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PIPING FABRICATION/INSTALLATION MANAGEMENT AND DELIVERABLES OF THE HYDROCARBON PROCESSING PLANT IN UMUSADEGBE, DELTA STATE, NIGERIA: AN OPERATIONS MANAGEMENT PERSPECTIVE

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ABSTRACT: *This study sought to establish the impact of piping fabrication/installation management on the project deliverables of Umusadege hydrocarbon processing plant in Kwale, Delta State, Nigeria. Piping fabrication/installation management was dimensioned with four cardinal management processes which include project initiation, planning, execution and closure. While the deliverables were measured using As-built documentations and On-site activities. This gave rise to eight hypotheses which were tested using the Pearson's Product Moment* Correlation *technique; aided by International Business Machine Statistical Product and Service Solutions (IBM SPSS) version 21.0 at the 0.05 level of significance. The analyses revealed that there is a strong significant relationship between the dimensions of piping fabrication/installation management and the measure of deliverables of the hydrocarbon processing plant. Based on this it was concluded that piping fabrication/installation management is an antecedent of the project deliverables of Umusadege central processing facility.*

KEYWORDS: as-built documentations, on-site activities, project initiation, project planning, project execution, project closure.

INTRODUCTION

The deliverables of every project form an integral and crucial part of the project cycle. Thus, without accomplishing the deliverables of a project, the project cannot be said to have been completed. In other words, it is with the deliverables of a project that it will be judged either as well executed or not. This calls for proper management of the project execution process so as to ensure that the project delivers according to design (i.e. As- built documentations); as well as guarantee that on-site activities conform to set standards geared towards timely delivery of the project.

Generally, hydrocarbon processing plants require fabrication and installation of large and several units of pipes. Fabrication of a hydrocarbon processing plant may be carried out commercially in a pipe fitting shop or a field-fitting shop; at this point, parts of the piping system are fitted into modules for subsequent shipping into the path of the final installation (Smith, 2005). There are specialized equipment for bending as well as the subsequent heat transfer associated with commercial pipe shops. Normally, pipes with DN 65 and more such as nuclear, major power stations, chemical industrial plants, petrochemical plants, industrial plants, resources and system

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units are most usually site-fitted. Whereas, pipes with DN 50 and less are usually shop-fitted, in this case some heat transfer system or clearing activities may likely be needed; if not, it is site-fitted. Piping systems that have fittings more than 5feet long and pipeline systems are normally field-assembled. Furthermore, when the fabrication or installation fittings are not selected properly it may result into a system that may likely fail before the end of its life cycle. As expected, fitting/installation workers must work in mutual relationship with the designers; bearing in mind the compulsory applicability of the American Petroleum Institute (API) codes. In order to satisfy their clients and achieve the required deliverables; the basic needs and limitations of the materials and those of the fitting and installation approach which is used should also be given due consideration (Shell, 1991). Correctly selected steel pipe offers the strength, curability and ductility required for the application; as well as the the ductility and machinability required in joining and forming it into piping (spools). These spools which are fabricated at the early stages of the hydrocarbon processing plant are vital for the successful completion and delivery of the facility. To guarantee this, the selected pipe must withstand the condition of use, especially pressure. These requirements are met by selecting pipe made to an appropriate standard, in almost all instances an American Society for Testing and Materials (ASTM) or API standard. The most used pipe for process piping or process lines, and welding, bending and coiling is made to ASTM A 53 or ASTM A 106, principally in wall thickness described by schedule 40, 80, and some other weight produced by the manufacturer, standard and extra strong (Nayyar, 2000). The essence of keeping to these standards is to ensure that the deliverables meet the expectations of the project owners; and that the facility functions as expected; especially in accordance with set standards. A key way of achieving this is by strict adherence to and compliance with the fabrication and installation design as manifest in As-built documentations and On-site activities. Specifically, deliverables as per "As-built documentations" comprise Piping and Instrumentation Drawing (P&ID), Piping General Arrangement (PGA), Process Flow Diagram (PFD), Isometric Drawing (ID) and Material Take Off (MTO). While deliverables as per "activities on site" comprise daily reports on work activities such as Non Destructive Examination (NDE),Welders Report (WR), Fitter/Fabrication Report (F/FR), Plant/Crane Operators Report (P/COR), Mechanic Reports (MR), Instrumentation/Electrical Reports (I/ER), Skilled Labour/Riggers Reports (SL/RR), Painters and Sand Blasters Reports (P&SBR), Scaffolding Reports (SR), Hydro-testing Reports (H-TR) and Pressure-testing Reports (P-TR).

It noteworthy to understand the details of work executed as well as details of natural or man-made hindrances that may obstruct work such as rain, human obstruction, inaccessibility of work site, etc. Thus is has been generally agreed by managers, engineers and researchers that the importance of high safety standards and strict adherence to design details cannot be overemphasised (Nayyar, 2000; Shell, 1991; Smith, 2005). Reasons being that proper functioning of any process facility is highly dependent on the plant design, materials specification, environmental factors, sabotage, maintenance activities etc. It is therefore imperative to maintain that effective management approach to fabrication and installation processes forms the bedrock for achieving the desired deliverables of a given project. This reality underscores the need for this study. In most places where hydrocarbon processing plants are sited, they are critical infrastructure of national economic importance; as is the case with the Umusadege central processing facility (CPF). Such facilities not only occupy large expanse of land, but as well run across several hundreds of square kilometres of land. Thus any malfunctioning, spoilage or damage of any part of the facility has catastrophic and severe impacts on the environment, economy and resources of the people. In extreme cases, human and animal lives are lost; not to mention equipment and property damage. All of these could be avoided if the process is properly managed. Effective management according to Nwachukwu (2009) entails the co-ordination of organizational resources through the process of planning, organizing, directing and controlling in order to achieve set objectives. These managerial processes cut across every type of organization irrespective of size and geographical location. Although there are no clear rules about the management process of a project (Lester, 2006). Four essential project management processes have been itemized by Project Management Methodology (2016). These include project initiation, project planning, project execution and project closure. Therefore, this study intends to use these four project management processes to x-ray the Umusadege CPF in relation to achievement of the deliverables of the facility in the form of 'as-built documentations' and on-site activities'. In doing this, effort was made at evaluating the applicable project management processes and how they may have helped in mitigating the major causes of project cost overrun as well guarantee that fabrication processes conform to API 5L and ASME B31.3 which are specifications for line pipe and design code for hydrocarbon processing plants (Francois, 2015). The envisaged relationship has been captured in the diagrammatic model below.

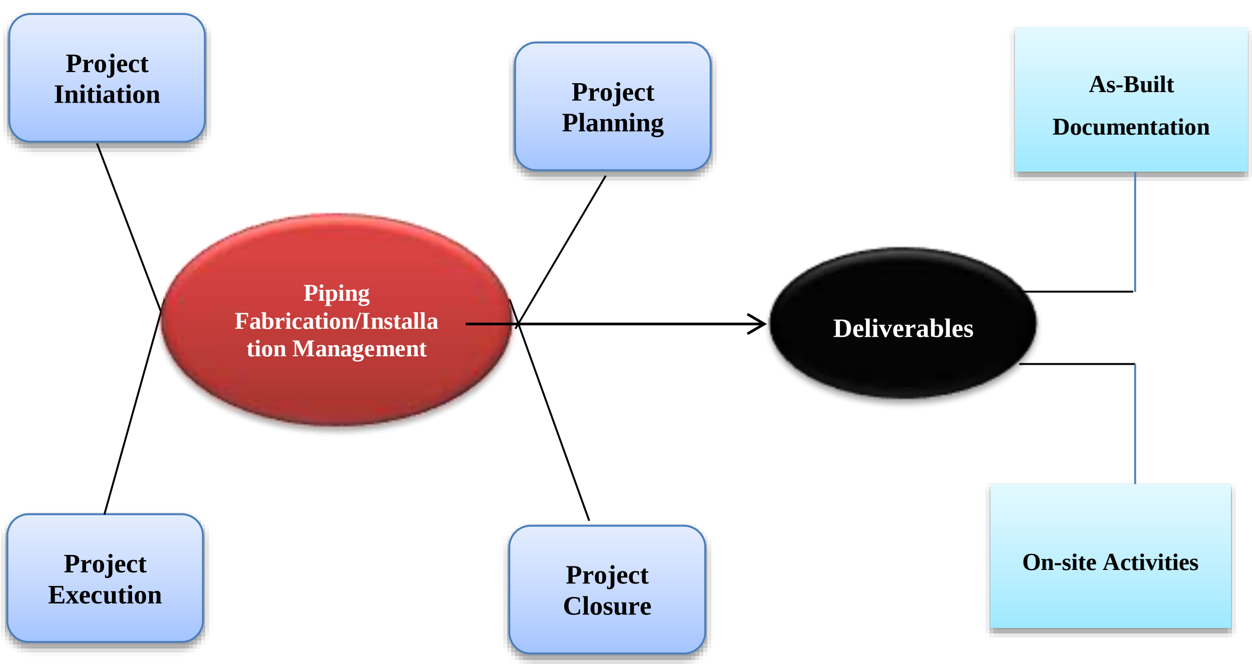

Figure 1: Diagrammatic Model of the relationship between Piping Fabrication/Installation Management and Deliverables
Source: ***Researchers' Conceptualization based on Identified Variables, 2018.***

Figure 1 shows that the arrow flows directly from piping fabrication/installation management to deliverables, suggesting a direct relationship. This suggested relationship was subjected to statistical analysis to ascertain the true direction and strength of the relationship. To accomplish this, eight hypotheses were stated:

***H*₀:1** There is no significant relationship between project initiation and as-built documentations.
***H*₀:2** There is no significant relationship between project initiation and on-site activities
***H*₀:3** There is no significant relationship between project planning and as-built documentations.
***H*₀**:4 There is no significant relationship between project planning and on-site activities.
***H*₀:5** There is no significant relationship between project execution and as-built documentations.
***H*₀:6** There is no significant relationship between project execution and on-site activities.
***H*₀:7** There is no significant relationship between project closure and as-built documentations.
***H*₀:8** There is no significant relationship between project closure and on-site activities.

It is expected that the outcome of this study will be of immense benefit to the relevant stakeholders which include plant owners, engineers, managers, government monitoring agencies, communities etc. For managers and engineers, it will spur their commitment to ensuring that effective management processes are strictly followed in the fabrication and installation of hydrocarbon plants. Government and regulatory agencies will find it as a veritable tool for policy formulation and regulation. While the academia will use it to further the course of research and increase the repertoire of knowledge on the subject matter. The scope of the study content wise, covered the body of knowledge and literature on the management approach to piping (carbon steel) installations and fabrications; as well as the deliverables of a typical hydrocarbon processing plant. Geographically, the study was based at the Umusadege central processing facility (CPF), belonging to Midwestern oil and gas, Kwale Delta State Nigeria. The unit of analysis is the organization. Thus data was generated from managers of the piping fabrication and installation crew as well as from the material controlling/management crew. A major limitation of this study was the fact that it was based on only one facility. Thus it may be difficult to make generalizations based on its outcome. However, since piping fabrication and installation are similar in most process plants, with API standards and management functions/processes universal, the impact of this limitation may be neglected.

LITERATURE REVIEW/THEORETICAL UNDERPINNING

The underlining theory for this study is the Agency theory. Agency theory tries to elucidate the scuffle associated with principals (owners) and agent (managers). It has been generally explored to explain the relationship between managers and owners of business enterprises. The theory explains that constant strife exists between managers and owner especially when it comes to service delivery. Brophy and Shulman (1993) asserted that the challenges of agency arise when the principal request the service of someone else to perform certain task on their behalf. This is the case of project management where a project sponsor bestows huge resources in the hands of project managers in expectation of certain deliverables. It is generally accepted that the central goal of every project is to accomplish some key deliverables. This can only be accomplished when management decisions are effectively and efficiently carried out. The theory underscores the need for project managers in collaboration with site engineers to strive vehemently for the attainment of project deliverables through effective management processes. Jansen and Meeking (1978) argued in this direction that managers must at all times endeavour to meet the expectation of the principal in the agency-principal relationship. This core objective forms the basis for this study to

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investigate the influence of effective piping/fabrication management process on deliverables of Umusadegbe hydrocarbon processing plant.

Piping Fabrication and Installation Management: An Overview

When individual pipe components are cut, bent and formed to each other as well as their corresponding heat transfer, non-destruction examination (NDE) to form a unit assembly for installation is known as Fabrication. The term installation is known as the physical placement of the piping fittings, valves in the final location relative to centrifugal pumps, compressors, and other equipment. There are some other processes to undergo before proper installation which are mechanical methods such as sandblasting, painting; leak testing and cleaning/flushing with the use of water (Nayyar, 2000).

Description of Piping Installation and Fabrication Processes

Pipe spool are usually developed in a fabricated shop by the application of the required fabrication processes by the pipe fitters according to engineering designs. Fabrication of pipe spool can have effect on sub-assembly and site installation which implies that it is an important stage not only in the piping system, but also on the whole industrial construction projects. If a piping fitting/installation work must get a green light, then the needed materials such as pipes, fittings, flanges of all types, and valves are transported to the fitting shop and kept in the required environment. When you are sure that all materials needed for the isometric work is within your reach, and then the fabrication drawing is made available to the pipe fitters for further fabrication processes Seyed et al. (2012). The main component of the spools which is pipe is usually cut according the required measurement, in lengths as required by the Iso-drawings. When that is achieved, the pipe fitters use grinding disc ($4^{1/2}$ or 9 inch) to grind the pipes in order to smoothen the surface-end of the pipes and possibly undergo bevelling if required. The pipes and fittings are transferred to the fabrication shops to be fitted together by the pipe fitters. As soon as the piping spools and other pipe fittings, such as concentric and eccentric reducer, globe, choke, gate, ball valves and ring type, flanges, are fitted, cranes transfer the piping assemblies to the welding stations. Fabricators usually transfer piping spool that weighs not more than 23kg by hand. Welding is usually achieved via roll welding and position welding. Roll welding involves fixing one end of the pipe into a pipe turner and rotating the spool while welding them. Position welding does not save time, thus its procedure is more rigorous when compared with roll welding. When spools are completed, they undergo quality control (QC) / quantity assurance (QA); then by considering what the drawings requires, they may be hydro tested or undergo coating, sandblasting and painting.A typical example of piping fabrication processes is as shown in Figure 2.

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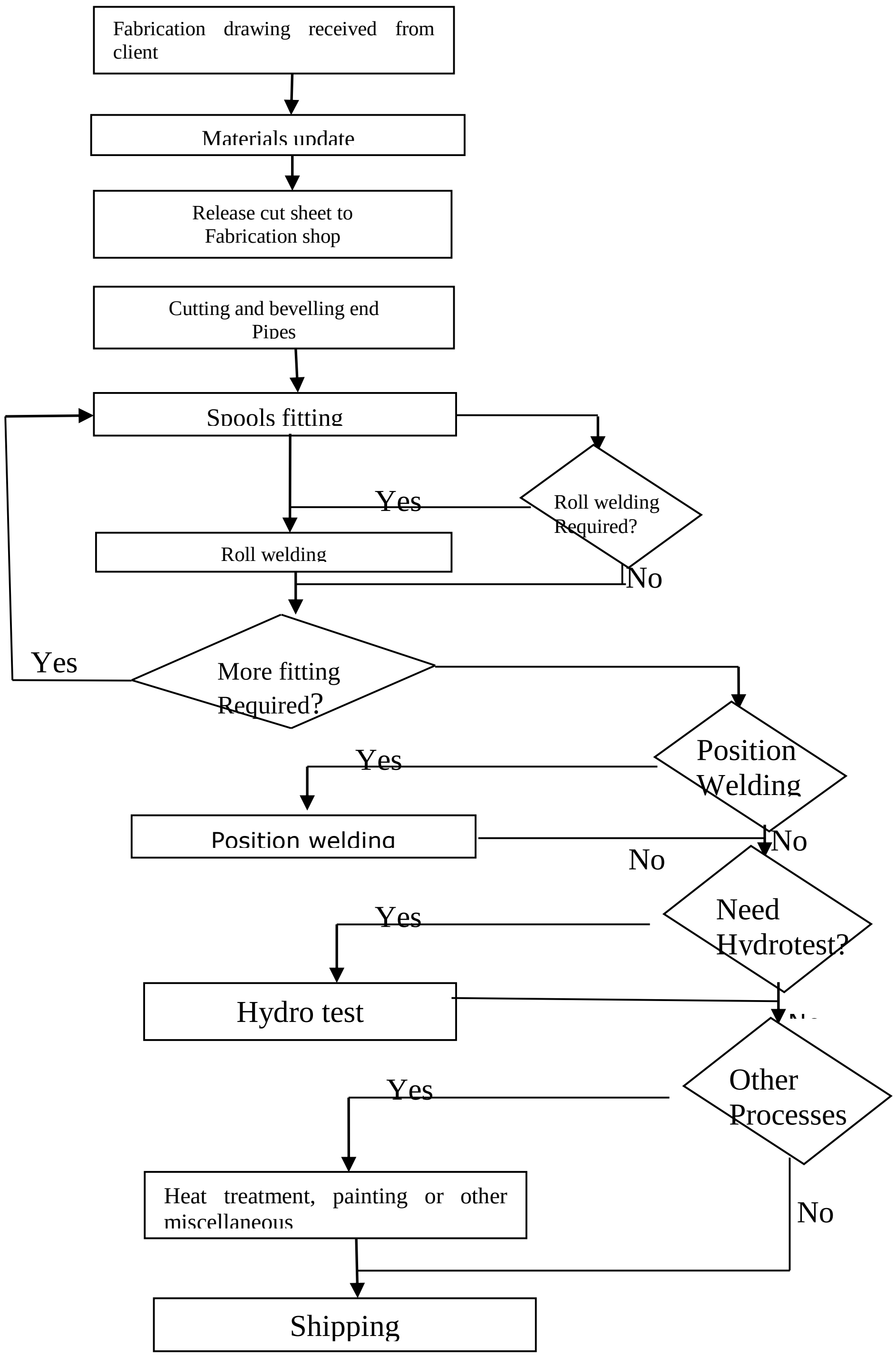

Figure 2: Pipe spool fabrication processes
Source: Adopted from Seyed, P. M., Aminah, R. F., Laury, Y, and Scott (2012)

Factors Affecting Productivity of Pipe Spool Fabrication

Simulation model used in this research talks about some factors that could affect the spool fabrication productivity that may really be accounted for in the spool production unit. More so, the effect of productivity factors individually, can be shown and techniques for modelling these factors are outlined. The research suggests a framework for a more understanding way of finding the productivity using production unit spools. According to Seyed et al. (2012), measurement of spool fabrication unit cost, production and productivity can be achieved using diameter inch (φ")This φ" is used to ascertain the quantity of man hours that is needed to accomplish a specific assignment. Materials with higher grades need extra time to be accomplished; as such, gets more factors φ".

The φ" involves every aspect of the pipe/fitting welds; material, wall thickness calculations, and welding techniques in physical nature. It is necessary to know that all work at the fabrication/welding shop usually features into the φ" of a spool. Project team leaders can rely on φ" for their cost estimation and scheduling. These data are usually known via careful monitoring of the piping fabrication/installation activities on site, data histories, and opinions of experts (Seyed et al., 2012). This reality necessitates the importance of an effective project management process. These factors have been summarized in Table 1.

Factor of Productivity	**Diameter inch** φ"	**What its affects**	**The Impact**	**How to measure it**
Welding in Position	Not Exactly	Weld work	100%	Welding in Position
Complexity Factor	Not Exactly	Fabrication processes	50%	Classify as 1- 5 Scale
Physical attributes	Not Completely	Fabrication processes	20%	Spool-Length
Handling	Not Completely	Handling	10%	Spool-Shape
Workers skill	Not Exactly	Fabrication processes	50%	Classify as 1- 5 Scale
Re-work	Not Completely	Fabrication processes	20%	Re-work on φ"

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Spool Change	Not Exactly	The whole process	100%	Spool % of φ"
Configure it	Not Exactly	The whole process	50%	Spool % of φ"
Layout- Shop	Not Exactly	The whole process	It varies	Modelling
Tools/ equipment	Not Exactly	Fabrication processes	It varies	Modelling
Weather factors	Not Exactly	Transportation	It varies	Wind

Table 1: Factors Affecting the Productivity of Spools
Source: Seyed, P. M., Aminah, R. F., Laury, Y, and Scott (2012)

Management of Piping Fabrication and Installation Processes
The management of the piping fabrication and installation processes can be divided into four phases, which have been useful in practice, as follows:
Project Initiation: Project initiation is the first phases to undergo when starting up a project. By establishing the purpose and scope, a project can be initiated. You will need to employ competent project managers, fix up a project office and undergo phases review. The project initiation phase involves the following management processes:

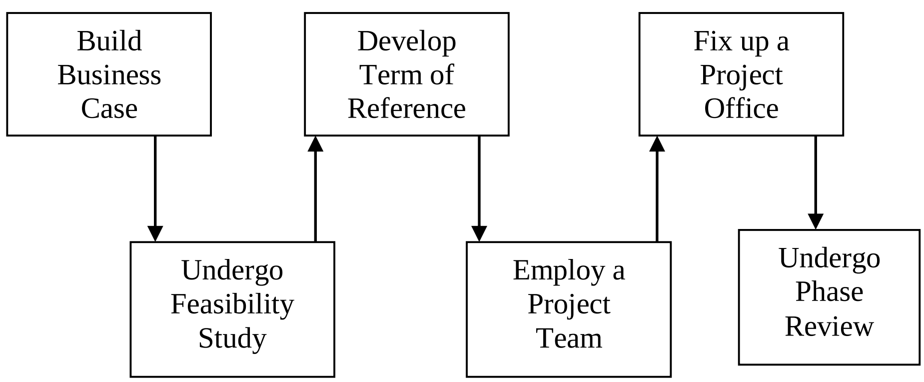

Figure 3: Management processes, of the piping fabrication and installation, phase one.

Source: *Project Management Methodology (2016)*

It is the feasibility study that determines if the project will be executed or not, since it helps for the proper goal evaluation, timeline and costs of the project. It stabilizes the needed available resources for the project to see if going ahead with the project work will be viable. Meanwhile business case is simply a financial documentation that is generated to display the cost benefit and needed investment the organization would need to undertake for the project to proceed.

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Project Planning

By establishing the project and employing the project managers, then the project has received a green light. You can now successfully precede the detail planning of the project phase. Which implies forming a suit of planning document and help guide the project managers through the project delivering? This is demonstrated in Figure 4

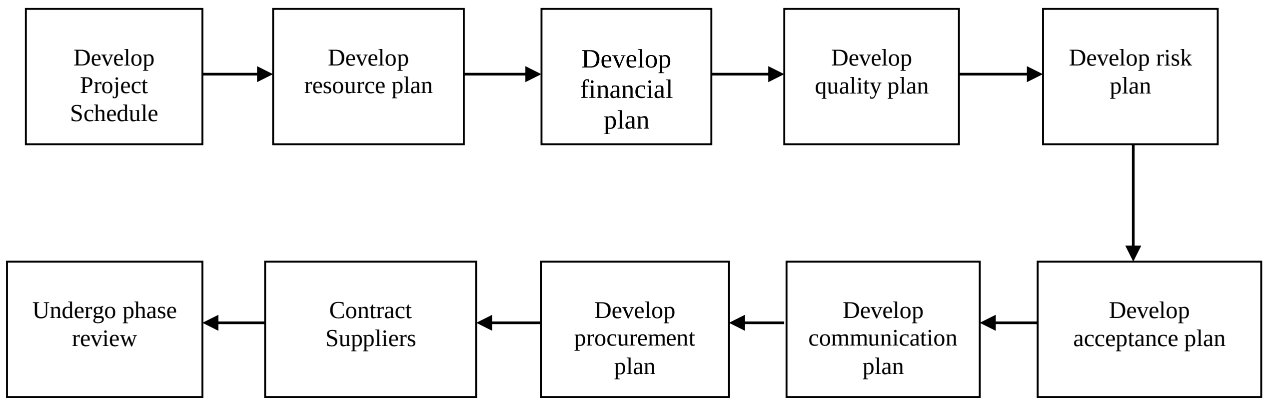

Figure 4: Management processes of the piping fabrication and installation phase two

Source: *Project Management Methodology (2016)*

Planning in this regards means setting out the map for the project. The project plans also equip the project managers for the obstacle they are likely to face during the execution phase of the project, and assists them comprehend the cost, scope and time frame of the project.

Project Execution

In this phase, deliverables such as P&ID, isometric drawing, NDE results, pressure testing and hydro-testing results, total MTO used in the project are physically developed and present to the clients or customers for acceptance. This constant vigilance helps jeep the project moving ahead smoothly. As the contractor produces all the deliverables and the client's acceptance is valid then the project can be said to be closing. See Figure 5 for the management processes

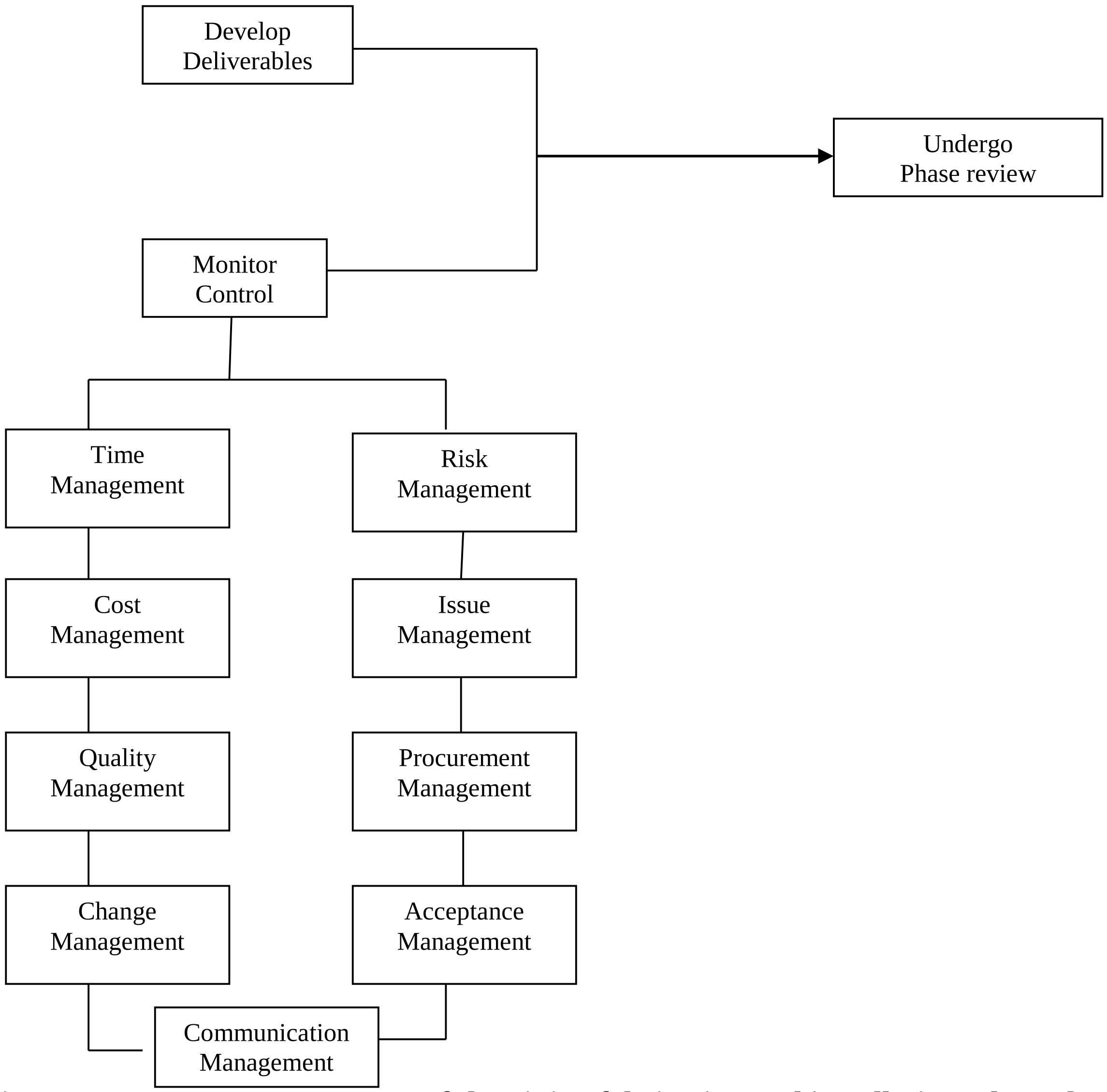

Figure 5: Management processes of the piping fabrication and installation, phase three

Source: *Project Management Methodology (2016)*

Project Closure

Project managers close a project when they deliver the finished product to the customer or clients. The processes involves presentation of the as-built documentations and activities on site to the clients, as well as stopping supplier contracts, releasing the needed resources for project closure and by communication to other stakeholders and client, and possibly commissioning as shown in Figure 6

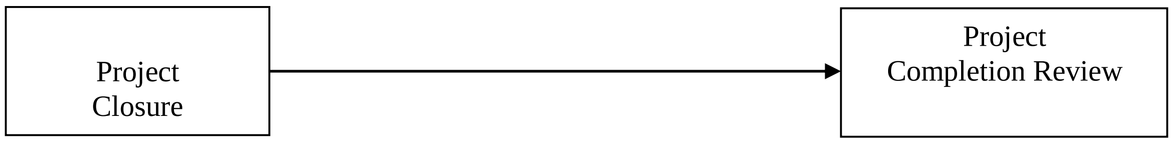

Figure 6: ***Management processes of the piping fabrication and installation, phase four***
Source: Project Management Methodology (2016)

METHODOLOGY

The study adopted a descriptive survey method for the research design. Specifically, the case study method was utilized since the study focused on a particular facility. This was adopted so as to have an in-depth understanding of the situation in the particular organization of the study (Baridam, 2008; kothari & Gaurav, 2013). In using this method, the observations in the study sample were analysed and the result used to make inference upon the study population. The study was conducted on Umusadegbe processing plant which boasts of 75 staff. Thus these staff comprised the population of the study. Purposively, the sample size of the study was chosen to be 50 personnel selected as follows; 20 personnel from the Quality Assurance/ Quality Control and supervisor group are made up of 8 selected randomly from welding group, 7 selected also randomly from fitting group. 5 personnel each were selected from inventory control, central receiving and delivery group respectively. The purposive sampling technique adopted in the study was due to the technical nature of the study; the researchers only considered staff with in-depth knowledge on the subject matter. Data for the study was collected primarily through a questionnaire developed by the researchers. The instrument was structured with responses in a 4 point Likert-like scale measured as follows: Strongly agree 4, Agree 3, Disagree 2, strongly dis-agree 1. To validate the instrument, copies were given to professionals in the field; to enable them make necessary corrections and inputs. These contributions were revised and incorporated into the final copy; which helped to guarantee both the face and content validities of the instrument. The instrument's reliability was guaranteed using the test - retest method; and the correlated results showed a stability level of 0.78. While the Pearson's product moment correlation (r) technique was used in testing the hypotheses at a significant level of 0.05. The Statistical Package for Social Scientists (SPSS) aided the analysis.

RESULTS AND DISCUSSION

Fifty copies of the questionnaire were administered; forty-two copies which amounted to 84% were retrieved out of this number, while three copies out of the responded questionnaire were found to be unsuitable for the analysis. Consequently, thirty-nine copies of the questionnaire were responded and returned, and found to be valid for the analysis; giving rise to a 78% response rate.

Test of Hypothesis One and Two

$H_0$1: There is no significant relationship between project initiation and as-built documentation.
$H_0$2: There is no significant relationship between project initiation and on-site activities.

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			Project Initiation	As-built Documentation	On-site activities
Pearson's r	Project Initiation	Correlation Coefficient	1.000	.662**	.570**
		Sig. (2-tailed)	.	.001	.001
		N	39	39	39
	As-built documentation	Correlation Coefficient	.662**	1.000	-.128
		Sig. (2-tailed)	.001	.	.494
		N	39	39	39
	On-site activities	Correlation Coefficient	.570**	-.128	1.000
		Sig. (2-tailed)	.001	.494	.
		N	39	39	39

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2: Correlation Result for Hypotheses One and Two

Source: SPSS Data Analysis Result, 2018.

It could be seen from table 2 that correlation co-efficient (r) for hypothesis one = 0.662 and P = 0.001. Since $P < 0.05$, the correlation is significant at the 0.05 level. Consequently, the null hypothesis of no relationship was not supported; while, the researchers stated that there is a significant relationship between project initiation and as-built documentation. Similarly, for hypothesis two, r = 0.570 and P = 0.001. Since $P < 0.05$, the correlation is significant at the 0.05 level. Since the, the null hypothesis of no relationship was not supported, the researchers upheld that there is a significant relationship between project initiation and on-site activities.

Test of Hypothesis Three and Four

H_0:3 There is no significant relationship between project planning and as-built documentation.
H_0:4 There is no significant relationship between project planning and on-site activities

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			Project planning	As-built Documentation	On-site activities
Pearson's r	Project planning	Correlation Coefficient	1.000	.746**	.439**
		Sig. (2-tailed)	.	.001	.001
		N	39	39	39
	As-built documentations	Correlation Coefficient	.746**	1.000	-.128
		Sig. (2-tailed)	.001	.	.494
		N	39	39	39
	On-site activities	Correlation Coefficient	.439**	-.128	1.000
		Sig. (2-tailed)	.001	.494	.
		N	39	39	39

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3: Correlation Result for Hypotheses Three and Four
Source: SPSS Data Analysis Result, 2018.

It could be seen from table 3 that the result showed a high direct and significant correlation for hypothesis three (r = 0.746 and P = 0.001). Since P < 0.05, the correlation is significant at the 0.05 level. Since the null hypothesis of no significant relationship was not supported, the researchers upheld that there is a significant relationship between project planning and as-built documentation. Similarly, for hypothesis four, r = 0.439 and P = 0.001. Since P < 0.05, the correlation is significant at the 0.05 level. Since the, the null hypothesis of no significant relationship was not supported, the researchers upheld that there is a significant relationship between project planning and on-site activities.

Test of Hypothesis Five and Six
H_0:5 There is no significant relationship between project execution and as-built documentation.
H_0:6 There is no significant relationship between project execution and on-site activities.

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			Project execution	As-built Documentation	On-site activities
Pearson's r	Project execution	Correlation Coefficient	1.000	.844**	.879**
		Sig. (2-tailed)	.	.001	.001
		N	39	39	39
	As-built documentations	Correlation Coefficient	.844**	1.000	-.128
		Sig. (2-tailed)	.001	.	.494
		N	39	39	39
	On-site activities	Correlation Coefficient	.879**	-.128	1.000
		Sig. (2-tailed)	.001	.494	.
		N	39	39	39

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4: Correlation Result for Hypotheses Five and Six

Source: SPSS Data Analysis Result, 2018.

It could be seen from table 4 that the result showed a high direct and significant correlation for hypothesis five (r = 0.844 and P = 0.001). Since P < 0.05, the correlation is significant at the 0.05 level. The null hypothesis of no significant relationship was not supported; hence the researchers upheld that there is a significant relationship between project execution and as-built documentation. Similarly, for hypothesis six, r = 0.879 and P = 0.001. Since P < 0.05, the correlation is significant at the 0.05 level. The the null hypothesis of no significant relationship was not supported; hence the researchers upheld that there is a significant relationship between project execution and on-site activities.

Test of Hypothesis Seven and Eight

H_0:7 There is no significant relationship between project closure and as-built documentation.
H_0:8 There is no significant relationship between project closure and on-site activities.

			Project closure	As-built Documentation	On-site activities
Pearson's r	Project closure	Correlation Coefficient	1.000	.904**	.912**
		Sig. (2-tailed)	.	.001	.001
		N	39	39	39
	As-built documentations	Correlation Coefficient	.904**	1.000	-.128
		Sig. (2-tailed)	.001	.	.494
		N	39	39	39
	On-site activities	Correlation Coefficient	.912**	-.128	1.000
		Sig. (2-tailed)	.001	.494	.
		N	39	39	39

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5: Correlation Result of Hypotheses Seven and Eight
Source: SPSS Data Analysis Result, 2018.

As could be seen from table 5, the result showed a very strong significant and direct correlation for hypothesis seven (r = 0.904 and P = 0.001). Since P < 0.05, the correlation is significant at the 0.05 level. The null hypothesis of no significant relationship was not supported; hence the researchers upheld that there is a significant relationship between project closure and as-built documentation. Similarly, for hypothesis eight, r = 0.912 and P = 0.001. Since P < 0.05, the correlation is significant at the 0.05 level. The the null hypothesis of no significant relationship was not supported; hence the researchers upheld that there is a significant relationship between project closure and on-site activities.

DISCUSSION

The first finding which emanated from the test of hypotheses one and two is in agreement with the findings of Alan et al. (2014) in their study 'Using Project Deliverables and Project Management for Timely Completion of Student Projects'. They argued based on their findings that project initiation is a critical stage that must not be handled with levity. This stage is blueprint of the entire process of a project, and if carried out shabbily, the success of such project is in doubt. The findings is further supported by Ulrik and Peter (2008) who discovered that in initiating a project, the need, scope, benefit, cost, and key deliverables of the project are clearly outlined and this enables managers to have a clear direction, procedure and approach to executing the project. A project that is properly initiated is more likely to succeed than that which is initiated wrongly.

The second finding which was generated from the result of hypothesis three and four also establishes the relationship between project planning and deliverables (As-built documentations and on-site activities). Specifically, the result indicated that relationships exist between project planning and as-built documentation of hydrocarbon processing plant at Umusadege Central Processing Facility. However, the relationship between project planning and activities on site is a moderately low one. Thus, it's a weak positive relationship. These findings are not surprising because planning is a critical step in management process. This is supported by the findings of Nwachukwu (2009), who argued that the importance of adequate planning to managers cannot be overemphasized as is it not only primary, but also pervasive in all management processes. The implication of this is that planning is primary and cuts across all other management processes. We plan to initiate, we plan to plan, we plan to execute and as well plan to close.

The third finding which came from the was from the result for hypotheses five and six shows that there is a strong significant relationship between project execution and deliverables of hydrocarbon processing plant at Umusadege Central Processing Facility. This finding is in agreement with that of Ulrik and Peter (2008) who found that execution of a project is beyond mere sketch but involves putting all planned activities into action, as such all the deliverables are physically developed. Alan et al. (2014) also had a similar finding when they discovered that a manager may have a fantastic plan, but failure to execute according to plan will frustrate all other processes. This is particularly revealing in the Nigerian context where exogenous factors can hinder managers not to execute works as initially planned. It is at this stage that managers ensure that all activities are carried out in line with planned quality, time duration, risk tolerance etc. The quality of a project will largely depend on the execution of such project. In other words, was it carried out as planned, and are the materials of standard specification etc. These are some key questions that must be rightly answered when executing a project.

Lastly, the fourth finding which was generated from generated from the result of hypothesis seven and eight also revealed that there is a strong significant relationship between project closure and deliverables (as-built documentations and on-site-activities) of hydrocarbon processing plant. These findings are in agreement with that of Smith (2005) who ascertained that at closure, a project must have delivered the desired finished product. The implication of this is that a project may be closed or conclude when tested and certified to have met all necessary requirements and deliverables as planned. Shell (1991) and PDM (2016) also gave similar findings that managers may choose to close project only when they have deliver the desired product or service to clients. However, in doing this they must endeavour to design a post implementation plan where necessary to ensure that adequate maintenance is put in place to sustain the life span of the project.

Implications

The findings of the study revealed that there is a strong positive relationship between the dimensions of piping/fabrication management and deliverables of Umusadegbe hydrocarbon processing plant. This implies that effective management process of a hydrocarbon plant is a strong condition for achieving desired deliverables. Hence, project managers who wish to be successful in achieving desired deliverables should ensure that they carry out detailed project initiation activities before commencing any project. This will help to establish the business case of the project especially in terms of the cost-benefit analysis of the project and the detailed requirements for effective execution of the project. Without adequate planning, a project will most likely fail. As the saying goes, "failure to plan is a plan to fail". Thus, project managers are advised to set out a clear road-map of the means and ways of executing a project before embarking on it. In fact, since planning is both primary and pervasive, it is recommended that the planning activity should be done before, during and after each major activity. They should also endeavour to execute projects according to plan and design. This is very crucial in achieving the project deliverables as-built documentations and as per activities on site. Adequate control measures should also be put in place to help monitor activities and track deviations capable of derailing the project track. Similarly, they should ensure that they systematically close projects by handing over relevant project documentations to the clients. Well-structured management processes are germane to achieving the desired deliverables of projects, especially in hydrocarbon processing plants. Specifically, engineering projects require management processes to achieve timely completion, As-built documentations, On-site activities, effective functioning and healthy relationship with all relevant stakeholders.

CONCLUSION

This study set out to investigate the relationship between piping/fabrication management and deliverables of Umusadegbe hydrocarbon processing plant. To accomplish the purpose of this study, eight hypotheses were stated and tested using the Pearson's Product Moment Correlation technique. The findings revealed that there is a strong positive relationship between the dimensions of piping/fabrication management and the deliverables. Based on these, it was concluded that an effective management process of hydrocarbon plant is a strong antecedent of achieving desired deliverables.

Suggestions for Further Studies

In line with the findings of the study, it is suggested that similar studies should be carried out in other major facilities especially process plants. A comparative study between different processing facilities or locations can also be attempted.

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