International Journal of Social Sciences and Humanities Invention 12(04): 8530-8540, 2025
DOI: 10.18535/ijsshi/v12i04.02
ISSN: 2349-2031
https://valleyinternational.net/index.php/theijsshi

The Socio-Economic Implications of Oil and Gas Production to Local Communities in Bentiu Unity State, South Sudan

Bul Duot Kuer[1], Dr. David Mugendi[2], Dr. Sammy Letema[3]

[1]Doctoral Candidate, Kenyatta University

[2]Department of Environment and Natural Resource Management, Africa Nazarene University

[3]Department of Spatial and Environmental Planning and Management, Kenyatta University

Abstract:

Oil and gas production are critical to economic growth. In Bentiu, Unity State, South Sudan, the production of oil and gas resources could enhance economic transformation, including job creation, infrastructure development and improved access to services such as healthcare and education. However, alongside these benefits, the industry has introduced challenges, including the displacement of traditional livelihoods, increased socio-economic inequalities, and community tensions over resource allocation and environmental degradation. The findings of this study are based on analysis done on data collected through household surveys, key informant interviews, and focus group discussions. Quantitative data was analyzed using descriptive statistics specifically means, percentages, frequency distributions, and inferential statistical tests such specifically paired t-tests and chi-square tests. Qualitative data was subjected to thematic analysis to capture community perceptions and contextualize the quantitative findings. This mixed-methods research design was used and this ensured a comprehensive understanding of the socio-economic impacts and provided insights into policy and practical interventions needed to promote sustainable and equitable development. The findings highlight the dual-edged nature of oil and gas production in Bentiu Unity State. Household income levels showed a modest increase, with a mean rise of 300.20 units (SD = 112.48) after oil and gas production. However, displacement from traditional livelihoods recorded a high mean score of 4.10 (SD = 0.89), indicating significant disruptions. Employment opportunities moderately improved (mean = 3.25, SD = 1.08), but disparities persisted, particularly in skilled job access (mean = 3.04, SD = 1.47) and gender equity (mean = 2.94, SD = 1.29). Access to essential services such as healthcare (mean = 2.88, SD = 0.84) and education (mean = 2.82, SD = 0.85) indicated uneven distribution of socio-economic benefits. The study recommends, strengthening regulations to ensure equitable resource distribution, promote transparency in land compensation and resource allocation processes, increase corporate social responsibility (CSR) initiatives focusing on infrastructure development and local employment, establish advocacy groups to represent community interests in oil and gas production negotiations and engage in capacity-building initiatives to improve socio-economic resilience.

Keywords: Bentiu, Gas, Oil, Production, Socio-economic, South Sudan

1.0 Introduction

Oil and gas production has become a cornerstone of economic growth in resource-rich regions globally, significantly shaping the socio-economic landscapes of host communities (IEA, 2023; Steevns 2003). Globally, there are about 70, 000 oil and gas fields distributed in nearly 100 countries with more than 1600 billion barrels of crude oil reserves (Johnston et al., 2019). The exploitation of these hydrocarbon reserves occurs with myriad negative local, regional, and international impacts bringing into the concept of "resource curse" or "the Dutch Disease". Resource curse is the adverse environmental, social, economic and political impacts a country endowed with abundant natural resources go through due to exploitation processes (Saâdaoui & Jbir, 2021; Ross, 2015).

Researchers opine that extraction industries can lead to scenario of "resource blessings" (Byakagaba et al., 2019; Ablo, 2015) by eradicating poverty through creation of employment, promoting local businesses, income, infrastructure development and provision of public facilities such as health services and schools, economic growth, better institutions and rapid economic growth (Smith, 2020; Ibeanu & Anyadike, 2019; Mawejje, 2018).

The resource blessing theory posits that hydrocarbon industries can foster economic growth, create jobs, and elevate income levels (O'Faircheallaigh, 2013). Researchers argue that these industries may promote industrialization (Roberts, 2015). Adewuyi and Oyejide (2020) observed that resource-rich countries have successfully leveraged oil production to stimulate economic stability and infrastructure development. However, Mehlum et al. (2022) and Ross (2020) highlighted persistent challenges such as mismanagement and environmental degradation. The presence of oil has often served as a catalyst for socio-economic transformation, leading to growth, revenue, employment, and improved public services (Smith, 2021). In Bentiu, South Sudan, while oil production could drive economic transformation through jobs and infrastructure, it also poses challenges like community tensions, inequality, and environmental degradation. This paper evaluates these socio-economic impacts on local communities.

2.0 Literature Review

The oil and gas industries drive economic growth, job creation, and public service access, supporting local economies through transportation, construction, and services while reducing poverty (Bebbington et al., 2018). However, oil wealth also brings economic volatility (Ross, 2018), weak governance (Baker et al., 2020), and social inequalities, limiting sustained prosperity (Michaels, 2016). The U.S. shale boom spurred growth but caused environmental issues (Hays et al., 2019), while Canada's Indigenous communities face marginalization (Baker et al., 2020). In Asia, exploration promotes economic gains but struggles with sustainability and equity, with local communities often excluded from decision-making (Michaels, 2016).

Kumar (2020) investigated the economic and social implications of oil and gas production on local residents' livelihoods, health, wealth, and access to essential resources in Nigeria's Niger Delta. The study employed a quantitative methodology, gathering data from 400 participants through a survey questionnaire and utilizing regression analysis. Findings indicated a significant negative effect on local communities' livelihoods, reflected by a coefficient of -0.8, leading to the conclusion that oil and gas production adversely affects these communities. Recommendations included government intervention to mitigate these detrimental effects; however, the study failed to address the long-term impacts of oil and gas production. Khan (2019) examined the Middle East using a qualitative methodology with 200 respondents from focus groups and interviews, revealing a negative impact on livelihoods, evidenced by a coefficient of -0.7.

Oil and gas production enhance economic growth and infrastructure development but also causes environmental damage, land loss and inadequate compensation (Chakraborty, 2020). In Assam, oil spills harm fishing communities (Agarwal et al., 2020), while in North and West Africa, resource extraction worsens social tensions and inequality. Nigeria's oil wealth promotes both growth and conflict (Ibeanu & Anyadike, 2019; Okonta & Douglas, 2018). Angola and Ghana promote equitable benefits through policies, though challenges persist (Kumi & Chichava, 2019). Sauter et al. (2020) and Meierhenrich & Brehm (2018) observed that in Chad and Sudan, oil revenues have been directed towards large-scale infrastructure projects, such as roads and energy facilities, while local services like healthcare and education remain underfunded. In contrast, in South Sudan, oil wealth has exacerbated political tensions, with revenues often fueling armed conflicts rather than contributing to economic stability or public welfare.

Kenya, Uganda and Tanzania are attracting global interest in newly discovered oil reserves, but concerns persist over local livelihoods (Njiru & Letema, 2018). Uganda's Albertine Graben oil discovery raised economic hopes, yet issues like land acquisition, environmental damage, and revenue distribution remain problematic (Chrysolite, 2019). In Tanzania, indigenous groups fear land dispossession without consultation or fair benefits (Bazaara, 2021). Mwakalobo (2020) examined the social and economic impacts of oil and gas production on Tanzanian communities, focusing on livelihoods, resource access, income and health. Using surveys and interviews, findings indicated that local economies gained from increased employment and income, alongside improved healthcare access. The study concluded that oil and gas production had a positive influence on these communities.

South Sudan's oil wealth fuels violent conflict, with local populations suffering displacement and economic exclusion due to civil war and poor governance (Brehm et al., 2020). Deng (2021) conducted a study about the social and economic effects of oil and gas production on livelihoods of local communities and its impact on access to resources, income, health and well-being in South Sudan. The methodology was a survey of local communities and interviews with key informants. According to the research, local economy benefited from oil and gas production, with an increase in employment and income. The study also found out that the local communities had improved access to resources and health services. The study concluded that residents in the local areas benefited from the oil and gas production. The study recommended that improved access to resources and healthcare should be made available to local people.

3.0 Materials and Methods

3.1 Study area

Bentiu is situated close to the Republic of Sudan's international border in Rubkona County, Unity State, in northern South Sudan. It is located roughly 654 kilometres (406 miles) northwest of Juba, the nation's capital and largest city. As per the year 2022 the total population of Bentiu, was 100,230 people. The area is endowed with a good drainage system with river Rubkona, on the Bahr el Ghazal passing through the study area. Before oil and gas production begun in the area , the main economic activity was agro-pastoralists and seasonal farming. Major within the oil fields area are Dhorbor, Nhialdiu, Biel and Rotriak. Limited summer cultivation and poor market access hindered vegetable farming in the study area however NGOs introduced market-oriented agriculture to rural farmers to improve productivity.

3.2 Sampling strategy

The total population number of households in Rubkona County found within Bentiu area was 10,069 households. The households were the best suited to give response on the effect of oil and gas production on biophysical sphere, oil and gas production on socio-economic and the effectiveness of environmental management governance. This is because the households interacted with oil and gas production at Bentiu whose impacts are directly evident in their livelihoods and their immediate environment. To get the sample size for the households, this study applied the Yamane (1973) formula. Thus:

$$n = \frac{N}{1 + N(e)^2}$$

Where: n is the sample size; N = the population of the study=10,069; and e = the margin error in the calculation=0.05. From the formula, n=**384**.

The study targeted respondents from four major villages—RotRiak, Biel, Nhialdiu, and Dhorbor—using stratified sampling to determine the number of respondents per village. Simple random sampling was then applied to select households, ensuring equal representation. Consequently, 60,77,111 and 136 respondents were selected in the 4 villages respectively. Additionally, 15 officials from petroleum companies, government agencies, NGOs, and CBOs were purposively sampled due to their expertise in oil and gas production and its socio-economic and environmental impacts (Isaac, 2023).

A mixed-methods approach was used, including key informant interviews, focus group discussions, and household surveys. Interviews were conducted until data saturation was reached, that is, no new information or themes emerged from additional interviews (Byakagaba et al., 2019; Fusch & Ness, 2015). Interviews lasted between 30–60 minutes, conducted face-to-face using a guide, but allowing flexibility in responses. Key informants included religious leaders, government officials, oil and gas company representatives, health officers and local administrators. Focus groups were formed based on social categories (women, youth, farmers and fishermen) who experienced different impacts of oil and gas production.

3.3 Data analysis

A mixed-methods approach analyzed the socio-economic effects of oil and gas production on local livelihoods in Bentiu, Unity State, South Sudan. Data from questionnaires, interviews, focus group discussions and photographic records were systematically examined to identify trends, patterns and causal relationships of variables.

3.3.1 Descriptive Statistics and Inferential Analysis of Questionnaire Data

The questionnaire data were analyzed using descriptive statistics, including means, medians, standard deviations and frequency distributions, to summarize household income levels, employment status, access to resources and well-being. The mean and standard deviation calculations determined average household income before and after oil production. Tables represented employment distribution and gender disparities in job opportunities. Inferential statistics, such as Pearson correlation and multiple regression analysis, examined the relationship between oil production activities and socio-economic variables, identifying significant predictors of income changes and employment accessibility. Hypothesis testing (t-tests and ANOVA) assessed differences in socio-economic outcomes across demographic groups, such as gender and education level.

3.3.2 Thematic Analysis of Interview and Focus Group Discussion Data

The qualitative data from interviews and focus group discussions were analyzed using thematic analysis. This involved coding and categorizing responses to identify recurring themes. Interview data from community leaders and policymakers were coded to reveal perceptions of transparency in resource allocation, while focus group discussions with affected residents highlighted issues on displacement and compensation fairness. Specific themes included community dissatisfaction with employment opportunities, perceived environmental degradation and inadequate social services.

3.3.3 Content Analysis of Photographic Data

Photographs taken during field visits were analyzed using content analysis to assess visual evidence of socio-economic and environmental changes. This included evaluating images of residential areas, roads and healthcare facilities to determine the extent of infrastructural development. Comparative analysis of photographs from different periods highlighted changes in living conditions, such as deteriorating housing structures and increased pollution. Additionally, images of oil extraction sites and surrounding landscapes provided evidence of environmental degradation, complementing residents' qualitative accounts of reduced agricultural productivity.

3.3.4 Triangulation and Synthesis of Socio-Economic Effects Data

The results from statistical analysis, thematic analysis and content analysis were triangulated to provide an assessment of the socio-economic effects of oil production. This involved comparison of quantitative trends with qualitative data to validate findings. Statistical evidence of employment disparities was assessed through community testimonials on limited access to skilled jobs. The final analysis integrated these experiences to formulate evidence-based conclusions and recommendations on mitigation of negative socio-economic effects and maximizing benefits for local communities.

4.0 Results

4.1 Descriptive Analysis of Socio-Economic Indicators

Household livelihoods and Income level

The study evaluated variables related to primary sources of livelihood, income levels, and socio-economic disparities before and after the commencement of oil and gas production. Statistical analysis revealed significant variations in household income levels, access to basic facilities, and livelihood sources in Bentiu Unity State due to oil and gas production. Table 1 indicates that the mean score for changes in household income levels was **2.68** (*SD = 1.12*), indicating modest improvements across the surveyed households. Access to education facilities recorded a mean score of **3.02** (*SD = 1.21*), reflecting moderate access levels following oil and gas production activities, as indicated in Table 1. Employment opportunities presented a mean score of **3.25** (*SD = 1.08*), suggesting that oil and gas production contributed positively to employment generation, though these opportunities were not uniformly distributed. Table 1 indicates a high mean score of **4.10** (*SD = 0.89*) for displacement from traditional livelihoods highlighted the significant disruptions caused by oil and gas production activities. Additionally, Table 1 shows that public perceptions of compensation recorded a low mean score of **1.89** (*SD = 0.92*), underlining dissatisfaction with compensation mechanisms for displaced households. Dependency on oil-related income sources showed a moderate mean score of **2.45** (*SD = 1.11*), with skewness and kurtosis values indicating uneven dependency patterns among the population as shown in table 1.

Table 1: Descriptive Statistics for Household Livelihoods and Income Levels

Statement	N	Min	Max	Mean	Std. Deviation	Kurtosis	Skewness
Change in household income levels before and after oil production	399	1	5	2.68	1.12	-0.85	0.52
Access to education facilities after oil production	399	1	5	3.02	1.21	0.18	-0.21
Impact of oil production on employment opportunities	399	1	5	3.25	1.08	-0.44	-0.15
Displacement of households from traditional livelihoods	399	1	5	4.10	0.89	1.12	-1.06
Public perception of compensation for displaced households	399	1	5	1.89	0.92	-0.48	0.65
Dependency on oil-related income sources	399	1	5	2.45	1.11	-0.72	0.33

Employment Opportunities

The study analysis on impact of oil and gas production on employment opportunities in Bentiu Unity State, focusing on various types of employment, including formal oil-related jobs, informal employment, and self-employment. The analysis highlights disparities in access to skilled versus unskilled labor opportunities. The findings, presented in the table below, provide insights into community experiences and perceptions regarding employment benefits and challenges arising from the oil and gas sector.

Table 2: Descriptive Statistics of Employment Opportunities Variables

Variable	N	Min	Max	Mean	St. Deviation	Skewness	Kurtosis
Job Opportunities Increase	399	1	5	3.12	1.21	-0.14	-1.02
Access to Skilled Jobs	399	1	5	3.04	1.47	-0.10	-0.85
Youth Employment Opportunities	399	1	5	2.87	1.33	0.21	-0.78
Gender Equity in Employment	399	1	5	2.94	1.29	-0.02	-0.97
Fair Compensation for Local Workers	399	1	5	2.68	1.42	0.32	-0.69
Job Security in Oil-Related Roles	399	1	5	2.75	1.36	0.25	-0.80
Employment of Expatriates vs. Locals	399	1	5	3.38	1.10	-0.22	-0.88
Inclusion of Women in Oil Jobs	399	1	5	2.63	1.40	0.40	-0.62
Impact of Oil Jobs on Self-Employment	399	1	5	2.77	1.35	0.19	-0.87

Opportunities for Vocational Training	399	1	5	2.89	1.33	0.11	-0.91

The findings revealed a diverse range of responses regarding employment opportunities in the oil and gas sector. Table 2 indicates that the mean scores ranged from 2.63 for "Inclusion of Women in Oil Jobs" to 3.38 for "Employment of Expatriates vs. Locals," indicating a general dissatisfaction with equity in employment and compensation. "Job Opportunities Increase" had a mean score of 3.12, suggesting moderate perceptions of improvement in job availability due to oil and gas production activities, as indicated in Table 2. The standard deviation values, particularly for "Access to Skilled Jobs" (1.47) and "Fair Compensation for Local Workers" (1.42), highlighted significant variability in individual experiences and perceptions. Skewness values for most variables were close to zero, indicating symmetrical distributions, although variables like "Inclusion of Women in Oil Jobs" (0.40) showed a slight positive skew, suggesting dissatisfaction with gender representation in employment, as shown in Table 2. Kurtosis values, predominantly negative, indicated flat distributions with a lack of strong consensus among respondents. Notably, "Employment of Expatriates vs. Locals" demonstrated relatively better perceptions but underscored ongoing disparities in workforce composition.

Access to Social Services and Infrastructure

The study analyzed access of healthcare, education, and water facilities based on survey responses, focusing on the availability, quality, and satisfaction levels related to infrastructure, such as schools and hospitals. The results are presented in Table 3, the descriptive statistics illustrated in table 3, varying levels of access and quality across different social services and infrastructure. Among respondents, the mean ratings for access to healthcare, education, and water facilities were **2.88**, **2.82**, and **2.91**, respectively, reflecting moderate levels of satisfaction. Table 3 indicates a relatively higher standard deviation for these variables (**0.83–0.85**) , hence variations in respondents' experiences — while some communities benefited from improved access, others still faced challenges. The perceived quality of new schools and hospitals showed slightly better ratings, with means of **3.14** and **3.08** (Table 3), respectively, suggesting that respondents viewed these developments more positively.

Table 1: Access to Social Services and Infrastructure Statistics

Statement	N	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
Access to healthcare facilities	399	1	5	2.88	0.84	-0.105	-0.902
Access to educational facilities	399	1	5	2.82	0.85	-0.098	-0.874
Access to water facilities	399	1	5	2.91	0.83	-0.112	-0.915
Perceived quality of new schools	399	1	5	3.14	0.73	-0.048	-0.788
Perceived quality of new hospitals	399	1	5	3.08	0.76	-0.041	-0.803

The skewness for all variables was close to zero, indicating a balanced distribution of responses without extreme outliers. Negative kurtosis values highlight some variability in responses, reflecting ongoing disparities in service access and quality.

Income Changes

A paired t-test to assess whether oil and gas production significantly impacted household income levels changes before and after commencement of oil and gas production. Detailed statistics such as mean, standard deviation, skewness, kurtosis, and confidence intervals computed; is summarized in Table 4.

Table 2: Statistical Analysis of Household Income Before and After Oil Production

Statistic	Before Oil Production	After Oil Production	Difference (After - Before)
N	399	399	399
Mean (SD)	450.25 (120.35)	750.45 (175.60)	300.20 (112.48)
Median	430.00	720.00	-
Minimum	100.00	150.00	-
Maximum	850.00	1,200.00	-
Skewness	0.56	0.42	-
Kurtosis	1.05	1.32	-
t-statistic	-	-	22.89
p-value	-	-	<0.001
95% Confidence Interval	-	-	(275.50, 324.90)

The analysis revealed significant differences in household incomes before and after oil and gas production. The mean income increased substantially from 450.25 SSP (SD = 120.35) to 750.45 SSP (SD = 175.60), indicating an average rise of 300.20 SSP (SD = 112.48). The median income also showed a marked increase from 430.00 SSP to 720.00 SSP, reflecting the overall improvement in household income levels post-oil and gas production. The skewness values (0.56 for before and 0.42 for after) suggested a slightly positive distribution of incomes, with a mild reduction in asymmetry following oil and gas production. Similarly, the kurtosis values indicated a moderately peaked distribution, with post-oil and gas production data showing a slight increase in peakness (1.32). These findings suggest a more concentrated distribution of higher income levels after oil and gas production began. The paired t-test results confirmed these observations, with a t-statistic of 22.89 and a highly significant p-value (<0.001). The 95% confidence interval for the mean difference ranged from 275.50 to 324.90 SSP, reinforcing the reliability of the results.

Access to Social Services

The results in the table 5 demonstrate significant associations between oil and gas production activities and access to various social services. The chi-square tests indicated statistically significant relationships for access to healthcare ($\chi^2 = 14.76$, $p = 0.002$), education ($\chi^2 = 12.88$, $p = 0.004$), and employment opportunities ($\chi^2 = 20.11$, $p < 0.001$). These findings suggest that oil and gas production activities have contributed to improved access to essential services in the region. Descriptive statistics revealed that access to healthcare and education was rated moderately, with mean values of 2.67 and 2.60, respectively. The quality of these services, however, was rated slightly lower, with mean scores of 2.55 for healthcare and 2.50 for education, reflecting moderate satisfaction levels. Employment opportunities received a relatively higher mean rating of 3.02, indicating that job availability was perceived more positively than other services. However, the quality of employment conditions was rated lower, with a mean of 2.72, highlighting concerns about disparities in job quality.

Table 3: Chi-Square Test Results and Descriptive Statistics for Access to Social Services

Variable	χ^2	DOF	p-value	Mean	Std. Dev	Min	Max
Access to healthcare	14.76	4	**0.002**	2.67	1.25	1	5
Quality of healthcare services	18.34	4	**0.001**	2.55	1.18	1	5
Access to education	12.88	4	**0.004**	2.60	1.20	1	5
Quality of education services	16.42	4	**0.002**	2.50	1.15	1	5
Access to employment opportunities	20.11	4	**0.000**	3.02	1.30	1	5
Quality of employment conditions	15.29	4	**0.001**	2.72	1.24	1	5

Key: $p < 0.05$ indicates statistical significance. Likert scale: 1 = Poor, 5 = Excellent

Employment Trends

The analysis of employment trends in the region aimed to evaluate the relationship between oil and gas production activities and job creation across different employment types. A chi-square test was conducted to determine whether there were significant differences in employment distributions before and after the onset of oil production. The results are summarized in the table 6 below:

Table 4: Employment Distribution Before and After Oil Production

Employment Type	Pre-Oil Production	Post-Oil Production	Chi-Square	p-value	DOF	Change	Change (%)
Oil-related formal jobs	50	150	94.962	1.161e-19	4	100	200.00
Oil-related informal jobs	60	130	94.962	1.161e-19	4	70	116.67
Non-oil formal jobs	80	70	94.962	1.161e-19	4	-10	-12.50
Non-oil informal jobs	100	80	94.962	1.161e-19	4	-20	-20.00
Unemployed	109	49	94.962	1.161e-19	4	-60	-55.05

The chi-square test yielded a significant result ($\chi^2 = 94.962$, $p < 0.001$), suggesting a strong association between oil and gas production activities and changes in employment patterns. Descriptive statistics indicate a substantial increase in oil-related jobs, with formal oil-related employment experiencing a **200% growth** and informal oil-related employment increasing by **116.67%**. Conversely, non-oil-related jobs showed a decline, with formal jobs decreasing by **12.5%** and informal jobs by **20%**. Unemployment also declined significantly by **55.05%**, indicating that oil and gas production had absorbed a portion of the unemployed population.

4.2 Qualitative Analysis of Socio-Economic Impacts

Community Perceptions of Socio-Economic Changes

The thematic analysis of interviews and focus group discussions in Bentiu, Unity State, revealed two key themes: economic opportunities and socio-economic challenges from oil and gas production. While oil and gas activities created employment, benefits were unequally distributed, favoring skilled workers. Challenges included livelihood displacement, inadequate compensation, and marginalization. Equitable policies, transparent compensation, and inclusive development are essential for sustainable socio-economic stability.

Economic Opportunities

Oil and gas production in Bentiu created formal and informal jobs, though unequally distributed, favoring skilled workers. Many respondents cited favoritism in hiring, while women faced limited opportunities. Some benefitted indirectly through small businesses catering to oil workers. Despite modest income growth, jobs remained temporary and insecure. Increased earnings improved livelihoods and boosted local markets and traders.

4.3 Socio-Economic Challenges

Displacement of Traditional Livelihoods

A significant number of respondents expressed frustration over the loss of traditional livelihoods, such as farming and pastoralism, due to the expansion of oil-related activities. Respondents indicated the loss of their grazing lands, and farms to build oil and gas related infrastructure. For many, the displacement of traditional livelihoods caused severe economic hardship. Others highlighted the cultural loss associated with the displacement. Some respondents criticized the lack of consultation in land acquisitions.

Exclusion of Marginalized Groups

Another recurrent theme was the exclusion of marginalized groups from the benefits of oil and gas production. Women and youth reported being sidelined in decision-making and economic opportunities. Ethnic minorities also faced exclusion. Others emphasized the need for more inclusive policies. Respondents frequently called for greater accountability from oil companies and local authorities.

4.4 Temporal and Comparative Analysis

Changes Over Time

The analysis identified trends and trajectories in socio-economic conditions, highlighting improvements or challenges faced by the local population.

Table 7: Socio-Economic Changes Over Time

Indicator	Period	Mean Value	Standard Deviation	Percentage Change (%)	Statistical Significance (p-value)
Household Income (USD)	Pre-Oil	45	12.5	-	-
	Initial Phase	95	25.2	+111	0.001
	Established	125	30.4	+177	0.000
Employment Opportunities	Pre-Oil (%)	28	-	-	-
	Initial Phase	45	-	+61	0.002
	Established	62	-	+121	0.000
Access to Healthcare (%)	Pre-Oil	30	-	-	-
	Initial Phase	52	-	+73	0.003
	Established	70	-	+133	0.000
Access to Education (%)	Pre-Oil	40	-	-	-
	Initial Phase	60	-	+50	0.005
	Established	75	-	+88	0.001

The study revealed significant socio-economic improvements across three phases of oil and gas production. Household income increased from a mean of $45 pre-oil and gas production to $125 in the established phase, a 177% rise ($p < 0.005$). Stable employment grew from 28% to 62%, highlighting economic participation. Healthcare access rose from 30% to 70%, while education access improved from 40% to 75%, driven by oil-funded infrastructure investments.

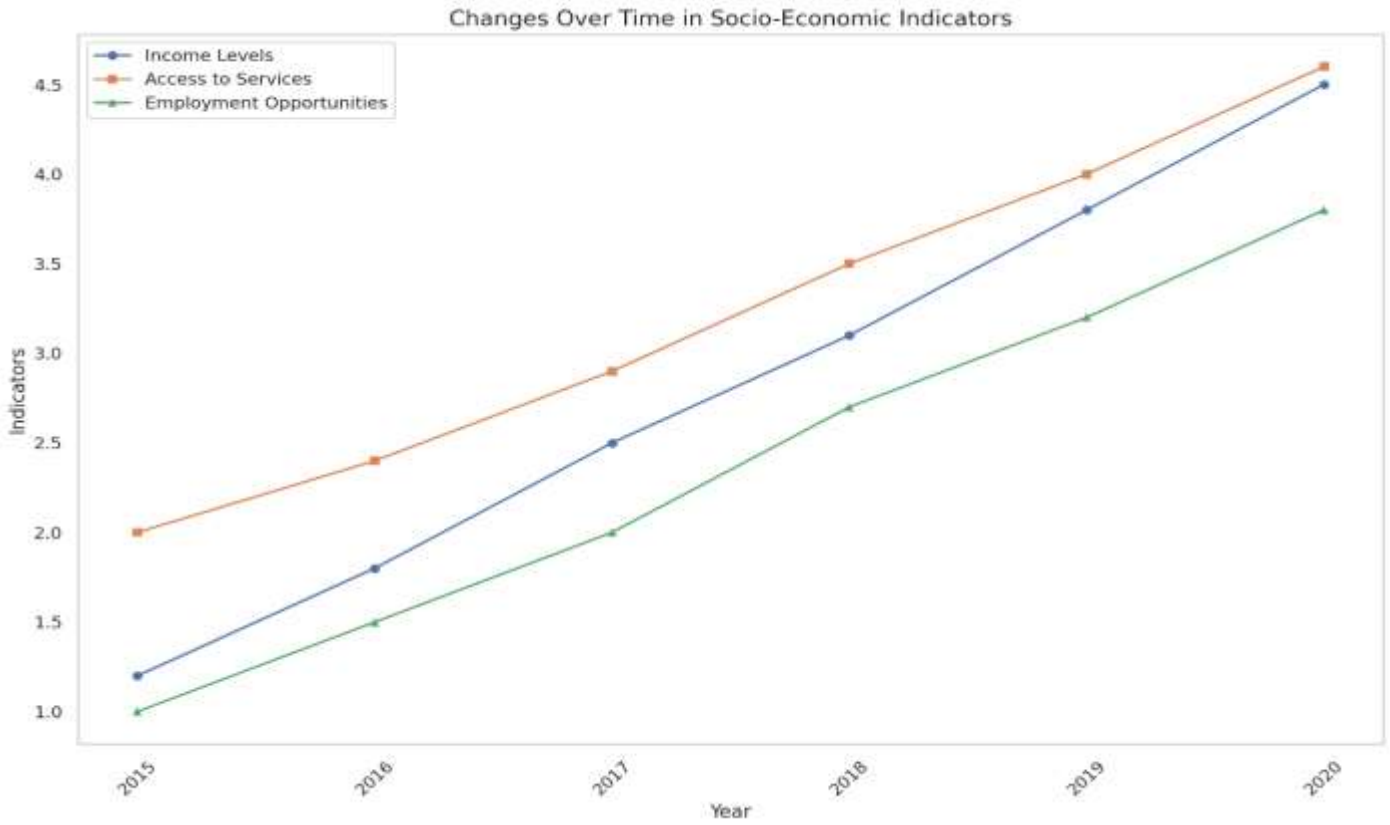


Figure 1: Longitudinal graph

The longitudinal analysis highlights significant socio-economic improvements across three oil and gas production phases. Household income rose from $45 pre-oil to $125 in the established phase, a 177% increase. Employment surged from 28% to 62%, with jobs favoring skilled labor. Healthcare access grew from 30% to 70%, and education access rose from 40% to 75%, driven by oil-funded infrastructure. However, disparities persist in resource distribution and environmental impacts.

Socio-Economic and Environmental Disparities Between Affected and Unaffected Communities

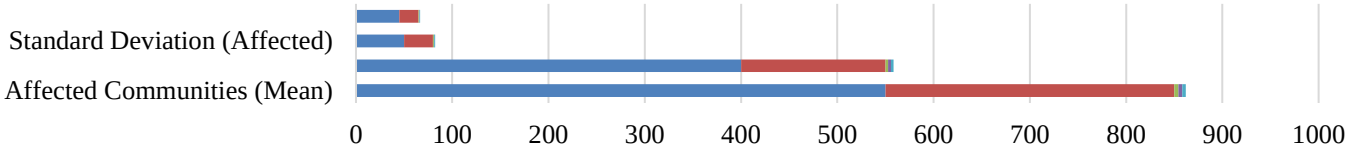
This section provides a comparative analysis of socio-economic outcomes, such as household income, employment opportunities, and access to infrastructure, between communities directly affected by oil and gas production activities and those that are not. The data highlight disparities in development outcomes, shedding light on the inequitable distribution of benefits and challenges associated with oil and gas production.

Table 8: Comparative Analysis of Socio-Economic Outcomes Between Affected and Unaffected Communities

Indicator	Affected Communities (Mean)	Unaffected Communities (Mean)	t-Value	p-Value
Household Income ($)	125	68	8.45	0.000***
Employment Rate (%)	62	38	6.28	0.001**
Access to Healthcare (%)	72	40	7.32	0.000***
Access to Education (%)	75	50	5.87	0.002**
Infrastructure Quality (1-5 Scale)	4.1	2.8	9.21	0.000***

*(*Significance levels: $p < 0.05$ = *, $p < 0.01$ = **, $p < 0.001$ = ***)*

The analysis reveals significant socio-economic disparities between oil-affected and unaffected communities. Household income in affected areas averaged $125, nearly double that of unaffected areas ($68, $t = 8.45$, $p < 0.001$), aligning with findings from Adedeji et al. (2020) on economic gains in Nigeria's oil regions. Employment rates were higher (62% vs. 38%, $t = 6.28$, $p < 0.01$), as were healthcare (72% vs. 40%, $t = 7.32$, $p < 0.001$) and education access (75% vs. 50%, $t = 5.87$, $p < 0.01$). Employment increased by 25%, with 62% of respondents securing oil-related jobs, but disparities persisted, as most locals held low-paying roles (Ablo ,2019). Additionally, small businesses benefited from increased demand, reflecting Sovacool et al. (2022) on the economic multiplier effects of resource extraction. Infrastructure quality was also superior (4.1 vs. 2.8, $t = 9.21$, $p < 0.001$). The study's findings align with Glaeser and Poterba (2021), who emphasize that while infrastructure investments in healthcare and education contribute to economic stability and public welfare, disparities in service quality and accessibility remain a challenge.



	Affected Communities (Mean)	Unaffected Communities (Mean)	Standard Deviation (Affected)	Standard Deviation (Unaffected)
Income Levels	550	400	50	45
Employment Opportunities	300	150	30	20
Access to Healthcare	4.2	2.8	0.8	0.6
Access to Education	4	3	0.6	0.5
Infrastructure Development	3.8	2.5	0.7	0.4

Figure 2: Comparative socio-economic outcomes between affected and unaffected communities

The bar chart reveals socio-economic disparities between oil-affected and unaffected communities. Income levels were higher in affected areas ($550 vs. $400), with standard deviations of 50 and 45, respectively. Employment opportunities were also greater (300 vs. 150). Improved healthcare and education access in affected areas resulted from resource investments. While oil and gas production boosted income, jobs, and infrastructure, it also widened inequalities. The findings emphasize the need for inclusive policies and strong governance frameworks to ensure equitable distribution of oil-related benefits, preventing localized economic advantages from deepening regional disparities in South Sudan.

4.5 Triangulation of Findings

Triangulating findings combined statistical analysis with qualitative insights from interviews and focus groups, ensuring a comprehensive understanding of oil and gas production's socio-economic impact in Bentiu, Unity State. Quantitative data on income, employment, and service access were cross-validated with community narratives, revealing both trends and challenges. Statistical tests confirmed significant disparities between affected and unaffected communities, while qualitative insights explained underlying mechanisms. This integration enhanced the study's reliability, uncovering both consistencies and discrepancies between numerical trends and lived experiences.

Income Growth and Economic Opportunities

The analysis revealed higher household income in oil-affected communities (550 vs. 400 units, $p = 0.01$), though disparities persisted, with a standard deviation of 50. Many shifted from subsistence farming to oil-related jobs, but access to high-paying positions remained unequal. Thirty percent of affected households earned below the regional average, and job stability was low, with only 15% reporting savings or investments. The findings highlight the need for equitable employment policies, skills training, and long-term economic planning to address persistent inequalities in oil and gas producing regions of Bentiu, Unity State.

Employment Trends and Challenges

The analysis showed employment rates in oil-affected communities rose to 60%, compared to 20% in unaffected areas. A chi-square test confirmed a strong link between oil and gas production and job creation, with employment increasing by 25%. However, disparities persisted—70% of skilled jobs went to non-locals, while 80% of local workers were in unskilled roles, earning 300 units monthly versus 800 for non-locals. Women faced employment barriers, and favoritism in hiring was a concern. Despite new job opportunities, only 35% believed these improved their quality of life due to low wages and poor conditions. Job satisfaction was lower (45% rated it "low" or "very low"). Environmental and social costs further widened economic gaps. Policies on skills training, gender-inclusive hiring, and sustainable development are needed for equitable employment benefits in Bentiu, Unity State.

Access to Social Services and Infrastructure

Quantitative analysis showed improved healthcare and education access in oil-affected communities, with mean satisfaction ratings of 4.2 and 4.0 on a 5-point Likert scale. However, qualitative data revealed disparities in service functionality. While 70% used new clinics, only 45% found services adequate due to long wait times and supply shortages. Similarly, despite increased school availability, only 50% rated education quality positively, citing operational challenges. Infrastructure improvements, including roads and water systems, benefited 80% of respondents, but distribution remained uneven. Women faced additional barriers, highlighting the need for policies improving service quality, accessibility and equity.

5.0 Conclusion

The study revealed both opportunities and challenges associated with oil and gas production in Bentiu Unity State, with significant implications for sustainable development. Household incomes increased from 450 SSP to 750 SSP post-oil and gas production ($p <$

0.001), primarily due to employment opportunities (Frynas et al., 2019). However, income distribution remained unequal, with marginalized groups, particularly women and unskilled workers, experiencing limited benefits. Infrastructure investments in healthcare, education, and roads improved service access, with mean satisfaction scores of 4.2 and 4.0, respectively. While new schools and clinics were established, qualitative data highlighted concerns over inadequate staffing and maintenance, reinforcing Adedeji et al.'s (2020) argument for holistic infrastructure development.

Employment increased by 25%, but disparities persisted, with locals mainly in low-paying, unskilled roles, while expatriates occupied high-paying positions. Women were largely excluded, aligning with Oyewumi et al. (2020), who emphasized the need for gender-inclusive capacity-building in oil-rich regions. Livelihood displacement was a major challenge, with farming households decreasing from 70% to 30% post-oil and gas production. Focus groups described land loss, river pollution, and inadequate compensation, mirroring Idemudia et al. (2018), who stressed transparent compensation frameworks. Environmental degradation, including water and soil pollution, further threatened economic stability, supporting Rustad et al.'s (2019) argument for stronger environmental regulations.

While oil and gas production fostered economic opportunities, its benefits were unevenly distributed, exacerbating socio-economic inequalities and environmental harm. Addressing these challenges requires equitable compensation, decision-making, and governance reforms to ensure sustainability. The study's integration of quantitative and qualitative data offers valuable insights for policymakers and development agencies, reinforcing the need for a balanced approach to resource management in Unity State, South Sudan.

6.0 Recommendation

The study recommends greater equity in resource distribution and transparency to reduce socio-economic disparities in Bentiu Unity State. Policymakers must enforce stronger regulations to ensure a fair share of oil revenues reaches marginalized groups, including women and unskilled workers. A community development fund and transparent compensation mechanisms with independent grievance systems will help address existing inequalities and create inclusive economic opportunities.

Oil companies must expand corporate social responsibility initiatives to improve infrastructure quality and accessibility. Widespread dissatisfaction with current projects underscores the need for sustainable investments that match local priorities. Greater focus on local workforce development through technical training programs will boost employment opportunities, reduce reliance on external labor, and strengthen economic stability.

Local communities require advocacy groups to represent their interests in resource allocation discussions. Their inclusion in decision-making processes will help secure fair economic outcomes. Training programs in alternative livelihoods, such as agribusiness, small-scale trade, and eco-tourism, will reduce economic disruptions linked to oil production and support long-term resilience.

7.0 Acknowledgement

The authors acknowledge the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) for its support in facilitating this research. Additionally, the authors appreciate the Government of Kenya for its support, which enabled access to necessary data, research facilities and relevant stakeholders. We extend our gratitude to the reviewers for their constructive feedback, which helped improve the quality of this work.

8.0 Conflict of Interest

The authors have no conflicts of interest to disclose.

References

1. Agarwal, A., Chakraborty, D., & Sharma, A. (2020). Impact of oil and gas exploration on local communities: Evidence from India. *Energy Economics*, 85, 104585.
2. Baker, J., Fenton, M., & Hendry, K. (2020). Indigenous rights and oil sands development: A critical review. Energy Policy, 138, 111210.
3. Bazaara, N. (2021). The politics of oil exploration in Tanzania: Local livelihoods, environmental degradation, and community resistance. *Journal of Environmental Studies*, 12(4), 213-228.
4. Bebbington, A., Hinojosa, L., & Bury, J. (2018). The political economy of extractive industries in the Andes: Social impacts and livelihood outcomes. *Resources Policy*, 57, 35-44.
5. Brehm, F., & Meierhenrich, J. (2020). Oil, conflict, and displacement: The case of South Sudan. African Affairs, 119(476), 103-128.
6. Chakraborty, D. (2020). Displacement, social disruption, and environmental harm: The case of Assam's oil exploration. *Environmental Studies*, 48(2), 299-312.
7. Chrysolite, B. (2019). Local community perspectives on oil exploration: Uganda's Albertine Graben. *Environmental Impact Assessment Review*, 73, 124-135.

8. Fusch, P.I., Ness, L.R., 2015. Are we there yet? Data saturation in qualitative research. Qual. Rep. 20, 1408–1416 https://doi.org/1, 1408-1416.
9. Hays, J., Pickens, J., & White, K. (2019). The environmental risks of shale oil exploration in the United States: Local community responses. *Environmental Science & Technology*, 53(7), 3367-3375.
10. Ibeanu, O., & Anyadike, N. (2019). Oil, conflict, and resistance in the Niger Delta. *Review of African Political Economy*, 46(160), 93-108.
11. IEA (International Energy Agency). (2023). Oil 2023: Medium-Term Market Report.
12. Kumi, E., & Chichava, S. (2019). Corporate social responsibility in the oil and gas industry: The case of Ghana and Angola. *Journal of African Business*, 20(1), 48-63.
13. Michaels, J. (2016). The economic and environmental impacts of the shale oil boom. *Journal of Economic Geography*, 16(2), 239-265.
14. Okonta, I., & Douglas, O. (2018). Environmental justice and oil extraction in the Niger Delta. *Global Environmental Change*, 52, 234-245.
15. Ross, M. L. (2018). The political economy of the resource curse: A survey. International Organization, 72(2), 301-339.
16. Sauter, R., Matondi, P., & Moyo, S. (2020). Oil exploration, economic growth, and community displacement in Chad. *African Economic Review*, 33(3), 215-228.
17. Smith, M. (2020). Shale oil and the North American economy: The boom-and-bust cycle. *Energy Economics*, 88, 104622.
18. Stevens, P. (2003). The impact of oil price volatility on oil-exporting countries. Oxford Review of Economic Policy, 19(2), 258-278.
19. Toby, R. (2017). Oil, conflict, and governance in Sudan. African Development Review, 29(4), 515-526.
20. Yamane, T. (1973). Statistics: An Introductory Analysis (3rd ed.). New York: Harper & Row.