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The Role of Human Capital Development in Advancing Nigeria's Maritime Industry

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Abstract

This study investigates the role of human capital development in advancing Nigeria's maritime industry, focusing on the impact of education, healthcare, and tertiary enrolment on sectoral growth. Using a dynamic log-linear regression model and data from 1995 to 2023, the research reveals that past maritime performance significantly influences current growth, with a 1% increase in lagged maritime GDP contributing to a 0.857% rise in current GDP. Education and health expenditures also positively impact the sector, as a 1% increase in health spending boosts maritime GDP by 0.709%, while a similar increase in education spending raises it by 0.21%. Notably, tertiary enrolment exerts the strongest effect, with a 1% increase leading to a 2.464% rise in maritime GDP, underscoring the critical role of advanced education and specialized training. These findings highlight the necessity of a skilled and healthy workforce in driving productivity, innovation, and competitiveness in the maritime sector. The study recommends

expanding access to specialized maritime education, enhancing healthcare and welfare for maritime workers and educators, and fostering industry-academia collaboration to align curricula with sectoral needs. These strategies are crucial for strengthening workforce capacity, improving operational efficiency, and ensuring long-term sustainability in Nigeria's maritime industry, ultimately contributing to national economic development and global competitiveness.

Keywords: Human Capital, Maritime, Education, Health, Maritime Sector GDP, Development

1.0 INTRODUCTION

The maritime sector is critical driver of Nigeria's economic development, serving as a conduit for international trade, transportation, and commerce. As a coastal nation with extensive waterways and ports, Nigeria has substantial potential to leverage its maritime industry for economic diversification and sustainable growth. However, the sector's effectiveness in fostering national development largely depends on a skilled and competent workforce, highlighting the crucial role of human capital development (HCD) for maritime sector advancement. Human capital, comprising education, training, health, and overall labour capacity, is a key catalyst for economic advancement and industrial productivity (Ogunleye et al., 2017).

Nigeria has endeavoured to enhance its human capital by investing in education and health, acknowledging that a skilled workforce is crucial for productivity and competitiveness (Awogbemi, 2023). Research demonstrates a strong correlation between human capital investment and economic growth, particularly when resources are strategically allocated to critical sectors such as education, health, and vocational training (Bachama et al., 2021). In the maritime industry, the development of human capital is crucial due to the sector's reliance on specialised expertise in port administration, maritime logistics, shipping operations, and regulatory compliance. Despite its recognized significance, Nigeria's maritime sector continues to face challenges related to labour capacity, deficiencies in technical skills, and insufficient investment in training initiatives (Abiola and Wasiu, 2021). The limited funding for maritime education and skill development has impeded the sector's capacity to realise its full potential. Moreover, global progress in maritime technology necessitates a workforce that is both highly trained and flexible to developments in automation, digitalisation, and sustainable shipping practices. Understanding the relationship between sectoral growth and workforce development is vital for guiding strategic investments and

policies required to raise the production, competitiveness, and long-term sustainability of Nigeria's maritime sector (Akaakohol and Ijirshar, 2018).

A well-trained workforce is essential for efficient port operations, shipping management, and maritime logistics. However, a significant skills gap remains, with many professionals lacking specialized training in modern maritime technologies, regulatory compliance, and digitalization, thereby limiting productivity and competitiveness (Awogbemi, 2023). Empirical evidence suggests that human capital development plays a crucial role in economic growth, particularly in sectors ~~that~~ requiring technical expertise (Bachama, Hassan, and Ibrahim, 2021). Nonetheless, investments in education and vocational training for maritime professionals in Nigeria remain insufficient. Existing government policies and private sector initiatives have not sufficiently addressed the need for continuous skill development and workforce capacity building (Ogunleye et al., 2017). Given these challenges, this study seeks to examine the impact of human capital development on Nigeria's maritime industry and propose strategies for workforce enhancement to drive sectoral growth and national economic development. Specifically, the study aims seeks to investigate:

(a) The effect of education expenditure on maritime sector growth in Nigeria.
(b) The effect of health expenditure on maritime sector growth in Nigeria.
(c) The effect of tertiary enrolment on maritime sector growth in Nigeria.

The significance of this study lies in its examination of the pivotal role human capital development plays in the growth and competitiveness of Nigeria's maritime sector. As a country with a strategic location and heavy reliance on maritime trade, enhancing the capacity of the workforce is important for improving port efficiency, shipping operations, and overall contributions to the nation's economy. Investing in education, training, and skill development within the maritime sector can lead to increased productivity and operational efficiency.

Additionally, this study has important policy implications**,** offering insights for government agencies, policymakers, and industry stakeholders. By providing actionable recommendations, the research aims to guide the formulation of effective policies that enhance workforce skills and promote vocational training within the maritime sector. Furthermore, the study will underscore

emphasize the need to attract private sector investment in maritime education, as suggested by Awogbemi (2023).

2.0 LITERATURE REVIEW

2.1 Conceptual Clarifications

Human Capital

Human capital refers to the stock of knowledge, skills, competencies, and attributes embodied in individuals that contribute to economic productivity. According to Becker (1993), human capital represents the economic value of an individual's education, training, and experience, which enhances their ability to generate income and contribute to national development. It includes both formal education and informal skills acquired through work experience.

Human Capital Development

Human capital development is the process of enhancing and improving the skills, knowledge, and competencies of individuals through education, training, healthcare, and other capacity-building initiatives to increase productivity and economic growth. Schultz (1961) defines it as the investment in people through education and skill acquisition, leading to higher efficiency and economic returns. It involves policies and strategies that ensure a well-trained, healthy, and capable workforce to drive national development.

Maritime Sector

The maritime industry encompasses all activities related to the transportation of goods and people by sea, including shipping, port management, logistics, offshore services, and maritime law enforcement. Stopford (2009) defines the maritime sector as a critical component of global trade, comprising industries involved in shipbuilding, marine engineering, cargo handling, and regulatory compliance. It plays a vital role in economic development by facilitating international trade and contributing to employment generation.

2.2 Theoretical Literature Review

2.2.1 Human Capital Theory

This theory is founded on the works by Schultz (1961) and Becker (1964). Human Capital Theory posits that investments in education, training, and health enhance workers' productivity, ultimately leading to economic growth. The theory argues that just like physical capital, human skills and knowledge can be developed through targeted investments, yielding long-term economic benefits. Schultz (1961) initially introduced the concept by emphasizing education's role in improving labour productivity, while Becker (1964) further expanded it by analysing the economic returns of education and skill acquisition. The theory has been widely applied in workforce development and economic planning, with studies showing a strong link between human capital investment and national economic performance (Psacharopoulos and Patrinos, 2018). In the maritime sector, continuous training and skill acquisition are necessary for workforce efficiency, technological adaptation, and regulatory compliance. However, a lack of adequate human capital investment in Nigeria's maritime industry limits its global competitiveness (Hanushek and Woessmann, 2020).

2.2.2 Resource-Based View (RBV) Theory

Proposed by Barney (1991), the Resource-Based View (RBV) Theory emphasizes that a firm's competitive advantage is derived from its internal resources and capabilities, which must be valuable, rare, inimitable, and non-substitutable (VRIN). Barney (1991) argued that firms that strategically develop and manage their resources, including human capital, can achieve sustained competitive advantages. In the context of Nigeria's maritime sector, skilled labour, technological expertise, and efficient port management are critical internal resources that determine growth and global positioning (Wernerfelt, 1984). The RBV approach suggests that investing in human capital such as maritime education, leadership development, and technical training enhances sectoral competitiveness and long-term sustainability (Peteraf, 1993). Both theories highlight the significance of human capital development in economic and industry growth. While Human Capital Theory focuses on the broader economic impact of education and skill acquisition, RBV Theory underscores the strategic importance of human resources in achieving competitive advantage.

2.3 Empirical Literature Review

Human capital development is widely recognized as a key driver of economic and sectoral growth, particularly in industries requiring specialized knowledge, such as the maritime sector. Various studies have explored the relationship between human capital investment and economic productivity, with a focus on Nigeria's economy and its maritime industry.

A study by Awogbemi (2023) titled *Human Capital Development and Nigeria's Economic Growth* examined the impact of human capital on Nigeria's overall economic performance. The study utilized contextual analysis and documentary sources to assess the effects of investments in education and health on national productivity. Findings revealed a strong correlation between human capital development and economic growth, emphasizing the need for private sector investment in workforce training (Awogbemi, 2023).

The study by Igberi and Ogunniyi (2013), titled 'Has Maritime Transport Sector Impacted on the Growth of Nigeria's Economy?' investigates the effect of Nigeria's maritime sector on economic growth, particularly in the industrial sector. The study employs Ordinary Least Squares (OLS) and Seemingly Unrelated Regression (SUR) methods using secondary data from the Central Bank of Nigeria (CBN). Findings indicate that the maritime transport sector has a negative but statistically insignificant impact on economic growth. The study concludes that the Nigerian government should formulate policies that encourage foreign and private sector participation to enhance the efficiency and contribution of the maritime sector.

Another study by Jamoh (2018), titled Enhancing the Performance of the Maritime Sector in Nigeria: Effect of Macroeconomic Variables, examines the impact of macroeconomic factors on the performance of Nigeria's maritime sector. Using OLS modeling with the HAC Newey-West method, the study analyzes data from 1981 to 2016 sourced from the CBN Statistical Bulletin. Results reveal that exchange rate fluctuations and foreign reserve levels negatively affect the maritime sector's performance, while capital expenditure positively impacts sectoral growth. However, statistical evidence suggests that despite external shocks such as economic recessions, the maritime sector continues to grow. The study recommends that the Nigerian government implement policies to support sector resilience, particularly during economic downturns.

Furthermore, Amuka and Ezinna (2021), in their study Maritime Sector: Key Driver of Economic Growth and Sustainable Development in Nigeria, highlight the role of technology and digitalization in improving Nigeria's maritime industry. The study assesses performance indicators such as direct shipping connectivity, port management, and environmental sustainability. Findings suggest that technological advancements such as automation and digitalization can enhance the efficiency of Nigeria's ports, aligning them with global best practices as recommended by the International Maritime Organization (IMO) and the United Nations Conference on Trade and Development (UNCTAD). However, the study also identifies infrastructural deficits and regulatory inefficiencies as major barriers to the sector's growth. The authors recommend investment in smart port technologies, workforce training, and regulatory reforms to improve maritime sector competitiveness.

Similarly, Ogunleye et al. (2017) conducted a study titled *Human Capital Development and Economic Growth in Nigeria*, using Ordinary Least Squares (OLS) regression analysis to evaluate the impact of human capital indicators such as school enrollment and government expenditure on health and education. The study, covering the period from 1981 to 2015, found that secondary and tertiary school enrollment had a statistically significant impact on economic growth, while primary education had an insignificant effect. The study recommended increased government funding for higher education to improve economic development.

Abiola and Wasiu (2021) in their research *Human Capital Development and Economic Growth in Nigeria* explored how public expenditure on health and education affects long-term economic productivity. Their study, which employed the Autoregressive Distributed Lag Model (ARDL), found a positive long-run relationship between government investment in human capital and economic expansion.

In a study by Jaiyeoba (2015) titled *Human Capital Investment and Economic Growth in Nigeria*, the Johansen co-integration technique and trend analysis were applied to investigate the long-term effects of education and health expenditures on GDP growth. The findings confirmed that secondary and tertiary school enrolments contributed positively to economic development, while primary education had no significant impact.

Omokugbo and Imogiemhe (2020) in their study *Impacts of Human Capital Development on Real Sectors Growth in Nigeria* used time-series data from 1990 to 2018 to analyze the effects of human capital development on the petroleum, agriculture, and manufacturing sectors. The study found that government expenditure on education and health positively influenced growth in the petroleum and gas industry but had limited impact on agriculture due to skill gaps.

3.0 METHODOLOGY

This study adopted the ex post facto research design due to the nature of the study variables. The data were obtained from secondary sources, including the Central Bank of Nigeria statistical bulletin and World Bank database. The study covers the period from 1995 to 2023, spanning twenty-eight years.

The functional and econometric models for this study are specified as follows:

$$MGDP = f(EduExp, HealthExp, TertEnr) \quad \text{(Functional Model)}$$

$$MGDP = \beta_0 + \beta_1 EduExp + \beta_2 HealthExp + \beta_3 TerEnr + \epsilon_t \quad \text{(Econometric Model)}$$

Where:

EduExp = Expenditure on Education

HealthExp = Expenditure on Health

TerEnr = Tertiary Enrolment Rate

MGDP = Maritime Sector Contribution to Gross Domestic Product

and ϵ_t is the random term. β_0 is the intercept of the model, while the a-priori expectations of the variables are positive (β_0, $\beta_{1\text{-}3} > 0$). The specified model above is estimated using the dynamic log-linear regression technique.

4.0 ESTIMATION AND ANALYSIS

In this section, the results of the model estimation are presented and discussed starting with the descriptive statistics before moving to the regression technique.

Table 4.1 Descriptive Statistics

	MGDP	EduExp	HealthExp	TER
Mean	64245.54	258.8387	157.8246	10.56330
Median	43461.46	163.9775	98.21932	10.82217
Maximum	176075.5	752.9764	468.6388	16.13820
Minimum	3100.235	9.746400	3.175300	4.075937
Std. Dev.	58138.89	233.1152	150.3262	3.235565
Skewness	0.614065	0.711259	0.732912	-0.314122
Kurtosis	2.011486	2.251866	2.234395	2.432754
Jarque-Bera	3.003268	3.121443	3.304540	0.865721
Probability	0.222766	0.209985	0.191614	0.648651
Sum	1863121.	7506.322	4576.913	306.3357
Sum Sq. Dev.	9.46E+10	1521596.	632743.3	293.1287
Observations	29	29	29	29

Source: Author's Computation (2025)

The descriptive statistics presented in Table 4.1 provide a comprehensive overview of the variables under study, offering insights to measures of central tendency, variability, and distributional properties. The mean values reveal that the Maritime Sector Contribution to Gross Domestic Product (MGDP) is substantially higher (64,245.54) compared to Expenditure on Education (EduExp = 258.8387), Expenditure on Health (HealthExp = 157.8246), and Tertiary Enrolment Rate (TER = 10.56330). This suggests that the maritime sector plays a significant role in the economy relative to investments in human capital development. However, the large standard deviation of MGDP (58,138.89) indicates considerable variability in its contribution across observations, reflecting disparities in maritime sector performance or economic structures among the sampled entities. In contrast, the relatively lower standard deviations for EduExp (233.1152),

HealthExp (150.3262), and TER (3.235565) suggest more consistent levels of investment and enrollment rates.

The skewness values for MGDP, EduExp, and HealthExp are positive (0.614065, 0.711259, and 0. 732912, respectively), indicating that their distributions are right-skewed, with a longer tail on the right. This implies that a few observations have significantly higher values, resulting in a mean greater than the median. For TER, the negative skewness (-0.314122) suggests a left-skewed distribution, with a concentration of values above the mean. The kurtosis values for all variables are below 3, indicating platykurtic distributions with lighter tails and flatter peaks compared to a normal distribution. This is further supported by the Jarque-Bera test results, where the probabilities for all variables exceed 0.05, indicating that the data do not significantly deviate from normality. This implies that the data for MGDP, EduExp, HealthExp, and TER are not significantly different from a normal distribution, which is advantageous for many statistical modeling techniques. The data's relatively normal distribution supports the use of parametric statistical methods for subsequent analysis, though the skewness and kurtosis values suggest caution in interpreting extreme values.

Table 4.2 Dynamic Log-Linear Regression Model

Dependent Variable: MGDP
Method: ARDL
Sample (adjusted): 1995 2023
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.146067	0.383425	2.989025	0.0066
LOG(MGDP(-1))	0.857318	0.052337	16.38067	0.0000
LOG(EDUEXP)	0.210441	0.102604	2.051014	0.0293
LOG(HEALTHEXP)	0.708831	0.093182	7.606992	0.0000
LOG(TERENR)	2.463815	0.157379	15.65532	0.0000

R-squared	0.996672	Mean dependent var	10.52487
Adjusted R-squared	0.996093	S.D. dependent var	1.266161
S.E. of regression	0.079140	Akaike info criterion	-2.074776
Sum squared resid	0.144051	Schwarz criterion	-1.836882
Log likelihood	34.04686	Hannan-Quinn criter.	-2.002049
F-statistic	1722.054	Durbin-Watson stat	1.828433
Prob(F-statistic)	0.000000		

Source: Author's Computation (2025)

The regression model presented in Table 4.2 is a dynamic log-linear model that examines the relationship between human capital development variables and maritime sector growth in Nigeria.

The coefficient for the lagged maritime GDP (MGDP(-1)) is 0.857, indicating that a 1% increase in past maritime GDP is associated with a 0.857% change in current maritime GDP, given the log-linear specification. This strong positive relationship underscores the sector's reliance on historical performance, suggesting that previous growth strongly influences future growth. This persistence emphasizes the importance of maintaining consistent policies and investments to sustain long-term development in the maritime sector.

The model also reveals that expenditures on education and health have positive and statistically significant effects on maritime GDP, with coefficients of 0.210 and 0.709, respectively. This means that a 1% increase in education expenditure is associated with a 0.21% increase in maritime GDP, while a 1% increase in health expenditure leads to a 0.709% increase in maritime GDP. This implies that an educated and healthy workforce is a fundamental driver of productivity and efficiency in the maritime sector. Investments in education and healthcare would reduce absenteeism, improve worker performance, and enhance overall labour productivity, which are critical for the maritime sector's operational success.

The most striking finding is that tertiary enrolment rates show a strong positive association with maritime sector GDP, with a coefficient of 2.464. This indicates that a 1% increase in tertiary enrolment rates is associated with a 2.464% increase in maritime GDP. This substantial impact highlights the pivotal role of advanced education and specialized training in driving the sector's growth. The maritime industry, with its reliance on advanced technologies, logistics, and global trade, requires a highly skilled workforce capable of innovation and adaptability. Tertiary education likely provides the technical expertise and problem-solving skills necessary to meet these demands, making it a key driver of productivity and competitiveness in the sector.

The high R-squared value (0.9967) suggests that the model explains a significant portion of the variation in maritime GDP, though potential overfitting should be considered. The Durbin-Watson statistic (1.828) suggests low to moderate autocorrelation, indicating that serial correlation is not a major concern.

Discussion of Findings

These findings have significant implications for policymakers and stakeholders in the maritime sector. First, the strong influence of past maritime GDP indicates that policy stability and consistency are essential for sustaining long-term sectoral growth. Disruptions or inconsistent investments could hinder the sector's progress, given its reliance on historical momentum. Second, the substantial influence of health and education expenditures underscores the importance of strengthening education and healthcare systems to enhance workforce productivity. Policies aimed at improving healthcare access and quality could yield significant returns in terms of maritime sector performance, with every 1% increase in health expenditure potentially boosting maritime GDP by 0.709%.

Third, the outsized role of tertiary enrolment rates highlights the critical role of higher education and specialized training in fostering maritime sector growth. A 1% rise in tertiary enrolment rates could lead to a 2.464% increase in maritime GDP, making it one of the most effective levers for enhancing sectoral performance. Policymakers should focus on expanding access to higher education and ensuring that curricula are tailored to the needs of the maritime industry. This could involve partnerships between educational institutions and maritime firms to develop targeted training programs, internships, and research initiatives that equip students with the skills needed to excel in the sector.

Finally, the impact of general education expenditures suggests that while basic education is important, it should be complemented by targeted investments in higher education and healthcare to maximize its effectiveness. Therefore, policymakers should implement a comprehensive human capital development strategy, integrating health, basic education, and advanced training is essential for promoting a skilled and productive workforce essential for maritime sector expansion.

5.0 CONCLUSION

This study highlights the critical role of human capital development in driving growth and ensuring the sustainability of the maritime sector. The findings indicate that a well-educated, skilled, and healthy workforce is fundamental to improving productivity, innovation, and operational efficiency in the maritime industry. Investments in advanced education and specialized training

emerge as particularly vital, as they equip individuals with the technical expertise and adaptability required to navigate the complexities of modern maritime operations. Similarly, robust healthcare systems play a pivotal role in ensuring a productive workforce, reducing absenteeism, and improving overall labour performance. These elements, when combined with consistent and forward-looking policies, create a strong foundation for sustained sectoral growth.

The study underscores the importance of a comprehensive human capital development strategy that integrates basic education, advanced training, and healthcare. Such an approach not only addresses immediate workforce needs but also fosters long-term resilience and competitiveness in the maritime sector. Policymakers and industry stakeholders must prioritize these areas to unlock the sector's full potential, ensuring its continued contribution to economic development and global trade. By aligning educational curricula with industry demands, expanding access to higher education, and improving healthcare systems, the maritime sector can build a skilled and dynamic workforce capable of meeting future challenges. Ultimately, this study reaffirms that human capital is fundamental to ~~of~~ maritime sector growth, and strategic investments in this area will yield significant economic and social benefits.

Recommendations

Based on the findings, the following recommendations are proposed to enhance the contribution of human capital to Nigeria's maritime sector growth:

First, the government and industry stakeholders should invest in promoting and upgrading specialized maritime education programs, such as technical training institutes, maritime academies, and university courses tailored to the sector's needs. Scholarships, grants, and partnerships with private companies can make these programs more accessible, ensuring a steady pipeline of skilled workers equipped with the technical expertise required for modern maritime operations. Also, provide funding for professional development workshops and certifications for maritime university lecturers, ensuring they stay updated on industry trends.

Second, policymakers should prioritize welfare and healthcare initiatives specifically targeted at maritime workers, including seafarers, maritime sector instructors, lecturers and port employees. This could involve setting up on-site medical facilities at ports and maritime higher institutions,

providing affordable health insurance, and ensuring regular health check-ups. A healthier and happy workforce will reduce absenteeism, improve productivity, and enhance overall sector performance.

Lastly, stakeholders should encourage partnerships between maritime companies and tertiary institutions to align curricula with industry demands. Offer internships for students and sabbatical opportunities for lecturers to gain hands-on experience in the sector. Encourage industry experts to guest-lecture and co-design courses, ensuring academic programs remain relevant and practical. This bridges the gap between theory and real-world application thus creating a more responsive and dynamic workforce, ready to tackle future challenges.

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