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Abstract

Purpose: the purpose of the study is to assess the challenges of operational efficiency faced by selected oil and gas exploration 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 study adopted a structured questionnaire. The study data was also analyzed using descriptive statistics and presented in tables and charts. Frequencies and percentages was used to explain data sets and results. Inferential statistics were drawn based on findings of the descriptive statistics.

Findings: Results indicate that operational efficiency would rise by 0.116 with every unit positive increase in community issues provided that other factors (infrastructure issues, local content, and security) 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. Holding other factors (community issues, infrastructure issues and security) constant, a unit increase in local content would lead to a 0.856 increase in operational efficiency ($p<0.001$). Lastly, a unit increase in security would lead to a 0.132 increase in operational efficiency these statistics being significant ($p<0.01$) at 95% of significance.

Unique Contribution to Theory Practice and Policy: 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 are the contributors to their performance metrics. This study has attempted to demystify the notion that all the independent variables have equal probability of affecting operational efficiency and instead has instead discovered that there exists a positive correlation and each independent variable has a hierarchical contribution towards the score of an operational efficiency performance metric.

Keywords: *challenges, oil and gas exploration organizations, operational efficiency, oil and gas exploration.*

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INTRODUCTION Background of Study

Oil and Gas industry plays a significant role in the growing of economies worldwide. Despite being the core unit of production in most countries worldwide, the industry faces many structural and operational challenges that inhibit efficiency in its exploration (Brown, 2013). Most African countries have not been in this trade. Kenya has not been an exception since they have only less than 10 years' experience.

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.

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).

Statement of the Problem

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

General Objectives

i. To analyze the effect of community issues on the operational efficiency of oil and gas organizations in Kenya. ii. To assess the effect of infrastructural issues on the operational efficiency of oil and gas organizations in Kenya. iii. To determine the effect of local content issues on the operational efficiency of oil and gas organizations in Kenya.

iv. To evaluate the effect of security issues on the operational efficiency of oil and gas industry organizations.

LITERATURE REVIEW Theoretical Framework Theory of Constraints

Goldratt and Cox postulated that organizational changes should be based on reducing the impact of risk factors ("bottlenecks") (Goldratt & Cox, 2004). By methodologically applying five steps of this theory, an organizations bottleneck keeps operations lean. He identified the bottleneck on the conditions of the risk factor or constraint; maximized bottleneck capacity, implemented adjustments on the non-bottlenecks which led to minimized wasted effort and maximized efficiency. He figured out scheduling non-bottleneck operations to make it a non-factor of productivity (William, 2012).

Mahesh & Lynn (2008) argue that this theory is general and useful only as a technique for scheduling intermittent production systems to make operations lean. Saxowsky (2010) noted that exploration activities intensively plan and schedule operations. Therefore, consideration of barriers and enablers for an organizational performance are essential for attaining positive efficiency metrics and competitiveness in the financial results (Roshni, Siti-Nabihaa, Dayana, & Yousif, 2016). The theory will be useful to assert how independent variable as risk factors influence on operational efficiency

Stakeholder Theory

Freeman (2010) supposed that a business has interconnected relationships with its shareholders and stakeholders whereby the business should create value for both using the six proposed principles. The principle of limited immortality argues that longer timeline of existence of a business is pegged on survival management and this will ensure success to shareholders and stakeholders. The principal of contract costs acknowledges that some costs of contracts are nonfinancial though if the cost is financial , parties should bear costs in proportion to their stake or advantages they accrue from the business. The agency principle states that managers are merely agents of the business. The principle of governance articulates that rules governing the relationship between stakeholders and the business is consensual. The principle of externality advances the thought that whoever is affected by the business is entitled to become a stakeholder and lastly, the principle of entry and exit stipulates that rules terminating ensuing relationships should be clear and transparent.

During exploration, Wilburn & Wilburn (2011).determined that identification and engagement of stakeholders is important step in obtaining goodwill and social license to operate since it is used to present the business case for vested and non-vested stakeholders. This study variables on community, local content , security, and infrastructure are often encountered as challenges which may require engagement with multiple stakeholders for successful operationalization. Research to bridge theory-practices gap provide evidence that early stakeholder engagement can contribute to

project value (effectiveness) and that since the stakeholder motivation are dynamic, proper managerial strategies are essential (Wojewnik, Dziadkiewicz, Dryl, Dryl, & Bęben, 2019)

Conceptual Framework

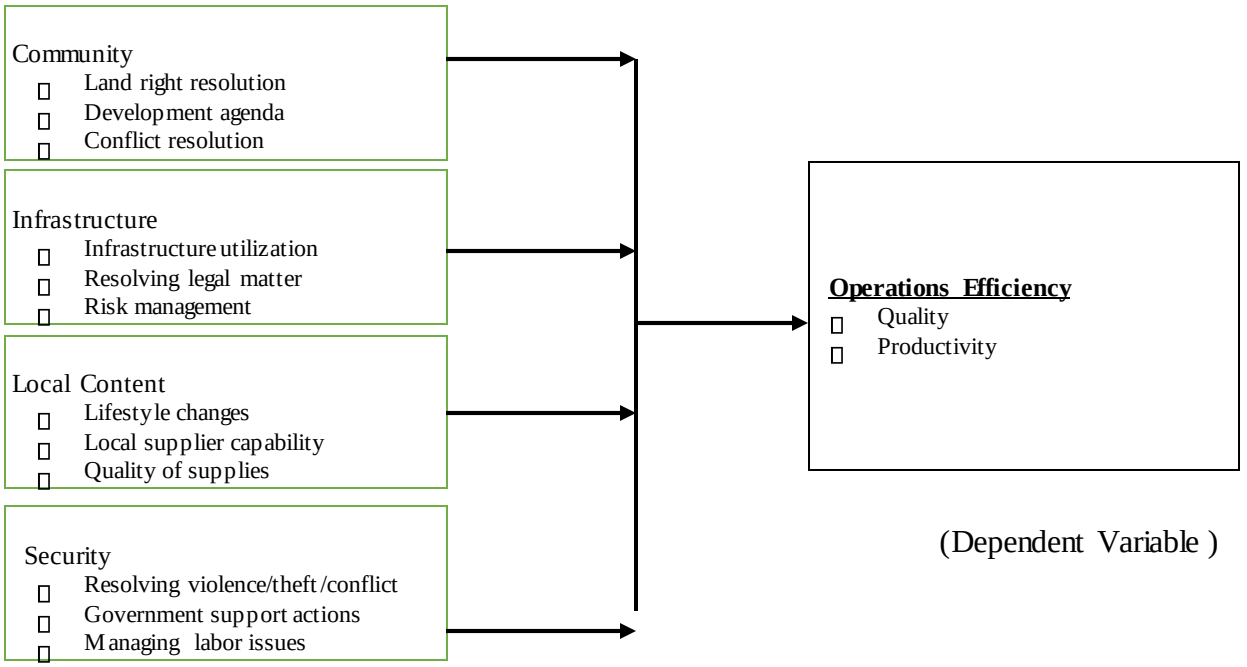

Figure 1 Conceptual Model Empirical review

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 to 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).

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).

Security issues such as vandalization and theft impact on productivity by limiting optimization of operations and production. (Saheed & Egwaikhide, 2012). Accruing impairment has additional costs that lead to material loss (Saheed & Egwaikhide, 2012) such as community agitation against environmental issues that stop operations leading to a complete decommissioning. Most incidents morph to security issues which are classified as operational cost in attempt to remedy and account for their effect on financial performance ratios (Davis & Franks, 2011).Labour makes about 60% of operating costs resulting to the need for effective labour utilization, efficient labour measurement and determination of its effect to productivity (Neingo & Cawood, 2014). Causes of labour inefficiencies affect unit costs and total cost of production and recently, it has been an issue squeezing the overall profit margins (Neingo & Cawood, 2014).

Public education in local communities imposes productivity and remedial-training costs for host companies in which educated local workforce will be a future benefit for company (Porter & Kramer, 2011). Against this background, studies have reported lifestyle changes and work-related safety incidents during exploration activities in which companies bear local community lifestyle burdens (Janis, Marcello, Jean, Malcolm, & Mieke, 2011) whereby associated costs jeopardize production costs and efficiency (Porter & Kramer, 2011).

A need to create shared value arises whereby, the company productivity efficiencies is enhanced by addressing gaps in the local content conditions (Porter & Kramer, 2011). Collaboration for example foster logistical efficiency which boost company productivity which, conversely productivity efficiencies suffers (Porter & Kramer, 2011). By improving or strengthening local suppliers to focus on their efficiency, yields, product quality, and sustainability, both collaborators benefit from productivity profit due to lean operations and innovation (Porter & Kramer, 2011).

Research gaps

A research gap exists on a comparative study of operational challenges faced by exploration organizations in Kenya. Most Research focus on socio-economic disposition of oil and gas and therefore it is not known if operational challenges from other studies draw relevance to the Kenyan situation. Additionally, significance of operational management in oil and gas exploration in Kenya has not been properly examined. The potential contribution of operational challenges in oil and gas exploration is not in focus and therefore its assertion. Exploration activities are handled in phased out project cycle a fact which has stretched and set in motion the dynamics of operations management which previous studies had observed as changing. Given that boundaries of operation management have changed, the effect on strategies, techniques, technology, and their influence on productivity are yet to be fully explored.

A research gap exists in on disaggregation and characterization of operational challenges in Kenya situation. The synergies have not been identified inline of the operations management thought and consequently, the characterization of operational challenges , synergies and complementariness to the Kenyan situation is hardly understood necessitating this study. A research gap exists in the construct of the effect of operational challenges to the exploration organizations. Research between characterized operational challenges and their effect on productivity require further study. Empirical studies contend that relationship between the operational challenges and observed phenomena in the industry has mixed outcomes and this has not been determined for Kenya situation. Quantification of the contribution of the operational challenges to productivity efficiencies also constituted the need for this study.

RESEARCH METHODOLOGY

This study applied descriptive research design and employ exploratory research to explore the variables. The researcher had an opportunity to collect systematic information to investigate the study topic and allow the use of mixed research methodology that combines fundamentals of qualitative research and quantitative research methods.

The population of interest in this study comprised of 37 selected entities involved in exploration. This diversity and know-how in the area of study is representative of the target population (Mugenda & Mugenda, 2008). The 37 entities will form the study units from which respondents will be drawn from community liaison, management, operations, quality and security departments giving a target population of 148 respondents.

This study shall sample from the target population of 148 respondents. Table 1 below shows a summary of sampling frame.

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Table 1: Sample Frame

Item (Department)	Population	Sample Percentage (%)
Community Liaison	12	8.1
Management	15	10.1
Operations	58	39.2
Quality	15	10.1
Security	48	32.4
Total	**148**	**100.0**

In this study, stratified sampling method will be used to select respondents from community department; purposive sampling method will be used to select respondents from security, quality and management departments and random sampling method will be used to select respondents from operations department.

To obtain a minimum population of study, the researcher adopted Yamane's formulae (Yamane, 1967).

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

Where,

N is the target population =

n is the sample size

The unit of study included National Oil of Kenya Limited (NOCK) and PTTEP (Cove Energy Limited) both of which were excluded from the primary selection and purposively sampled for the pilot study having exhibited observable characteristic of being an operator and a regulatory body in their respective countries.

The study will adopt a structured questionnaire. A follow-up an interview either via phone or via face interview will be organized with respondent to accord the interviewer a clearer perception should the feedback on questionnaire not be properly populated. Data will also be analyzed using descriptive statistics and presented in tables and charts. Frequencies and percentages will be used to explain data sets and results. Inferential statistics will be drawn based on findings of the descriptive statistics whereas qualitative data will be drawn from open-ended questions in the questionnaire, document analysis and interview guide to present the findings.

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The regression equation for this study given *n* observations.

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Whereby; y = Operations efficiency

β_0 = Regression constant factor

X_1 = Community

X_2 = Infrastructure

X_3 = Local content

X_4 = Security

β_1 to β_4 = Coefficient of determination

ε = Error term

FINDINGS Response Rate

108 questionnaires were administered, and 106 responses were obtained giving a response rate score of 98%. The response rate of this study met and exceeded the minimum threshold and therefore sufficient for the researcher to conduct data analysis.

Descriptive statistics Community

Descriptive analysis was carried out for the test variable community. The data analysis are summarized in Table 2 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 2 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 3 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 3 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**

Local contents

Descriptive analysis was carried out for the test variable Local Content. Table 4 summarizes the analytical results. The data analysis indicates that test variable for health, workplace injuries and social ills constitute lifestyle risks (mean=4.65), incapacity, local politics and uncertainty risks of

local supplier (mean 4.36) and substandard product/services, compliance costs and unsustainable standards constitute quality risks (mean=3.87) all effect operations efficiency. The average mean was 4.29. The average standard deviation score was 0.782. In hierarchical order, substandard product/services, compliance costs and unsustainable standards constitute quality risks (standard deviation=1.13), incapacity, local politics and uncertainty risks of local supplier (standard deviation=0.958) and health, workplace injuries and social ills constitute lifestyle risks (standard deviation=0.707), were all above the average standard deviation mean score. This indicates that the local content issues are significantly dispersed or diverse and effect operations efficiency a finding which concurs and asserts research conclusions by Ogwang, Vanclay & Arjanvan (2018) and Janis, Marcello, Jean, Malcom & Mieke (2011).

Table 4 Local Content

Statements	Never	Rarely	Sometimes	Often	Always	N	Mean	Standard Variation
Health, workplace injuries and social ills and other lifestyle risks affect exploration operational efficiency metrics?	1.90%	0%	10.40%	11.30%	76.40%	105	**4.65**	**0.707**
Incapacity, local politics and uncertainty of local supplier affect exploration operational efficiency metrics?	0%	6.60%	14.20%	16%	63.20%	105	**4.36**	**0.958**
Substandard product/services, compliance costs, unsustainable standards and other quality related risks affect exploration operational efficiency metrics?	0%	15%	25.50%	17%	42.50%	105	**3.87**	**1.13**
Average							**4.29**	**0.782**

Security

Descriptive analysis was carried out for the test variable Security. The results are summarized in Table 5 below. The data analysis indicates test variable go slows, local politics, transportation, unqualified/untrained worker constitute (mean=3.78), civil unrest, standoffs, labour unrest/ strikes, untimely government interventions/in actions (mean=3.69) and Intra/extra community conflicts, asset loss or violence and theft (mean=3.56) effect operations efficiency. The mean score was 3.676. The average standard deviation score was 0.769. Arranged in hierarchical order, civil unrest, standoffs, labour unrest/ strikes, untimely government interventions/in actions (standard deviation=1.116), go slows, local politics, transportation, unqualified/untrained worker constitute standard deviation=1.024), and intra/extra community conflicts, asset loss or violence and theft (mean=0.996) were observed to be above average standard deviation score indicative that security issues were diverse and significantly effect operations efficiency . This finding is in tandem with research conclusions by Saheed & Egwaikhide (2012), Kathry (2015) and Davis & Frank (2011).

Table 5 Security

Statements	Never	Rarely	Sometimes	Often	Always	N	Mean	Standard Deviation
Intra/extra community conflicts, asset loss or violence, theft and other security threats affect exploration operational efficiency metrics?	3.90%	10.60%	27.40%	43%	15.10%	160	**3.56**	**0.996**
Civil unrest, standoffs, labour unrest/ strikes, untimely government interventions or in actions and other security challenges affect exploration operational efficiencies?	1.90%	14.40%	28.40%	24%	31.30%	160	**3.69**	**1.116**
Go slows, local politics, unqualified or untrained worker and other similar items are security threats that affect exploration operational efficiencies?	3.80%	3.80%	31.10%	33%	28.30%	160	**3.78**	**1.024**

Average	**3.68**	**0.769**

Operational Efficiency

Descriptive analysis was carried out for the dependent variable Operational Efficiency and Table 6 below presents a summary of the analytical results. The data analysis indicates test variable economic performance indicators (mean=3.44), social performance indicators (mean=3.77), health, safety, environment performance indicators (mean=3.19), quality (mean 2.59), cost of compliance (mean=1.95) and project downtime (mean 2.42) are performance metrics effected by independent variable. The average mean was 2.89. The average standard variation score was 0.808. In hierarchical order, health, safety, environment performance indicators (standard deviation=1.28), social performance indicators (standard deviation=1.08), quality (standard deviation=1.22), project downtime (standard deviation=1.16), economic performance indicators (standard deviation=1.16) and cost of compliance (mean=1.03) were above the average standard deviation score. This indicates the diversity of the operational efficiency performance metrics , their use and value and assert previous research finding on their significance in measuring the value derived from each (Roshni, Siti-Nabihaa, Dayana, & Yousif, 2016), (Porter & Kramer, 2011) (Devold, 2013)

Table 6 Operational Efficiency

Statements	No extent	Small extent	Moderate extent	Great extent	Very great extent	N	Mean	Standard Deviation
Economic performance Indicators	8.50%	12.30%	22.30%	39.60%	17.00%	106	**3.44**	**1.163**
Social performance indicators	3.80%	8.50%	23.60%	34.90%	29.20%	106	**3.77**	**1.080**
Health Safety Environment performance indicators	14.20%	13.20%	30.20%	24.50%	17.90%	106	**3.19**	**1.280**
Quality	15.10%	43.40%	20.80%	9.40%	10.40%		**2.59**	**1.217**

Cost of compliance	45.30%	23.60%	21.70%	9.40%	0.00%	106	**1.95**	**1.027**
Project downtime	18.90%	45.30%	19.80%	7.50%	7.50%	106	**2.42**	**1.162**
Average							**2.89**	**0.808**

Correlation analysis

Correlation analysis was performed to establish the strength of relationship between the variables. Table 7 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 ($R=0.554$, $p<0.001$). Community issues are also positively moderately correlated with Security Issues ($R=0.417$, $p<0.001$); positively and moderately correlated with local content issues ($R=0.482$, $p<0.001$) and positively and strongly correlated infrastructure issues($R=0.735$, $p<0.001$). It can be concluded that community issues are diverse and intertwined with these variables and will effect an organizations operational efficiency.

Conclusion can be derived that Infrastructure issues are positively and moderately correlated with operational efficiency ($R=0.591$, $p<0.001$). Infrastructure issues are positively and strongly correlated with Security Issues ($R=0.613$, $p<0.001$) and positively and moderately correlated with local content issues ($R=0.513$, $p<0.001$). This means that challenges and issues on infrastructure are diverse to include security and local content issues and effect an oil and gas operational efficiency.

Table 7 further illustrates that Local Content issues are positively and (very strongly) significantly correlated with operational efficiency ($R=0.877$, $p<0.001$). In addition, Local content issues are positively and weakly correlated with Security issues ($R=.0.368$, $p<0.001$. This means that local contents issues are diverse to include security issues and that they either singly of collectively effect operational efficiency of oil and gas entities. Security issues are positively and weakly correlated with operational efficiency ($R=0.495$, $p<0.001$). This indicates that security issues alone will effect operational efficiency of oil and gas exploration entities. It was observed that the correlation analysis yielded positive results and hence the variable were data mined for regression analysis to test their contributions to the score observed.

Table 7 Correlation Matrix

Variable Statements	Communitys	Infrastructure	Local content	Security	Operational Efficiency
Community	1				
Infrastructure	**.735****	1			
Local content	**.482****	**.513****	1		
Security	**.417****	**.613****	**.368****	1	
Operational efficiency	**.554****	**.591****	**.877****	**.495****	1

**Correlation coefficient is significant at the 0.001 level (2-tailed)

Regression Analysis Model

of Analysis

Regression analysis was performed to illustrate the existing relationship between the variables. Table 8 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 8 show the fitness model employed in the regression analysis.

R shown in Table 8 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, local content, and security) and operational efficiency was very good. RSquare 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, infrastructure issues, local content, and security. 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 8 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 9 was used to present the regression model significance. An Fsignificance 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 9 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 10 Regression coefficient presents the summary of results. The adopted linear regression formulae attempts to model a relationship between four exploratory variable and responders variable by plotting a linear equation to the response variable as stated by Cresswell (2009).

Table 10 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
Content	.856	.058	.754	14.752	.000

Security	.132	.047	.154	2.819	.006

a. Dependent Variable: Operational efficiency

From Table 10, the following regression model is established:

Operational efficiency = -0.154 + 0.116X_1 + 0.049X_2 + 0.856X_3 -+0.132X_4 P = 0.000

Where X_1= community, X_2= Infrastructure, X_3= Local content, X_4= Security; β_0 = -0.154; β_1 = 0.116; β_2= 0.049; β_3= 0.856; and β_4= 0.132.

The regression constant shows that when the independent variables (community issues, infrastructure issues, local content, and security) are constant at zero, operational efficiency value would be -0.154. This shows that without the four 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 (infrastructure issues, local content, and security) 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. Holding other factors (community issues, infrastructure issues and security) constant, a unit increase in local content would lead to a 0.856 increase in operational efficiency (p<0.001). Lastly, a unit increase in security would lead to a 0.132 increase in operational efficiency these statistics being significant (p<0.01) at 95% of significance. Findings imply that community issues, infrastructure issues, local content, and security each are positively related with operational efficiency with the effect of local content and security being significant. This means that local content and security are the greatest contributors to operational efficiency.

Discussions

An exploration into the issues that have effect on operational efficiency of oil and gas entities in Kenya has revealed multiple challenges that these companies face in their ways of operations. The data analysis support that respondents who participated in this research and responded to the questionnaire are familiar with their organizations operations and have worked with the oil and gas exploration industry in sufficient amount of time. This increased the accuracy and efficiency of the collected information to make a conclusion about this topic.

This study reinforces previous research findings in other jurisdictions that community issues in Kenya are challenges that need to be identified (Brenda L., 2015) (Emah, Mehraz, & Mridula, 2017) (Nenibarini & Gustaf, 2017) and addressed to avoid escalation (Cristina Udelsmann, 2017).

The evidence in Table 2 presents some community issues that cause challenges to oil and gas exploration entities. Devold (2013) assert that community issues are an expense and that they have direct and indirect costs. This study has not only found that community issues are factually challenging in Kenya, but they are of dispersed nature meaning that the process of acquisition of

social right from the community in order to operate will often lead to issues that affect operational efficiency (Davis & Daniel, 2014). This study concluded in Kenyan context that the community issues are moderately correlated with operational efficiency and that there exists a positive moderate correlation with security and local content and a strong correlation with infrastructure.

In Table 3, there are various infrastructural issues related to the process of exploring oil and gas that need to be taken into account. They constitute the bottlenecks (Goldratt & Cox, 2004) Respondents have identified Infrastructure as a challenging issue when it comes to exploration of oil and gas in Kenya. The critical nature of infrastructural in underpinned by Mackenzie & Cusworth, (2016) who argue that exploration organization cannot fail to consider infrastructural costs which will ultimately affect their cash outflow. Collier & Ireland (2015) assert that infrastructure issues effect operational efficiency on which the project bankability apart from impacting on the cash flows. Respondents in this study have recognized that infrastructure issues are diverse. It is positively strongly correlated with security issues and positively moderately correlated with local content issues. There exists a positive correlate with operational efficiency , a view which is supported by other researchers identified in this study.

In Table 4, there are various issues that constitute local content. Though researchers have a wide scope of issues that constitute local content (Ogwang, Vanclay, & Arjanvan, 2018). It has been asserted that investing in local community is a costing with an added future operational cost (Porter & Kramer, 2011). Respondents in this study had identified local content issues as dispersed and significantly effect operational efficiency. Previous study have not asserted local content as unavoidable (Huq, Stevenson, & Zorzini, 2014) and that the value of local content and efficiency was unclear (Walker, Seuring, Sarkis, & Klassen, 2014). This study found and asserts that local content is positively and very strongly correlated with operational efficiency. It agrees with other researchers that local content is diverse. In Kenyan context, local content is only positively weakly correlated with Security and assertion that is effects operational efficiency a view which was previously not clear from previous results (Blome, Paulraj, & Kai, 2014)

In Table 5, the research findings only agree with the research findings by Davis & Daniel (2014) to the extent that security costs are significant to oil and gas exploration operations and findings by Gunasekarana & Ngai (2012) that operational research must respond to demand to address organizational performance in face of numerous concerns such as environmental concerns, communities, and other broad social demands. Respondents indicated that security issues are diverse. This view is supported by many authors who view that Security issues take many forms of threats (Saheed & Egwaikhide, 2012) (Kathryn,, 2015). In Table 6, challenges on other independent variables will have a positive correlation effect on Security. Hence security issues are significant on their own instances (Davis & Daniel, 2014). Indeed, oil and gas explorations companies operating in high security threat areas such as a hostile jurisdiction, will often be subjected to closure each and every time. Ultimately, the financial performance of such companies will be affected at a great level (Saheed & Egwaikhide, 2012). The extent to which these effects

operational efficiency has not been digested (Walker, Seuring, Sarkis, & Klassen, 2014) (Kathryn,, 2015) and this study asserts and postulate new matter. That security issues positively and strongly correlated to operational efficiency.

In Table 6, assertions by Collier & Ireland (2015) that quantification of costs is essential to determine where inefficiencies come from are supported. The data supports that a sum variety of operational challenges and issues effect operations efficiency. Porter & Kramer (2011) view on efficiency is proven relevant to oil and gas exploration entities. Diversity of issues that form independent variable require to be totally mapped so that determination of operational cost whose value is in derivation of performance metrics may aid the management during risk-based decisions in order to reduce impact of risk factors (Goldratt & Cox, 2004). This study establishes that the operational efficiency metrics as used in the study were very broad. However, social performance, economic performance and health, safety, environment performance indicators are significantly used owing to the effect they have on operation efficiency.

CONCLUSION AND RECOMMENDATIONS Conclusion

Evidence from prior research studies had identified multiple operational challenges that oil, and gas exploration companies 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.

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 are the contributors to their performance metrics. This study has attempted to demystify the notion that all the independent variables have equal probability of affecting operational efficiency and instead has instead discovered that there exists a positive correlation and each independent variable has a hierarchical contribution towards the score of an 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 the variable that has significant impact on their operational performance in order to retain the value and competitiveness of their organization in oil and gas exploration industry riddled with diverse, dispersed, and emergent risks.

The study was limited to oil and gas entities engaged in Kenya situation. Given that their operations scatter within the East African region, further research may be considered to encompass cross border operations which may also have rich unfettered information. In addition, further research may consider the effect of other diverse and dispersed operational variable that this study may have not covered but may have a significance of research study. Intrinsically, a financial research leveraging on the outcome of this study may consider the phenomena of the influence of these variable on competitiveness and survival of exploration companies in Kenya.

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