nigerian Maritime Services (NMS) - 53, Egina Offshore Field Operators - 57, Aquatrans Nigeria Limited - 47, Marine Platforms Limited - 36, Ocean Marine Solutions - 40, Nigerian Trawler Owners Company - 55, Blue Sea Energy Limited - 43, and Cruise and Maritime Services - 40. This represents a recovery rate of 96.61%, which is considered excellent according to Fincham (2008), who notes that a response rate of at least 50% is generally acceptable in social science research, with higher rates of 60-70% being preferable for better reliability and validity.

### Descriptive Statistics

**Table 4.2: Descriptive Statistics**

| Statistic | GRT | MBT | ONT |
|---|---|---|---|
| **Mean** | 3.348 | 3.075 | 4.412 |
| **Median** | 4.104 | 3.243 | 4.303 |
| **Maximum** | 5.000 | 5.000 | 5.000 |
| **Minimum** | 1.000 | 1.000 | 1.000 |
| **Std. Dev.** | 1.642 | 1.602 | 1.378 |
| **Skewness** | -1.483 | -1.554 | -0.202 |
| **Excess Kurtosis** | 2.120 | 2.219 | 2.015 |

Table 4.2 presents descriptive statistics for three variables: Growth (GRT), Marine Biotechnology (MBT), and Ocean Tourism (ONT). For Growth, the mean is 3.348, indicating a moderate to high perception of growth among respondents. This is supported by the median of 4.104, which is higher than the mean, suggesting a positive skew with most respondents rating growth favorably (Pallant, 2020). The standard deviation of 1.642 shows substantial variability in responses, reflecting diverse opinions on growth (Cohen, 2013). The negative skewness of -1.483 further confirms that respondents tend to rate growth higher, with a long tail towards lower ratings (George & Mallery, 2019). The excess kurtosis of 2.120 indicates a leptokurtic distribution, meaning there are more extreme values in growth ratings compared to a normal distribution (Mertler & Vannatta, 2017).

For Marine Biotechnology, the mean of 3.075 suggests a somewhat lower average rating compared to growth, as indicated by the median of 3.243, which is lower than the mean. This discrepancy shows that more respondents rated Marine Biotechnology towards the lower end of the scale (Field, 2018). The standard deviation of 1.602 reflects high variability in opinions about Marine Biotechnology, similar to

Growth. The skewness of -1.554 indicates a negative skew, where high ratings are more common, and the excess kurtosis of 2.219 suggests a pronounced peak and heavier tails in the distribution (Leech, et al., 2015). Ocean Tourism has a mean of 4.412, indicating a strong positive perception. The median of 4.303 is close to the mean, signifying a balanced distribution of high ratings (Hair et al., 2014). The standard deviation of 1.378 is lower, showing less variability in responses compared to the other variables. The skewness of -0.202 is nearly zero, indicating a symmetrical distribution, and the excess kurtosis of 2.015 reveals a leptokurtic distribution with a moderate peak (Mertler & Vannatta, 2017).

**Table 4.3: Factor Loading**

| Latent Variable | Manifest Variable | Loading | t-statistic |
|---|---|---|---|
| Marine Biotechnology (MBT) | MBT1 | 0.789 | 22.449 |
| | MBT2 | 0.751 | 19.887 |
| | MBT3 | 0.790 | 23.738 |
| | MBT4 | 0.784 | 15.094 |
| | MBT5 | 0.762 | 17.160 |
| Ocean Tourism (OTN) | ONT1 | 0.829 | 24.618 |
| | ONT2 | 0.772 | 18.903 |
| | ONT3 | 0.776 | 17.880 |
| | ONT4 | 0.821 | 12.299 |
| | ONT5 | 0.830 | 12.177 |
| Growth (GRT) | GRT1 | 0.801 | 11.988 |
| | GRT2 | 0.818 | 11.799 |
| | GRT3 | 0.811 | 13.610 |
| | GRT4 | 0.829 | 14.421 |
| | GRT5 | 0.790 | 15.232 |

**Source: Researcher's Compilation from Smart PLS**

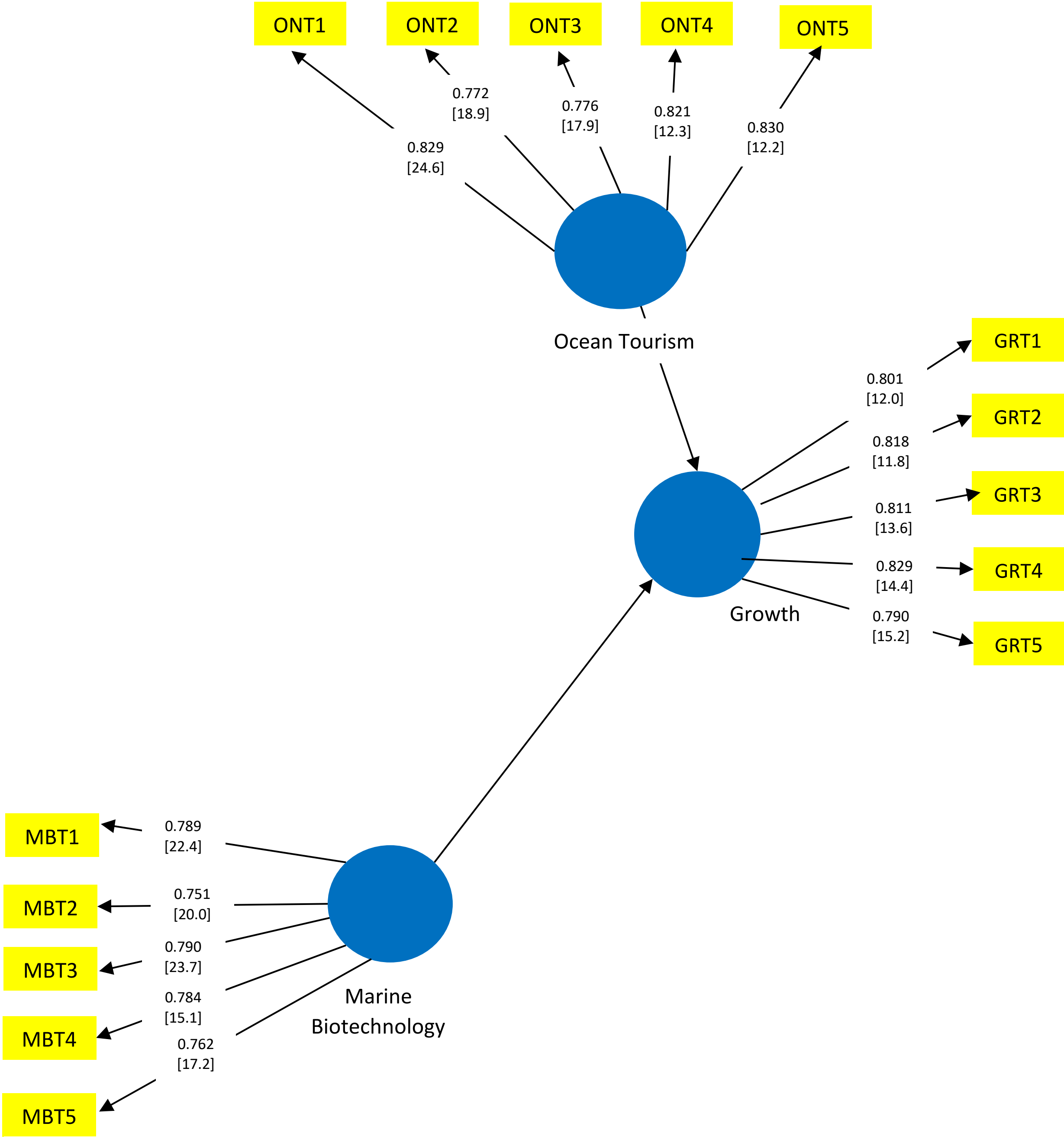
The factor loadings and t-statistics for the manifest variables in the context of Marine Biotechnology (MBT), Ocean Tourism (ONT), and Growth (GRT) reflect the strength and significance of the relationships between the latent and observed variables.

For Marine Biotechnology (MBT), the factor loadings are consistently high across all manifest variables, ranging from 0.751 to 0.790, with corresponding t-statistics well above the critical value of 1.96 (Hair et al., 2014). This indicates that each manifest variable, such as MBT1 through MBT5, has a strong and statistically significant contribution to the latent variable of Marine Biotechnology. Specifically, MBT1 has a loading of 0.789 and a t-statistic of 22.449, while MBT4 has a loading of 0.784 and a t-statistic of 15.094. These high loadings and t-statistics confirm that the indicators effectively measure the underlying construct of Marine Biotechnology (Gefen, Straub, & Boudreau, 2000).

Ocean Tourism (ONT) also shows robust factor loadings, with values ranging from 0.772 to 0.830. Manifest variables like ONT1 (0.829, t-statistic of 24.618) and ONT5 (0.830, t-statistic of 12.177) exhibit high loadings, demonstrating their strong association with the latent variable of Ocean Tourism. These values exceed the common threshold of 0.70 for adequate factor loadings (Tabachnick & Fidell, 2013), ensuring that the indicators reliably reflect the construct of Ocean Tourism.

For Growth (GRT), the factor loadings for the manifest variables range from 0.790 to 0.829, indicating strong relationships with the latent variable. Variables such as GRT1 (0.801, t-statistic of 11.988) and GRT4 (0.829, t-statistic of 14.421) have high loadings and significant t-statistics, reinforcing their relevance in measuring Growth (Bagozzi & Yi, 1988). These loadings surpass the acceptable threshold of 0.70, suggesting that the indicators are reliable in capturing the construct of Growth.

**Figure 4.1: PLS Algorithm (Item Loadings and t-statistics)**




Note: t-statistics are in square brackets, [].

**Source: Researcher's Construction from Smart PLS, 2024.**

**Figure 4.2: Structural Model (Path Coefficients and $R^2$)**

Figures 4.1 and 4.2 illustrate the significant impact of marine biotechnology and ocean tourism as independent variables in predicting the growth of selected maritime companies in South-South Nigeria. Both variables demonstrate statistical significance, as evidenced by their t-values and probability values from the analysis. To solidify the basis for hypothesis testing, it is crucial to examine component scores associated with each variable. Establishing connections between these latent variables—specifically assessing how marine biotechnology and ocean tourism influence the growth of maritime companies—enables a more comprehensive understanding of their collective effect on growth in the region. This detailed analysis allows researchers to better grasp the interactions and contributions of these independent variables to the development of the maritime sector in South-South Nigeria.

## Hypotheses Testing

**Table 4.4: Path Coefficient of the Model for Hypotheses Testing**

| Hypothesis | Beta | t-value | p-value | Decision | $f^2$ |
|---|---|---|---|---|---|
| $H_{o1}$: Marine Biotechnology → Growth | -0.211* | -2.979 | 0.003 | Rejected Ho | 0.255 |
| $H_{o2}$: Ocean Tourism → Growth | 0.025 | 1.025 | 0.153 | Accepted Ho | 0.001 |

*Notes: *indicates significance at 5% significance level.*
*Source: Smart-PLS Results*

**Hypothesis One**
**$H_{01}$:** Marine biotechnology has no significant effect on the growth of selected maritime companies in south-south Nigeria

In the context of hypothesis testing for the effect of Marine Biotechnology on Growth, the result shows a negative relationship with a beta coefficient of -0.211, a t-value of -2.979, and a p-value of 0.003. According to the threshold criteria, a p-value less than 0.05 indicates statistical significance, allowing us to reject the null hypothesis (Ho1) which posits no effect of Marine Biotechnology on Growth.

The t-value of -2.979, which is greater than the critical value of ±1.96 for a 5% significance level, supports this conclusion, reinforcing that the relationship between Marine Biotechnology and Growth is significant. The effect size, represented by $f^2$, is 0.255, which indicates a medium effect according to Cohen's (1988) conventions. This medium effect size suggests that Marine Biotechnology has a moderate impact on the growth of the maritime companies.

Thus, the significant p-value and substantial t-value, coupled with the medium effect size, collectively suggest that marine biotechnology has a negative insignificant effect on the growth of selected maritime companies in south-south Nigeria.

**Hypothesis Two**
**$H_{02}$:** Ocean Tourism has no significant effect on the growth of selected maritime companies in south-south Nigeria.
In the context of hypothesis testing for the effect of Ocean Tourism on Growth, the result shows a positive but non-significant relationship with a beta coefficient of 0.025, a t-value of 1.025, and a p-value of 0.153. According to the threshold criteria, a p-value greater than 0.05 indicates a lack of statistical significance, leading to the acceptance of the null hypothesis (Ho2), which posits no effect of Ocean Tourism on Growth. The t-value of 1.025, which is less than the critical value of ±1.96 for a 5% significance level, further supports this conclusion, indicating that the relationship between Ocean Tourism and Growth is not statistically significant. The effect size, represented by $f^2$, is 0.001, which indicates a very small effect according to Cohen's (1988) conventions. This very small effect size suggests that Ocean Tourism has a negligible impact on the growth of the maritime companies.

Therefore, the non-significant p-value and low t-value, coupled with the very small effect size, collectively suggest that Ocean Tourism does not significantly influence the growth of the selected maritime companies in South-South Nigeria.

**Table 4.5: $R^2$ of the Model**

| Dependent Variable | $R^2$ |
|---|---|
| Growth | 0.698 |

*Source: Researcher's Computation from Smart-PLS.*
The result presented in Table 4.5 shows the $R^2$ value 0.698. This denotes that, changes in measures of deep blue economy – marine biotechnology and ocean tourism– account for 69.8 percent of the changes observed in the growth of selected maritime companies in South-South Nigeria. The remaining 30.2% of changes in the growth of the selected maritime companies in South-South Nigeria are attributed to other

factors which accounts for factors affecting the growth of the maritime industry in Nigeria not included in the model of the study and the errors of measurement.

**Discussion of Findings**

*Marine biotechnology and the growth of selected maritime companies in south-south Nigeria*

The first objective of this study was to examine the effect of marine biotechnology on the growth of selected maritime companies in south-south Nigeria. The result obtained show marine biotechnology has a negative insignificant effect on the growth of selected maritime companies in south-south Nigeria. Meaning that Marine biotechnology may not be a core or critical component of the operations and business models of the selected maritime companies, and hence its effect on their growth is limited. This means that investments in marine biotechnology are not contributing positively to the growth of these companies. Instead, they may be detracting from growth, although this impact is statistically insignificant. Therefore, maritime companies should reconsider their strategies regarding marine biotechnology, as current efforts are not effectively driving growth. It suggests that resources might be better utilized in other areas that have a more substantial impact on growth, prompting a strategic shift in investment and operational focus. This result disagrees with Wang et al. (2020) who used a computable general equilibrium (CGE) model to examine the effect of marine biotechnology in China and found marine biotechnology to have a positive significant effect on growth.

*Ocean Tourism and the growth of selected maritime companies in south-south Nigeria*

In the second objective, this study sought to ascertain the extent to which ocean tourism influence the growth of selected maritime companies in south-south Nigeria. The result from the analysis suggest that Ocean Tourism does not significantly affect the growth of the selected maritime companies in South-South Nigeria. This suggests that investments and efforts in promoting ocean tourism are not yielding measurable positive effects on the growth of these companies. Therefore, maritime companies might need to reassess their strategies related to ocean tourism, as the current initiatives do not significantly drive growth. This finding implies that focusing on alternative areas or enhancing the effectiveness of ocean tourism strategies may be necessary to achieve desired growth outcomes. This result aligns with Naluba (2020) who examined the effect of ocean tourism on growth of Ogoni region in Rivers state. The result further disagrees with Adongoi, (2018) who found a positive insignificant effect of ocean tourism on growth in the Niger-Delta region.

## CONCLUSION AND RECOMMENDATIONS

The research utilized structural equation modeling with partial least squares (PLS-SEM) to analyze the influence of different elements of the deep blue economy on selected maritime companies in South-South Nigeria. Based on the results, it can be concluded that both marine biotechnology and ocean tourism do not significantly influence the growth of the selected maritime companies in South-South Nigeria. Marine biotechnology exhibits a negative and insignificant effect, while ocean tourism shows no significant impact on company growth. These findings suggest that current strategies and investments in these areas are not contributing effectively to the growth of maritime companies in the region. Therefore, it is imperative for these companies to reconsider their focus and possibly explore other growth-enhancing initiatives.

Based on the findings of this study, the study makes the following recommendations:

i. Maritime companies should reconsider their investment strategies in marine biotechnology. Instead of allocating substantial resources to this sector, companies should focus on improving the efficiency and innovation of their existing operations. Conducting a detailed cost-benefit analysis can help identify more profitable areas for investment within the blue economy.
ii. Maritime companies should collaborate with local governments and tourism boards to develop and promote comprehensive tourism packages. These packages should include infrastructure improvements, marketing campaigns, and partnerships with travel agencies to attract more tourists and increase the economic benefits from this sector.

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## Appendix

### Research Questionnaire and Data

| | **Marine Biotechnology (MBT)** | **SA** | **A** | **N** | **D** | **SD** |
|---|---|---|---|---|---|---|
| **MBT1** | Marine biotechnology plays a role in promoting the sustainable growth of the maritime industry in Nigeria | | | | | |
| **MBT2** | The Nigerian government is doing enough to promote research and development in marine biotechnology | | | | | |
| **MBT3** | My organisation encourages investments in marine biotechnology research and development | | | | | |
| **MBT4** | I believe that marine biotechnology can help to solve some of the challenges facing the maritime industry in Nigeria, such as overfishing and pollution | | | | | |
| **MBT5** | I am optimistic about the future of marine biotechnology in Nigeria | | | | | |
| | **Ocean Tourism (ONT)** | | | | | |
| **ONT1** | Ocean tourism plays a role in promoting the sustainable growth of the maritime industry in Nigeria | | | | | |
| **ONT2** | The Nigerian government is doing enough to promote sustainable ocean tourism | | | | | |
| **ONT3** | My organisation provides ocean tourism experiences that are certified sustainable | | | | | |
| **ONT4** | My organisation is concerned about the environmental impacts of ocean tourism | | | | | |
| **ONT5** | I believe that ocean tourism has helped to raise awareness of the importance of marine conservation | | | | | |
| | **Growth (GRT)** | | | | | |
| **GRT1** | The maritime industry through my organisation contributes significantly to Nigeria's GDP | | | | | |
| **GRT2** | The maritime industry through my organisation creates jobs and supports livelihoods in Nigeria | | | | | |
| **GRT3** | The maritime industry through my organisation is a key driver of economic growth in Nigeria's coastal communities | | | | | |
| **GRT4** | The Nigerian government is doing enough to support the economic growth of the maritime industry | | | | | |
| **GRT5** | I am optimistic about the future economic growth of the maritime industry in Nigeria | | | | | |