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ECONOMIC IMPACT ANALYSIS OF NATURAL GAS PIPELINE DEVELOPMENT IN NIGERIA

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Abstract:
The paper presents the economic benefits of the long term development of gas pipeline infrastructure in Nigeria. The study reviewed related literature and modeled a sensitivity analysis of the tax rate with tax holiday, without tax holiday and economic impact analysis. The sensitivity analysis of tax rate with tax holiday and without tax holiday was also evaluated and it indicated that the 20% corporate income is more viable for gas pipeline projects in Nigeria. The economic impact analysis evaluated the direct, indirect and induced impact of the gas pipeline project on GDP, employment and tax revenue in Nigeria with respect to short term (5 years), medium term (15 years) and long term (40 years): The impacts analysis indicates a total GDP of 60 billion USD, 55,626 jobs created and 1.6 billion USD tax revenue generated as a result of the gas pipeline project.

Keywords: Tax Rate; Gross Domestic Product; Economic Benefit; Gas Pipeline.

1. Introduction

According to DPR (2017), Nigeria loses $10 billion due to gas flaring at the rate of $2.00 per MMBtu. It has been estimated that Nigeria loses about $1 billion of revenue due to gas flaring and its inability to capture and commercialize flared gas in the country (Derefaka, 2018). "He further stated that if flared gas is properly exploited, it has the potential to create about 300,000 jobs, produce 600,000 MT of LPG per year and generate 2.5 GW of power from new and existing IPPs, as approximately 700mmscf/d is flared at 178 flare sites in Nigeria" (Derefaka,2018).

Nigeria Gas Competence Seminar (2016) posits that flare gas utilization would yield significant economic and social benefits for stakeholders and host communities.

Natural gas is a non-renewable fossil fuel that is formed from the remains of sea animals and plants that died 300 to 400 million years ago, it comprises of hydrocarbon and non-hydrocarbons

in the gaseous phase or in solution with oil in natural underground reservoirs at reservoirs conditions (World Energy Council, 2013).

According to the National Gas Policy (2017),the fiscal setting for gas in the upstream has been dependent on oil and therefore the historical trend was that companies with upstream tax capacities tends to bring mid-stream projects for cost recovery under upstream; the fiscal setting of the Nigerian Petroleum Industry is underpinned by three different types of petroleum arrangement namely the:

- Royalty/ Tax Fiscal Regime
- Production Sharing Contract System
- Risk Service Contract (RSC) System

The gas fiscal terms have historically been developed on project basis and non-statutory pronouncements, while two main laws (section 11 and 12 of the Petroleum Profit Tax (PPT) Act, upstream gas terms and section 39 of Corporate Income Tax Act (CITA), mid-stream gas terms) defines the full range of fiscal incentives for natural gas in Nigeria (National Gas Policy, 2017).
According to National Gas Policy (2017), the distortions associated with the development of the natural gas industry and infrastructure in Nigeria includes:

- It discriminates against non-oil tax capacity investors (that is, it discriminates against companies who do not have oil operations, and therefore are unable to expense their gas costs against oil operations in the manner that upstream investors in gas projects can).
- It incentivizes oil companies to build gas infrastructure (in some cases unnecessarily oversized gas infrastructure) for fiscal reasons (to include in their cost oil base and offset against their profit oil, which ultimately is paid for by the Nigerian government).
- Gas infrastructure has been mainly built by the Nigerian government.

Figure 1.0 shows the tax foregone and a projection of tax foregone as a result of the midstream and downstream tax incentives of five years tax holidays.
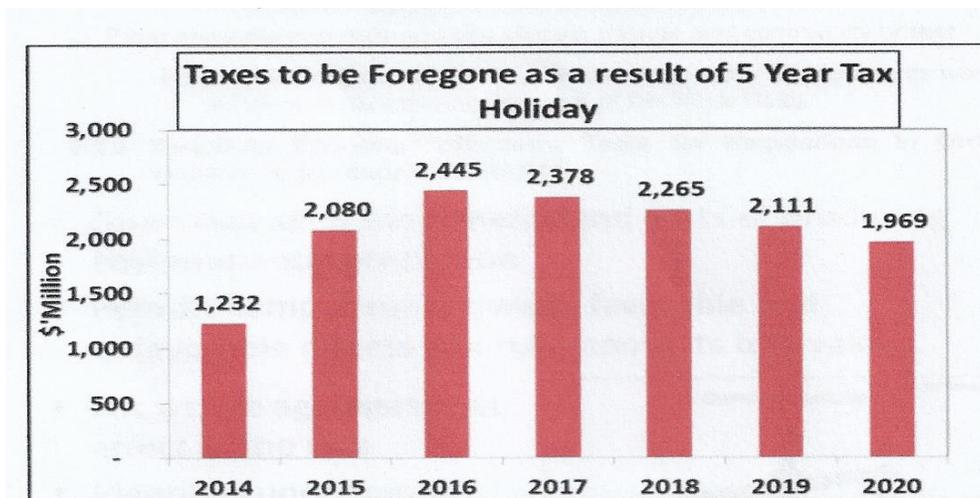
Figure 1.0: Tax foregone due to tax holiday in the consolidated natural gas and oil projects in Nigeria
Source: National Petroleum Fiscal Policy (2016)

Echendu and Iledare (2016), posit that investment in gas infrastructure and proper siting is a plausible option for guaranteed access to energy and also posit that in the long run, locating gas infrastructure at strategic locations could be done using accrued revenues from the short to medium term profit margin.

The purpose of this study is to present the economic benefits of the long term development of gas pipeline infrastructure in Nigeria.

This study is significant because, the development of gas pipeline infrastructure will lead to effective management of gas production and utilization would be a means to boost the economy through increase in revenue accruing to the government and stakeholders. The typical example of gas based economy is the Qatar Gas with a proven gas reserve of 896 tcf and fourteen (14) LNG trains whose gas earning accounts for about 57.8 % of the Gross Domestic Product while the Nigerian liquefied natural gas contributes about 4% to GDP (http://www.qatargas.com/english, 2018; http://www.nlng.com/nignlng/home, 2019).

The scope of this research is the proposed critical gas pipeline infrastructure (417km Calabar to Ajaokuta).

The aim of this paper is to present the short, medium- and long-term economic benefits from the development of natural gas pipelines in Nigeria.

2. Materials and Methods

The study adopts extensive literature review, excel spreadsheet model, analytical framework and sensitivity analysis to determine the economic impact analysis of gas pipeline development in Nigeria.

Model Assumptions
Table 2.1 shows the model assumptions considered for the economic impact analysis from the development of 417km gas pipeline from Calabar to Ajaokuta.

Table 2.1: Model Assumptions

S/N	Item Description	Value	Remark
1.	Direct Impact (Equivalent Jobs for 1km)	1.50	Based on historical gas pipeline project in Nigeria
	Indirect Impact (Jobs)	2 X Direct Impact	Based on historical gas pipeline project in Nigeria
	Induced Impact (Jobs)	Direct Impact + 2% of Direct Impact	Based on historical gas pipeline project in Nigeria
2.	GDP Impact	Direct 75%	Based on historical gas pipeline project in Nigeria

		Indirect 15%	Based on historical gas pipeline project in Nigeria
		Induced 10%	Based on historical gas pipeline project in Nigeria
3.	Tax Revenue -Indirect Impact	71% of Direct Impact	Based on historical gas pipeline project in Nigeria
4.	Tax Revenue -Induced Impact	57% of Direct Impact	Based on historical gas pipeline project in Nigeria
5.	Short term period	years	
6.	Medium term period	15 years	
7.	Long term period	40 years	

The economic impact analysis of the gas pipeline is based 1km of gas pipeline to approximate of 1.5 direct employment or jobs, the indirect job is direct employment multipled by two and the induced is based on the direct impact plus 2% of the direct impact. The basis for the Gross Domestic Product (GDP) impactis based on historical data on gas pipeline and this is with a distribution of GDP direct impact of 75%, GDP indirect impact of 15% and GDP induced impact of 10%. The indirect tax revenue impact is based on 75% of direct tax revenue and induced tax revenue is based on 57% of the direct tax revenue. The economic life cycle is categorized as the short term period (4 years period), medium term (15 years period) and long term (40 years period).

The major sources of data in this research paper includes the following:
- Data from related literature
- Data from Department of Petroleum Resource
- Nigerian National Gas Policy (2017)

3. Results and Discussions

This study adopts secondary data as shown in Appendix C and evaluates the sensitivity analysis on the tax rate with tax holiday and without tax holiday.

3.1. Tax Rate Sensitivity Analysis of Calabar to Ajaokuta Gas Pipeline

Table 3.1: Sensitivity of Tax Rate with Tax Holiday

Tax Rate	20%	30%	40%
Net Present Value (NPV) ($ billion)	14.4	12.8	11.1
Internal Rate of Return (IRR)	23.05%	23.05%	23.05%
Profitability Index (PI)	8.31	7.46	6.62
Growth Rate of Return (GRR)	27.29%	27.03%	26.73%
Discounted Pay Back Period (Yrs)	7.6	7.9	8.2

Sensitivity analysis is an uncertainty evaluation technique used in studying the profitability of the gas pipeline with respect to tax rate. The base case tax rate is 30% in accordance with corporate income tax policy in Nigeria, but there is an incentive of tax holiday (for 5 years period) for midstream and downstream gas development of the first three years and then another two years. The sensitivity analysis is to evaluate the profitability of Calabar to Ajaokuta gas pipeline project under various tax scenarios and this analysis is performed in an excel worksheet as shown in table 3.1 and 3.2 respectively.

Table 3.2: Sensitivity of Tax Rate without Tax Holiday

Tax Rate	20%	30%	40%
Net Present Value (NPV) ($ billion)	14.6	13.0	11.4
Internal Rate of Return (IRR)	20.61%	19.35%	18.07%
Profitability Index (PI)	8.37	7.55	6.74
Growth Rate of Return (GRR)	27.31%	27.06%	26.77%
Discounted Pay Back Period (Yrs)	7.3	7.4	7.5

Table 3.1 shows the sensitivity analysis of the tax rate without five (5) the tax holiday with a base tax rate of 30% as the most likely scenario, the worst case scenario of 20% and best case scenario of 40%, the profitability analysis within the 20% tax rate scenarios indicates a relatively higher NPV of $14,6 billion as compared to the base case NPV ($13 billion) and 20% tax rate scenario with tax holiday (NPV, $14,4 billion).The internal rate of return at 20% tax rate scenario is 20.61% and relatively higher than the base case tax rate (19.35%) and best case tax rate scenarios (18.07%).The Profitability Index (PI) at the 20% tax rate scenario is 8.37 and this higher than base case tax rate (PI of 7.55) and best case tax rate scenario (PI of 6.74). The Growth Rate of Return (GRR) at 20% tax rate scenario is 27.31% and this higher than the base case scenario with GRR of 27.06%, but the best case scenario has the best Growth Rate of Return of 26.77%. The discounted pay back period at 20% tax rate scenario is seven years and three months and this is shorter than the base case scenario of 30% tax rate and best-case scenario of 40% tax rate.

Economic impact analysis of the Calabar to Ajaokuta gas pipeline shows the benefit derived by government and the people from the development of the gas pipeline for the 40 years period. The economic impact analysis variables includes the following:

- Gross Domestic Product (GDP)
- Employment or Job created
- Tax revenue generated

According to Dwivedi (2013), the Gross Domestic Product is the monetary value of all goods and services produced in the local economy or state (Nigeria) as a result of the development of Calabar to Ajaokuta gas pipeline.

The Gross Domestic Product is calculated as follows:

$$GDP = Private\ Consumpt + Gross\ Invest + Government\ invest + Govt\ spending + (Export - Import) \quad\quad\quad\quad\quad 3.1$$

Where:

GDP = Gross Domestic Product

The job created or employment generated in Nigeria as a result of the development and operation of the gas pipeline is considered in this study as key economic variable or another output factor in the impact analysis.

The tax revenue that will be accruing to Nigeria as a result of the development of this gas pipeline project is third output factor or economic variable for the impact analysis and the corporate income tax is at 30% and this study considered the tax holiday for the first 5 years of the project in accordance incentive for midstream and downstream gas development in Nigeria.

The impact study analysis is performed based on direct, indirect and induced effects on GDP, employment and tax revenue from the gas project.

Table 3.3 shows the details of the impact analysis for 417km gas pipeline project in Nigeria. It shows the Gross Domestic Product (GDP), employment for each phase of the project from engineering, procurement, construction, operation and maintenance phase showing the direct, indirect and induced impact. This is calculated using an excel worksheet with the model assumption based on historical studies as stated in table 2.1. Table 3.4 shows the summaries of the impact analysis with a total GDP of $60.7 billion within the forty years period resulting from direct, indirect and induced impact; the jobs created within the 40 years period is 55,626 jobs resulting from direct, indirect and induced employments from the gas pipeline development/operation and tax revenue that will accrue to the Nigerian government or state for the 40 years period is $1,548,893,831.21.

Further analysis to reflect and capture the short term (5 years period), medium term (15 years period) and long term (40 years period) impact analysis in this study is detailed in table 3.5 with a short term GDP of $8.6 billion, medium term GDP of $21.2 billion and long term GDP of $60.7billion. The jobs created in the short term is 10,058 jobs, in the medium term is 22,631 jobs and in the long term is 55,626 jobs. The tax revenue that will accrue to Nigeria in the short term is zero (0), because of the tax holiday considered in the study, the medium tax revenue is $0.7 billion and the long term tax revenue to the Nigerian state is $1.5 billion.

Table 3.3: Summary of economic impact analysis

Impact	Direct Impact	Indirect Impact	Induced Impact	Total
Gross Domestic Product (GDP) for 40 yrs ($ billion)	48.6	7.3	4.9	60.7
Jobs / Employment for the Period of 40yrs	15012	26897	13717	55626
Tax Revenue for 40 yrs ($ billion)	0.67	0.48	0.39	1.5

Table 3.4: Economic Impact Analysis

	Impact	Unit	2019-2021 (3yrs)	2022-2023 (2yrs)	2024-2033 (10 yrs)	2034-2043 (10 yrs)	2044-2053 (10yrs)	2054-2058 (5yrs)
Direct	Gross Domestic Product (GDP)	Dollar ($)	1,977,068,990.23	2,461,058,856.37	1,006,727,105.83	1,236,849,491.24	1,279,872,437.27	1,285,208,127.66
	GDP for the Period	Dollar ($)	1,977,068,990.23	4,922,117,712.74	10,067,271,058.26	12,368,494,912.38	12,798,724,372.74	6,426,040,638.29
	Annual Employments	Per year (Yr)	626	313	313	313	313	313
	Employments for the period	Years (Yrs)	1877	626	3128	3128	3128	3128
	Tax Revenue for period	Dollars ($)	0	0	320,287,337.35	172,717,690.29	118,243,191.10	68,091,180.91
Indirect	Gross Domestic Product (GDP)	Dollar ($)	296,560,348.53	369,158,828.46	151,009,065.87	185,527,423.69	191,980,865.59	192,781,219.15
	GDP for the Period	Dollar ($)	296,560,348.53	738,317,656.91	1,510,090,658.74	1,855,274,236.86	1,919,808,655.91	963,906,095.74
	Annual Employments	Per year (Yr)	1251	626	626	626	626	626
	Employments for the period	Years (Yrs)	3753	1251	6255	6255	6255	3128
	Tax Revenue for period	Dollars ($)	0	0	227,404,009.52	122,629,560.11	83,952,665.68	48,344,738.45
Induced	Gross Domestic Product (GDP)	Dollar ($)	197,706,899.02	246,105,885.64	100,672,710.58	123,684,949.12	127,987,243.73	128,520,812.77
	GDP for the Period	Dollar ($)	197,706,899.02	492,211,771.27	1,006,727,105.83	1,236,849,491.24	1,279,872,437.27	642,604,063.83
	Annual Employments	Per year (Yr)	638	319	319	319	319	319
	Employments for the period	Years (Yrs)	1914	638	3190	3190	3190	1595
	Tax Revenue for period	Dollars ($)	0	0	182,563,782.29	98,449,083.47	67,398,618.93	38,811,973.12

Table 3.5: Summary of economic impact analysis (Short, Medium- and Long-Term Perspective)

Impact	Short Term (5 years)	Medium Term (15 years)	Long Term (40 years)
Gross Domestic Product (GDP) for the Period ($ billion)	8.6	21.2	60.7
Jobs / Employment for the Period	10,058	22,631	55,626
Tax Revenue for the Period ($ billion)	0.00	0.7	1.5

4. Conclusion and Recommendation

From this study, the sensitivity analysis of tax rate shows that 20% corporate income tax rate is more profitable with no tax holiday for the first five (5) years. The impact analysis provides an increase in Gross Domestic Product (GDP), improves employment opportunities within the project locations in Nigeria and increase in government revenue from taxation in the short term, medium and long term.

The study shows the economic benefit derived from the development of Calabar to Ajaokutagas pipeline as modeled in this study as an impact analysis, with measurable output variables of Gross Domestic Product (GDP), employment generation and tax revenue to the government. In the long term, the contribution to the Gross Domestic Product (GDP) will be approximately $60 billion, with 55,626 jobs created and $1.6 billion tax revenue to government.

The study provides an economic model that improves and support economic development through increased tax revenue generation to Nigeria that would be subsequently used to build basic infrastructures and support economic activities and development in Nigeria.

The study provides an economic model that increases social benefit to the growing population in Nigeria through direct, indirect and induced employment opportunities resulting from the development of Calabar to Ajaokuta gas pipeline infrastructure.

Appendices

APPENDIX A: Typical natural gas revenue chain in Nigeria

Source: National Petroleum Fiscal Policy (2016)

APPENDIX B: Natural gas revenue in Nigeria (1997 – 2015)

					Sales Revenue Domestic (N) Million	Sales Revenue Export ($) Million	
GAS REVENUE - DOMESTIC AND EXPORT (1997 - 2015)							
Year	**Gas Produced(Bscf)**	**Gas Flared (%)**	**Upstream Players**	**Qty Sold (Bscf)**			**Remark**
1997	1,142	70.21	SPDC + NGC	238.541	3,240.783		85% sold TO NEPA @ subzidized rate
1998	1,308	63.8	SPDC + NGC	102.472	* 2.732Billion	14.46	28,756,800mscf, 2.2% losses due to handling
1999	1,328	60.11	SPDC + NGC	203.806	4661.909	78.34	
2000	1,599	55.2	SPDC + NGC	190.062	4054.642	237.39	
2001	1,823	50.52	SPDC + NGC	241.005	5,074	145.098	Plus transmission fee
2002	1,652	45.05	SPDC + NGC	176556.058	*5.719Billion	267.127	
			Trans. fee	1.388	95.213		
2003	*1,828,541,855mscf	46	SPDC	499.464	6,597.45	416.658	Plus transmission fee
2004	2,082.28	42.54	SPDC	198.62	9,675.98	643.467	Increase in Global Demand of LPG + TF
2005	2,093.63	38.8	SPDC + JV	679.922	11,604.62	237.801	Lower due to Niger delta crises +TF
2006	2,182.43	36.66				Not reported	
2007	*2,414,649,040mscf	32.68				Not reported	
2008	2,282.44	27.06				Not reported	
2009	1,837.28	27.72				Not reported	
2010	2,392.84	24.3				Not reported	
2011	2,400.40	26				Not reported	
2012	2,580.17	23				Not reported	
2013	2,325.14	18				Not reported	
2014	2,524.27	11.47				Not reported	
2015	2,929.85	11.65				Not reported	

Source: Nigerian National Petroleum Corporation Annual Report (1997 - 2015)

APPENDIX C: Discounted cash flow model for Calabar to Ajaokuta 417km gas pipeline

Year	Period	Cash Flow ($)	Discount rate (%)	Discount Factor	Discounted Cash Flow (NPV) ($)	Cumulative DiscountedCash Flow ($)
	0	-1.98E+09	0.00	1.0000	-1.98E+09	-1.98E+09
2019	1	0.00E+00	0.06	0.9392	0.00E+00	-1.98E+09
2020	2	0.00E+00	0.06	0.8820	0.00E+00	-1.98E+09
2021	3	0.00E+00	0.06	0.8284	0.00E+00	-1.98E+09
2022	4	4.44E+08	0.19	0.4908	4.44E+08	-1.53E+09
2023	5	4.44E+08	0.19	0.4108	4.44E+08	-1.09E+09
2024	6	3.80E+08	0.18	0.3716	3.80E+08	-7.08E+08
2025	7	3.80E+08	0.18	0.3150	3.80E+08	-3.27E+08
2026	8	3.80E+08	0.18	0.2671	3.80E+08	5.29E+07
2027	9	3.80E+08	0.18	0.2265	3.80E+08	4.33E+08
2028	10	3.80E+08	0.18	0.1920	3.80E+08	8.14E+08
2029	11	3.80E+08	0.18	0.1628	3.80E+08	1.19E+09
2030	12	3.80E+08	0.18	0.1381	3.80E+08	1.57E+09
2031	13	3.80E+08	0.18	0.1171	3.80E+08	1.95E+09
2032	14	3.80E+08	0.18	0.0993	3.80E+08	2.34E+09
2033	15	3.80E+08	0.18	0.0842	3.80E+08	2.72E+09
2034	16	3.76E+08	0.20	0.0533	3.76E+08	3.09E+09
2035	17	3.76E+08	0.20	0.0444	3.76E+08	3.47E+09
2036	18	3.76E+08	0.20	0.0369	3.76E+08	3.84E+09
2037	19	3.76E+08	0.20	0.0308	3.76E+08	4.22E+09
2038	20	3.76E+08	0.20	0.0256	3.76E+08	4.60E+09
2039	21	3.76E+08	0.20	0.0213	3.76E+08	4.97E+09
2040	22	3.76E+08	0.20	0.0178	3.76E+08	5.35E+09
2041	23	3.76E+08	0.20	0.0148	3.76E+08	5.73E+09
2042	24	3.76E+08	0.20	0.0123	3.76E+08	6.10E+09
2043	25	3.76E+08	0.20	0.0102	3.76E+08	6.48E+09
2044	26	3.88E+08	0.23	0.0050	3.88E+08	6.87E+09
2045	27	3.88E+08	0.23	0.0041	3.88E+08	7.26E+09
2046	28	3.88E+08	0.23	0.0033	3.88E+08	7.64E+09
2047	29	3.88E+08	0.23	0.0027	3.88E+08	8.03E+09
2048	30	3.88E+08	0.23	0.0022	3.88E+08	8.42E+09
2049	31	3.88E+08	0.23	0.0018	3.88E+08	8.81E+09
2050	32	3.88E+08	0.23	0.0015	3.88E+08	9.20E+09
2051	33	3.88E+08	0.23	0.0012	3.88E+08	9.58E+09
2052	34	3.88E+08	0.23	0.0010	3.88E+08	9.97E+09
2053	35	3.88E+08	0.23	0.0008	3.88E+08	1.04E+10
2054	36	3.34E+08	0.23	0.0006	3.34E+08	1.07E+10
2055	37	3.34E+08	0.23	0.0005	3.34E+08	1.10E+10
2056	38	3.34E+08	0.23	0.0004	3.34E+08	1.14E+10
2057	39	3.34E+08	0.23	0.0003	3.34E+08	1.17E+10
2058	40	7.64E+08	0.23	0.0003	7.64E+08	1.25E+10
				Net Present Value ($)	**12,459,499,322.45**	

Internal Rate of Return (IRR)	23.05%
Profitability Index (PI)	7.30
Growth Rate of Return @ 22%	26.97%
Discounted Pay Back Period (Yrs)	7.86

Source: Biose, Dosunmu and Nwaozuzu (2019)

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