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An Evaluation of Critical Success Factors For Deepwater Oil & Gas Project Portfolio's in Nigeria

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Abstract

Deepwater project portfolios are complex and high risk with a lot of uncertainty, challenges and require high capital intensity. This study with the use of SPSS tool identified thirteen critical success factors required for successful deepwater development offshore Nigeria. It identified factors affecting schedule and cost overrun are most times interlinked. It further gave insights that to effectively overcome schedule delay and cost overrun in deep water oil and gas project portfolios, issues relating to project management capability, effective risk allocation, innovative technology, proper estimation of capital cost, understanding of local environment, and stakeholders' management would have to be addressed.
Keyword: *critical success factors, project portfolio, deepwater, oil & gas, Nigeria*

1.0. Introduction

This research is about the investigation of Critical Success Factors in Deepwater oil and gas project portfolio's offshore Nigeria. These offshore deepwater oil and gas Project portfolios are oil/gas developments about 120km off Nigerian coastal water. Nigeria offshore fields comprise of reservoirs containing commercial hydrocarbon volumes. Ideally, the reservoir will contain sufficient energy to cause hydrocarbons to flow freely to the surface. To optimize the recovery of the resource a well is drilled into the hydrocarbon reservoir, requiring deep water subsea wells tied back by flowlines, with the aid of manifolds and subsea risers, to an FPSO, before final processing and transportation to energy markets. [1] defines project as a unique process, consists of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time, cost and resources. A portfolio is a collection of projects or programs that are grouped together to facilitate effective management of that work to meet strategic business objectives [2]. Strategy is the framework, which guides those choices that determine the nature and direction of an organization [3]. Deepwater development projects differ from civil/construction projects- the fast changing and hash project environment impose numerous time, cost, and financial legal ethical environmental and logistic constraints. The project portfolio contains numerous interdependent and interrelated activities. These interact technically, economically and socially within the environment as well as within other organizations structures and systems while at the same time employing voluminous resources. This complexity requires an explicit understanding of how to compete. Particularly, there is a dearth of such studies from the perspective of deepwater oil and Gas development projects. To cover this knowledge gap, the current research attempts to address the following objectives: (1) to examine the causes of delay and cost overrun in major deepwater development project portfolios in Nigeria (2) to explore the perception of various construction stakeholders (client, consultants, designers, contractors) about the critical success factor requirements.

2.0 Parent Discipline

Petroleum Industry is identified, as the parent disciple for this research. Petroleum and gas deposits occur naturally throughout the world in every continent and ocean. Most of the deposits are several thousand meters deep. The petroleum industry's mission is to find, develop, refine, and market these resources in a fashion that achieves the highest economic return to the owners or investors while adequately protecting the fixed investment in the operation [4].The main facets of the oil and gas industry are exploration, production, refining, transportation and marketing. According to [5] exploration for oil and gas reservoirs consist mainly of geological testing and drilling of exploratory "wildcat wells. To find crude oil or gas reserves underground, geologists search for sedimentary basin in which shales rich in organic material have been buried for a

sufficiently long time span of tens of millions to a hundred million years. Oil and gas from the drilled well is produced through primary separation facilities, into individual stream of gas, oil and water. The produced liquids and gases are then transported to a gas plant or refinery by truck, railroad tank car, ship or pipeline [6]. While Shipment, from continent to continent is accomplished by large tanker vessels, carriers or ships, which is the most economical method of shipment. According to [6] the final facet involves marketing, here bulk plants, distribution and marketing terminals store and distribute finished products from refineries and gas plants. Typically these facilities handle gasoline, diesel, jet fuels, asphalts and compressed propane or butane. The oil and gas industry is complex and requires expertise in various areas and technical disciplines as well as technological capability and capital to fund these high-risk ventures [7, 8]. To meet this demand multidiscipline function such as Drilling Engineering, Production Engineering, Offshore Engineering, exist to provide the latest technical knowledge on upstream production and downstream aspects of oil and gas engineering. The petroleum industry stretches worldwide it operates in the most hostile environments including deepwater offshore Nigeria. The international Energy Agency expects 1.6 million barrels of oil demand growth in 2010. By 2020 the world will need about 40 million barrels per day of new oil production on stream from fields that have not been developed yet [9] With oil and gas reserves dwindling in most regions of the world attention has shifted immensely to deepwater drilling and exploration development in hash and complex environments. [10] indicates that, the most prolific discoveries in recent time are in deepwater. The large upfront expense of deepwater exploration means that this is a much higher risk investment than onshore or shelf exploration [10, 11] has stressed that key issues faced by the oil and gas industries are effective project delivery, risk, reliability, safety, environmental protection and sustainable development. According to [12], the security and economic stability of many nations and multinational oil companies are highly dependent on the safe and uninterrupted operation of their oil and gas facilities. Offshore facilities are dramatically different from onshore facilities, and pose a development challenge with inherent risks and hazards [12]. They require a combination of unique technologies [13].

4.0 Theoretical Framework

The topics that are discussed under this section are critical success factors, organization/portfolio management strategy, budget, and project delivery schedule.

4.1 Critical Success Factors

Project success is a vague term [14, 15] points out that "before attempting to categorize projects as a success or failure, it is necessary to determine the criteria upon which this evaluation will be made. A synonym for success is effectiveness, which is measured in terms of the degree of achievement of objectives [16]. According to [17] cost performance is a key success criterion for project sponsors. [18] established eight independent CSFs in BOT projects in China: appropriate project identification; stable political and economic situation; attractive financial package; acceptable toll/tariff levels; reasonable risk allocation; selection of suitable subcontractors; management control; and technology transfer. For an Australian sports stadium project, [19] identified the CSFs as: solid consortium with a wealth of expertise; considerable experience; high profile and a good reputation; an efficient approval process that assisted the stakeholders in a very tight timeframe; and innovation in the financing methods of the consortium. Among other factors, good governance is identified by [20, 21]; government support by [22]; a stable macro-economic environment by [23]; and suitable legal and administrative framework by [24-27]. Sound economic policy [28], including available financing market [29, 30]; strong and good private consortium [31, 32]; feasibility study/cost–benefit analysis [33, 34] and effective risk allocation [35] are all regarded as critical factors for the success project success. An innovative technical solution [31, 36] is also thought to be important. 'Soft' critical success factors include: social support [3]; commitment [37]; [38]; mutual benefit [35, 39, 40] have emphasized the importance of procurement transparency and competitive procurement process. Successful accomplishment of new ventures requires effective management of constraints of the stakeholders [41], leadership styles and work environment [42] are also revealed as factors behind the success of project efforts. Critical success factors would influence all the project management process/phase from formulation, planning, execution, controlling and closing process. These processes though unique to each project have tremendous bearing on the critical success factor requirements and would impact on the cost/schedule of the project life cycle [43].An understanding of the process in the project life cycle of deepwater developments, by carrying out value assurance reviews (VAR), ensuring that all the significant risks opportunities and uncertainties have been identified, before final investment decisions (FID) and consistently asking the question what did we learn, would help establish which critical success factors that are prevalent in meeting project objectives, and help reduce schedule delays and budget overruns. [43] identified five project objectives that requirement management attention. These are (1) scope, (2) organization, (3) quality, (4) cost and (5) time, with management of risk inherent in each objective.

To adequately comprehend the critical success factors needed in deepwater development projects, an understanding of why projects fail is essential. According to [44] main causes of such failure can be attributed to faulty cost estimation and inefficient management. In 2001, the Gartner group updated their research to include lack of executive sponsorship as a major contributor to project failures. They attributed other causes to client cost estimate failure, wrong contractors cost estimate and management failures, this span the spectrum of planning, organizational, resource, directional, controlling, coordination failure and failures due to procurement of faulty machinery and materials, bad workmanship poor performance of sub-contractors, accidents unfavorable weather conditions and a failure to adapt to local conditions. Thus, this hypothesis is forwarded:
H1: Critical success factors are criterias for deepwater project success.

4.2 Organization/Portfolio management strategy

All projects arise from a need to fulfill specific strategic objectives. [43]. "The creation of a project independent of the corporate plans is the most dramatic pitfall because more than anything else it is most likely to ensure the failure of the project" [45]. A project cannot address every organisational strategic goal but rather its aim is 'to contribute to the organisation's ability to perform some of its tasks in some improved way. [45]. Therefore all business are built around objectives for success; achieving high productivity, improving quality, delivering at the appropriate time, decreasing cycle time, growth of market share, utilising resources effectively and managing cost [46]. The project goal is the overall strategic orientation to which the project will contribute and should be consistent and extracted directly from the strategic plans of the organisation. [43]. According to the western Australian Treasury Department's Project Evaluation Guidelines, projects require a strategic justification. This strategic justification essentially requires that the objectives of the project are consistent with government, agency's strategic objectives. The strategic justification criteria are fundamental to the process of defining a projects desired outcome. Linking all projects to the strategic direction of the organisation is crucial to success [47]. Projects are taken to fulfil the strategic plans of the initiator. All projects should support the organisation's strategic goals [2]. Thus, this hypothesis is forwarded:
H2: Organization/Portfolio management strategy is dependent on the critical success factors.

4.3 Budget

[48] established that cost escalation was strongly dependent on the length of the implementation phase. [49, 50] identified other variables which impact construction time and cost overrun. Their study identified predominant causes of delay as design changes, poor labour productivity and inadequate planning. Other main causes of cost overrun identified and ranked according their perceived importance were inflationary increase in material cost, inaccurate material estimating and project complexity. Furthermore, feasibility studies tend to underestimate the as built capital costs of the project [51]. They further opined that as built capital cost are on average, 14% higher than estimates in the bankable feasibility study. They reasoned that this bias in capital cost estimation is intentional and driven by scarcity of project financing and the need by the project sponsors to inflate the project economics in a bid to secure financing. Cost overruns of 100% or more happen roughly in one out of thirteen projects [51, 48] indicated that large construction cost escalations in infrastructure projects are common and exists across different types, different continents and different historical periods. They concluded that an increase in project size translates into need for improved planning processes and institutional set-ups for infrastructure development and management.Study conducted by the Ministry of Statistics and Programme Implementation Government of India identified four main factors contributing to the overruns in public sector projects as inadequate project formulation, poor planning for implementation, lack of proper contract planning and management, and lack of Project Management during execution. Thus, this hypothesis is forwarded:
H3: Critical success factors positively influence deepwater project Budget.

4.4 Project Delivery Schedule

[52] opined that the concept of project duration is important in assessing the success or viability of a project. Estimation of time has continued to be a problem of great concern and interest to both researchers and contractors [53]. [54], in their study of major construction projects in Thailand identified the most significant problems causing construction delays are factors related to designers, contractors and consultants. Issues such as lack of resources, poor contractor management, shortage of labour, design delays, planning and scheduling deficiencies, changed orders and contractors' financial difficulties were also highlighted in the study. Construction delays do not only result in cost overruns and poor quality but also greater disputes [55], Companies have been finding it difficult to deliver on time not because of lack of financial resources but mainly due to the fact that they are facing enormous pressure of multiple jobs and parallel deadlines with less than adequate human resources [56]. Focus on reducing the delays can also help to reduce resources spent on heavy litigation processes [57]. According to a recent Gartner Institute study, 50% of all projects were delivered above schedule and/or budget. Thus, this hypothesis is forwarded:
H4: Critical success factors positively influence deepwater project delivery schedule

5.0 Data Analysis

5.1 Overview

The data gathered using a questionnaire. The data collected were analyzed utilizing the Statistical Package for Social Science (SPSS) version 17 software. Descriptive analysis, which are, the calculation of mean, minimum, maximum, and standard deviation are utilized to obtain descriptive measures on the variables. Reliability analysis was carried out to check for inter-item consistency reliability of measure or in by other mean to identify whether the same group of variables can be combined or not by looking at Cronbach's alpha or known as the cutting point. Cronbach's alpha coefficient of 0.8 or more is expected to establish goodness of measure. For hypotheses testing, T test has been used.

5.2 Analysis of the Validity and Reliability of the Study

For this study, it was established that the value of 0.7 and above would be reliable for questions having between 5 and 13 items. The overall Cronbach's alpha coefficient for all scaled questions was 0.925 which satisfies the reliability test requirements [58]. Table 1 shows the reliability test summary for questions relating to (1) critical success factors (CSF), (2) Portfolio management strategy (PMO) (3) project budget (PB) (4) project schedule (PS). The measurement of reliability test assessed were analyzed using Cronbach alpha reliability coefficient as depicted in Table 1. Generally, the reliability for prevalence of the listed critical success is high, with the Cronbach alpha value of 0.812. The reliability for portfolio management strategy influencing critical success factors for deepwater project success is also very high with the Cronbach alpha value of 0.878. The reliability for Project Budget as highly dependent on the listed critical success factor is strong with the Cronbach alpha value of 0.779. The reliability for total that that critical success factors will influence project schedule for deepwater project success is relatively high with the Cronbach alpha value of 0.839.

Table 1: Cronbach Alpha for Variables

Variables	No. of Items	Items Dropped	No. of Items Used	Cronbach Alpha
Critical Success Factors	13	2	11	**0.812**
Portfolio Management Strategy	13	0	5	**0.878**
Budget	13	4	5	**0.779**
Project Schedule	13	0	3	**0.839**
All Variables	52	6	46	**0.925**

5.3 Respondents' demographic profile

A total of 200 e-mail questionnaires were distributed to Nigeria's deepwater oil and gas project population. From the total 200 questionnaires distributed, 170 were returned on time for the analysis process. This represents an average response rate of 85%. The Profile of Respondents with majority between the age group of 43 – 47 which represent 40.6% and 48 years and above 30% Most of the respondents are Project Senior Engineers (41.8%), followed by Project Engineers (20.6%) and Project Managers (18.8%). Most of the respondents work in the major oil and gas companies (43.9%) and majority of them possess a degree mainly masters degree holder respondents are dominant with 52.9%, followed by Bachelor Degree holder respondents with 44.1% The majority of the respondents have more than 10 years working experience (58.8%). While 24.7% have less than 5 years experience. 100% of the respondents were male.

5.4 Descriptive Analysis Company Profile

80% of the respondents were from the major oil and gas industry, 90% of these companies have been in operation in Nigeria for more than 20 years., with an estimated annual profit between three to nine billion united states dollars While other marginal oil and gas firms, have been in operation in Nigeria for 6-10years most earning above 30 million United states Dollars. Amongst the major oil firm only NNPC is a solely owned Nigerian entity while the other majors are joint venture partnerships. All the marginal firms are joint venture partnerships.

5.5 Hypothesis Test- One Sample T-test

This section discusses the hypothesis, in total four hypotheses are tested against the findings from the research instrument. The T test was used to test the hypothesis. To determine if there were any significant differences

between the four variables Critical Success Factor, Portfolio Management Strategy, Project Budget, Project Schedule, a one sample T test was carried out. A review of table 2 indicated that in all *p=.000*. So, all hypotheses are accepted. There was huge consensus of opinion with regards the prevalence of critical success factors and relationship between the prevalence of critical success factors and the overall organizational/project portfolio strategy. The data results show compelling evidence of congruency with 95% confidence level that the interval contains the population mean and with all significant, indicating that the null hypothesis H01, H02, H03 and H04 are not accepted**.**

Table 2: One-Sample Test

					Test Value = 3					
									95% Confidence Interval of the Difference	
	N	Mean	Std Deviation	Std Error Mean	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
CSF	170	4.3406	.46608	.03575	37.504	169	.000	1.34064	1.2701	1.4112
PMS	170	3.8312	.55396	.04249	19.564	169	.000	.83122	.7473	.9151
PB	170	3.9601	.54682	.04194	22.894	169	.000	.96013	.8773	1.0429
PS	170	4.0416	.50943	.03907	26.659	169	.000	1.04163	.9645	1.1188

The survey questionnaire had asked the respondents to identify those independent variable crucial to deepwater project strategy. The respondents were given the opportunity to select the appropriate boxes. Analysis of the raw data indicated that the external environment was crucial to deepwater project strategy. Table 3 shows the original frequencies of the variables. It may be seen that external environment was important to 87.1% respondent, while project action accounts for 74.1%, human related factors was seen as important by 66.7.% and project procedures 61.12%.

Table 3: Factors important to deepwater project strategy (opened ended question)

	N	**%**
Project related factors	113	66.7
Project procedures	104	61.12
Project management action	126	74.1
Human related factors	108	63.5
External environment	148	87.1

6.0 Discussion

Due to the complex nature of deepwater oil and gas exploration and development, having a master's degree seems to be an added advantage for securing positions in deepwater project development portfolios. The study finding indicated that the deepwater project environment is mainly dominated by male workers of the 170 respondents none are women. This calls for the need for gender inclusiveness and diversity in the deepwater project portfolio environment. Study identified that the external environment, project action and human related factors was crucial to deepwater project strategy that emphasis on the need for effective communication with stake holder and community. The implication that can be drawn from this result is that the researched dependent variables are criteria's for deepwater project success and are impacted and dependent on the 13 listed critical success factors (refer Table 4).

Table 4: List of 13 Critical Success Factors

No	**Critical Success Factors**
1	Proper Contract Planning and Management
2	Good Project Formulation
3	Project Management Capability
4	Good Project Implementation
5	Realistic Project Duration
6	Effective Risk Allocation
7	Understanding of Local Environment
8	Resource Availability

9	Access to Secure Finance
10	Fast Project Delivery
11	Communication
12	Innovative Technology
13	Proper Estimation of Capital cost

The limitation of the study only relevance to the Nigerian context, but to make generalization for the whole oil and gas deepwater project environment, further research has to be conducted in other regions to confirm that the findings can be universally applied. This research has focused specifically on the critical success factors for deepwater oil and gas development organizations in Nigeria. The validation of the existence of critical success factors for deepwater oil and gas project portfolio's by this research calls for further clarification and more rigorous evaluation of the patent factors that are associated with each of these thirteen critical success factors and their relationship to deepwater project success that can be further research in the future.

7.0 Conclusion

The researcher believes that further research into the capability and critical success factors requirement for deepwater facility fabrication contractors are to be carried out. This is based on the research findings, that most of the major deepwater oil and gas facilities are designed fabricated and integrated at various locations outside the shores of Nigeria. This practice has brought about several deepwater project cost escalation and schedule overrun. Therefore, as a key component of deepwater oil and gas project success, the proposed study of the local content capability to support deepwater facilities Fabrication projects in Nigerian should be contemplated. This will add value to the current drive for local content involvement in major oil and gas development projects and also support the about to be enacted Petroleum Industry Bill (PIB). The research collaborated with the literature that project portfolios contains numerous interdependent and interrelated activities. The results of the study clearly shows that the key prerequisite for project success in deepwater oil and gas project portfolio's is the prevalence, and understanding of the required critical success factors, project management capability, fast project delivery and proper budget implementation and control. Thirteen most prevalent critical success factors within deepwater oil and gas project portfolios were identified including their most prevalent themes; this offers a deeper understanding of the characteristics of each critical success factor. All The variables that were sourced from the literature review found to achieve high significance in their relationships It identifies that there is a positive relational congruency between the prevalence of critical success factors and the overall organizational/ project portfolio strategy. The statistical data analysed substantiates this position with a high significant 2 tail of $p= 0.000$.Understanding local environment and proper contract planning and management is of high prevalence and importance within the questionnaire respondents. This perhaps reflects the complex, uncertain and risk prone environment of deepwater project portfolios. Furthermore, the study identified that critical success factors in mega construction projects can be applied in deepwater oil and gas projects As well as this, the critical success factor for understanding local environment is identified, which has not been previously recognized as critical success factor. The research shows that most of the analysed critical success factors require specific competency and skill sets and what came out was the need for project management capability (Project management action) and increasing technological expertise. Understanding and coping with the external environment - stake holder management came out as a core capability requirement for consistent positive outcomes in deepwater project portfolio's.

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