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# EFFECT OF COMMUNITY AND INFRASTRUCTURAL ISSUES ON OPERATIONAL EFFICIENCY OF OIL AND GAS ORGANIZATIONS IN KENYA

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## ABSTRACT

**Purpose:** The study investigated effect of community and infrastructural issues on operational efficiency of oil and gas organizations in Kenya

**Methodology**: This study applied descriptive research design and employ exploratory research to explore the variables. The population of interest in this study comprised of 37 selected entities involved in exploration. The 37 entities formed the study units from which respondents were drawn from community liaison, management, operations, quality and security departments giving a target population of 148 respondent.

**Findings:** Results indicated the significant and challenging issues faced by exploration organizations are diverse and dispersed in their nature. The exploration organizations have to face the risks whether they emanate internally or externally as they operate or envision to operate in Kenya.

**Unique Contribution to Theory Practice and Policy**: The study points out that organizational changes should be based on reducing the impact of risk factors and is in line with the postulates of theory of constraints theory that drove this study. This theory is general and useful only as a technique for scheduling intermittent production systems to make operations lean. Operational managers need to visit research papers to ascertain what the contributors to their performance metrics are.

**Keywords**: *Community, Infrastructural issues, operational efficiency*

## INTRODUCTION

About 67% of global energy requirements are met with oil and gas supplies (Kamara, Anyanwu, Juel, Mondlane, & Iwayemi, 2009). The oil forecasts during 2003–2008 were associated with unexpected growth in emerging economies (Lutz & Hicks, 2013) though there is a correlation between energy consumption and economic growth (Bildirici & Tahsin, 2014). Higher oil prices decline in capacity to supply and increasing demand can be attributed to BRICTS countries and GCC members' rise in energy consumption due to faster economic growth (Al-Maamary, Kazem, & Miqdam, 2016). According to Kamara et al., (2009) with a 57% global energy demand projection, means that Africa's energy resources will be a focus of new discoveries.

Oil reserves in Africa grew by over 25 %, while gas reserves grew by over 100 % over the last 20 years (Kamara, Anyanwu, Juel, Mondlane, & Iwayemi, 2009). The discoveries occurred despite commonly diverse challenges exploration companies face such as governance frameworks in Australia (McKenzie, 2013) and the risk of external uncertainty (Akpata, Bredenhann, & White, 2013). Modern geophysical science and exploration technologies have improved Africa's geology knowhow rapidly leading to 51 out of 54 countries into exploration and encounter of oil and gas basins.

Bottlenecks for exploration companies on community issues mostly deal with integration of projects into the local development plans, land use rights and involvement in the projects (Brenda, 2015). Failure to seek, understand and integrate community perception cause incidents of conflict amongst host communities or against exploration companies (Idemudia, 2009). Community issues start and escalate to where they agitate for previously unattainable social justice goals (Cristina, 2017). Recurring tension emerge between business global expectations, local challenges, and opportunities in context of community demands (Frynas, 2010) (Uwafiokun, 2009).

Exploration has unavoidable land modifications that have been observed to have several environmental impacts (Aniefiok, Udo, Margaret, & Sunday, 2013). Due to the variable factors involved, land modification impact on production efficiencies owing to its costly expenses (Devold, 2013). Costs of complying with environmental regulations and technological limitation practiced by exploration companies have risks which link associated direct and indirect costs (Aniefiok, Udo, Margaret, & Sunday, 2013).

Porter & Kramer (2011) define value as benefits relative to costs often tied to profits. Part of the profit success is pegged on social progress of the community. Community-led agitations and/or conflicts over exploration activities impact both operational plans and costs and erodes the value (Aniefiok, Udo, Margaret, & Sunday, 2013). The time taken for susceptible projects to resume operations has a significant increase in costs (Davis & Franks 2011). Costing community disturbances requires analysis of the costs arising at the project's life cycle stages (example, costs to financing, construction, operations, reputation etc.) whereby cost and value foregone are accounted for in Net Present Value an accounting efficiency metric term (Davis & Franks, 2011).

Accessibility of roads are a frequent infrastructure issues for oil and gas exploration companies (Whillans, 2017). Advance planning for operation machinery, travel ways, land, electrical, water and waste networks with realistic scheduling and costing may reduce effect of challenges and risks (Whillans, 2017).Failure to integrate cost estimates and scheduling in infrastructure areas may lead to cash outflow issues (Mackenzie & Cusworth, 2016). Most exploration companies are ill-equipped internally to promote or solve infrastructure issues (Hevina & Puplampu, 2015). This has given rise to legal challenges around infrastructure development and/or use in addition to legal risks linked to shared-use infrastructure, ownership issues, financing, construction, operation, maintenance, and regulation (Ireland & Sophie, 2015).

Infrastructure may cause certain environmental problems such as oil spills (Aghalino & Eyinla, 2009) or gas flaring and venting both of which result in annual economic loss estimated at $2.5 billion (Saheed & Egwaikhide, 2012). Transportation issues count as operational costs of logistics (Porter & Kramer, 2011) which limit the benefits due from efficient access to essential inputs and collectively these factors erode profitability and competitiveness (Porter & Kramer, 2011). Regulatory limitations and uncertainty impact on the operational efficiency and cash flows needed to service the project's debts (Collier & Ireland, 2015). Yet well designed regulations can eliminate inefficiencies and avoid disputes characterized by multiplied unavoidable and un-quantified costs (Collier & Ireland, 2015).

Infrastructure is a non-technical risk and cumulatively with stakeholder issues, account for nearly half of the total risks faced by exploration companies (Davis & Franks, 2011). Their potential threat require adoption of a cost/benefit approach management which, if not appropriate, then use of value of risk management to the company value as a measure of efficiency should be adopted (Davis & Franks, 2011).Exploration has an uncertainty factor (Omontuenmhem, Bredenhann, & Bedwei, 2016), (Uyi ,Akpata ;Chris, Bredenhann ;Darcy, White, 2013). The absence governance structures reminds investors that investments in exploration may worsen if the political and economic situations go fragile (Auge & Nakayi, 2014). Kenya's maritime border disputes causes uncertainty for exploration companies such as ENI Ltd. and Total Ltd. (Brown, 2013). Lake Malawi border dispute between Malawi and Tanzania withholds investments by exploration companies ( (Ihucha, 2014).

Vanoil's suit against Kenya Government refusal to renewing its Blocks 3A and 3B license added to its exit plan (Passin, 2014). Pancontinental Ltd remains in default over notices for non-payment in 2015 (Thielsen, 2017), (Nicholas, 2016). Ophir Energy Plc suffered an impairment loss of $62.6 million by exiting certain Blocks which dented its capital for operations (Dr. Nick, 2016). Challenges are faced on vendors' capabilities, host community issues and joint venture influence (Emah, Mehraz, & Mridula, 2017) to more specific issues such as water use and water pollution (Nenibarini & Gustaf, 2017).

**Statement of the Problem**

Exploration organizations should address emergent challenges that spur performance to achieve.

**Objective of the Study**

The study sought to establish effect of community and infrastructural issues on operational efficiency of oil and gas organizations in Kenya.

## METHODOLOGY

This study applied descriptive research design and employ exploratory research to explore the variables. The population of interest in this study comprised of 37 selected entities involved in exploration. The 37 entities formed the study units from which respondents were drawn from community liaison, management, operations, quality and security departments giving a target population of 148 respondent. Stratified sampling method was used to select respondents from community department; purposive sampling method was used to select respondents from security, quality and management departments and random sampling method was used to select respondents from operations department. Purposive sampling method was used to select significant respondents from units of analysis. Random sampling method was used to select respondents with operational experience as their participation aims to complement the study. The researcher-maintained anonymity by separating information such as code numbers from the data itself. Secondary data were obtained from previous materials obtained from the companies' websites and published information extracted from other researchers. The study adopt a structured questionnaire instruments data collection tool.

A follow-up an interview either via phone was organized with respondent to accord the interviewer a clearer perception. To ensure that data was reliable and valid, a statistical test was done .Data was analyzed using descriptive statistics and presented in tables and charts. Frequencies and percentages were used to explain data sets and results. Inferential statistics was drawn based on findings of the descriptive statistics whereas qualitative data was drawn from open-ended questions in the questionnaire, document analysis and interview guide presented the findings. The researcher conducted a multiple regression analysis to measure the strength of variables relation.

## RESEARCH FINDINGS AND DISCUSSION

**Response Level**

The Likert scale questionnaire was administered to the respondents from the selected organizations. 108 questionnaires were administered, and 106 responses were obtained giving a response rate score of 98%. Mugenda & Mugenda (2008) assert that above 50% response rate is adequate for descriptive study.

Above 95% response rate sought by study is acceptable (Hussey & Collis, 2009).The response rate of this study met and exceeded the minimum threshold and therefore sufficient for the researcher to conduct data analysis.

**Demographic Results**

This section describes pertinent characteristics of the respondents such as the department, the position, status of their current position, their experience based on the number of years in their current position and in the oil and gas industry at large.

**Department**

Respondents indicated their department or department which is typically associated and relevant to their position. The results are indicated on Table 1 below and the findings indicate that majority of respondents at 37.7% were from Operations department; 17.9% of respondents were from Security department; Quality and Community Liaison departments each had 15.1% of the respondents whereas Management respondents were the least at 14.1%. The findings established that critical and relevant departments were considered for the study. Mugenda & Mugenda (2008) asserts that population of study must be empirical and involved various respondents in their diversity.

**Table 1 Departmental Distribution of Respondents**

| Department | Frequency | Percentage |
|---|---|---|
| Community Liaison | 16 | 15.1 |
| Management | 15 | 14.2 |
| Operations | 40 | 37.7 |
| Quality | 16 | 15.1 |
| Security | 19 | 17.9 |
| Total | 106 | 100.0 |

**Position**

Respondents were also classified based on their actual position within the respondent's organization and department. The results are presented in Table 2 below. The findings of the test analysis shows the distribution of the respondents in their various positions. Respondents in other position at 32.1% lead in the participation of the research followed by Security Managers at 28.3%. Operation Managers participated in the study at 15.1% followed by Quality Managers at 13.2%. General Managers participate the least at 11.3%. This study drew from a closely related study population with rich unfettered information as asserted by Cooper & Schindler (2006).

**Table 2 Position Distribution of Respondents**

| Position | Frequency | Percentage |
|---|---|---|
| General Managers | 12 | 11.3 |
| Security Managers | 30 | 28.3 |
| Quality Managers | 14 | 13.2 |
| Operation Managers | 16 | 15.1 |
| Other positions | 34 | 32.1 |
| **Total** | **106** | **100.0** |

## Current Position

The study determined the status of the respondents in relation to their position as to whether they had resigned, moved to different oil and gas entity, or moved to a different department within the organization or incumbent. The results are presented in Table 3 below. 85.8% of respondents were incumbents whereas 4.7% of the respondents had resigned from their current position though they responded to the questionnaire whilst still holding their position. 6.6% of respondents moved to different oil and gas companies indicating though they responded to questionnaire in their current position in the organization, they were transitioning to a new organization. 2.8% of respondents moved to a different department indicating that they had changed departmental roles. This indicates that data was obtained from credible respondents as asserted by Cresswell (2009).

**Table 3 Current Position Distribution of Respondents**

| Status | Frequency | Percentage |
|---|---|---|
| Resigned | 5 | 4.7 |
| Move to different oil company | 7 | 6.6 |
| Move to different department | 3 | 2.8 |
| Yes | 91 | 85.8 |
| **Total** | **106** | **100.0** |

## Descriptive Statistics of the Study Variables

### Community

Descriptive analysis was carried out for the test variable community. The data analysis are summarized in Table 4 below. The community issues test variable of conflict (mean=3.90) and development agenda (mean=3.60) and land and water rights (mean=3.25).Have its effect on operations efficiency. The average mean score of test variable was 3.51. The average standard variation score was 0.84. In hierarchical order, development agenda (standard deviation=1.152), land and water rights (standard deviation=1.031) and conflict (standard deviation=1.004) had higher than the average standard deviation score which indicate the level of diversity of the issues.

Indication that community issues are dispersed on all the test elements which effect operations efficiency asserts the research conclusions by Davis & Frank (2011), Devold (2013) and Idemudia (2009).

**Table 4 Community**

| Statements | Never | Rarely | Sometimes | Often | Always | N | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|---|
| Land/Water rights affect exploration operational efficiency metrics? | 4.70% | 19.90% | 31.20% | 34.80% | 9.40% | 106 | **3.25** | **1.031** |
| Development agenda affect exploration operational efficiency metrics? | 3.80% | 15.10% | 25.50% | 28.20% | 27.40% | 106 | **3.60** | **1.152** |
| Conflict affects exploration operational efficiency metrics? | 2.80% | 5.70% | 22.70% | 37.70% | 31.10% | 106 | **3.90** | **1.004** |
| **Average** | | | | | | | **3.58** | **0.844** |

## Infrastructure

Descriptive analysis was carried out for the test variable Infrastructure. The analytical results are summarized in Table 5 below. The data analysis indicates that test variable for equipment breakdown or en-route theft (mean= 4.03), bad roads/access routes, telecommunications, water/wastewater management (mean 3.87) and court cases/injunctions on development constitute legal challenges (mean =3.67) effect operations efficiency.The average mean score was 3.85. The average standard variation score was 0.806. In hierarchical order, bad roads/access routes, telecommunications, water/wastewater management (standard deviation=1.07), court cases/injunctions on development constitute legal challenges (standard deviation =1.067) and equipment breakdown or en-route theft (standard deviation= 0.99) had higher than the average standard deviation score which indicate the level of dispersion or diversity of the issues. That infrastructure issues are diverse and significantly effect operations efficiency corroborate and asserts Porter & Kramer (2011) conclusions.

**Table 5 Infrastructure**

| Statements | Never | Rarely | Sometimes | Often | Always | N | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|---|
| Bad roads/Access routes, telecommunications, water and wastewater management affect exploration operational efficiency metrics? | 6.60% | 1.90% | 18.90% | 43.40% | 29.20% | 106 | **3.87** | **1.070** |
| Court cases/injunctions on exploration and other legal challenges affect exploration operational efficiency metrics? | 3.70% | 12.30% | 23.60% | 38.70% | 21.70% | 106 | **3.67** | **1.067** |
| Equipment breakdown or En-route theft and other similar risks affect exploration operational efficiency metrics? | 1.90% | 5.70% | 18.90% | 34.80% | 38.70% | 106 | **4.03** | **0.990** |
| **Average** | | | | | | | **3.855** | **0.806** |

## 4.5 Inferential Statistic

Correlation analysis was performed to establish the strength of relationship between the variables. Table 6 below presents a summary of the findings.Correlation coefficient defines the magnitude between two variables where a positive coefficient means there is a positive relationship between variable and a negative coefficient means opposite and a zero coefficient means there is no relationship (Mugenda & Mugenda, 2008). Kothari (2004) asserts that a perfectly positive correlation is where variations in independent variable explain the variation in the dependent variable and this is somehow a constant unit of change in the dependent variable.Information obtained supports that community issues are positively and moderately correlated with operational efficiency ($R=0.554$, $p<0.001$). Conclusion can be derived that Infrastructure issues are positively and moderately correlated with operational efficiency ($R=0.591$, $p<0.001$).

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**Table 6 Correlation Matrix**

| Variable Statements | Community s | Infrastructure | Operational Efficiency |
|---|---|---|---|
| Community | 1 | | |
| Infrastructure | **.735**** | 1 | |
| Operational efficiency | **.554**** | **.591**** | 1 |

Correlation analysis was performed to establish the strength of relationship between the variables. Table 6 below presents a summary of the findings.Correlation coefficient defines the magnitude between two variables where a positive coefficient means there is a positive relationship between variable and a negative coefficient means opposite and a zero coefficient means there is no relationship (Mugenda & Mugenda, 2008). Kothari (2004) asserts that a perfectly positive correlation is where variations in independent variable explain the variation in the dependent variable and this is somehow a constant unit of change in the dependent variable.Information obtained supports that community issues are positively and moderately correlated with operational efficiency (R=0.554, p<0.001)..

Conclusion can be derived that Infrastructure issues are positively and moderately correlated with operational efficiency (R=0.591, p<0.001).

**Table 4.10 Correlation Matrix**

| Variable Statements | Community s | Infrastructure |
|---|---|---|
| Community | 1 | |
| Infrastructure | **.735**** | 1 |
| Operational efficiency | **.554**** | **.591**** |

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## Regression Analysis

### Model of Analysis

Regression analysis was performed to illustrate the existing relationship between the variables. Table 7 presents the model summary. Cresswell (2009) supposes that regression is conducted to estimate the relationship between independent and dependent variable. He argues that if assumptions under multiple linear regression holds that relationship between independent and dependent variable be linear, all variables be normal and that their exists little or no multi-linearity in the study data (Cresswell, 2009). Table 7 show the fitness model employed in the regression analysis.

R shown in Table 7 is the correlation between the observed and predicted values of dependent variable implying that the association of 0.902 between the factors (community issues, infrastructure issues) and operational efficiency was very good. R-Square is coefficient of determination and measures the proportion of the variance in the dependent variable – factors - that is explained by variations in the independent variables - community issues and infrastructure issues. This implied that 81.4% of variance or correlation between dependent and independent variables. That is, 81.4% of variations or changes in operational efficiency are caused by the factors. This model is therefore fit in explaining the significant of the relationship of the variable. However, it does not reflect the extent to which any particular independent test variable is associated with the operational efficiency.

**Table 4.11 Regression Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .902[a] | .814 | .806 | .33289 |

### Analysis of Variance

Kothari (2004) asserts that analysis of variance is a statistical analysis that aims to check for differences in means and their statistical significance to the independent variables in a study. The ANOVA statistics shown in Table 8 was used to present the regression model significance. An F-significance value of p=0.000 was established showing that there is a probability of 0.0% of the regression model presenting a false information. This means that the model is statistically significant in predicting the how the independent variable effect the operational efficiency of oil and gas exploration entities. The ANOVA regression model compares the magnitude of the coefficients of the independent to determine which one had more effects on operational efficiency. Therefore, the model is very significant.

**Table 8 ANOVA**

| Model | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Regression | 48.895 | 4 | 12.224 | 110.306 | .000 |
| Residual | 11.192 | 101 | .111 | | |
| Total | 60.087 | 105 | | | |

**Regression Analysis**

A multiple linear regression formula was adopted for this study. Table 9 Regression coefficient presents the summary of results. The adopted linear regression formulae attempts to model a relationship between exploratory variable and responders variable by plotting a linear equation to the response variable as stated by Cresswell (2009).

**Table 9 Regression Coefficients**

| **Model** | **Unstandardized Coefficients** | | **Standardized Coefficients** | **t** | **Sig.** |
|---|---|---|---|---|---|
| | **B** | **Std. Error** | **Beta** | | |
| (Constant) | -.154 | .226 | | -.681 | .497 |
| Community | .116 | .076 | .099 | 1.528 | .130 |
| Infrastructure | .049 | .098 | .037 | .498 | .620 |

a. Dependent Variable: Operational efficiency

From Table 9, the following regression model is established:

**Operational efficiency = -0.154 + 0.116$X_1$ + 0.049$X_2$**

Where $X_{1=}$ community, $X_{2=}$ Infrastructure

The regression constant shows that when the independent variables community issues and infrastructure issues, are constant at zero, operational efficiency value would be -0.154. This shows that without these factors, operational efficiency would be negatively insignificant. Results indicate that operational efficiency would rise by 0.116 with every unit positive increase in community issues provided that other factors are constant, and the statistic is insignificant at 95% confidence level (p=0.130). The application of infrastructure issues would lead to an increase in operational efficiency by factor of 0.049 at p= 0.620 should other factors be held constant.

## SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

### Summary of Findings

The study had an objective to establish effect of community and infrastructural issues on operational efficiency of oil and gas organizations in Kenya. The independent variable for the study included: community and infrastructure. The study revealed that variables community and infrastructure had a positive and significant effect on operations efficiency.

### Conclusion

Evidence from prior research studies had identified multiple operational challenges that oil, and gas exploration company's face, which has negatively affected the performance of these companies. With the projected increase in demand for energy and significant increase in oil and gas supplies to meet this demand, many entities have increased their interest in oil and exploration companies. The significant and challenging issues faced by exploration organizations are diverse and dispersed in their nature. The exploration organizations have to face the risks whether they emanate internally or externally as they operate or envision to operate in Kenya.

The challenges have been clustered as local content issues, security issues, infrastructure issues and community issues. The pertinent issues around these variables have been identified as diverse and dispersed in nature. Given their positive correlation to operational efficiency, this study has asserted that their very nature results into operational inefficiencies and that the performance metrics for operational efficiencies are effected. Organizations have to factor these variables in order to avoid drawing operational inefficiencies and thus their organizational performance metrics when it comes to carrying out oil and gas exploration activities.

Multiple researchers have discussed and still continue to investigate and explore the variables under this study with view to enrich the topic of operational management in oil and gas industry. Involving various respondents from the organizations within the field had helped to assert that operational challenges indeed effect the operational efficiency of these companies and their general efficiency performance metrics. The current findings add to the existing research on operations management about the issues that Kenyan oil and gas exploration organizations and other regional countries face and need to consider in their hierarchical order of significance.

### 5.3 Recommendations

Operational management acts are measured by an organization efficiency performance metrics. Given that operations management is evolving into a service activity, operational managers need to visit research papers to ascertain what the contributors to their performance metrics are. This study has attempted to demystify the notion that all the independent variables have equal probability of affecting operational efficiency and instead has discovered that there exists a positive correlation between community and infrastructure issues and operational efficiency performance metric. This finding allows operation managers to do a proper scenario planning and to develop appropriate and focused mitigations to mitigate the effect of community and infrastructure issues which has a significant impact on operational performance in order to retain the value and competitiveness of their organization in oil and gas exploration industry.

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