



Maritime Labour Demand for LNG Carriers Operations in Nigeria: Augmented Trend Analysis

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To cite this article:

Nwokedi Theophilus Chinonyerem, Okafor Cajethan Onyedikachi, Hussani Yusuf Kodo, Johnson Mathew Ndubuisi, Gbasibo Lawrence Addah. Maritime Labour Demand for LNG Carriers Operations in Nigeria: Augmented Trend Analysis. *International Journal of Transportation Engineering and Technology*. Vol. 6, No. 2, 2020, pp. 44-51. doi: 10.11648/j.ijtet.20200602.12

Received: March 28, 2020; **Accepted:** April 16, 2020; **Published:** May 11, 2020

Abstract: The study analyzed the maritime labour demand for LNG carriers operations in Nigeria using augmented trend analysis. The objectives of the study among other things were to estimate the demand for maritime labour for LNG carriers operations in Nigeria and to estimate the instantaneous rates of change (IROC) as well as the average rate of change (AROC) for maritime labour demand for LNG carriers operations in Nigeria between 1998 –2016. Historical design approach was adopted and data on maritime labour demand (D_{ml}) and tonnages of seaborne LNG trade between 1998 -2016 were sourced from the annual statistical reports of the Nigeria Liquefied Natural Gas (NLNG) company and Nigeria Petroleum Corporation (NNPC) 2017 editions, covering a period of 19years. The data obtained was analyzed using trend analysis augmented by rate of change and derivative functions from the theory of differentiation. It was found that there exists a significant decrease in the trend of demand for maritime labour for LNG carriers over the years covered in the study. The instantaneous rates of change of demand for maritime labour for LNG carrier per annum over the period was not constant as it showed being driven by the significant relationship between the demand for maritime labour for LNG carriers operations and growth in tonnages of seaborne LNG export trade. It was recommended among other things that to stop the current practice where almost half of the vessels serving the shipping needs of the NLNG are owned and management by foreign ship management companies who employ foreign maritime labour; the management of all LNG vessels serving the shipping needs of the NLNG must be handled by NLNG Ship Management Limited (NSML).

Keywords: Maritime-Labour, Demand, LNG-Carriers, Nigeria

1. Introduction

The International Labour Organization (ILO) in setting out the seafarers 'Bill of Rights via the Maritime Labour Convention (MLC) in 2006 refers to maritime labour as a concept used to describe professional workers engaged in the discharge of various job functions and service types in the maritime industry; as seafarers onboard vessels and as professional maritime workers and employees in Dockyards, seaports, and other maritime-allied organizations. Maritime labour thus represent employees and workers whose occupation and job functions is discharged at sea and in

dockyards and who spend majority of their working hours at sea, in port and/or at dockyard. Strictly speaking, the concept is best used to describe the seafarers whose job is most times onboard vessels of varied types at sea. It therefore applies to all seafarers including those with jobs in dockyards and seaports as pilots, passenger vessels, yachts/hotels, cruise ships, LNG carriers, oil tankers, commercial cargo ships, Floating production storage and offloading systems (FPSOs), offshore fixed production systems, coastal vessels, etc. The above definition represents the view of the current study on the

concept of maritime labour but with emphasis on seafarers working on Liquefied Natural Gas (LNG) Carriers in Nigeria. Labour represent a major component factor of production whose lack and/or inadequacy in supply holds the capacity to mar productivity, success and progress of investments [1, 2]. Incapacity of employers to proactively determine and demand for employment the optimum level of human capital (labour) required for achieving and sustainably progressing operations and productivity also holds the potential to mar the achievement of productivity targets and progress. Productivity which is viewed as a measure of the output of labour in relation to the input resources (land, labour, capital, land and entrepreneur) has been proved to have a positive correlation with the quantum and quality of labour employed. Maritime operators, businesses and investments must thus forecast and demand the appropriate quantum and quality of labour as well as ensure optimal mix between labour and other factors of production that will guarantee improved output and sustainable growth [3].

Our emphasis in the study is on the demand for maritime labour for LNG carriers operations in Nigeria; which is explained in this article as the number of seafarers/workers that the Nigerian Liquefied Natural Gas (NLNG) company is willing and able to employ for LNG carriers operations (manning LNG carriers) at a given wage rate in a given time period in Nigeria. It is important to state clearly that being a public owned company, though set-up through joint venture investment strategy and involved in the business of ocean energy/natural resources exploitation and export, part of the core primary social responsibility of the NLNG should be the massive employment generation and local maritime manpower training and capacity development to boast not only its operations; but to make Nigeria a global hub and source of quality maritime labour for LNG carriers operations. This is necessary, given the very specialized training needs to function as seafarers onboard LNG carriers and must be a priority area of focus for the management of the NLNG if the country is to maximize her benefits from the LNG value chain [4].

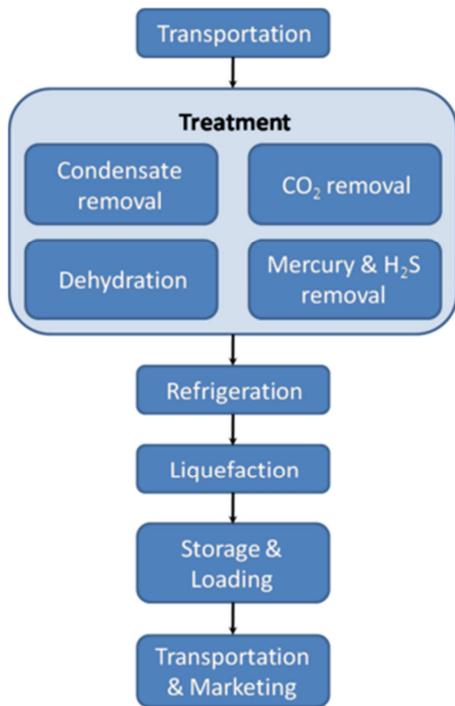
According to NLNG reports [5], Nigeria LNG Limited (NLNG) was incorporated as a limited liability company on May 17, 1989 with the objective of to harness Nigeria's vast natural gas resources and produce Liquefied Natural Gas (LNG) and Natural Gas Liquids (NGLs) for export. The International Gas Union [6] report notes that the ownership of the company is by four shareholders, viz, the Federal Government of Nigeria, represented by Nigerian National Petroleum Corporation (49% shareholding), Shell (with 25.6% shares), Total LNG Nigeria Ltd (15% shares) and Eni (10.4% shares).

However, the turning point in the attempt to harness the natural gas reserve in Nigeria was the November 1995, when Final Investment Decision (FID) was signed by the shareholders to build a Liquefied Natural Gas (LNG) plant in Finima, Bonny Island in Rivers State, Nigeria. This was

followed in December 1995 by the award of a turnkey Engineering, Procurement and Construction (EPC) contract to a consortium of engineering firms comprised of Technip, Snamprogetti, M. W. Kellogg and Japan Gas Corporation (TSKJ) for the Plant (consisting of two trains: Trains 1 and 2, called the Base Project), the Gas Transmission System (GTS) and the Residential Area (RA) while trains 3 to 6 of the project will follow later. Construction at the plant site commenced in February 1996 and on August 12, 1999, Train 2 was ready for start-up. Production of LNG commenced on September 15 1999 while the first export of LNG occurred on October 9, 1999. The subsequent completing of Train 1 on February 27, 2000 and Final Investment Decision (FID) of the other train marked the commencement of the expansionist drive to development of seaborne LNG trade in Nigeria [5, 7, 8].

Currently plaguing Nigeria is the challenge of graduate unemployment, a challenge which is equally common toady among graduate of maritime colleges and seafaring cadets many who have over the years looked up to major players in the maritime sector for bell-out without achieving attention. The LNG production, liquefaction storage and export process offers opportunities for massive employment of seafarers and maritime workers in the LNG value chain which seems to have been overlooked or under-utilized over the years in the drive to engage the teeming army of unemployed seafarers in Nigeria. It is equally important to note that sea borne trade of LNG is completed by signing a sale and purchase agreement (SPA) between a supplier and receiving terminal, and by signing a GSA (gas sale agreement) between a receiving terminal and end-users. These LNG carriage contracts employ the "ex ship" contract term; holding the seller of LNG responsible for the transport of the gas [9][10]. This offers further opportunity for the NLNG to employ and train indigenous manpower from the local maritime labour market for manning LNG carriers for gas delivery operations to trade partners globally. A glance at the LNG process train below provides better insight of maritime labour/seafarers job opportunities across the LNG value chain.

The first maritime labour generation node in the LNG value chain is the transportation from natural gas production facilities to the liquefaction plant by ship prior to liquefaction. The second and third nodes in the LNG value chain generating the demand for maritime labour is the storage and loading at dock; and transportation & marketing which marks the last operation in the LNG value chain at the liquefaction plant. The Nigeria Liquefied Natural Gas (NLNG) company in recognition of the need to maximize the benefits to the country offered by the LNG value chain in the maritime transport and shipping sector established the Bonny Gas Transport (BGT) Limited in 1989, following the incorporation of Nigeria LNG Limited, to provide shipping capacity for the NLNG project. NLNG subsequently set-up.



Source: www. wikipedia.com. Hashimoto and Hiroshi (2011).

Figure 1. A typical Natural Liquefaction Train/ process Value Chain.

NLNG Ship Management Limited (NSML) in 2008 to realize NLNG's vision of sourcing, developing and managing shipboard personnel for BGT vessels. These were all in the

bid to creditably serve the shipping needs of the NLNG and the trading partners whose order for LNG is based on ex ship contract terms as aforementioned [11, 12]. The operation of NLNG is seen to be rapidly expanding as LNG production and export is seen to have shown expansionary trend in the past 18 years starting from when she made her first LNG production and export. However, it seems obvious that the trend of demand and training by NLNG for maritime labour from the local labour market for LNG carriers operations in Nigeria continue to show decreasing trends. This suggests that there is greater preference for foreigner cadets and maritime manpower to indigenous hands. This portends a bad trend and danger to the quest for development of adequate maritime labour (seafaring manpower) capacity in the entire maritime sector of Nigeria and LNG seaborne trade in particular. The study is therefore cast to trace the trend of maritime labour demand for LNG carriers operations in Nigeria and measure the relationship between NLNG output and the level of demand for maritime labour for LNG vessel operations.

According NLNG reports [5], the NLNG has 24 vessels in her shipping fleet and charter-in using voyage charter party terms to augment the services of her captive fleet as need arises. The table below summarizes the ownership and management of the LNG carriers in the NLNG fleets influencing the demand for onboard maritime labour (cadets) and the markets from which the needed maritime manpower is sourced.

Table 1. Summary Ownership and Management of LNG vessels serving the shipping needs of NLNG.

LNG Vessel Owner Company	Bonny Gas Transport (BGT) Limited	BW Gas	Nippon Yusen Kaisha (NYK)	Voyage Charter arrangement (Various Companies and Years)
Number of ships in Fleet	13	8	2	4 vessels (2014), 2 Vessels (2015), 1 Vessel (2012 -2015)
Ship type	Four membrane and nine Moss carriers)	8 (All membrane carriers)	2 (All membrane carriers)	-
Management Company/Number of Vessels	10: NLNG Ship Management Limited (NSML) 3: Shell International Trading & Shipping Company Ltd (STASCo)	BW Gas	Nippon Yusen Kaisha (NYK)	Angola LNG, 3 Oceanus LNG-1 Cool Voyager from Energy Shipping-1

Source: NLNG (2017).

It is evident from the table above that out of 23 LNG carriers used for seaborne delivery of LNG products to her trade partners; the BGT owns 13 out of which the NLNG ship management limited manages only 10 while Shell trading and shipping company Ltd manages 3. BW Gas and Nippon Yusen Kaisha (NYK) which are foreign companies own and operate 8 and 2 respectively. The inadequacy of shipping capacity induced NLNG induced into voyage charter party contracts in which it chartered-in seven (7) LNG carriers between 2012 and 2015 to meet up with trading demands. The implication of such charters is that the owners of the vessels take responsibility for management of the vessel engaged in voyage charter and will thus retain responsibility to use and/or employ her indigenous crew (maritime labour) while the contracts last. This amounts to loss of jobs by Nigeria and Nigerians whose drive to

maximize the opportunities offered by the LNG value chain for job creations for and human capital development of her citizens is marred. With those charters, the demand for indigenous maritime labour from the local labour market by the NLNG will suffer decline; carrier development, technology transfer rate, and indigenous capacity building for LNG carrier operations will subsequently suffer decline. This is the actual reason that despite widespread expansion in NLNG operations, improved natural gas output, increased quantum of seaborne LNG export trade and increasing revenue fortunes, the demand for maritime labour from the local labour market for LNG carriers operations in Nigeria seems to be ironically declining or rather infinitesimally appreciating to the dislike and disadvantage of the highly expectant Nigerian public. A close observation of table 2 below showing the quantum of seaborne LNG export in

metric tons, revenue from NLG export in U.S. dollars and NLNG demand for maritime labour from the local market for LNG carriers operations in Nigeria between 2010 and 2015 lends support to the argument of continued decline in trend of demand for local maritime labour for LNG carriers operations in Nigeria.

Table 2. NLNG Demand for Maritime Labour, LNG Export and Revenue (2010- 2015).

Year	LNG EXPORT (MT)	Maritime Labour Demand	LNG EXPORT REVENUE (USD)
2010	992,293,989	16	6968091772
2011	1,114,860,569	10	11591840993
2012	1,131,321,835	0	9668258456
2013	964,809,782	0	10791380802
2014	1123511431	0	6843087203
2015	1,157,835,000	0	5024853847.75

Source: NLNG Report (2017), NNPC report (2017).

As aforementioned, the trend for maritime labour demand for LNG carriers operation in Nigeria continues to decline in the face of increasing seaborne LNG trade and revenue. NLNG may have shown preference for voyage charter of foreign owned LNG carriers with the negative effect of impeding indigenous manpower development and technical-know-how transfer in the sector. While the available data support the argument that demand for indigenous maritime labour in the sector has declined over the years, the study is cast to scientifically determine the trend, instantaneous rate of change (IROC) and average rate of change (AROC) of the demand for maritime labour in the sector from the local maritime labour market.

2. Aim and Objectives of the Study

The main aim of the study is to analyze the maritime labour demand For LNG Carriers Operations by the Nigeria Liquefied Natural Gas (NLNG) Company. The objectives of the study are: (i) To estimate the trend of demand for maritime labour (seafaring cadets) from the local labour market for LNG carriers operations in Nigeria.

(ii) To measure the instantaneous rate of change (IROC) of demand for maritime labour for LNG carriers in Nigeria per annum from 1998 to 2016.

(iii) To determine the average rate of change (AROC) of maritime labour demand for LNG carriers over the period covered in the study.

(iv) To establish the relationships between demand for maritime labour from the local labour market for LNG carriers and seaborne LNG export from 1999 – 2016.

3. Research Questions

(a) What is the trend of demand for maritime labour from the local labour market for LNG carriers operations in Nigeria between 1998 –2016?

(b) What is the instantaneous rate of change of demand for maritime labour for LNG carriers in Nigeria between per

annum from 1998 to 2016?

(c) What is the average rate of change (AROC) of maritime labour demand for LNG carriers operations in Nigeria over the period covered in the study?

(d) What nature of relationship exists between the demand for maritime labour for LNG carriers and seaborne LNG export trade over the period 1998 –2016?

4. Materials and Methods

The study employed historical design method and obtained time series data on maritime labour (seafarers) demand and/or recruitment and training from 1998 -2016 for LNG carriers operations by the Nigerian Liquefied Natural Gas (NLNG) company. Time series data on the quantum (in Metric Tons) of seaborne LNG export trade carried by the LNG carriers was also obtained from the Nigerian national Petroleum Corporation (NNPC) statistical report from 1998 – 2016. Trend analysis was used to analyze the data to determine the trend of demand for maritime labour for LNG carrier operations relative to trend of growth in seaborne LNG trade handled by vessels over the period of almost two decades of NLNG operations in Nigeria. Since the demand for maritime labour (D_{ml}) is an occurrence which depends on Time (T_{ml}), we postulate that

$$D_{ml} = \alpha + \beta T_{ml} + \varepsilon \quad (1)$$

Equation is used to estimate the trend of demand for maritime labour (seafarers) for LNG carrier operations in Nigeria where $\alpha = \text{constant}$, $\beta = \text{coefficient of term}$ and $\varepsilon = \text{error term}$.

Since D_{ml} is dependent on time (i.e; 18 years; between 1998 -2016); we assumed linearity of relationship and postulate that the trend of D_{ml} is a function of time; i.e:

$$D_{ml} = f(T_{ml}) \quad (2)$$

The instantaneous rate of change of demand for maritime labour can be viewed as the derivative of the maritime labour demand function at an instant of time and/or a point (one year) and determines the difference or change in demand for maritime labour from previous year. This is equivalent to finding the slope of the tangent line to the function at a point. This is represented using the general form of derivative functions based on the mathematical theory of differentiation as:

$$\lim_{\Delta x \rightarrow 0} (f(x_0 + \Delta x) - f(x)) / \Delta x = df(x)/dx = \partial D_{ml} / \partial x \quad (3)$$

This is so since $F(x) = D_{ml}$; $\Delta = \text{change}$, $x = \text{values of } D_{ml}$ at the instantaneous point (year), $x_0 = \text{previous year value } D_{ml}$ value.

Equation—(3) was used to estimate the instantaneous rate of change (IROC) of maritime labour demand for LNG carriers operations in Nigeria representing the quantum by which maritime labour demand changes per annum over the period.

An average rate of change (AROC) of maritime labour

demand is the rate of change of maritime labour determined for the entire time period in years (19 years) for the entire corresponding maritime labour demanded over that period. It can be determined using the total gap in maritime labour demanded between 1998 and 2016, divided by the time gap. Since demand for maritime labour (D_{ml}) is an event whose occurrence is dependent on time (t_{ml}) such that $D_{ml}=F(t_{ml})$, A long-term change in t_{ml} on the average will induce an average change on the demand for maritime labour over the same period provided that the seaborne export of LNG trade over the period increases on the average and labour is assumed to be mobile. Thus we write that the average rate of change of the function on a given interval [$1998=(D_{ml1}, t_{ml1})$, and $2016=(D_{ml2}, t_{ml2})$] is:

$$AROC = \frac{\partial D_{ml}}{\partial t_{ml}} = \frac{f(D_{ml2}-D_{ml1})}{t_{ml2}-t_{ml1}} \quad (4)$$

5. Results and Discussion

Table 3. Trend of Maritime Labour Demand for LNG Carriers Operations.

Descriptive Statistics			
	Mean	Std. Deviation	N
MARITIMELABOUR	15.2632	11.51252	19
Tml	9.9474	5.58245	19

ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	173.242	1	173.242	1.331	.265 ^b
	Residual	2212.442	17	130.144		
	Total	2385.684	18			

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	20.791	5.460		3.808	.001
	Tml	-.556	.482	-.269	-1.154	.265

Source: Authors calculation.

The result of the trend analysis above indicates that the mean annual maritime labour demand over the period by the NLNG for LNG carriers operations in Nigeria is 15.26 maritime worker (seafarers) with a standard deviation of 11.51. The model equation showing the trend of maritime labour demand (D_{ml}) for LNG carriers operations over the 19 years period covered in the study based on equation $D_{ml}=\alpha + \beta T_{ml} + \varepsilon$ (1) is given as. $D_{ml}=20.791 - 0.556 T_{ml} + \varepsilon$.

The implication is that there is a decreasing trend in the demand for maritime labour for LNG carriers operations in Nigeria. The negative coefficient of the explanatory term T_{ml} indicates and confirms the general decreasing trend in maritime labour demand for LNG carriers operations in Nigeria. The cause of this can be traced to preference to chartering-in of LNG carriers on voyage charter terms for product delivery to demand markets, which aids the use of foreign crew in the execution of such voyages rather than the employment of own-account fleet and/or use of time charter party which favours the demand and use of Nigerian indigenous maritime labour. The effect is that transfer of

Where D_{ml1} and D_{ml2} quantum of maritime labour demand for two respective years chosen 1998 – 2016.

t_{ml1} and t_{ml2} corresponding time between the intervals. ($t=1, 2, 3, 4, \dots, n, n=19$)

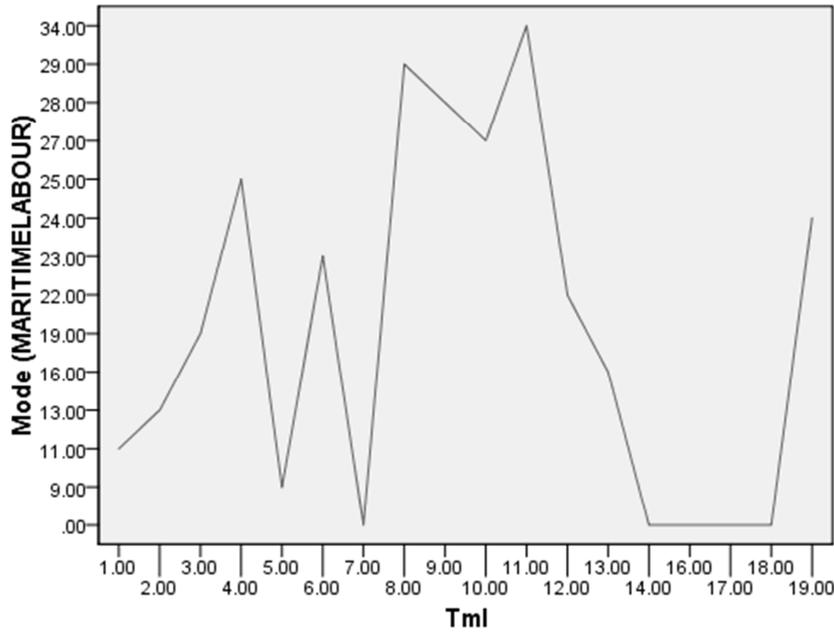
Using equation---(4), we determined the AROC for maritime labour demand for LNG carriers operations over the period covered in the study. Similarly, the rate of changes in demand for maritime labour for LNG carriers operations in Nigeria relative to changes in trend of seaborne LNG export trade in Nigeria was determined using the methods discussed above.

Based on the trend lines and the average and instantaneous rates of change, the future maritime labour demand for LNG carriers operations in Nigeria can be forecasted for future years.

technical-know-how in the operations of LNG carriers to indigenous maritime labour is negatively affected such that the country cannot attain in the shortest possible time, adequacy and sufficiency in the supply of competent maritime labour for LNG carriers operations, needed to harness her natural gas reserves and trade. Local content development in the area of maritime labour is thus hampered, Whereas countries without or with little endowment in the natural gas trade are tapping into the benefits offered by the shipping sector of LNG value chain by supply maritime manpower for LNG carriers operations; Nigeria with huge endowment and better comparative advantage to stand as a global hub, source and maritime labour supply center for LNG carriers operations has over the years been denied the benefits offered by the shipping sector aspect of the LNG value chain by unfavorable voyage charter arrangements causing decreasing trend in demand for maritime labour in the sector from the local labour market.. A t-stat of -1.154, and P-value of .265 at 0.05 level of significance and 17 degrees of freedom; indicates that there is a significant

decrease in the trend of demand for maritime labour for LNG carriers operations in Nigeria between 1998 – 2016. The chart of LNG carrier’s maritime labour demand over the

period is shown below for further insight into the trend of NLNG’s demand for maritime labour from the local maritime labour market



Source: Author’s.

Figure 2. Chart showing Trend of Maritime Labour Demand for LNG Carriers by NLNG (1998-2016).

As earlier stated in section 3.0, we used $\lim_{\Delta x \rightarrow 0} (f(x_0 + \Delta x) - f(x)) / \Delta x = df(x) / dx = \partial D_{ml} / \partial x$ ------(3) to determine the instantaneous rates of change of demand for maritime labour each year over the period covered in the study between 1998 -2016. The results are shown below.

Table 4. Estimating the Instantaneous Rate Of Change (IROC) Of Demand For Maritime Labour (Seafarers) For Lng Carriers In Nigeria Between 1998 And 2016.

Year	T _{ml}	D _{ml}	IROC = ∂D _{ml} / ∂x
1998	1	11.00	-
1999	2	13.00	2.00
2000	3	19.00	6.00
2001	4	25.00	6.00
2002	5	9.00	-16.00
2003	6	23.00	14.00
2004	7	0.00	-23.00
2005	8	29.00	29.00
2006	9	28.00	-1.00
2007	10	27.00	-1.00
2008	11	34.00	7.00
2009	12	22.00	-12.00
2010	13	16.00	-6.00
2011	14	10.00	-6.00
2012	15	0.00	-10.00
2013	16	0.00	0.00
2014	17	0.00	0.00
2015	18	0.00	0.00
2016	19	24.00	24.00

Source: Author’s calculation.

From the table, it can be seen that the NLNG first demand for and employment of maritime for LNG carriers operations

in Nigeria was in the year 1998 in which it demanded for 11 seafarers to execute her first ever seaborne LNG export in 1999. The instantaneous rates of change in demand for maritime labour for LNG carriers operations was 2.00 in 1999 and 6.00 each in years 2000 and 2001 respectively; leading increases in demand for maritime labour for LNG carriers in those periods. The instantaneous rate of change in labour demand in year 2002 is -16. This implies that there occurred a decrease in demand for maritime labour for LNG services by a total of 16 seafarers from previous year’s demands. Similarly, while the instantaneous demand for maritime for LNG carriers operations in years, 2004, 2006, 2007, 2009, 2010, 2011, 2012, shows decline in maritime labour demand of -23, -1, -1, -12, -6, and -10 respectively; there was a 0.00 IROC in each of 2013, 2014 and 2015. The negative coefficient of IROC of maritime labour demand implies that there was a decline in demand in maritime labour for LNG carriers operations in Nigeria from previous year values. The 0.00 coefficients of IROC imply there was a zero change in maritime labour demand in those. As seen from the table 1, there about seven new vessels were chartered between 2013 1nd 2015 on voyage charter party terms by the NLNG for shipping of LNG export product. The implication of this is that the supposed growth in local demand for maritime labour for LNG carriers operations were given to foreign seafarers from the countries from which the new vessels were chartered on voyage charter terms to the disadvantage of the local maritime labour market; thus the 0.00 demand indigenous maritime labour for LNG carriers operations in Nigeria in 2013, 2014, and 2015. The instantaneous rates of change in maritime labour demand in

2005, 2008 and 2016 were 29.00, 7.00 and 24.00. Demand for maritime labour for LNG carriers operations increased in 2005, 2008 and 2016. The values of the instantaneous rates of change evidently support the result of the trend analysis that maritime labour demand for LNG carriers operations in Nigeria over the past 19 years mostly shows a decreasing trend.

Estimating the Average Rate of Change (AROC) Of Demand for Maritime Labour (Seafarers) For LNG Carriers in Nigeria between 1998 and 2016.

We estimated the average rate of change (AROC) for demand maritime labour for LNG carriers operations in Nigeria using equation--- (4) as discussed in chapter three that:

$$AROC = \frac{\partial D_{ml}}{\partial T_{ml}} = \frac{f(D_{ml2}-D_{ml1})}{T_{ml2}-T_{ml1}}$$

$$AROC = \frac{(34-13)}{11-2}$$

$$AROC = \frac{21}{9} = 2.33.$$

The average rate of change of demand for maritime labour for LNG carriers operations in Nigeria between 1998-2016 is 2.33. Based on the average rate of change value, we can forecast the trend of future demand for maritime labour for LNG carriers operations in Nigeria by aggregating the preceding/previous year D_{ml} value and the AROC value.

Table 5. Measuring the Relationship between Demand for maritime Labour For LNG Carriers Operations and Tonnage of Seaborne LNG Trade.

Descriptive Statistics			
	Mean	Std. Deviation	N
MARITIMELABOUR	15.2632	11.51252	18
LNGEXPORT	877069126.5556	9465728.11523	18

ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	189.650	1	189.650	1.434	.248 ^b
	Residual	2115.461	16	132.216		
	Total	2305.111	17			

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.683	3.745		3.120	.007
	LNGEXPORT	3.529E-009	.000	.287	1.198	.248

Source: Author's.

It is assumed as true that one the major component variables that influences demand for maritime labour for LNG operations is the level of growth of LNG export trade carried by sea (seaborne LNG export trade).

Thus the decision to measure the relationship between seaborne LNG trade and demand for maritime labour for LNG carriers operations. The table above indicates that while the average demand for maritime labour for LNG carriers operations is 15.26 per annum with a standard deviation of 11.51; an average of 877069126.555MT (metric Tons) with a standard deviation of 9465728.11523. IMT of LNG was lifted by sea per annum between 1998 – 2016. The model showing the quantitative relationship between demand for maritime labour and seaborne LNG export trade with maritime labour as the dependent variable is given as: $D_{ml} = 11.683 + 3.529E-009 \text{ LNGEXPORT} + \epsilon$. The implication of this relationship and the positive coefficient of the explanatory variable is that demand for maritime labour for LNG operations increases with increase in seaborne LNG trade. The t-value of 1.198, P-value of 0.0248 at 0.05 level of significance further indicates significant relationship between maritime labour demand and seaborne LNG export trade. It is important to however observe again as seen in literature that Nigeria is not exploiting in maximum terms the benefits offered by the above relationship given the various voyage charter arrangements and ship management structures adopted by

the NLNG as seaborne LNG export from Nigeria continues to grow. These charter arrangements and ship management arrangement continue to deny Nigeria citizens opportunities of employment in the seafaring sector (maritime labour) offered by seaborne LNG operations.

6. Conclusion

The result of the study shows that the mean annual maritime labour demand over the period by the NLNG for LNG carriers operations in Nigeria is 15.26 seafarers with a standard deviation of 11.51. This implies that the NLNG between 1998 and 2016 has demanded and employed a paltry 290 seafaring cadets for LNG carriers operations in Nigeria from the local maritime labour market. The trend of maritime labour demand (D_{ml}) for LNG carriers operations over the 19 years period covered in the study is represented by the equation: $D_{ml} = 20.791 - 0.556 T_{ml} + \epsilon$. There is thus a significantly decreasing trend in demand for maritime labour for LNG carriers operations in Nigeria.

The instantaneous rates of change (IROC) in demand for maritime labour for LNG carriers operations for years 1999, 2000, 2001, 2005, 2008 and 2016 are 2.00, 6.00, 29, 7, and 24 respectively; implying that demand for maritime labour for LNG carriers operations increased in those years by the respectively determined IROC values. The IROC for maritime labour demand in years 2002, 2004, 2006, 2007,

2009, 2010, 2011, and 2012, are is -16, -23, -1, -1, -12, -6, and -10 respectively. This implies that maritime labour demand for LNG carriers operations decreased by the IROC values determined for in respective years. There were 0.00 coefficients of IROC for maritime labour demand for for LNG operations in 2013, 2014 and 2015 imply there was a zero change in maritime labour demand from the local maritime labour market in those years.

The average rate of change of demand for maritime labour for LNG carriers operations in Nigeria is 2.33. This implies that demand for maritime labour for LNG carriers operations from the local labour market on the average increased and/or decreased by 2.33 over the 19 years period covered in the study. Refer to figure 2 for the trend chart for clearer view of the general trend.

It is also important to note that while the average demand for maritime labour for LNG carriers operations is 15.26 per annum with a standard deviation of 11.51; an average of 877069126.555MT (metric Tons) with a standard deviation of 9465728.1MT of seaborne LNG was lifted per annum between 1998 – 2016. The model showing the quantitative relationship between demand for maritime labour and seaborne LNG export trade with maritime labour as the dependent variable is given as: $D_{mi} = 11.683 + 3.529E-009 LNGEXPORT + \varepsilon$. The implication of this relationship and the positive coefficient of the explanatory variable is that demand for maritime labour for LNG operations increases with increase in seaborne LNG trade.

7. Recommendations

To reverse the unfavorable decreasing trend of demand for maritime labour for LNG carriers operations from the Nigerian indigenous labour market and make Nigeria safe sufficient in and supply hub of LNG shipboard labour, it is recommended that:

- (i) The management of all LNG vessels serving the shipping needs of NLNG must be handled by NLNG Ship Management Limited (NSML). This will eliminate the current trend where the management of almost half of the vessels serving the shipping needs of the NLNG are being owned and management by foreign ship management companies who employ foreign maritime labour to the disadvantage of the local maritime labour market.
- (ii) The current practice of engaging foreign owned LNG carriers on voyage charter terms should equally be eliminated in favour of time charter parties and/or ownership of more captive fleets by the NLNG since that will give room for crewing of such captive fleets and time charters (bareboat charters) from the local maritime labour market. This if done will ensure that the country benefits maximally from the opportunities and benefits offered by the shipping sub-sector of the LNG value chain.
- (iii) Nigerian indigenous ship owners should be encouraged to invest in LNG vessel acquisition in partnership with

the NLNG through joint venture strategy to enable the NLNG acquire more LNG vessels and use such to meet her shipping needs rather than voyage charter from foreign owners. This will ensure that maritime labour for LNG carriers is sourced from the local maritime labour market.

References

- [1] Nwokedi T. C., Moses N., Ibe C. C., Onyemechi C. (2017) Economic Implications of Marine Oil Spill to Nigeria: A Case for Improvement in Coastal Pipeline Management and Surveillance Practices. *International Journal of Economy, Energy and Environment*. Vol. 2, No. 3, 2017, pp. 40-47. doi: 10.11648/j.ijeee.20170203.12.
- [2] Chinedum O., Nwokedi T. C., Nwokedi1, Okeke O. K., Igboanusi C. C., Odumodu C. U., Chikwendu D. (2017) A Business Ecosystem's Model For Harnessing Nigeria's Ocean Economy. *Journal of Traffic and Transportation Engineering 5* (2017) 279-284 doi: 10.17265/2328-2142/2017.05.005.
- [3] Charles B. and Andrew C. (2015) Analyzing Cheniere Energy's Commodity Price Exposure - Market Realist. Available at: [http:// www.chenieryenergy.com/](http://www.chenieryenergy.com/). Retrieved July 2, 2018.
- [4] Hai-Y. Z., Wen-W. X., Qiang J., Qi Z. (2018) Exploring the driving factors of global LNG trade flows using gravity modeling. *Journal of Cleaner Production* 172 (2018) 508- 515
- [5] NLNG (2017) Nigeria LNG Limited: Facts And Figures on NLNG 2017. Annual Statistical Publication of NLNG. Available at: [http://: www.nigerianlmg.com](http://www.nigerianlmg.com). Retrieved on 21/08/2018.
- [6] IGU (2017) IGU 2017 World LNG Report. International Gas Union.
- [7] Nigeria national Petroleum Corporation (2016) 2016 Annual Statistical Bulletin. Available at: [http://:www.nnpcgroup.com](http://www.nnpcgroup.com). Retrieved on 21/08/2018.
- [8] Raimonds Farah, Christa Paolo, Edwin Davide and Thierry Hub (2016) Offshore Natural Gas Resources in the Eastern Mediterranean in the Relations to the European Union: A Legal Perspective through the Lenses of MedReg. *Journal of World Energy Law and Business*. 8 (8). 134-143.
- [9] Linda C., Jack X., Jackson S., Rio W., (2017) Analysis of Venezuela, Russia and Nigeria Natural Gas Industry and the Impact on Natural Gas Sector in China. A paper presented at the LNG Conference organized by the Australia China Natural gas Technology Development Fund, China, 2017.
- [10] Chukwueyem S. Rapu, Adeniyi O. Adenuga, Williams J. Kanya, Magnus O. Abeng, Peter D. Golit, M. J. H., Ibrahim A. U., Emeka R. O. (2015) Analysis of energy market conditions in Nigeria. Central Bank of Nigeria, Abuja. Occasional Paper No. 55.
- [11] International gas Union (1993) International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk IGC Code. 1993 Edition.
- [12] Johan A. and Anna Ö. (2017) Safety manual on LNG bunkering procedures for the Port of Helsinki. Port of Helsinki Report.