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Blue Economy in Nigeria: The Interface of Community Investment in Marine Fisheries Growth and Opportunity in Selected Coastal Villages in Niger Delta Region

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ABSTRACT

This study investigated the interface of community investment in marine fisheries growth in the Niger Delta region. The study specifically aimed at unlocking the investment potentials offered by the marine fisheries sector of the Nigeria's blue economy. Through the use of structured questionnaires, field observations, and focused group discussions, data on 30 defined investment variables on marine fisheries' development were obtained and analyzed from 660 fishers' in 20 randomly sampled fishing settlements from five out of nine Niger Delta States. The analysis of the data using factor analysis model yielded four principal dimensions of fishing investment potentials which accounted for 78.7 percent of the variation in the original 30 primary variables; which depicts a composite indicator defining the investment potentials with optimal returns. Of these dimensions, investments on the methods of fish capturing and fish vessel/equipment accounted for the highest investment potentials as they significantly contributed 56.79 and 9.4 percent in the original investment variables followed by investments on fish processing/storage and transportation/docking facilities. The factor scores that arose from the analysis revealed that all the settlements performed distressingly on all the investment indicator variables. This implies that most of the existing facilities for fish harvesting; processing and storage, as well as transportation/docking are grossly inadequate for the exploitation of fishery products in the Niger Delta region. The study recommends the need to promote a market-oriented, growth-inducing approach that expands opportunities for investment in modern fishing vessels and appropriate gear by the government and investors, both local and foreign.

Keyword: Blue Economy, Marine fisheries, Investment, Growth, Niger Delta Region

INTRODUCTION

There is growing interest in blue finance, which encompasses using inventive financial instruments to back up sustainable ocean development. This innovative financial instrument includes impact investing, green bonds, and other forms of sustainable finance. The Blue economy paradigm entails a sustainable use of ocean resources for economic advancement and improved wellbeing. It considers aquatic resources as a new opportunity that promotes economic growth and improves livelihoods (Cohen et al., 2018). The blue or ocean economy as a concept was introduced by United Nations Conference on Sustainable Development in the year 2012 (UN, 2016). The concept consolidates all economic activities around exploration of water resources (ocean, rivers, lake, seas, etc.). Blue economy involves the use of water bodies - sea, river, ocean, lake and its resources for the purpose of sustainable economic growth while green economy is concerned with how to reduce carbon emissions and environmental risks or hazards in order to achieve sustainable economic development. The work of Pauli (2010) titled blue economy significantly showcased the essence and the need to further explore the concept of blue economy. In his discourse, he offered a model for supply of low cost product, job creation at local level with respect to the disruption of environment. The classes of concept encompassed by blue economy as propounded by scholars like Costa, de Freita, Lisboa, Santos, de Fraga Brusch, and de Morais, (2019) and Phelan (2020) summarily consist of commercialization of ocean resources for sustainable development.

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The Blue Economy is an evolving economic activity that have been brought into national and international policy discourse in recent times while consolidating the great opportunities offered by oceans and seas. In recent times, people have begun to look in the direction of aquatic resources as a panacea towards improving their socio-economic development, livelihood, economic regeneration and poverty reduction in the short-, medium- and long-term strategies (Attri, 2016). FAO (2019; 2020) reported a remarkably increase in the global export value of fish and fishery products from US$15 billion in 1980 to US$ 164 billion in 2018 in recent times, with about 50 per cent of the totals coming from the developing world, where the net export revenue that these countries receive from fish trade is larger than their exports of tea, rice, cocoa and coffee combined (FAO, 2019; 2020) despite the fact available estimates for 2019 revealed about a 2 per cent contraction in both value and quantity compared with 2018 values. These values are further projected to diminish more owing to the Covid19 outbreak (FAO, 2020).

Blue economy sub-sector such as fisheries, aquaculture, marine and coastal tourism have been adopted to stimulate food security, decent livelihoods and economy in a number of coastal developing countries, with the aim of progressively incorporating it with other vital economic sectors (Ababouch, 2015). United Nations Economic Commission for Africa (UNECA) (2016) noted that in spite of the weighty contributions of blue economy to the development of national economies in Africa, its potential is yet to be fully realized. Corroborating this position, Odongkara, Abila and Luomba (2009) noted that aquatic resources are not adequately monitored, understood and valued in the context of national development agendas in Sub-Saharan Africa (SSA).

Nigeria is a maritime state where nine (9) of the thirty-six (36) states of the federation have a shoreline in the Atlantic Ocean. The coastal states of Nigeria are Ogun, Lagos, Ondo, Edo, Delta, Bayelsa, Rivers, Akwa Ibom, and Cross Rivers States, located in the southern part of the country. This suggests that Nigeria is well-endowed with water resources and reasonably rich in fishery resources, which makes fisheries a potentially important sector in the nation's economic growth. The significance of the fisheries sector to individuals and the economy of many developed and developing countries cannot be overstated as fish is responsible for more than 60% of the world's supply of protein, mostly in developing countries. The importance of fish could both directly and indirectly felt among rural and urban dwellers in Nigeria. In Nigeria, fisheries, constitutes a vital subsector as it contributes about 3.00–5.00% to the agriculture share of the Gross Domestic Product (GDP) and generation of foreign exchange through exports. Fish are important sources of protein in the food intake of Nigerians asides being a major source of employment generation to many coastal households. FAO (2020) reported that employment in the marine fisheries and aquaculture sector production in Nigeria has remained relatively stable since 1995 and was estimated at 59.5 million in 2018. This is because over 820 million people throughout the world are valued to depend on fish for all or part of their income (FAO, 2022), while WorldFish (2022) report on Nigeria, testified that 1,477,651 people were engaged in the fisheries and aquaculture sector of the country. The industrial fisheries sector that involves the use of trawlers for fishing and shrimping currently employs about 9000 Nigerians; though the actual number of people engaged in the fishery sector in Nigeria cannot be ascertained due to the lack of all-inclusive data.

In spite of the impact of the sector to the local and national economy, Nigeria is yet to manage and fully exploit its fishery sub-sector for economic development as evidence in its contribution to the country's Gross Domestic Product (GDP), which according to the NBS (2021) is very negligible; and has remained so constantly over the last decade, ranging from 1.09% of the country's total GDP in the year 2020 and 0.9% in the third Quarter of 2021 (NBS, 2022). According to SeaAround Us (2016), Nigeria has a continental shelf area of 43,514 km^2 and a continental coastline length of 853 km (Nwilo and Badejo, 2007), despite this shoreline's advantages, Nigeria has not utilize its full fisheries resources potential. This informed in part why the country is considered a net importer of fishery products which may possibly reflect the fact that other sectors might be growing much faster than the fisheries sector, even though it is also true that a large amount of catch is consumed before going to formal markets, and thus cannot adequately be reflected in official GDP statistics. In spite of the irresistible significance of the marine fisheries sector in opening up opportunities of the blue economy, gaps abound in knowledge on the subject matter, especially on the investment opportunities in marine fisheries by the government, stakeholders and artisanal fisher-folks. This study is designed to unlock the investment opportunities presented by marine fisheries exploitation in Nigeria in the context of the blue

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economy by identifying the potential opportunities for marine fisheries that could improve the prospects of blue economy in Nigeria.

MATERIALS AND METHODS

Location of the Study

The Niger Delta area in Nigeria is located in the Gulf of Guinea between longitude 5.05°E-8.68°E and latitude 4.15°N-7.17°N,. It is the largest wetland in Africa and the third largest in the world consisting of flat low lying swampy terrain that is crisscrossed by streams, rivers and creeks. It covers 20,000 km^2 within the wetlands of 70,000km^2 which is mostly formed by the depositions of sediments. It has an average annual rainfall of 2400-4000mm and greatly influenced by the localized convection of the West African monsoon with fewer contribution from the mesoscale and synoptic system of the Sahel. The rainy (wet) season in the region begins in May, in line with the seasonal northward movement of the Intertropical Convergence Zone (ITCZ), with its cessation in October. Niger Delta region has an equatorial monsoon climate controlled by the south west monsoonal winds (maritime tropical) air masses which originate from the South Atlantic Ocean. It is home to 20 million people with over 40 different ethnic groups spread across nine states of the federation (Abia, Akwa-Ibom, Bayelsa, Cross-River, Delta, Edo, Imo, Ondo and Rivers states). Four of these ethnic groups namely; the Andonis', Ijos', Ilajes', Ibibios' and Urhobos' have long standing traditions as fisher folk, although the Ijos' and Ilajes are more renowned for their fishing tradition than the others.

The Niger Delta is made up of three broad ecological zones; the freshwater zone, the marine or salt water zone in the coastal area, and the brackish water or estuarine zone, where fresh and salt water meet. The brackish and salt water zones have large amounts of fish stock and sustains Nigeria's fishing industry. Almost 37% of the entire Niger Delta area is made up of fresh water. Estuaries, beach ridges, rivers and mangrove swamps make up the brackish water zone which takes up about 449 square kilometers' in area. These estuaries and rivers along with the continental shelf constitute the locations for the bulk of the variety of fish reserves in the area and are earmarked as prime grounds for situating fishing camps. Fishing camps are scattered around most of the coastline and inshore waters of the region.

Methods of Data Collection

Sources of Data

Data for the study was obtained from two major sources viz-a-viz primary and the secondary sources. Primary data was obtained through direct field observation, interview guided by the use of structured questionnaire and data obtained through focus group discussions, in-depth interviews. Secondary data regarding the impacts of marine fisheries to the Nigeria's GDP, the number of people employed in marine fisheries, export revenues and trends of marine fisheries production were obtained from the review of the records of the National Bureau of Statistics. Focus group discussions (FGDs) were employed to bring together all the fishing households in the selected fishing communities. Each focus group consisted of 8 fishing heads' of households. Attempt was made to ensure that the focus group discussions were as representative as possible, with specific attention paid to gender representation and age differential. Focus group discussions (FGDs) were undertaken to validate the information obtained from individual respondents. A total of two (2) separate FGDs (One for men and another for women) were conducted in each of the fishing settlements with 5-8 households including fishers, fish processors, fishmongers, fish traders, village elders and leaders.

Study Population

The study population covers all the fishing household heads in the ten (20) fishing settlements selected for the study in the five Niger Delta States. A population sample of 660 respondents drawn from twenty fishing settlements in ten (10) Local Government Areas of five (5) out of nine Niger Delta States (Akwa, Ibom, Bayels, Cross Rivers, Delta and Rivers) were purposively selected for the study. Sixty six (66) heads of fishing households were randomly selected in each of the fishing settlements for the study thereby bringing the total number of sampled fishers to 660. The ten Local Government Areas drawn from five out of the nine Niger

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Delta States were selected to accommodate diverse locations where fishing activities are conducted. The structured questionnaires were designed to capture key information relating to information on available investments opportunities that can increase the value of the fishing industry for people's livelihoods and Nigeria economic growth.

Sampling Technique

Multi-stage sampling technique was adopted in selecting the representative respondents. The first stage was the selection of five (5) states from the nine Niger Delta States. The second stage involved the selection of two (2) Local Government Areas from each of the selected five (5) Niger Delta States while the third stage involved the random selection of two (2) fishing settlements noted for intensive and concentrated fishing activities in each of the five (5) LGAs selected for the study thereby bringing the total number of fishing settlements selected for the study to ten (10) (Table 1). The fishing settlements in each of the LGAs of the selected Niger Delta States were strategically selected based on (1) their dependence on fisheries and proximity to the coast; (2) the presence of fish markets; (3) accessibility and availability of other fisheries-related economic activities together with the activeness of fishing throughout the year; (5) the availability of robust information on marine fisheries activities.

Table 1: List of Sampled Settlements Selected for the Study

S/N	Fishing settlements	LGA	State
1	Ibaka (James town)	Mbo	Akwa Ibom
2	Esuk Mma	Oron	Akwa Ibom
3	Ineedekghekpu	Oron	Akwa Ibom
4	Efiat	Mbo	Akwa Ibom
5	Forokpa fish town	Brass	Bayelsa
6	Sangana	Brass	Bayelsa
7	Ekeni	Southern Ijaw	Bayelsa
8	Ezetu	Southern Ijaw	Bayelsa
9	Okoyong	Odukpani	Cross River
10	Ikperi Ikan	Bakassi	Cross River
11	Ikan	Bakassi	Cross River
12	Eniong Abatim	Odukpani	Cross River
13	Ekemetagbene	Bomadi	Delta
14	Akparemogbere	Burutu	Delta
15	Ogulagha	Burutu	Delta
16	Iduwini Kingdom	Burutu	Delta
17	Oyorokoto	Andoni	Rivers
18	Ifoko	Bonny	Rivers
19	Mbisu 1	Bonny	Rivers
20	Uku –Mbi	Andoni	Rivers

The target population of the study consisted of members of the fisher-folks in the selected settlements; particularly fishers, fishmongers and processors. Key informants included village leaders, elders, gear

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makers/sellers, community leaders and fisheries officers from government ministries/departments. The study interviewed only heads of households, but where relevant information could not be provided by the head of households (assumed to be the decision-maker), their spouse or other household members were asked to provide such information. Respondents who had lived in the village for the past 15 years and preferably older than 30 years were mainly targeted. Interviews of the selected respondents were conducted in their homes using open- ended questionnaires; this gave them the opportunity to provide relevant information germane to the objectives of the study. Data on demographic characteristics of the sampled fishing households was collected.

Data on Investment Opportunities in Marine Fisheries in Niger Delta Region

These sets of variables are adopted from literature and would be used as benchmarks for exploring the investment opportunities in marine fisheries generated through structured questionnaire and Focus Group Discussion. The variables include:

Table 2: Defined Investment Indicator Variables

Investment Opportunities	Variable
Trawling	X_1
Netting	X_2,
Human muscle	X_3
Motor cycles	X_4,
Trucks/lorries	X_5
Long lining	X_6
Gill netting	X_7
Fish trapping	X_8
Ring nets	X_9
Buckets	X_{10}
Refrigerator	X_{11}
Ice block	X_{12}
Cooling boxes	X_{13}
Modified hook and line	X_{14}
Hook and line	X_{15}
Sun drying	X_{16}
Frying	X_{17}
Smoking and drying	X_{18}
Brining and smoking	X_{19}
Drying	X_{20}
Buckets	X_{21}
Freezing	X_{22}
Chilling and brining	X_{23}
Traditional boats	X_{24}

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Motorized boats	X_{25}
Fishing gear	X_{26}
Plastic bags	X_{27}
Canoe/ boat	X_{28}
Bicycle	X_{29}
Docking/landing sites	X_{30}

Methods of Data Analysis

Both descriptive and inferential statistical analytical techniques were employed in the data analysis. The descriptive statistics include the use of simple percentages, arithmetic mean, tables and charts in the presentation and analyzes of the field data. The inferential statistical methods involved the use of multivariate statistical techniques such as factor analysis in summarizing the investment opportunity variables into major dimensions which is considered as the best optimal investment potential in the blue economy. The independent samples T-test for equality of means was utilized to compare investment opportunity data distribution among the 20 sampled fishing settlements and to test the hypothesis that investment potentials in marine fisheries sector of the blue economy amongst the 20 fishing settlements do not significantly different.

Factor Analysis Model

Factor Analysis was employed in identifying the investment opportunities in the marine fisheries development sectors. Factor Analysis was used to collapse the 30 indicator variables of possible investment opportunities offered by marine fisheries sector of the blue economy into fewer factors or dimensions viewed as the possible investment opportunities with optimal returns and least cost in the Niger Delta region. It was necessary to collapse these variables into smaller dimension or factors which were interpreted as indicators of investment opportunities among the artisanal fisher folks in the study area.

Specifically, the R-mode factor model was employed using the Statistical Package for Social Science (SPSS) package (version 17.0) to reduce the 30 indicator fishing investment opportunity variables into smaller and more meaningful form. For the set of data supplied, the program printed a range of statistical tables including the correlation matrix, factor loadings, rotated factor loadings and factor scores. Four factors with eigen values of 1.0 and above were selected and used in the description of the marine fisheries investment opportunity indicators.

Variables with loadings of 0.5 and above (negative or positive) were regarded as those associated with each factor and a variable was assigned to the factor on which it has the highest loading. The four factors identified were regarded as defining the major investment opportunity in the study area. Consequently, the scores of the unit areas on these factors or dimensions were regarded as measures of their investment needs. Positive scores were taken to mean a vital investment opportunity with possibility of having optimal returns and negative scores as investment opportunity that is not worthwhile. Factor analysis was preferred above other technique because generally, it produces a clearer structuring of variables (Esin, 2014).

Factor analysis is a multivariate statistical technique which is generally applied in research to achieve parsimony in data description. It is suitable for examining the underlying patterns or relationship for a larger number of variables and determines if the information can be condensed into smaller set of factors. The factor analysis model can be expressed as:

$X_1 = b_{11}f_1 + b_{12}f_2 + b_{13}f_3 + \ldots\ldots\ldots\mu_1 + €_1$
$X_2 = b_{21}f_1 + b_{22}f_2 + b_{23}f_3 + \ldots\ldots\ldots \mu_2 + €_2$ etc
Where:
μ_1 = the mean of X_1
$€_1$ = the residual specific to the ith test after taking account of the contribution of the factors

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f_1, f_2, f_3 = The value of the factors which vary from one subject to another but have zero mean and unit variance, and are assumed to be uncorrelated with one another and with the residuals.

bif = constants, like regression coefficients, indicating how much that is affected by each factor. These bif are known as factor loadings.

Factor analysis is usually applied in a research problem which concern itself with data reduction or summarization. Before applying the model, the researcher first determine:

i. The variables to be included
ii. The number of variables to be measured
iii. How the variables are to be measured
iv. If the sample size is sufficiently large enough

Like other multivariate statistics, factor analysis has its pitfalls. This relates largely to abnormality of data, size of sample, error in measurement etc. These problems were summoned by working with large sample sizes and ensuring that data were measured on interval and ratio scale in order to reduce error to the barest minimum.

The Student's-Test

The student's-test for two sample test is statistically expressed as:

$$t = \frac{|\overline{X} - \overline{Y}|}{\sqrt{\frac{\delta x^2}{NX} + \frac{\delta y^2}{Ny}}}$$

Where:

T = students t-value
$\overline{X}$ = Mean of sample X
$\overline{Y}$ = Mean of Sample Y
δx^2 = Square of standard deviation of X
δy^2 = Square of standard deviation of Y

In the present study, for the purpose of employing the student's t-test analysis, all the sampled fishers' in Akwa Ibom and Cross River States are classified into similar group while fishers' in Bayelsa, Delta and Rivers States are classified into similar groups since these fishers in these states have homogeneous characteristics in terms of culture and environmental attributes.

RESULTS AND DISCUSSIONS

The results of defined original indicator variables employed in the factor analysis model yielded four major dimensions which are indicators for possible investment in the marine fishery sector of blue economy as revealed in Table 3.

Table 3: Factor Analysis on Indicators of Investment Opportunities on Marine fisheries in Niger Delta

S/N	Variable	Factors				Communalities
		1	2	3	4	
1	Docking/landing sites				.52	.807
2	Canoes				.83	.729
3	Trawlers		.72			.769
4	Traditional boats		.81			.874
5	Motorized boats		.89			.870

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6	Fishing gears		.50			.792
7	Refrigerator			.69		.692
8	Bicycle				.50	.712
9	Long lining	.75				.796
10	Hook and line	.73				.683
11	Ring net	.71				.870
12	Modified hook and line	.57				.914
13	Gill netting	.58				.880
14	Trawling	.52				.705
15	Plastics bags			.57		.681
16	Truck/lorries				.55	.874
17	Motor cycles				.62	.798
18	Smoking			.76		.795
19	Smoking and drying			.81		.739
20	Buckets			.70		.775
	Eigen value	**11.360**	**1.890**	**1.264**	**1.242**	
	Percent of variance	**56.799**	**9.450**	**6.318**	**6.209**	
	Cumulative percent	**56.799**	**66.249**	**72.567**	**78.77**	

Source: Author's Field Data Analysis (2024)

The application of factor analysis procedure using Varimax and Kaiser Normalization rotated method on the defined possible investment indicator variables yielded a four-dimensional solution Table 3. The communalities which can be regarded as indication of the importance of the variables in the analysis are high. This implies that most of the defined investment opportunity marine fisheries variables (30) considered in the study are appropriate and relevant. The four factors which significantly accounted for 78.7 percent of variance in the original data primary variables may be seen as a composite indicator defining the best investment opportunity with highest optimal returns in marine fisheries sector of the blue economy of the Niger Delta Region. The variables were extracted on the basis of their high loadings on the four factors while the 20 sampled fishing settlements were classified based on their loadings on each of these factors. The matrix of factors scores was employed to unlock the spatial pattern of the investment opportunity (to determine if the investment opportunity differed spatially across the sampled fishing settlements). Accordingly, the four dimension of investment opportunities in marine fisheries obtained from the factor analysis in Table 3 include:

The analysis indicated that factor1 accounted for 56.79 percent of the total variance of 78.7 percent. This shows clearly that factor 1 is the most important investment indicator in marine fisheries across the Niger Delta region. Of the 29 indicator variables in the analysis, six variables loaded highly and positively on this dimension. These variables which are associated with factor 1 include: long lining (.75), hook and line (.73), ring net (.71), modified hook and line (.57), gill netting (.58) and trawling (.52). Factor 1 is therefore named ''Investment in Fish Capture Technology" because of its positive loading on the aforementioned variables. Factor 1 (Investment in Fish Capture Technology) is without doubt a more important investment opportunity in marine fisheries exploitation in the blue economy of the Niger Delta region. This implies that investing in fish capture technology is very crucial to the development of marine fisheries in the Niger Delta region. This is so because the quality of freshly caught fish and its usefulness for further utilization in processing is affected by the method of the fish capture. Inappropriate fishing method does not only cause mechanical damage to the fish, but also creates stress and the conditions which fast-track fish deterioration after death as fish is highly predisposed to deterioration without any preservative or processing measures asides lowering the catches.
The results of the analysis indicated that Factor 2 accounted for 9.4 percent of variance in the original variables included in the analysis. Associated with this factor are three variables which loaded highly and positively. The

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variables include: motorized boats (.89), traditional boats (.81) and trawlers (.72). This factor seems to represent fishing vessels/equipment and is thus named ‘‘Investment in Fishing Vessels/Equipment Factor”. This indicator points to the significance of investing in the equipment used in fish harvesting/catch. It is revealed from the factor loadings that most fishers in the Niger Delta region use traditional fishing gear and vessels, which limits their ability to reach Exclusive Economic Zone (EEZ) resources with attendant impact on the fish catch. Investment on these existing methods (motorized and traditional boats) cannot allow the fishers to access deep water resources in the EEZ and improve the value of their fishery products. This suggests that investing in trawling technology in marine fishery exploitation in the Niger Delta blue economy will in no small measure yield optimal results as the emergence of trawling as a technologically efficient method in the exploitation of marine fishery resources is well recognized and has increasing helped in aggregate domestic fish production in Nigeria.

Factor 3 accounted for 6.3 percent of variance in the original data set. Five variables were significantly variables clustered to produce Factor 3: These variables include: smoking and drying (.81), smoking (.76), buckets (.70) and refrigeration (.69) and plastic bags (.57). These factors seem to represent fish processing and storage facilities and may be named ‘‘Investment in Fish Processing and Storage Technology Factor”. This implies that aside investing in fish capture/harvesting technology and fishing vessels/equipment, there is an increasing need to invest in fish processing and storage facilities in order to maximize the potentials of the marine fisheries sector of the Niger Delta blue economy. Inadequate or poor fish processing and storage facilities as revealed during field work have significantly contributed to large-scale post-harvest losses in marine fisheries harvesting in the Niger Delta region. This corroborates the assertion by Hoof and Kraan (2017) that post-harvest losses are primarily caused by improper handling of catches on board, inadequate processing and storage facilities and techniques, and losses further up the marketing chain in transportation and trade. Post-harvest losses result in the loss of income, and should be considered a problem that has to be resolved. It is undisputable fact that improving fishing processing and storage facilities will help enhance and strengthen fishing and blue economy activities, which will in turn result into improved livelihoods and increased revenues for the government. Hence, the urgent need to invest on this dimension by stakeholders’ and the government.

Factor four is dominated by canoes (.83), motorcycles (.62), truck/lorries (.55), bicycle (.50) and docking/landing sites (.52) variables. These variables which have high positive loadings in all the 30 variables employed in the analysis accounted for 6.2 percent of variance in the original data set. This factor may be named ‘‘Investment in Fish Transportation and Docking/landing Sites Factor”. This clearly indicates that increasing need for investment in transportation development and docking or landing sites if marine fishing capacity in the blue economy sector is to be bolstered. Field observation has revealed that most of the existing facilities for storage, transportation, and processing are completely inadequate for the exploitation of large scale fisheries production.

In the proceeding section, the factor scores that define the indicators of investment option in marine fisheries in the 20 sampled fishing settlements are presented. It is important to note that the factor scores were aggregated to generate a score designated as “Investment Scores”. Essentially, the investment score was used to determine the performance of each of the sampled fishing settlements with respect to the 30 defined investment in fishing indicator variables. Table 4 displays the investment indicators performance profile of the 20 sampled fishing settlements in the Niger Delta region.

Table 4: Investment Indicator Performance Profile of Sampled Fishing Settlements

S/N	Settlement	Factor 1	2	3	4	Aggregate score
1	Ibaka (James town)	0.00	-0.35	-0.51	-0.00	0.88
2	Esuk mma	-0.09	-0,41	-0.51	-0.39	-1.16
3	Ineedekghekpu	0.02	-0.73	-0.25	-0.75	-1.32
4	Efiat	0.04	-0.83	0.14	-0.29	-1.22

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5	Forokpa	0.44	-0.53	-0.15	0.11	-0.73
6	Sangana	-0.27	-0.27	0.76	-0.05	-0.58
7	Ekeni	-0.51	-0.57	0.01	-0.15	-1.44
8	Ezetu	-0.44	-0.15	-0.19	-0.36	-0.90
9	Okoyong	-0.34	-0.71	0.66	-0.26	-0.53
10	Ikperi Ikan	-0.08	-0.67	0.79	-0.56	-1.02
11	Ikan	0.19	-0.06	0.30	0.01	0.52
12	Eniong Abatim	0.29	-0.37	1.43	-0.86	0.50
13	Ekemategbene	0.45	-0.76	0.06	-0.02	-0.27
14	Akparemogbere	-0.45	-0.08	-0.26	-0.26	-1.07
15	Ogulagha	-0.56	-0.39	-0.48	-0.45	-1.90
16	Iduwini	-0.03	-0.31	-0.46	0.08	-0.73
17	Oyorokoto	0.26	-0.03	-0.65	-0.05	-0.93
18	Ifoko	0.05	-0.57	-0.10	-0.09	-0.73
19	Mbisu	-0.60	-0.60	-0.60	-0.60	-2.43
20	Uku Mbi	-0.44	-1.18	0.97	-0.12	-0.77

Source: Author's Field Data Analysis (2024)

Data on Table 4 highlighted the four components of investment opportunity in marine fisheries exploitation in the Niger Delta region and the relative performance of the sampled settlements on these components or factors. It is important therefore, to highlight the differentials in the investment opportunity performance between these fishing settlements on each defined indicators of investment components.

It is an undisputable the fact that the method of fish capture is a critical factor in defining the total catch made. Data in Table 4 revealed that of the 20 fishing settlements sampled in the study, only 9 settlements representing 45 percent had positive scores on the "fish capture methods factor''. Of the 9 settlements, none had factor scores up to 0.50. This shows the quantity of catch that could be harvested using the traditional methods of fish capture. The possible outcome would manifest in low or poor catch with attendants effects on the livelihood of the fishers' households in particular and the nation in general. This is evidently a major issue for the sustainability of artisanal fishers' livelihood, and national economic development at large. There is the major concern that the local fishermen in the Niger Delta region may face the challenge of being unable to exploit Exclusive Economic Zone (EEZ) resources if investment geared at using modern technology of fish capture (e.g., purse seines and long lines, trawling etc), is not made.

It is evident in Table 4 that most fishermen may not be able to access and exploit the EEZ resources because majority of the fishers bank on the traditional fishing gear and vessels that are incapable of performing this. This position has been confirmed by Mbukwa et al. (2019) and Abdallah, Mgaya, Lokina and Mushymost (2022) who affirmed that fishers who use traditional fishing gear and vessels limits their ability to reach Exclusive Economic Zone (EEZ) and exploit its' rich resources. This therefore calls for the need for investment in modern fishing gear by stakeholders and government in particular. This is further corroborated by Katikiro et al. (2013) and Silas (2022), who observed that traditional fishing gear—such as the use of diverse kinds of traps and hand lines have been replaced by motor-powered boats that operate fishing nets in a bid to withstand exposure to adverse weather conditions in offshore fishing grounds, and hence increase fish catch. This may probably account for the low fish catch by the artisanal fishers' in the sampled fishing settlements.

Data on Table 4 indicated that none of the fishers' in the 20 sampled fishing settlements had positive scores on the "Fishing Vessels factor". This means that all the fishers' do not have modern vessels/equipment (trawlers)

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of fish harvesting as virtually all of the fishers' rely heavily on traditional boats complemented by motorized boats in fish capturing; as none of the fishers' in the 20 sampled settlements had factor scores of 0.50 and above. Essentially, all the fishers' in the 20 sampled settlements had negative scores on the fishing vessels and equipment factor. This has obvious implications in the development of the marine fishery sector of Nigeria's blue economy. Given the fact that artisanal fisheries are mainly found in shallow areas along coral reefs, mangrove creeks and sea-grass beds, where fishers' fish for species connected with these habitats, as well as small pelagic species, given the insignificant size of these traditional boats with limited range and are mostly driven by paddles and long poles, the artisanal fishers may be unable to access and exploit resources in the deep sea (Exclusive Economic Zone) except with modern fishing gears/vessels. These could severely limit fish catch. Thus, a very viable profit oriented investment opportunity in the marine fishery sector of Nigeria's blue economy which should be exploited by stakeholders and the government should be investment in modern fishing vessels/equipment.

Appropriate processing of fish enables maximal use of raw material and production of value-added products which is obviously the basis of processing profitability. Data on Table 4 revealed that only 9 (45percent) of the fishing settlements had positive scores on fish processing factor. Compared to the method of fish harvesting, the fishers' appear to fare relatively better on this factor owing to the fact that majority of them produce at small scale for immediate consumption with the sales of considerable quantity to meet their family needs. Ineffective processing and storage facilities could results in post-harvest losses. This confirms the assertion by Hoof and Kraan (2017) that post-harvest losses are primarily caused by improper handling of catches on board, inadequate processing and storage facilities and losses further up the marketing chain in transportation and trade. Post-harvest losses result in the loss of income, and should be considered a problem that has to be resolved. The high incidence of fish losses due to poor processing and storage facilities as a major impediment to the realization of government goal towards increasing the contribution of the sector to the overall national economy has also been reported by Opara and Al Jufaili (2006). Investing on the use of appropriate technology as a radical approach to stem up production and processing technique has become inevitable in boosting fishery productivity in the Niger Delta region.

As revealed in Table 4, only 3 (15 percent) of the 20 sampled fishing communities had positive scores on this dimension, implying that more than 85 percent of the fishers' lacks mobility and access to landing/docking facilities. What this suggests is that most of the existing facilities for transportation and docking are completely inadequate for the protection and preservation of the value of fishery products. This situation has contributed to significant post-harvest losses. This in part contributes to dominance of foreign trawlers and fishing vessels that operate in the Exclusive Economic Zone. These vessels are obliged to berth all catch in ports because of the availability of suitable docking facilities. However, because of the lack of these docking facilities in majority of the fishing settlements, rudimentary means of transportation are employed to convey the catch to consuming centers. As a result, revenue and resources are lost. This is obviously a major issue for the sustainability of artisanal fishers' livelihood, and national economic growth. This is an issue that necessitates huge investment in the establishment of proper docking and landing facilities for trawlers and foreign fishing vessels, as well as procuring modern fishing vessels in order to enhance indigenous participation in the exploitation of marine fishery potentials of the nation's blue economy.

Table 5: Independent Samples T-test for Equality of Means

	Levene's Equality of Variance		**T-test for Equality of Means**				**Confidence interval of the diff**	
	F	Sig.	T	df	Sig. (2-tailed)	Std. error	Lower limit	Upper limit
Equal Variance assumed	1.261	.362	-5.53	46	.000	0.48	-3.674	-1.715
Equal Variance not assumed			-4.04	15.8	.000	0.66	-4.108	-1.281

Source: Data Analysis

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As data on Table 5 indicated, the obtained T-value of -5.53 with 46 degree of freedom and a P-value of less than 0.05 implies that there is significant difference in the group's mean. In other words, the T-test confirms the hypothesis that investment in the marine fishery sector of the blue economy in the Niger Delta region differs significantly from one fishing settlement to another in the study area. The Levene's test Equality of Variance further adds credence to the result. The F-value of 1.261 at .362 significance level shows that the assumption of Equality of Variance has not been violated and therefore, the observed difference in investment scores across the fishing settlements is valid and can be trusted for policy decision.

CONCLUSION

This study unlocks the potential investment opportunities inherent in Nigeria's fisheries in the context of the blue economy paradigm, using coastal marine fisheries as a case study. The study identified existing investments in the fisheries sector, the indispensable investments for further development of the sector; and how all the investment openings could be exploited to improve the input of marine fisheries to the development initiatives of the blue economy of the Niger Delta region and Nigeria at large. In the face of the myriads of economic challenges besetting Nigeria, the study revealed the urgent need to manage fisheries resources sustainably as this could directly or indirectly enhance the livelihoods of the fishers' and strengthened the foreign exchange earnings of Nigeria. It is evident in the study that local fishers have a limited access to the resources in the EEZ due to continued reliance on traditional fishing gears and vessels, which incapacitate them from exploiting the resources of EEZ.

RECOMMENDATIONS

The study has established that most of the existing facilities for fish harvesting; processing and storage, as well as transportation/docking in the Niger Delta region are grossly inadequate for the exploitation of fishery products. It has further been revealed that investments on the methods of fish capturing and fish vessel/equipment are the optimal marine fishery opportunity with optimal returns offered in the marine fishery sector of Nigeria blue economy. Based on this, the study recommends a radical investment on the provision of modern fishing gears and vessels with well-equipped fish processing and storage facilities by Nigeria government in particular and local/foreign investors in general as it could induce access to the development and exploitation of the Exclusive Economic Zone resources of the marine fisheries sector which has not been fully taken advantage of in Nigeria. Policies that would improve and promote fishers' wellbeing through a market-oriented and growth-inducing approach that expands opportunities for fish harvesting and production through support to access credit facilities are also recommended.

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