Time and Cost Performance of Oil Well Drilling and Completion Projects in Warri Delta State, Nigeria: A Situational Analysis[1]

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Abstract

This study focused on the time and cost performance of Oil Well Drilling and Completion projects in Warri Delta State as to the success or failure of Aroh- 1 and 2 Oil Well projects. The aim basically is to assess the performance of these projects with regards to cost and schedule requirements and the possible causes of variation, if any. Earned value analysis (EVA) model was the major tool used for the project monitoring and it was also used to analyze the performance of these projects. Aroh-1 and 2 Oil Well drilling and completion projects were selected for the analysis using judgmental sampling base on the availability of necessary data. The analysis revealed that most of the activities undertaken by the contractors show some elements of "fatigue" as they experienced cost and time overrun. This problem seems to come from the mechanical and logistics arrangement which appears in the form of equipment breakdown and delays by the staff of Joint Tax Force (JTF).

Keywords: time and cost overrun; project performance; Aroh-1 and 2; oil well drilling and completion; cost and time performance; earned value analysis.

Introduction

Nigeria is developing country that is heavily dependent on petroleum resources for development. This much awaited development can only be achieved if projects, especially the oil and gas projects, can be realized free of any negative variations in cost, time and quality performances. This is because they are the major criteria for judging projects success. Project is therefore seen as a proposal for an investment to increase, expand and/or develop certain facilities in order to increase the production of goods and/ or services in a community during a given period of time (Echeme, 2015). Again for evaluative purposes, a project is a unit of investment, which can be distinguished technically, commercially and economically from other investment. Akpan and Chizea (2013) explained the term project to connote any unique activity, situation, task , programme, scheme, or any human endeavour in which human, time and other resources are utilized to satisfy a definable and definite one-off (single or multiple) objective, the realization of the set objective generally signals the completion of this unique activity.

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Furthermore, it was added that the word “completion” as used may not be implicit and could be discriminatory as it can come out to be unsatisfactory completion depending on the set criteria. An unsatisfactory completion connotes that though the project was realized, its realization did not adhere to the set criteria of cost, schedule and quality. However, Kezner (2009) added that a successful project implementation occurs if the project, comes on-time, on-budget, achieves all the goals originally set for it, and is adopted and used by the clients for whom the project is intended. It implies the successful achievement of time, cost and quality objectives, as well as the quality of the project process. Since the existence of a project is for development purposes, the determination of the time and cost performance becomes very necessary, especially for oil and gas projects in Warri, Delta state.

This study analyzed the level of performance of time and cost indices in the Oil Well Drilling and Completion project execution in Warri, Delta State. The benefits derivable from a successful project management, especially in the area of execution have renowned multiplier effects on the economies of our various societies.

Unfortunately, many projects are been abandoned in recent times, those completed were not realized within their planned budget and schedules. Sequel to this, primary investigations have indicated that costs of establishing and completing oil and gas projects are on the high side to the detriment of investors and all other beneficiaries. Also, a critical view of the complex nature of the phases of project management with special reference to the project implementation have revealed that the oil drilling companies and their construction activities have continuously been made behind the planned time and cost thereby failing the criteria for measuring successful projects.

Hence, this study is set to determine how to achieve better implementation of oil and gas construction projects, especially, drilling and completion of oil well projects in Warri, Delta state. To do this, the research analyzed and determined the level of variations in Oil and Gas Well construction projects as it relates to cost and time requirements since they are the major criteria for assessing project success.

2.0 THEORETICAL FRAMEWORK

Project success have been discussed by many authors and theories propounded. Among the various contributions to this is Lim and Mohamed (2002) cautioned that project managers should not only look at project success as the achievement of some predetermined project goals like time, cost, performance, quality and safety, but also consider the users who do not have similar pre-determined goals regarding the project at all. Hence, the expectation on the outcome of the project and the perception of project success or failure will be different for everyone, if viewed in the context of Lim and Mohamed (2002). Dangayach and Mittal (2011) even suggested the inclusion of ethics as one of the factors of project success because according to them this factor will result in the sustainability of the project by increasing satisfaction and loyalty of the customers as well as create harmony, trust, brotherhood, values and morality among team members. Quite a number of papers relating to critical success factors have appeared in the open literature especially in the 1980s. Pinto and Slevin (1987) concentrated on success critical factors of time-budget-quality triangle and added as well the client satisfaction. One may even wonder whether the contractor is expected to do more than what was specified in the contract document (client requirement/specification) in order to satisfy the client. This fourth aspect is quite unnecessary if these three success factors are satisfactorily met as client satisfaction is a part and parcel of quality specification.

The above reviews point to the conclusion by Steinfort and Walker (2007) that success needs to be investigated from the perspective of active project team stakeholders as well as from that of their client/recipient's benefit and in the theoretical and empirical/practical review of critical success criteria and factors on any project. Even the Books of Knowledge (BoKs) of the two leading professional bodies in the field – the Project Management Institute (PMI) and Association of Project Managers (APM) seem to place much emphasis on project outcome, that is the profitability and the marketing strategy of the product of the project (post-project aspect) which should have been considered before the project is accepted (i.e. pre-project based on feasibility and viability analysis), rather than on project implementation which is the fulcrum on which project rests. There is basically no measuring yardstick in these two BoKs as to the success factors just like these other ones enumerated above at the implementation stage since the emphasis is placed more on the outcome of the project which can only be appraised after implementation. However, the outcome is influenced by the operation strategies which are outside the scope of project management according to Akpan (2009). A project may successfully be executed and delivered on time, within budget and quality specification but suffers from management inefficiencies during its normal operations. So there should be a boundary of what constitutes project management and operations management in order to determine project success criteria. Based on the above literature reviews, this study deemed it fit at this point in time to make a theoretical and empirical review of the performance of Oil Well Drilling and Completion projects based on time and cost criteria which ended in Delta state seven years ago (that is 2011).

2.1 HISTORICAL BACKGROUND OF OIL AND GAS WELL DRILLING AND COMPLETION PROJECTS

The study focused on two oil well drilling and completion projects/operations executed in Warri, Delta state, Nigeria as discussed below;

2.1.1 Well -1 Initial Drilling and Completion Project

Well History

Aroh-1 well was drilled in 1992 as a straight hole to test a seismic anomaly. The well which was drilled to a total depth of 13,278ft MD encountered 431ft net oil in 20 sands and 151ft net gas condensate in 3 sands.

Objectives

To complete well initially on the D-05 Sand and with D-02C (selective) on Long String and D-02B Sand on Short String, With SCSSSV to be installed in both Strings.

Table 1 Summary of Planned Activities

S/N	DESCRIPTION OF ACTIVITY
1	Mobilize, Rig moved from NPDC jetty to AROH-1 well location.
2	Position Barges and observe barges stability. Reposition equipment and tack-weld same.
3	Check well head pressures, bleed off pressure if any. Remove well head cap, install and test BOP. (Required Adapter
4	Drill out cement plugs at 363'– 663' & 9,416'- 9,508' and locate top cement plug at 10,512ft. Circulate hole clean with High-Vis pill.
5	RIH 8-3/8" Bit and Scraper assembly to top cement plug at 10,512ft. Circulate hole clean with Hi-Vis pill. Close BOP and pressure test casing integrity to 2,500psi. Drop Gyro.
6	POOH 8 3/8" Bit and Scraper assembly.
7	Logging: Log GR/CCL/CET. If CET shows poor bond, carry out remedial cement squeeze, If not go to item 9.
8	RIH 8 3/8" Bit and Scraper assembly to top of cement plug at 10,512ft. Carry out well bore cleaning and displace hole to clean filtered inhibited brine. POOH bit and scraper assy. Note: If Halliburton completion Assy not on site, RIH 1000' Kill string in Aroh-1 well & skid Barge-mounted HWU to Aroh-2 well. If completion item is available, continue with item 9.
9	Logging: RIH 7" High Short Density 12 SPF Gun and perforate D-05 sand interval 9,785 – 9,810ft MD. (3
10	RIH 9 5/8" Halliburton RTTS Retrievable Packer plus 10ft tail assy. Set Packer at 9745ft with tail at 9,755ft. Check Packer setting with 500psi in Annulus. Displace string to diesel cushion & carry out production test on D-05 sand as per programme.
11	Kill well, unset Packer & run tail below perforations. Reverse circulate bottoms up. POOH 9 5/8" retrievable packer plus 10ft tail assy.
12	Logging: (1) RIH 9 5/8" Gauge Ring plus Junk Basket Assy to 9,600ft. (11) Set Lower Sump type 'VSR' Packer at 9535ft.
13	RIH 4.75" SSP Plug, Set in sump packer at 9,535ft & pressure test plug w/500psi. Dump 2 x 50lb sacks of gravel. POOH running tool assy.
14	Logging: Perforate D-02C sand intervals 9,508 – 9,526ft W/ 7" HSD gun 12 SPF. (2 runs)
15	RIH 9 5/8" RTTS retrievable packer plus 10ft tail assy. Set packer at 9,468ft with tail at 9,478ft. Check packer setting with 500psi in Annulus. Displace string to diesel cushion & carry out production test on D-02C sand as per programme.
16	Kill well, unset packer & run tail below perforations and reverse circulate bottoms up. POOH production test assy.
17	RIH SSP Plug retrieving tool to top plug at +/- 9,535ft. Reverse circulate out gravel. Engage plug and POOH same plus running tool assy.
18	RIH 9-5/8" VTA Gravel pack packer plus 5-1/2"screen liner c/w locator seal assy. Stab into VSR sump packer @ 9,535ft, with GP packer at 9,461ft. Gravel pack D-02C sand as per programme. Observe well for losses and POOH setting tool assy.

19	RIH 5" SSP Plug, Set in VTA GP Packer at 9,461ft pressure test plug w/500psi. Dump 2 x 50lb sacks of gravel. POOH running tool assy.
20	Logging: RIH 7" HSD 12SPF Gun and perforate D-02B sand intervals 9,438 – 9,456ft. POOH 7" Gun carrier. (2 runs)
21	RIH 9 5/8" RTTS retrievable packer plus 10ft tail assy. Set packer at 9,398ft with tail at 9,408ft. Check packer setting with 500psi in Annulus. Displace string to diesel cushion & carry out production test on D-02B sand as per programme.
22	Kill well, unset packer & run tail below perforations. Reverse circulate bottoms up. POOH 9 5/8" retrievable packer plus 10ft tail assy.
23	RIH SSP Plug retrieving tool to top plug at +/- 9,461ft. Reverse circulate out gravel. Engage plug and POOH same plus running tool assy.
24	RIH 9-5/8" VTA Gravel Pack packer plus 5-1/2"screen liner c/w locator seal assy, Stab into VTA GP packer at 9,461ft. Gravel Pack D-02B sand interval 9,438 – 9,456ft as per program with top VTA GP Packer at 9,359ft. Observe well for losses & POOH setting tool assy.
25	Complete well as Dual strings multiple producer with D-02B on short string, D-05 and D-02C selective on long string with wireline retrievable SCSSSVs installed in both strings.
26	Install Xmas Tree and produce well clean and hand Over well to Asset Team. Prepare and skid HWU to AROH-2 well head.
	Total Estimated Days - If Remedial squeeze is not Required= 65
	Total Estimated Days – If Remedial squeeze is required=68

Source: Project Data

The idle time experienced during the implementation of Well 1 completion project is shown in Table 2 below;

Table 2 Non Productive Time (NPT) Reporting

S/N	Failure Classification	NPT hrs	Failure Description	Company	Date
1	Mechanical	2	Faulty Back up tong	TECON	18/10/10
2	Mechanical	71	Pump and Mud Motor Failure	TECON/WEAFRI	22/10/10
3	Mechanical	4	Pump Failure	TECON/WEAFRI	23/10/10
4	Mechanical	1	Faulty Power tong	TECON	25/10/10
5	Mechanical	136.5	Pump Failure	TECON	25-31/10/10
6	Mechanical	13	Faulty Power tong jaw and Dice	TECON	03-04/10/10
7	Mechanical	3	Faulty 50 ton crane	TECON	08/11/10
8	Mechanical	3	Problem breaking out bit sub due to tight connection	TECON	17/02/11
9	Completion Running	51	Waiting on 9-5/8'' sump packer (Available sump packer set on surface)	HALLIBURTON	20-22/02/11
10	Mechanical	4.5	Working on broken stationary slip arm	TECON	05/03/11
11	Mechanical	106	Faulty rig crane(over heating)	TECON	06-10/03/2011

12	Completion Running	27.5	Waiting on Completion Supervisor and Completion basket containing Sump packer	Halliburton	17-18/03/2011
13	Logistics	81.5	Waiting on Diesel	NPDC	29/03/2011-
	Total	**504**			

Source: Project Data

Remark: The total actual days of about Ninety (90) days spent was as a result of the NPT of about 21days incurred plus other unplanned but necessary activities that arose during the course of the operations .

2.1.2 Well- 2 Initial Drilling and Completion Project

Well History

Aroh -2 well was spudded on October 7, 1994. The well was directionally drilled from Aroh-1 well surface site to a total depth of 13,013ft-KB MD (12,242ft-KB TVD) to test the down dip LKO limits in the C-06, D-02, D-04, D-05 and D-06 sand packages. Additional objectives included providing additional seismic and well control for the Aroh field 3-D seismic project, and testing the deliverability of the oils in the 'D' sand packages.

Objectives

To complete well initially on the D-07 Sand and with D-05 (selective) on Long String and D-04 Sand on Short String, With SCSSSV to be installed in both Strings.

Table 3 Summary of proposed Activities

S/N	DESCRIPTION OF PROPOSED ACTIVITY
1	Skid & position HWU on Aroh-2
2	Remove wellhead cap, install BOP and Test BOP
3	Drill out cmt plugs @ 363ft; 9698ft; 10222ft.
4	Log GR/CCL/CBL/CET. Test csg
5	Remedial Squeeze
6	Carry out wellbore cleaning. Displace hole to filtered brine
7	Perforate D-07 & D-05 sands W/7" HSD gun 12 SPF.
8	Make 8-3/8" + 9-5/8" Bit & Scraper run to top plug
9	Set Lower sump Packer @ 10347ft
10	Install IGP across the D-05 sand. Intervals 10,322' to 10,342ft AH RIH with DP and set isolation packer at 10,226ft. POH.
11	RIH and set Straight pull plug in packer at 10226FT. POH
12	Perforate D-04 sand 10,186'-10,206' AH W/7" HSD gun 12 SPF
13	RIH & retrieve Straight pull plug from packer at 10226Ft
14	Install IGP across the D-04 sand at 10,186ft – 10,206ft AH. AH
15	Complete well as a two string (multiple) Selective producer
16	Install Christmas tree and produce well

	Total Estimated Days =66 Days

Table 4 Non Productive Time (NPT) Reporting

S/N	Failure Classification	NPT hrs	Failure Description	Company	Date
1	Logistics	2	Boat Bringing in Mud Motor was detained by JTF personnel. Prevented crane from picking Mud Motor	JTF	14/11/2010
2	Mechanical	3	Tripping BHA	TECON	15/11/10
3	Mechanical	6	Mud Pump failure	HES	16/11/10
4	Mechanical	2.5	Leaking cross over on Kelly Hose	TECON	16/11/10
4	Mechanical	0.5	Faulty Power tong	TECON	17/11/10
5	Mechanical	4	Faulty Power tong	TECON	18/11/10
6	Mechanical	18.5	Hard pressure build up in string while circulating bottoms up with 10bbls of Hi-vis pill. Worked strings to unplug nozzles. No success. Had to POOH bit plus Mud motor assembly(6'' MM problem)	TECON	19/11/10
7	Mechanical	24	Still pulling out bit plus Mud motor assembly (6'' MM problem)	TECON	20/11/10
8	Mechanical	19.5	Still pulling out bit plus Mud motor assembly (6'' MM problem).	TECON	21/11/10
9	Mechanical	3.0	Power Tong failure	TECON	21/11/10
	Mechanical	1.5	Difficulty in torquing bit without bit breaker	TECON	21/11/10
8	Mechanical	1.5	Rig Tong failure	TECON	23/11/2010
9	Mechanical	9.5	Pump failure (gear box)	TECON	24/11/2010
10	Mechanical	24	Pump failure (gear box)	TECON	25/11/2010
11	Mechanical	24	Pump failure (gear box)	TECON	26/11/2010
12	Mechanical	24	Pump failure (gear box)	TECON	27/11/2010
13	Mechanical	17	Working on Pump	TECON	28/11/2010
14	Mechanical	6.5	Pump failure	TECON	29/11/2010
15	Mechanical	4	Power Tong failure	TECON	05/12/2010
16	Mechanical	6	Power Tong Failure	TECON	06/12/2010
17	Mechanical	4	Power Tong Failure	TECON	20/12/2010
18	Mechanical	2	Power Tong Failure	TECON	24/12/2010
19	Logistics	27.5	Waited on TECON to mobilize buttress threaded shooting nipple(TECON' thread SLX couldn't fit HES buttress)	TECON	27-28/12/2010
20	Mechanical	2	Repaired Jack Hydraulic supply hose which busted	TECON	14/01/2011

21	Mechanical	15	TECON crane Broke down	TECON	15/01/2011
22	Mechanical	19.25	TECON crane under repairs	TECON	16/01/2011
23	Mechanical	2.5	Power Pack/Counter balance Supply hose failed	TECON	16/01/2011
24	Mechanical	1.50	Power Pack/Counter balance Supply hose fixed.	TECON	17/01/2011
25	Mechanical	13.5	Fixed Jack Hydraulic System	TECON	17- 18/01/2011
26	Mechanical	20	W/O sub assembly crossover connection to adapt HCS to BTS	TECON	26-27/01/2011
		308.25			

Source: Project Data

Tables 3 and 4 show the periods (hours) when project activities were constrained and the various reasons behind the obstruction of activities. It also reflects the contractor responsible for the delay or idle time. These the study believed contributed immensely to the time and cost overrun witnessed in most oil well drilling and completion projects around Nigeria and other developing countries.

2.2 Project Implementation

Implementation as Nutt (1996) put it, is a series of steps taken by responsible organizations to plan change process and to elicit compliance needed to install change. Managers use implementation to make planned changes in organizations by creating environments in which changes can survive and be rooted. Amsoff (2004) made several important distinctions pertinent to these procedures, called, the entrepreneurial, exploration, control and implementation sub – processes. Hence implementation can be viewed as a procedure used in planning change process that lays out steps taken by the entire stakeholders to support change.

A good implementation programme includes a great deal of measurement. That is, accurate data which is a function of continuous auditing process. Project control is also dependent upon measurement; in this case the matrix is used to compare progress against the plan. The third dimension of measurement is regular monitoring of key performance criteria within the business / project so that improvements resulting from the implementation can be assessed. These performance criteria will include the feasibility study but not be restricted to the areas of benefit established by the feasibility study (Luscombe, 2012).

2.3 Causes of Project Cost and Time Variations

Project of varying kinds and dimensions are and will remain a document feature of organizing investment in developing countries of the world today. However, the path from selecting for optimal projects to achieve development goals to the planning, management and implementation of such projects often leads to disaster. This research will be incomplete without mentioning some of the obstacles and problems encountered in their implementation. It should be noted that the records of project management in these developing countries has been mixed. This is because the obstacles and difficulties that inhibits overall economic, social growth and public administration also constrain effective project planning, organization and implementation.

Many developing Countries, like Nigeria, have become highly dependent on foreign experts and international assistance for any aspect of project planning still meet unanticipated difficulties and as a result simply fail. Some that succeed produce only temporary or narrowly distributed benefits. Nwachukwu, Echeme and Okoli (2010) posited that the problems of implementing and managing projects in developing countries are varied and intractable, running from the gamut difficulties of translating national and sectorial plans into feasible investment proposals, to the inability to formulate and prepare internationally acceptable prospectuses due to Technically deficient design, Inappropriate appraisal, Difficulties activating and organizing project management units, Faculty planning, programming and scheduling of tasks, Contractors performing below standard and expectations, Escalation of project cost due to inflation, Design change, Difficulty in payment to contractors due to bureaucracy, Weakness of supervision, monitoring and control, The technical failure, The laxity in evaluating project result and assessing opportunities for further investment, Scarcity of skilled planners and managers, The scarcity of local resources for supporting or maintaining projects and the problems of budgeting and allocating funds frequently cause problems even for internationally assisted projects, Obstruction by regulatory agencies, The use of culturally, incompatible management methods by foreign consultants also reduce the effectiveness of projects in many parts of the developing world.

3.0 Materials and Methods

The method of research design adopted is the survey technique which is observational and explanatory. Two oil well drilling and completion projects were selected in Warri for analysis. This was based on the projects that have time and cost indices needed to conduct the analysis. Hence, the data analysis focused on the activities of two (2) oil and gas construction projects in Delta State, Nigeria.

Data collected as specified above were subjected to Descriptive statistics involving percentages, charts, etc and Earned Value Analysis (EVA) model to analyze the level of performance as it relates to cost and time specifications, since they are the main criteria for judging the project implementation success. This analysis also afforded us the opportunity to determine the level of variations experienced in Aroh 1 and 2 Well Drilling and Completion projects. This model according to Akpan (2013) is used to compare the planned amount of work with what has actually been completed, to determine if the cost, schedule and work accomplished are progressing in accordance with the plan. Based on this methodology as given by Payne et al (1999), we have

Schedule Performance Index (SPI) = BCWP/BCWS ………………………….………(1)

Schedule Variance (SV) = {(BCWP-BCWS)/BCWS}*100}…………………………......(2)

Cost Performance Index (CPI) = ACWP/BCWP ……………………………….….(3)

Cost Variance (CV) = {(ACWP-BCWP)/BCWP}*100}...(4)

Where **BCWS** is budgeted cost of work scheduled or planned budget, **BCWP** is budgeted cost of work in place, i.e. earned value at the time of evaluation, **ACWP** is actual cost of work in place.

A positive schedule variance calculated at a given point in time means that the project is behind schedule while a positive cost variance means that the project is over the budget.

4.0 RESULTS AND DISCUSSIONS

4.1 Analysis of the Performance Data of Aroh-Well 1 Project in Warri, Delta State

The tables (5, 6, 7, and 8) below analyzed the key performance of Aroh-Well 1 drilling and completion project embarked upon by the Nigeria Petroleum Development Company (Contractor) in Warri based on the cost and schedule variances. This is done to determine whether the project was completed within its cost and schedule requirements and the factors responsible for the negative or positive variations. To do this, we adopted the Earned Value Analysis (EVA) model.

Table 5 Oil Well Drilling Completion Timing (Planned vs Actual Duration)

S/N	DESCRIPTION OF ACTUAL ACTIVITY	Planned Duration (Days)	Actual Duration (Days)	Schedule Variance (Days)	Schedule Performance Index
1	Mobilization, Rig moved from NPDC jetty to AROH-1 well location.	3	2	1.0	0.67
2	Positioned Barges and observed barges stability. Repositioned equipment and tack-weld same.	3	2.13	1.13	0.71
3	Checked well head pressures, bled off pressure. Removed well head cap, installed and tested BOP. (Required Adapter 13 5/8" x 5K by 11" x 5K) and Rigged Up HWU	2	4.17	-2.17	2.09
4	Drilled out cement plugs at 394'– 655' & 9,450'- 9,507' and located top cement plug at 10,420ft. Circulated hole clean with High-Vis pill.	4	17.79	-13.79	4.45
5	RIH 8-3/8" Bit and Scraper assembly to top cement plug at 10,420ft. Circulated hole clean with Hi-Vis pill. Closed BOP and pressure tested casing integrity to 2,500psi.	1.5	1.94	-0.44	1.29
6	POOH 8 3/8" Bit and Scraper assembly.	1.5	1.79	-0.29	1.19
7	Logging: Log GR/CCL/CET.	1	0.73	0.27	0.73
8	Suspended Aroh-1 and skidded to Aroh-2 well on 13/11/2010	0	4.3	-4.3	0.0

9	Skidded to Aroh-1 on 5th February, 2011. R/U HWU and Tested BOP	1	2.5	-1.5	2.5
10	RIH 8 3/8" Bit + Scraper Assy to TOC plug @ 10,420ft. POOH.	3	3.4	-0.4	1.13
11	Perforated D-05 sand interval 9,785 - 9,797ft W/ 7" HSD gun 12 SPF.	2	0.71	1.29	0.36
12	RIH 9 5/8" Guage Ring + Junk Basket Assy to 9,600ft. POOH	1	0.21	0.79	0.21
13	RIH 4.75" SSP Plug, Set in sump packer at 9,535ft. POOH Running Tool	3	0	3	0.0
14	Perforated D-02C sand intervals 9,508 – 9,526ft W/ 7" HSD gun 12 SPF.	1	2.2	-1.2	2.2
15	RIH SSP Plug retrieving tool to top plug at +/- 9,535ft. Reverse circulate out gravel. Engage plug & POOH same + running tool Assy.	3	0	3	0.0
16	RIH Bit & Scrapper Assembly across the perforation intervals 9508-9526 and 9785- 9810 to 9870ft. POOH	0	2.63	-2.63	0.0
17	RIH Guage ring and Junk Basket Assembly across the perforation intervals 9508-9526 and 9785 -9810. POOH	0	3.23	-3.23	0.0
18	RIH VSR Sump packer and set packer @ 9536ft. POOH running tool	0	3.38	-3.38	0.0
19	RIH 9-5/8" VTA Gravel pack packer + 5-1/2"screen liner c/w locator seal assy. Gravel pack D-02C sand. POOH setting tool assy.	5	3.98	1.02	0.80
20	RIH 5" SSP Plug, Set in VTA GP Packer at 9,461ft pressure tested plug w/500psi. Dump 2 x 50lb sacks of gravel. POOH running tool assy.	3	2.48	0.52	0.83
21	Comprehensive BOP Test	0	0.54	-0.54	0.0
22	Logging: RIH 7" HSD 12SPF Gun and perforate D-02B sand intervals 9,438 – 9,456ft. POOH 7" Gun carrier.	1	0.94	-0.06	0.94
23	RIH SSP Plug retrieving tool to top plug at +/- 9,461ft. Reverse circulate out gravel. Engage plug & POOH same + running tool assy.	3	2.73	0.27	0.91
24	RIH 9-5/8" VTA Gravel Pack packer + 5-1/2"screen liner c/w locator seal assy. Gravel Pack D-02B Sand. POOH setting tool assy.	5	9.33	-5.67	1.87
25	Completed well as a two string (multiple) Selective producer	5	10.3	-6.70	2.06
26	Installed Xmas Tree and displaced well to diesel. Prepared and skid HWU to AROH-2 well head.	2	6.75	-5.25	3.38
	Total Estimated Days	**54**	**90**	**-36.00**	

Source: Project Performance Data

Table 5, show that Aroh-1 Well projects suffered fatigue because of the level of time overrun noticed in the implementation of the project. Although, some activities

(1,2,7,11,12,13,15,19,20,22,23) were completed earlier than planned, the overall analysis show that the total planned duration for the activities is 54 days but the actual completion time for the activities is 90 days. This means that Aroh-1 well project was delayed by 36 days. The Schedule Performance Index (SPI) also show that most of the activities associated with the project did not do well. Hence we can say that Aroh-1 project though completed but was not successful. Figure 1 below show the nature of the variations with respect to project planned and actual durations.

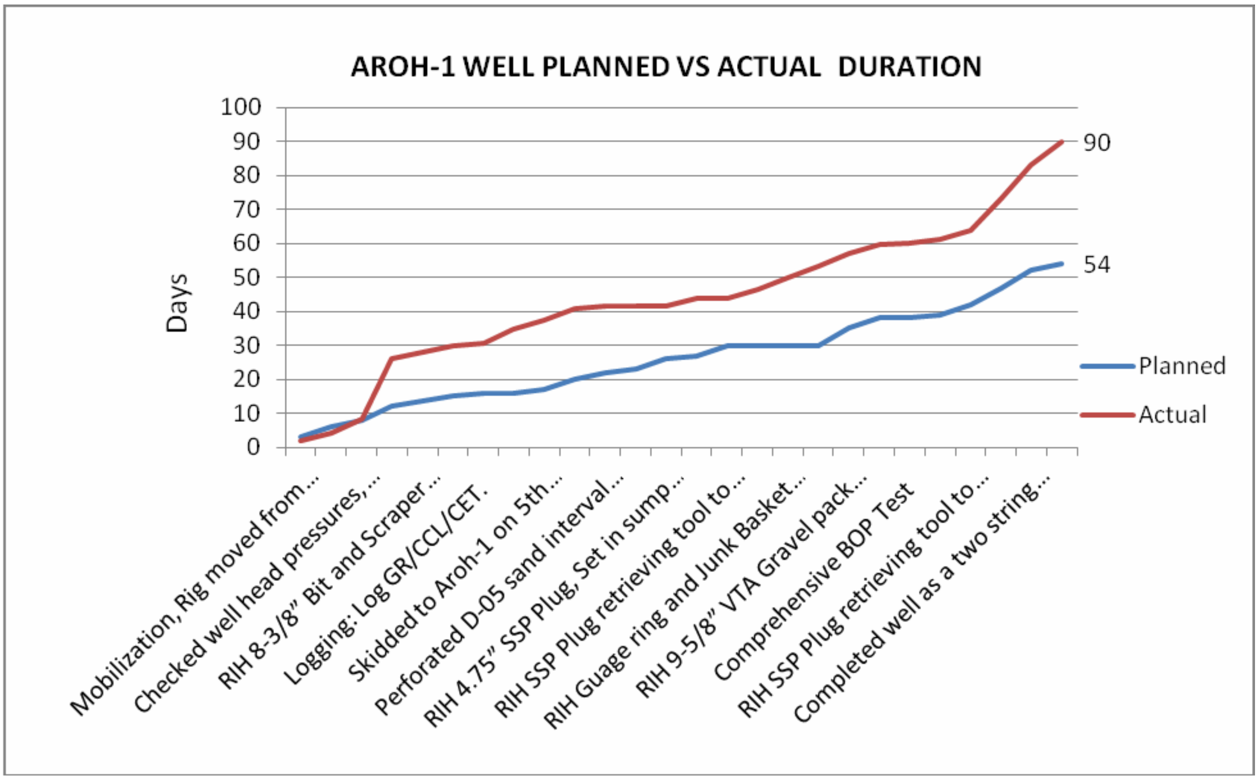

Figure 1 Planned vs Actual Duration Plot
Source: Project Performance Data (Table 5)

The figure 1 show that this project kicked off on a good note and later started experiencing fatigue by way of delays in completing the activities.

4.2 Analysis of the Performance Data of Aroh-2 Well Project in Warri, Delta State

This analysis was also done in line with Aroh-1 well project above using earned value analysis (EVA) model.

Table 6 Oil Well Drilling and Completion Timing (Planned vs Actual Duration)

S/N	DESCRIPTION OF ACTUAL ACTIVITY	Planned Days	Actual Days	Schedule Variation (Days)	Schedule Performance Index
1	Skid & position HWU on Aroh-2	3	2	1.00	0.33

2	Remove wellhead cap, install BOP and Test BOP	2	0.52	1.48	0.74
3	Drill out cmt plugs @ 413ft-689ft , 9721ft-9987ft and 10186ft - 10271ft. POOH BHA	12	17.3	-6.60	-0.55
4	Comprehensive BOP test	0	0.65	-0.65	0.00
5	RIH Bit and Scrapper assembly. POOH	0	3.65	-3.65	0.00
6	Log GR/CCL/CBL/CET. Test csg	1	0.77	0.23	0.23
7	Remedial Squeeze	7	5.94	1.06	0.15
8	Comprehensive BOP Test	0	0.35	-0.35	0.00
9	RIH 8-3/8’’ Bit, B/sub, DCs, HWDP assembly to drill hard/soft cement from 9895 to 9943 & 10867to 11071. POOH	0	8.40	-8.40	0.00
10	Carry out wellbore cleaning. Displace hole to filtered brine	4	4.52	-1.48	0.37
11	Perforate D-07(10537-10549, 10000-10012 TVD) & D-05 (10329- 10342 & 10329-10322) sands W/7" HSD gun 12 SPF.	2	3.42	-1.42	-0.71
12	Make 8-3/8" + 9-5/8" Bit & Scraper run to top plug	3	3.17	-0.17	-0.06
13	Set Lower sump Packer @ 10352ft(top at 10,348ft)	1.5	0.83	0.67	0.45
14	Install IGP across the D-05 sand. Intervals 10,322’ to 10,342ft AH. POOH running tool.	4	5.5	-1.50	-0.38
15	RIH with DP and set isolation packer at 10,226ft. POOH running tool.	3	3.58	-0.58	-0.19
16	RIH and set Straight pull plug in packer at 10226FT. POOH running tool.	3	2.90	0.10	0.03
17	BOP Test	0	0.19	-0.19	0.00
18	Perforate D-04 sand 10,186’-10,206’ AH W/7" HSD gun 12 SPF	1.5	2.81	-1.31	-0.87
19	RIH & retrieve Straight pull plug from packer at 10226Ft	3	2.63	0.37	0.12
20	Install IGP across the D-04 sand at 10,186ft – 10,206ft AH.	4	5.42	-1.42	0.36
21	Complete well as a two string (multiple) Selective producer	10	10.17	-0.17	-0.02
22	Install Christmas tree and Well displacement	2	1.56	0.44	0.22
	TOTAL	**66**	**86.28**	**-20.28**	

Source: Project Performance Data

Aroh-2 Well drilling and completion project had similar experience as Aroh-2 Well project. This is because of the negative variation noticed in the completion time of the activities. The total planned duration for the activities is 66 days as against the 86.28 days of actual completion time. By this, Aroh-2 well drilling and completion project was delayed by 20.28 days. The study believe that this could also attract negative cost variations in both projects implemented in Warri, Delta state.

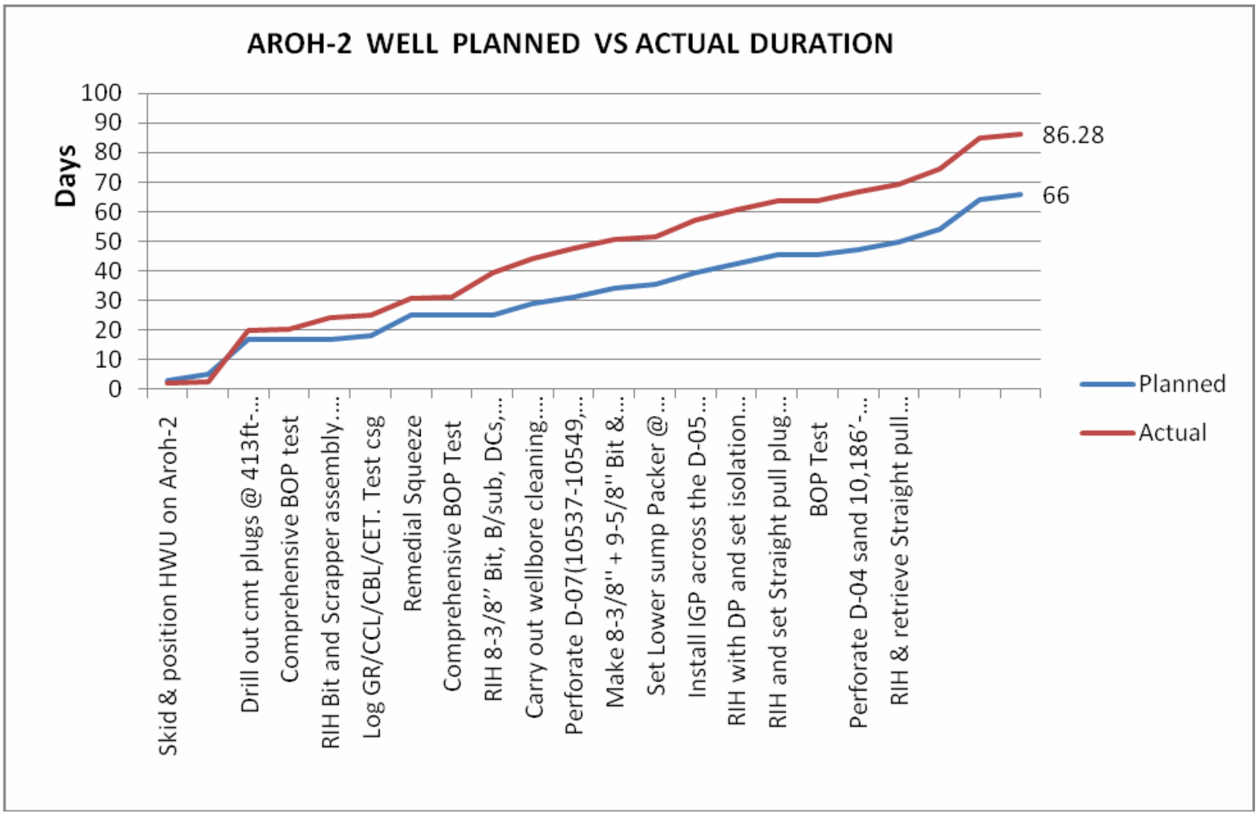

Fig. 2 Planned vs Actual Duration Plot
Source: Project Performance Data (Table 6)

Figures 1 and 2 also show similar nature. This is because of the high time overrun witnessed in the Aroh- 1 and 2 Well Drilling and Completion projects. However, Aroh Well-2 performed better than Aroh Well-1 given the total schedule delays experienced in the completion of the two selected projects.

Table 7 Cost Analysis of Total Planned Cost vs Actual Cost for Aroh-1 & 2 Well Drilling and Completion Projects According to the Contracting Firms

S/N	COMPANY	PLANNED COST ($)	ACTUAL COST ($)	COST VARIATION ($)	% COST VARIATION	CPI

1	ARKAD OIL & GAS	352,000.00	496,791.50	-144791.5	-41.3	-0.41
2	HALLIBURTON	4,864,802.51	5,283,961.54	-419159.03	-8.6	-0.09
3	FILCO	233,806.86	128,677.50	105129.4	45.0	0.45
4	COMM. CONTRACTOR	1,215,853.88	1,539,597.68	-323743.8	-26.6	-0.27
5	ZALES & MARVEL	339,004.00	527,728.90	-188724.9	-55.7	-0.56
6	CONS. TOOL PUSHER	283,200.00	425,894.57	-142694.6	-50.4	-0.50
7	AP OIL FIELD SERV.	646,094.61	522,002.25	124092.4	19.2	0.19
8	TECON OIL SERV.	6,165,654.60	9,811,887.02	-3646232.4	-59.1	-0.59
9	CNL(Xmas Trees)	700,446.43	700,446.43	0	0	0.00
10	WELTEK	275,037.62	275,037.62	0	0	0.00
11	VEHICLE RENTAL	21,483.00	21,483.00	0	0	0.00
12	NPDC	484,384.30	484,384.30	0	0	0.00
13	BG Technical	38,146.50	38,146.50	0	0	0.00
14	Choke beans	92,190.00	92,190.00	0	0	0.ndb
15	Vmart	33,660.00	16,332.40	17327.6	51.5	0.51
16	Pressure Control	7,001.00	7,001.00	0	0	0.00
17	African Oil field	8,078.70	8,078.70	0	0	0.00
18	RISEBAY	1,526.67	1,526.67	0	0	0.00
19	NPDC(TUBING COST)	945,296.25	945,296.25	0	0	0.00

Table 8 Summary of the Cost Performance for Aroh-1 & 2 Well Drilling and Completion Projects

PLANNED COST	16,707,666.93
ACTUAL COST	21,326,463.86
COST PERFORMANCE %	127.64

COST OVERRUN %	27.64

Source: Project Performance Data (Table 7)

Out of the 19 contracts undertaken by these contractors, ten (contractors 9, 10, 11, 12, 13, 14, 16, 17, 18, and 19) were completed within their cost requirements. Three (contractors 3, 5, 15) were completed below the planned cost, while six (contractors 1, 2, 4, 5, 6, and 8) incurred very high negative cost variation. It is evidence from Table 8 that both projects jointly incurred 27.64% cost overrun. This is not surprising given the rate of time overrun witnessed in this analysis.

It is also noticed that seven (7) out of the nineteen (19) jobs executed by the contractors experienced cost overrun at the different levels of the Oil Well Drilling and Completion projects. Only contractors number 3 (FILCO), 7 (AP OIL FIELD SERVICES) and 15 (Vmart) experienced cost underrun in the execution of their contracts. This is revealed in Table 7. As pointed out by Akpan, Echeme, and Ubani (2017), caution must be applied when interpreting the results obtained from the EVA model as the results are meant for management consumption, not for the contractors. If there is a favourable CV, that means that the project would be completed below the budgeted cost, this does not really confer any advantage to the management/client as the contactor is very unlikely to accept a sum lower than the contact sum which is basically the budgeted cost. In this case, the issue of calculating the forecasted cost does not arise as it is just meaningless in reality.

It is difficult to talk about schedule variance for the whole project as this term seems to apply to individual work packages or units. It is even absurd to use cost information to determine the schedule performance index and schedule variance. In a situation where the work plan is presented in the network scheduling format to help in determining among others the project duration, the project with work units having floats/slack and experiencing negative schedule variance which indicates a longer time duration for the work unit in question, the project as a whole may not necessarily experience time overrun. There is therefore no need to calculate the forecasted time when the whole project is involved.

5.0 Discussion of Result

Based on the data available to us and even based on the analysis, it could be deduced that the main factor stalling the oil well drilling and completion projects in Warri, Delta State Nigeria and probably the other developing economies is mechanical which takes the form of technology and equipment gap (see Tables 2 and 4). These equipment breakdown often or delayed by the officers of Joint Tax Force (JTF), hence may not enable the contractors to work according to the planned schedule and this might have contributed to increases in project duration. What was somehow surprising was the frequency of equipment breakdown and the inability/reluctance of the contractors to immediately replace the equipment which they blamed high foreign exchange and cost of logistics involved in equipment replacement process. Further study will show the level of relationship and influence these bottleneck have on the overall performance of the Oil Well Drilling and Completion projects in the area understudy. It must be appreciated that these projects were implemented to enhance the production of petroleum which is major source of revenue for Nigeria and its success will have a multiplier effect in the quest for economic stability and national development.

6.0 Conclusion

For the standard of living of people to improve in the country and Warri Delta state in particular and to check the influx of rural migration, basic amenities must be provided. This requires a move towards the application of a holistic and integrated project management approach designed to achieve successful project delivery within time and cost constraints and ensuring that appropriate technology and equipment are made available for prompt replacement of worn out drilling equipment. The funding was mostly provided by the Federal Government of Nigeria, the client and it is the contractors' duty to ensure that appropriate technology and equipment are employed to guaranty successful delivery of these Well Drilling and Completion projects for enhanced development and standard of living. From the analysis, it was observed that the mechanical and logistics related factors in some cases were not fully considered either by the client or the contractors and that might have led to low project completion rate even with substantial time overrun as at the time of the appraisal.

The project management tool used for project monitoring is in doubt to guarantee project success. There is no rationale why cost information should be used to determine the schedule performance index (SPI) and schedule variance (SV) which was in turn used to forecast the eventual completion time of the project. In the analysis undertaken, this information was left out as most of the jobs executed by the contractors experiencing time overrun. From the above, it could be concluded that for the successful project outcome, the choice of technology and equipment/materials envisaged for the project should be made available according to plan and that an appropriate project management technique should be utilized.

REFERENCES

Akpan, E.O.P. (2009), *Project Management: A Catalyst for Rapid Development for Emerging Economies*; 15th Inaugural Lecture of the Federal University of Technology, Owerri (FUTO), Imo State, Nigeria on 25th November, 2009.

Akpan, E.O.P. and Chizea, E.F. (2013), *Project Management: Theory and Practice (5th Edition)* FUTO Press Ltd, Owerri, Nigeria.

Akpan, E.O.P., Echeme, I.I. and Ubani, E.C. (2017) Situational Analysis of Time and Cost Performance of World Bank-assisted Local Empowerment and Environmental Management

Project (LEEMP) in Imo State, Nigeria, *Project Management World Journal, Vol. VI, Issue III*, www.pmworldjournal.net, March, pp. 1-19.

Amsoff, S.M.O. (2004): *Investment Appraisal in Developing Countries*; Avebury Gower Publishing Company, Ltd., England; pp.608.

Dangayach, G. S. and Mittal, M. L. (2011), "An ethical approach towards sustainable project success". *Procedia and Behavioural Sciences*, 25, 338-344.

Echeme, I.I. (2015) *Analysis of Critical Factors Hindering Successful Implementation of World Bank-Assisted LEEMP Projects in Imo State*, A PhD thesis, Federal University of Technology, Owerri, Nigeria.

Kezner, H. (2009), *Project management; A systems approach to planning, Scheduling, and controlling*. John wiley & sons, Inc, New Jersey.

Lim, S. C. and Mohamed, M. Z. (2002), "Criteria of project success: an exploratory re-examination". *International Journal of Project Management*, 17(4), 243-248.

Luscombe, R.S. (2012): Project Monitoring: A key to performance measurement, *International Journal of Management Sciences, 3(2)*, 23-32.

Nutt, P.C. (2006): Tactics of Implementation Approaches for Planning Projects; *Academy of Management Journal, Vol. 8, No.60-0-611*; pp.34.

Nwachukwu, C.C., Echeme, I.I., & Okoli, M.N. (2010): "Project Management Factor Indexes; A Constraint to Project Implementation Success in the Construction Sector of a Developing Economy", *European Journal of Scientific Research, Vol.43 No.3;* pp.392, www.eurojournals.com

Payne, A.C., Chelsom, J. V. and Reavill, L. R. P. (1996), *Management for Engineers*. John Wiley & Sons, Chichester, England.

Pinto, J. K. and Slevin, D. (1987), "Critical Factors in successful project implementation". *IEEE Transactions on Engineering Management*, 34(1)

Steinfort, P. and Walker, D. H. T. (2007), "Critical success factors in project management globally and how they may be applied to aid project". *Proceedings of the PMOZ Achieving Excellence – 4th Annual Project Management Australia Conference*, Brisbane, 28-31

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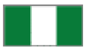

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