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ORGANIZATIONAL FACTORS INFLUENCING MANAGEMENT OF PROJECT COMPLEXITIES IN UPSTREAM OIL AND GAS OPERATIONS IN NIGERIA: AN EXPLORATORY STUDY

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Abstract
This study examined and investigated the organizational factors influencing management of project complexities in the Upstream Oil and Gas Operations (UOGO). The aim is to have a better understanding of the problems and explore effective techniques for achieving success. Oil and gas industry is usually characterized by project complexities in its operation, facilities and infrastructure development. Descriptive and quantitative survey research design with purposive sampling technique were employed on a sample of 6 selected major upstream companies and 64 target respondents who are experienced professionals in the field. The instrument of primary data collection and measurement was well-structured and standardized questionnaire modeled in Likert five-point scale. The methods of data analysis were Relative Importance and Severity Indexes (RII and RSI). In addition, multiple regression and correlation analysis were used for hypothesis testing and in establishing the integrated relationship between organizational factors and successful management of project complexities in UOGO. The RII results and findings indicate that uncertainty is the most important factor affecting project complexities. The RSI results and findings infer that the severest type, causes and incremental factor of project complexities are technical/ technological, interrelationship/interconnections and environment respectively. The results and findings from hypothesis testing show that the variables that most influence successful management of project complexities in UOGO are Information and Communication Technology (ICT) knowledge, training, resource allocation and top management support; in ranking significant order. The study suggests that more attention should be focused on modern ICT knowledge acquisition and training while top management support is essential for adequate resources allocation and good decision-making structure.

Keyword: *Project complexity, organizational factor, upstream oil and gas, resource allocation, relative importance and severity indexes, regression model, environment.*

Introduction

Upstream Oil and Gas Operations (UOGO) happen to be the highest revenue earner for Nigeria and core business value of the sector as the middle and downstream sectors are deficient in refineries and petrochemical processing facilities. Effective management system approach through in-depth evaluation of organizational factors are required to address the complexities associated with the operations, facilitates and infrastructure development projects in upstream Oil and Gas (OG) sector. OG industry contributes to the economy as one of the most important sectors by taking into advantages of being the most demanding, challenging and exciting engineering and technological advances, which interest the engineers at large.

Rahim et al. (2017) aver that as the OG industry has become financially attractive yet risky to be implemented, it is therefore important to look into the effective way of managing the OG projects. Considering the riskiness and complexity of OG projects, organizational factors are aimed at addressing these challenges especially in the upstream sector. Rising complexities, costs and risks combine to make efficiency in OG projects more important than ever. Mecreery, Philips and Cigala (2018), aver that complexity and inefficiency exist in UOGO and posited that they are available opportunity for improvement. In the same vein, Schwalbe (2006) advocates that good project execution requires a supportive organizational culture. Organizational procedures can help or hinder project execution. If an organization has useful guidelines and templates for project management that everyone in the organization follows, it will be easier for project managers and their team to plan and do their work. If the organization uses the project plans as the basis for performing and monitoring progress during execution, the culture will promote the relationship between good plan and execution. Complex projects require competence and skills for comprehensive scope definition, detailed work breakdown structure, design analysis, review and optimization to elucidate all the specifications and structural framework of the project.

Caitti (2016) views that complex projects are due to budget and team size, strategic viewpoints, stakeholder engagement and impact of dedicated teams doing project based work that may span from one to five years with extension. Managing complex project presents a series of challenges of greater magnitude than found in typical project management. Upstream (exploration and production) companies are established to explore and produce crude oil and gas. Some hold licenses to produce crude oil, some partner with those that have licenses in joint venture arrangements. According to Jarushub (2013), upstream is generally the most lucrative aspect of OG business, but it is also by far the most capital intensive. Jarushun (2013) also attested that OG industry in Nigeria is a quite complex industry, and many outsiders struggle to understand the various types of companies and the business they do. Problems of low productivity, schedule and cost overruns and failure to meet up with planned targets in exploration and production of crude oil and gas could be attributed to complexities associated with upstream oil and gas projects. However, organizational resources are not thoroughly and scientifically harnessed to address

these project complexities. More than 80% of projects failed due to low production rate, schedule or cost overrun. On the average, Gate (2016) investigated that in $50 billion project, the average overrun cost is $17 billion, which is around 34% of the total overall cost. Similarly, the exploration and production impairments and schedule cost can be equivalent to that amount. As a result, companies have to bear the loss of billions of dollars. The reasons for this loss and its frequent occurrence are many. However, the major one is that of OG, which has become more complex and poses challenges in managing their project complexities. The complexities that exist in upstream oil and gas projects predispose several interconnected parts and hence, the failure of one part affects other parts. These failures could occur in an unpredictable manners and no project manager can foresee the occurrence before time.

This study is aimed at identifying different types and causes of project complexities in UOGO, factors affecting and aggravating them and assesses their respective in importance or severity indexes to serve as action response plan for mitigation and effective management. It is also to develop strategic decision model for management and optimization of OG operations, exploration and production through organizational variables, and evaluate the level of relationship between organizational factors and successful management of project complexities. The study will answer research questions on the severity index of each type, causes, incremental variables and factors affecting project complexities. Research hypothesis based on the above will be tested to deduce and ascertain decision support system for successful management of project complexities.

Literature Review.

The review of related literature consisted of conceptual, theoretical frameworks, and empirical review. One of the crucial tasks of a project manager is to handle project complexity (Harrin et al. 2019). The tasks should be re-validated and profiled before commencement of the project. They stated that early profiling of project complexity helps in efficient allocation of resources and make important project management decision. Project complexity can be either inherent to the project or due to project context. Baccarini (1996), proposes a definition of project complexity as consisting of many varied interrelated parts and can be operationalized in terms of differentiation and interdependency. This definition can be applied to any project dimension relevant to the project management process. Project managers need to determine project complexity to ensure efficient decision-making and attaining project goals. The most important factor in measurement of project complexity is not accuracy, but consistency. The first step in evaluating the complexity of a project is to determine the project requirements, find out the estimated time and cost to complete the project. The higher the cost and time required to complete a project, the more complex is the projects as obtained in UOGO. There are simple, moderate and high complex projects; depending on the estimated durations and number of team members. According to Rahim et al. (2017) OG industry mostly involves in mega

projects and they defined mega project as the one in excess of USD1 billion expenditure.

Harrin (2019) avers three ways to reduce complexity once the sources are known are:

i. Resolve it – just fix it and make it to go away, use different technology that is tried and tested. Add more time to the schedule and more money to the problem.
ii. Reduce it – Making the complexity less severe with less of an impact on the project. This really relies on full understanding of what are behind the complexity and device some strategies to contain it.
iii. Live with it – This has to do with managing the complexity, run with it and working out a practical response to dealing with it rather than passively doing nothing. Getting the right team in place and framing their involvement in the project in the right way can help to mitigate the impact of complexities if it cannot be manage out in any other way. However, management system approaches to these complexities based on organizational factors in UOGO could be appropriate for this study. Complexities are bound to arise spontaneously considering the technical and environmental nature of UOGO.

Organizing is a major function of management. It entails the setting up and equipping of appropriate organizational system complete with operational procedure, and guidelines with people assembled together with the sole aim of realizing a pre-determined objective(s) for effectiveness. All within the system should know the purposes for which the organization was established as well as their individual purpose and value within. One of the avenues for facilitating this is the organizational framework or structure. Choudhary and Sarikwal (2017) aver that knowledge is an important organizational source that provides the sustainable competitive advantage in a competitive dynamic economy.

Complexity theory suggests that the creation of a successful project will always be an uncertain journey, but the path to success or failure can and will be influenced by the actions and attitudes of the actors within and around the project team. (Mosaic white paper 2011). The key element is how effective the project team uses its social network to gather the resources (knowledge and support) needed to create success. These ideas are closely related to stakeholder theory; which suggests that project is only successful if its stakeholders perceive the project to be successful. In a similar vein, organizational theory consists of many approaches to organizational analysis. Organization could be defined as social units of people that are structured and managed to meet a need, or to pursue collective goals. The three main organization theories are classical, neo-classical and modern organizational theory. According to Venkatesh et al. (2019), the classical writers view organization as a machine and human beings as components of the machines. They were of the view that efficiency of the organization can be increased by making human beings efficient. Similarly, neo-classical theory of organization focused main attention on physiological and mechanical variables of organizational functioning. Modern organizational theory has

the distinctive qualities of conceptual analytical base, reliance on empirical research data and above all, its integrating nature. These qualities are framed in a philosophy which accepts the premise, that the only meaningful way to study organization is to study it as a system. Venkatesh et al. (2019) report on the factors that influence organization as; environment, technology, size of operations and people.

UOGO refers to those activities that take place from exploration of oil and gas up to production of crude oil and gas (Wright and Gallun 2008). The activities involved also include; geological and geophysical studies, drilling, lifting of oil and natural gas. Congruent objectives cannot be achieved without decisive operations strategies as the projects are characterized by enormous complexity, riskiness, capital intensive, multiple and interconnected tasks. Avena Group (2018) postulates that digital transformation holds the key for the oil and gas industry to develop agile business models, with higher margin, improve regulatory compliance, streamline process innovation, capture and retain workforce knowledge and enable a zero accidence culture focused on operational excellence. Production optimization ensures the recovery of developed reserves while maximizing returns. Optimization activities include efficiency of oil and gas transport, design of surface facilities and fluid handling capacity, production system debottlenecking, well integrity etc.

Remington and Pollack (2018) posited that four types of complexities determine selection of projects. These include structural, technical, temporal and directional complexities. Technical complexity refers to challenges in project design, and technical details. The complexity is associated with new projects about which sufficient technical details are not available. Ziadat (2019) avers that technical complexity in UOGO can be the brown/green field, local infrastructure, logistics, supply chain, weather or seasonal issues, surface geography, subsea geography, fluid properties and reservoir properties. Structural complexity refers to difficulty in managing interconnected activities. Examples of projects with high structural complexity include engineering, construction and defense projects. Temporal complexity refers to projects that are with uncertain environment. The uncertain factors especially in the UOGO include unexpected legislative changes, environmental impacts and the likes. Directional complexity refers to challenges in determining project goals and objectives. These goals are generally shared with hidden agenda and vague project requirements. Qureshi et al. (2013) also state that project complexity takes various forms namely social, technological, environmental and organizational. They concluded in their study that organizational complexity worried project manager more than technical or environmental complexities. Caietti (2016) notes that some causes of complexity to include: details – number of variables and interfaces, ambiguity – inability to pre evaluate actions, unpredictability – the inability to know what will happen, dynamics – rapid rate of change, social structure - number and types of interactions, interrelationship – many interdependencies and interconnections. She proposed four steps in complexity management process as diagnosis of project complexity using project complexity model, assignment of competent leaders commensurate with the

complexity profile, selection of the project approach commensurate with complexity profile, management of complexity dimensions that are present on the project. Ziadat (2019) also identified socio-political project complexity as inherent in UOGO and pointed out that they can be cost or schedule pressure, contractors or vendors, local resources, organizational, commercial, the engagement of NGOS, partnership alignment, community engagement, regulatory regime, political and legal environment.

Identifying the sources and factors that contribute to increase project complexity is paramount to project managers. Carral et al. (2018) identify four different sources of increasing complexity as; employed resources, level of scientific and technological knowledge required, environment and number of different parts in the workflow. The above steps can help in effective profiling of complex projects. Project managers should use the right management tools and work management software that will help them in effective management of projects complexities. Ziadat (2019) warns that project managers need to avoid falling into estimation fallacy and make decision based on a narrative fallacy or person opinion instead of facts obtained through detailed data analysis. In project management, the success or critical successes factors are aimed at assessing managerial or organizational factors that lead to success or failures and examine the reasons for successes or failures. The organizational factors likened to management of project complexities in UOGO as identified by Santos et al. (2019), Ziadat (2019) Hussin et al. (2016) etc. are, organisational culture, top management support/management styles, change management with goal alignment, ICT knowledge, training and allocation of resources as narrated below.

1. Organizational culture encompasses values and behaviours that contribute to the unique social and psychological environment of a business. It defines proper way to behave within the organization. This culture consists of shared beliefs and values established by leaders and then communicated and reinforced through various methods, ultimately shaping employees perceptions, behaviours and understanding. Organizational culture promotes a positive structured work environment that helps companies to achieve success.
2. Top management support is conceptualized as the involvement and participation of the executive or top-level management of the organization in the decision-making pertaining to project activities. Top management support facilitates the deployment of strategic factors while lack of the top management support inhibits the strategic use of resources. The management support also influences decision-making structure to decide on the type of control or delegation of decision-making authority throughout the organization and the extent of participation by organization members. Top management as well supports a proactive and decisive management styles, which could influence, coordinate and direct peoples' activities towards a group objective. The support of top

management has a decisive influence on the success or failure of projects. (Santos et al. 2019).

3. Change management related to how organization communicates goals and values, negotiate for agreement and cooperation, reward behaviours that support change, redirect resources to support change and increase participation and decision-making, (Santos et al 2019). Goal alignment can therefore communicate these goals involved in linking together the business goals and the corporate goals. To promote the achievement of organizational goals, the complex project plan such as in UOGO could be tied to overall organizational plan.
4. Good communication is related to provision of adequate networking and required data to all key actors in project implementation. Managerial ICT knowledge could therefore be referred to as senior management experience and knowledge concerning ICT (Hussin et al 2016). Information Technology (IT) is an important mechanism that can improve knowledge transfer in project environment through digital platforms or cyber-connectivity. The technology increase the openness of communication and make knowledge transfer easier, which may overcome difficulties of geographical distance, data and information sharing, data acquisition and analysis, and virtual project management.
5. Training is usually a planned effort by organization to facilitate learning in skills and behavours related to the jobs. Nolan and Garavan (2016) noted that training can build relevant skills. It is important that managers receive training to develop interpersonal and technical skills especially in the areas such as ICT, strategic management, business development etc.
6. Allocation of resources could be concerned with allocating resources to different work packages or work breakdown structure and tasks. Resources could be categorized into people, money, and time. According to Ein-Dor and Segev (1978), resources include money, people, and time that are required to successfully complete a project. Resources lead to a better organizational commitment and overcome organizational obstacles (Hussin et al. 2011). Sufficient resources also lead to organizational implementation success and project implementation success (Wixom and Watson 2001).

Sheikhzadeh et al. (2012) in their study title; “Identifying Key Success Factors in Upstream sector of Oil and Gas in Iran”, the results and findings indicated that top three key success factors are competence of human resources, sufficiency of financial resources and adequacy of technological capabilities. Similarly, in a study on organizational factors influencing project success: An Assessment in the Automotive Industry, conducted by Santos et al (2019), the researchers carried out quantitative survey on a sample of 72 companies and the data was analysed through confirmatory factor analysis. The results and findings indicated that the variables that most influences project success are organizational culture and top management supports. The results also infer that culture of flexibility and climate that support innovations tend to influence project performance. Similar research was carried out by Hussin et al. (2007) on the title; the influence of organizational factors on

information systems success in E-Government agencies in Malaysia. The results and findings ascertained the following influential organizational factors; decision making structure, top management support, goal alignment, managerial IT knowledge, management style and resources allocation.

Though many researchers such as Hussin et al. (2007), Sheikhzadeh et al. (2012), Santo et al. (2019) and Venkatesh (2019) carried out studies on organizational factors and their influences on project success. There are gaps in the areas of project complexities in upstream sector and how they could be managed successful using units of people that are structured and coordinated to meet the needs or project goals has not been addressed. Poveda-Bautista et al. (2018), opine that specific complexities in projects, might require specific competence development. Despite the prominence of organizational factors in project management, no study has addressed the integrated relationship among the set of factors and successful management of project complexities. According to Poveda-Bautista et al. (2018) Bosch – Rekveldt argued that specific complexities in project might require specific competence development and inherent complexity within projects must be studied in a particular way. In this sense, Williams (2005) indicates in his study that increase in complexity of projects is one of the main causes of project failure. Bennett (1999) opined the need for exceptional level of management in complex projects and pointed out that inadequacy of the implementation of conventional management systems for noncomplex or moderately complex projects be developed for complex projects. It could be on this premise that Shenhar (2001) notes that different types of projects complexities require different managerial approaches. Baccarini (1996) proposes that project complexities can be defined in terms of differentiation and interdependency and it is managed by integration. The study on impact of project complexity and Environmental factors on Project Success, a case study of OG sector of Pakistan was conducted by Ishtiaq and Jahanzaib (2017) using structural equation modeling for data analysis. The results and findings inferred and concluded that project complexity has negative impact on project success whereas better control over environmental factors enhances the project success rate. The study conducted by Rahim et al. (2017), on Project Management in OG Industry: A Review; the findings indicated that in the OG project execution, a systematic for project management is developed with the aim to improve the decision-making process and overall project execution success. They assert that systematic project management consists of five main phases, mainly; (1) appraisal (2) selection and definition, which are both associated with (3) planning phase as well as (4) execution and first year operations that are associated with (5) control phase. In addition, the project management approach was also found to be executed in a typical OG development stages namely: (1) conceptual design (2) front end engineering design (3) procurement of long lead equipment (4) detailed design (5) construction/fabrication (6) onshore pre-commissioning (7) transportation/ installation (appreciation for offshore platforms) and (8) hookup and commissioning prior to handover to end users. (Rahim et al. 2017)

Methodology

Exploratory and descriptive survey research designs were used in the study in order to explore, develop and innovate strategies for managing project complexities. A structured questionnaire designed and modeled in five point Likert scale was used for data collection and measurement. Organizational factors considered appropriate to influence results and successful management of project complexities associated with UOGO operations, facilities and infrastructure development include the following constructs.

Table 1: Factors and detailed statements for data collection

Code	Factors and sub-factors
X_1	Organizational Culture: Open Organizational culture and trust, norms and value are united, employees respond to common goals, human resource practices in place, institution of mechanisms that boost the absorption of new ideas.
X_2	Communication/IT knowledge: Seamless flow of information, data acquisition and analytics, data and information sharing; and networking, cyber connectivity, knowledge transfer and sharing.
X_3	Change Management: Communication of change to stakeholders, change management strategy and values, influence on goal alignment, availability of contingency plan for change, change control mechanisms.
X_4	Top management support and decision making structure: proactive management decisions, motivation of workforce, management commitment, timely release of sufficient resources, management by objective policy.
X_5	Allocation of resources: Level of financial allocation, material allocation and timely delivery, number and dexterity of workforce, job design and responsibility matrix, number and capacity of machines and equipment such as flow station, seismic devices etc.
X_6	Training: Development of skills in managing complexity in UOGO, capacity building workshops and seminars in coping with project complexity, guidance and knowledge associated with project complexity in UOGO, goal orientation, definition and impartation in managing complexity of UOGO, optimal job performance due to training.
Y	Successful Management of Project Complexities in UOGO: Detailed diagnosis and analysis of project design, precise project definition with detailed work breakdown structure, project task simplification and structural decomposition, project completion within estimated budget, desired geospatial scope coverage, projects completed within schedules, quality and desired output quantity, environmental friendliness and sustainability, work method study, top management support for UOGO optimization, conceivability of new and emerging technology in UOGO.

According to Jarushub (2013), there is a population size of 54 upstream oil and gas companies in Nigeria. The target respondents are professional technical and managerial skilled personnel such as petroleum and gas engineers (PG), mechanical engineers (ME), environmental geophysicist (EG), electrical/electronics (EE), and Project/civil engineers (PM). The study adopted convenient sampling technique on the selected 6 major oil companies operating upstream in the South South geopolitical zone of Nigeria. The zone is justified because of their vast and viable economic crude deposits. The sampled states in the zone are Akwa Ibom, Rivers, Delta and Bayelsa, with the following upstream oil companies; Addax, Agip, Chevron, Mobil, Shell and Texaco. Also, following the information from the human resource units of the six selected oil companies, the population size **"N"** of target respondents is 313 as distributed below in terms of their upstream oil and gas companies and the professional skills of target respondents.

Table 2: Distribution of Population size of target respondents

Upstream Oil and Gas Companies	Professionals and Experts in UOGO					
	PG	ME	PM	EE	GP	TOTAL
Addax	7	8	6	7	6	34
Agip	10	7	6	8	8	39
Chevron	13	13	12	14	14	66
Mobil	12	12	10	8	10	52
Shell	15	17	14	16	15	77
Texaco	8	8	12	9	8	45
total	65	65	60	62	61	313

The statistical sample size "n" of the target respondents was calculated from the region population using the formula given by Sediary (1994) as

$$\mathbf{n} = \frac{\boldsymbol{n^1}}{\mathbf{1}+\frac{\boldsymbol{n^1}}{\mathbf{N}}} \quad \text{.....(1)}$$

where $n^1 = \frac{S^2}{V^2}$ where S = maximum standard deviation in population at a confidence interval of 95%, S^2 = P x (1-P) = 0.25, V = standard error of sampling distribution = 0.05.

From equation 1 above, the n= 76, and therefore 76 copies of questionnaire were distributed to the target respondent to elucidate their intuitive opinions, perceptions and attitude on the subject matters. The questionnaire was firstly pilot tested in two steps. First two project managers and three academicians verified the questionnaire. Secondly, a group of 10 professionals from the target UOGO companies who were physically contacted assessed and answered the questions contained in the questionnaire. After the feedback from the respondents, the questionnaire was adjusted in both form and content for its final version.

Methods of Data Analysis

The study adopted two major methods of data analysis.

(i) Relative Importance Index (RII) and Relative Severity Index (RSI) which were used to assess the level of importance and severity of each; factors, types, causes and increasing factors of project complexities in UOGO.

RII analysis allows identifying most of the important criteria based on participants' replies and it is also an appropriate tool to prioritize indicators rated on likert-type scales.

$$RII = \frac{\sum w}{AN} = \frac{5n5 + 4n4 + 3n3 + 2n2 + 1n1}{5N} \quad \text{.....} \qquad (2)$$

where W= Weighting given to each of the factors by the respondent

A= the highest weight i.e. 5 in this case

N= the total number of respondents; in this case 64

n_5 , n_4 , n_3 , n_2 , and n_1 represent the number of respondents, based on the following weighted scores in 5 point scale as: strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, strongly agree =5.

The formula is also consistent with calculation of RSI, which is weighted score of each factor divided by the total weighted score of all the factors.

(ii) Multiple regression and correlation analysis were used to evaluate the extent of relationship between organizational factors and successful management of project complexity in UOGO. Lee and Xia (2002) and Hussin et al. (2007) used regression model to assess complexities in information system development projects.

Table 3: Questionnaire distributions and returns by professions

Target Respondents	Number of Questionnaires		% Returns
	Distributed	Returned	
PG	18	13	72.22
ME	18	16	88.89
PM	12	9	75.00
EE	15	14	93.33
GP	13	12	92.31
Total	76	64	84.21

Table 4: Questionnaire distributions by upstream firms

Target Respondents	Number of Questionnaires		% Returns
	Distributed	Returned	
Addax	10	6	60.00
Agip	12	10	83.33
Chevron	14	12	85.71
Mobil	12	10	83.33
Shell	16	14	87.50
Texaco	12	12	100.00
Total	76	64	84.21

Table 5: Relative Importance Index (RII) of factors of project complexities in UOGO

S/N	Code	Factors of Project Complexity	Frequency of respondents					Total No of Respondents (TNR)	Total score	RII (%)	Rank
			SD	D	N	A	SA				
1.	OM	Organizational Management	4	10	12	18	20	64	232	72.50	2nd
2.	UN	Uncertainty	3	10	8	20	23	64	252	78.75	1st
3.	OC	Overlap of construction elements	4	7	20	15	18	64	228	71.25	3rd
4.	IH	Inherent	14	4	13	16	17	64	210	65.63	4th
5.	RS	Rigidity of sequences	15	24	16	14	5	64	189	59.06	5th
6.	NT	Number of trade	17	24	13	6	4	64	148	46.25	6th

Table 6: Relative Severity Index (RSI) of types of project complexities in UOGO

S/N	Code	Factors of Project Complexity	Frequency of respondents					Total No of Respondents (TNR)	Total score	RSI (%)	Rank
			SD	D	N	A	SA				
1.	ST	Structural	4	8	15	20	17	64	230	71.88	3rd
2.	TT	Technical/Technological	3	8	12	18	23	64	242	75.63	1st
3.	OG	Organizational	12	20	22	3	5	64	155	48.44	5th
4.	DR	Directional	18	17	20	5	4	64	152	47.50	6th
5.	SP	Social-Political	14	10	22	18	0	64	139	43.44	7th
6.	EV	Environmental	2	10	12	20	20	64	238	74.38	2nd
7.	TE	Temporal	3	13	15	17	16	64	222	69.38	4th

Table 7: Relative Severity of Causes of project complexities

S/N	Code	Factors of Project Complexity	Frequency of respondents					Total No of Respondents (TNR)	Total score	RSI (%)	Rank
			SD	D	N	A	SA				
1.	DT	Details- number of variables and interfaces	4	10	15	18	17	64	226	70.63	3rd
2.	AM	Ambiguity – inability to pre-evaluate actions	4	12	15	18	15	64	224	70.00	4th
3.	UN	Unpredictability –inability to know what will happen	6	2	12	21	23	64	245	76.56	2nd
4.	DY	Dynamics –rapid rate of change	9	10	10	17	18	64	217	67.81	5th
5.	SS	Social structure –number of interactions	12	8	20	14	10	64	194	60.63	6th
6.	IN	Interrelationship–many interdependences and interconnections	0	4	15	20	25	64	258	80.63	1st

Table 8: Relative Severity Index of factors that contribute to increased project complexities

S/N	Code	Factors of Project Complexity	Frequency of respondents				Total No of Respondents (TNR)		Total score	RSI (%)	Rank
			SD	D	N	A	SA				
1.	ER	Employed resources	15	15	20	10	4	64	165	51.56	4th
2.	LK	Level of scientific and technological knowledge required	4	4	13	22	21	64	244	76.25	2nd
3.	EV	Environment	0	9	10	20	25	64	253	79.06	1st
4.	WF	Number of different parts in the workflow.	3	6	20	17	18	64	233	72.81	3rd

Regression Results

Table 9: Descriptive Statistics

	Mean	Std. Deviation	N
y	40.63	2.875	64
X_1	19.56	2.462	64
X_2	17.41	2.922	64
X_3	18.81	1.693	64
X_4	17.53	2.245	64
X_5	17.66	2.352	64
X_6	17.28	1.889	64

Table 10: Model Summary

Model	R	R Square	Adjusted R Square	St, Error of the Estimate	Durbin-Waston
1	.809	.655	.572	1.311	2.134

a. Predictors: (Constant) , X_1, X_2, X_3, X_4, X_5, X_6

b. Dependent Variable: Y

Test of Statistical Hypotheses and Significance

Seven research hypotheses were and subjected to statistical test using SPSS computer software, version 21 at 5% significant level.

The Analysis of Variance (ANOVA) was used to establish the level at which all the organizational factors could leverage and influence the successful management of project complexity in UOGO. The null hypotheses , HO_1 is for aggregate relationship between all the independent variables; X_1, X_2, X_3, X_4, X_5, and X_6 with Y as indicated in F-test result shown on table 11. The t -test results of HO_2, HO_3, HO_4, HO_5, HO_6 and HO_7 are for independent variables; X_1, X_2, X_3, X_4, X_5, and X_6, respectively are presented on table 12 for each of individual relationship with Y.

Table 11: ANOVA A[b]

Model	Sum of Squares	df	Mean Square	F	Sig.
1. Regression	169.072	6	38.179	18.34	.000
Residual	46.428	25	1.457		
Total	305.500	31			

Table 12: Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std Error	Beta		
1. (Constant)	18.528	4.837		4.307	.000
X1	6.766E-02	.124	.084	.709	.485
X2	.578	.141	.612	4.12	.000
X3	-3.90E-02	.186	.019	.156	.877
X4	.108	.111	.094	.1967	0.048
X5	.387	.159	.295	2.177	.041
X6	.413	.146	.206	2.146	.044

a. Dependent Variable: Y

The predictive regression model established by the study is therefore deduced from table 12 as follows:

$$Y= 18.528 + 0.06766X_1 + 0.578X_2 - 0.039X_3 + 0.108X_4 + 0.387X_5 + 0.413X_6\text{-------3}$$

Statement of research hypothesis; F-test and t-test"

Null hypotheses H_O: The collective and individual influence of organizational factors in the successful management of project complexities in UOGO will not be significant. From tables 11, HO_1 is significant. From table 12, the test results indicate that HO_3, HO_5, HO_6, and HO_7 are significant at 0.05 significant level, while HO_2 and HO_4 are not found to be significant in this study.

Discussion of Results and Findings

The RII and RSI analysis assessed the importance and severity of project complexity characteristics and issues. The multiple regression analysis was used to determine the extent of relationship between the successful management of project complexities and six variables of organizational factors. From table 9, strong relationship exists between organizational factors and successful management of project complexities in UOGO with R= 0.809 and R^2 = 0.655; indicating strong coefficients of correlation and determination respectively. From table 11, HO_1 is

significant. Similarly, from table 12, the t-test indicate that hypotheses results; HO_3 for X_2, HO_6 for X_5, HO_7 for X_6 and HO_4 for X_3 are significant. The fitted regression model established in equation 2, implies that taking all the organization factors constant at zero, the success level of managing project complexities in UOGO would be 18.528.

Communication/IT knowledge ranked first in the order of significance as a decisive organizational factor that could influence management of project complexities in UOGO. Communication is usually integrated with IT as ICT. Effective communication tend to encourage teamwork, increase information sharing and ensure involvement of key stakeholders, which favours the probability of projects achieving their goals within the assigned time and resources (Santos et al 2019). IT is the use of computers to store, retrieve, transmit and manipulate data or information. It is considered to be a subset of ICT. Several products or services within the economy associated with IT includes; computer hardware, software, electronics, semiconductors, internet, telecom equipment and e-commerce. IT is an important mechanism which can improve knowledge transfer easier, and which may overcome the difficulties of geographical distance (Ren et al. 2018). Avena Group PLC (2018) concurs that digital transformation holds the key for the oil and gas industry to develop agile business models with higher margin, improve regulatory compliance etc. Hand (2015) also suggests high tech database such as remote sensor monitoring, operating efficiency software and enterprise resource planning to be employed in UOGO. In a similar vein, PSAC industry review (2018) reported that, Canadian Upstream Petroleum Industry has attained international reputation for excellence in many areas due to its operations strategies that include; high tech exploration and production methods among others. EMC (2015) attests that, operational efficiency improvement techniques of oil and gas be categorized and summarized into; blueprinting production, real time production, data acquisition/IT, production data surveillances and deploying production optimization workflow. Managing an oil field effectively requires gathering and analyzing real time and vast operational data from various sources through installed electronic sensors, supervisory control and data acquisition. ICT could help in delivering improved performance in complex operations, facilitates and infrastructure projects of UOGO from the following areas; seismic data and real time data analytics, assessing life of oil well or field, production optimization, collaboration and data access. Chakraborty (2016) attests to alignment of IT/operations technology are examples of most innovative and technologically challenges initiatives in oil and gas production business. It could be therefore be inferred that improvement in ICT innovations will lead to successful management of project complexities in UOGO.

Resource allocation ranks second with t-value =2.117 and p-value = 0.041. Resource allocation assigns resources for project implementation. The project complexity in UOGO requires sufficient and right resources in order to surmount the complexities associated with exploration and production optimization through top management support. The support of top management will have a decisive influence

on the success or failure in the management of project complexities in the UOGO. Top management improve project performance by approving and allocating sufficient resources, motivation of workforce and institution of appropriate management system to cope with project complexities. Top management support and decision making structure would as well influence training of team members and allocation of sufficient resources to achieve that by sponsoring and providing state-of-art training facilities.

Though, change management and organizational culture are important organizational factors, they were not found significant in the management of project complexities in this study. It could be that the managers of complex projects in UOGO usually adopt the tools such as environmental scanning, strength, weakness, opportunities and threats (SWOT), and stakeholder analysis to contain issues of change management as proposed by Jacobs et al. (2013). Secondly, organizational culture is in-built in the management system as there could be already existing values, belief and behaviour that constitute people's way of life in peculiarities of the UOGO with or without projects.

Conclusion

Complexities are the main causes of many projects failures. Organizational factors in the field of project management are important for the success of projects. Enhancing the capacities and competences of organizational team members would provide a management systems that will be effective in managing UOGO, facilitates and infrastructure projects complexities.

The study identified types, causes, factors affecting, and increasing project complexities in addition to organizational factors to cope and manage them. An exploratory and descriptive survey research and convenient sampling techniques were carried out using some selected upstream oil and gas companies operating in the South South geopolitical zone of Nigeria. A structured questionnaire was designed and modeled in Likert five point scale as an instrument of data collection and measurement. The identified organizational factors which were used as independent variables are; organisational culture, top management support, change management, communication and IT knowledge, allocation of resources and training. RII and RSI were used to assess the importance and severity of types, sources and factors affecting project complexities in UOGO. The results and findings from the data analysis indicate that the most important factor of complexity is uncertainty. Severest types of project complexity in UOGO are technical/ technological, environment etc. The severest causes of project complexities in UOGO are interrelationship-many interdependencies and interactions, unpredictability-inability to know what will happen, dynamics rapid rate of change etc in ranking order. Also the severest factors that contribute to increase in project complexity are environment, level of scientific and technological knowledge required, number of different parts in the workflow etc.

The findings from multiple regression and correlation analyses and test of hypotheses revealed that the following organizational factors are significant in managing project complexities in UOGO: communication/IT knowledge, resource allocation, training and top management support with decision-making structure. Change management and organizational culture were not found to be significant for this study. Development of competence level, innovation in technical skills and acquisition of emerging and trending ICT knowledge as well as regular and periodic capacity building for the team members are recommended for development and effective management of project complexities in the UOGO. In addition, training in environmental management, project design and optimization are also recommended.

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