

# Evaluation of Factors Influencing Timely Delivery of Natural Gas Pipeline Projects in Niger Delta Zone of Nigeria<sup>1</sup>

Ibeawuchi Ifeanyi Echeme, PhD<sup>2</sup>

Department of Project Management Technology  
Federal University of Technology, Owerri  
Owerri, Nigeria

## Abstract

This study evaluated factors that influence timely delivery of natural gas pipeline projects in Niger Delta zone of Nigeria. The objectives are to: determine if there is any variation in the time objectives of gas pipeline projects executed by Oilserv Nigeria limited; examine the individual effect of the identified factors on timely delivery of the natural gas pipeline projects in the Niger Delta Zone of Nigeria; ascertain whether the collective effect of identified factors on timely delivery of the natural gas pipeline projects in the Niger Delta zone of Nigeria is significant or not. The literature study reveals that the main factors influencing the timely delivery of natural gas pipeline projects include construction issues, administration and management issues, contract award, financial and economic issues, and design-related issues. The survey was conducted via administering questionnaires. Multiple regression analysis and descriptive statistics were used to analyze collected data. Results show that most of the projects suffered time overruns. The timely delivery of natural gas pipeline projects in the zone was influenced by the factors both individually and jointly. Hence, the study recommends that project teams should enhance their organizational knowledge, planning and scheduling skills, supervise subcontractors on site properly, provide sufficient funding, strictly adhere to existing laws and regulations, and accurately design construction projects while taking the unique characteristics of the project locations into account. Ultimately, it is imperative that project managers, team members, and other key stakeholders have sufficient training in managing conflicts that frequently develop throughout project operations.

**Keywords:** Time Management, Influencing Factors, Natural Gas Pipeline Projects, Engineering, Procurement, Construction.

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<sup>2</sup> email: [ibecheme@yahoo.com](mailto:ibecheme@yahoo.com); [ibeawuchi.echeme@futo.edu.ng](mailto:ibeawuchi.echeme@futo.edu.ng)

## 1.0 Introduction

Effective time management is allocating the appropriate amount of time to the appropriate task at the appropriate time. Good time management enables people to allocate particular time slots to tasks based on their priority. According to Obodoh and Chikasa (2016), a project is considered successful if it is completed within the specified timeframe, budget, and to the satisfaction of all involved parties. Nonetheless, a sizable amount of the world's energy consumption is derived from oil and gas. based on a number of methods used by the oil and gas sector to motivate contractors to enhance their project planning and execution techniques in order to cut down on the time and costs associated with oil and gas projects. The concerning trend in oil and gas pipeline projects is the growing number of delays, which has raised international attention. On the other hand, when the project cannot be completed within the allotted time, there will be a delay or time overrun. On the other hand, in order to satisfy the clients' goal of increasing productivity and profitability, oil and gas contractors must complete projects more quickly, more affordably, and with higher quality (Shehzard, 2015).

Currently, one of Nigeria's biggest obstacles to economic development is project failure and/or abandonment due to schedule and budget overruns. Infrastructure and industrial expansion, especially in public sector initiatives, are at risk due to this issue. Akpan, Echeme, and Ubani (2017) claim that because this has persisted for such a long time, it seems to be impeding the nation's advancement. Since we are a developing nation, we must concentrate our efforts on finding solutions. However, it appears that ineffective project time management is a major contributing factor to these problems, which could lower project quality and expense. Because of poor project time management among other reasons, critics increasingly see public initiatives as little more than a conduit pipe through which our fast-diminishing resources are wasted.

In Nigerian oil and gas wells, enormous amounts of natural gas are produced as a raw material. Despite the large-scale generation of this energy source, a greater percentage of it is flared due to a lack of suitable transmission and distribution (transport) infrastructure, wasting valuable and scarce foreign exchange for the nation (Anyadiegwu, Ohia and Ukwujiagu, 2015). In order to transport natural gas across large distances quickly and effectively, a large network of interconnected pipes is required. The pipeline system is among the safest methods of distributing natural gas because it is subterranean and permanent. The three main categories of pipeline transportation are distribution, transmission, and gathering pipelines. (Yan and Zhang Zhang, 2018).

The majority of Nigeria's natural gas pipelines are located in the Niger Delta Region. In addition to its enormous oil and gas reserves, the Nigerian Niger Delta region has garnered national and international attention recently due to environmental concerns, disputes over wealth and revenue sharing, civil unrest, and poverty among its people,

according to Babatunde (2020). Since infrastructure development in Nigeria is driven by critical gas pipeline operations (engineering/construction projects), a multitude of internal and external variables seem to impede the timely completion of many gas projects. In light of this, the purpose of this study was to assess the crucial variables affecting time management in a few chosen natural gas pipeline projects in Nigeria's Niger Delta.

Time is a key resource that project managers must work with. In the case of the Niger Delta natural gas pipeline project, improper scheduling and timing have led to delays, poor project managing, and bad timing. This project aims to prevent the negative effects of inadequate project financing, design flaws, poor construction execution of project works, ineffective administrative/management processes, and poor project time management. It also aims to prevent the negative effects of noncompliance with statutory and regulatory laws. Research indicates that Nigeria's productivity and infrastructure development are lacking (Babatunde, 2020). This is a result of the transportation and oil and gas processing operations' intricate structures, which are usually entwined. The amount of work required in oil and gas projects at different phases makes proper programme and project monitoring necessary from inception to completion.

Nigeria's export revenue in the first quarter of 2018 was N4.69 trillion (US\$153.4 billion), according to the National Bureau of Statistics (2018). Crude oil sales contributed N3.58 trillion (US\$11.7 billion) to Nigeria's export earnings between January and March 2018, making up 76.3 percent of the country's total income. Condensates and lubricants, which are processed oil products, brought in an additional N535.8 billion (US\$ 1.75 billion), or 11.4 percent of the total revenue from exports. Effective project time management is essential to guarantee that project durations are meticulously planned, monitored, and controlled, especially considering the strategic nature of the sector.

According to Obodoh and Chikasa (2016), Nigerian oil and gas contract works are heavily influenced by safety and regulatory requirements, technical advancements, quality assurance, the country's evolving socioeconomic landscape, scope modifications, and contract reviews. Arbitration, litigation, schedule overruns, cost overruns, disagreements, and ultimately project abandonment are all possible outcomes that could rob taxpayers of the project's advantages. Addressing the direct and indirect effects of neglect requires a thorough investigation of every aspect of an oil and gas development project. Therefore, this research is necessary to determine the best course of action for resolving the issue of natural gas pipeline project delays, particularly for projects in the Nigerian public sector.

### **Objectives of the Study**

The aim of this research is to evaluate the factors influencing timely delivery of natural gas pipeline projects in Niger Delta zone of Nigeria. The specific objectives are to:

- (a) Determine if there is any variation in the time objectives of gas pipeline projects executed by Oilserv Nigeria limited.
- (b) Examine the individual effect of the identified factors on timely delivery of the natural gas pipeline projects in the Niger Delta Zone of Nigeria,
- (c) Ascertain whether the collective effect of identified factors on timely delivery of the natural gas pipeline projects in the Niger Delta zone of Nigeria is significant or not.

## **Hypotheses Statement**

To answer the research questions, the following hypotheses were formulated:

**H0<sub>1</sub>:** The individual effect of the identified factors is not significant to timely delivery of natural gas pipeline projects in Niger Delta zone of Nigeria.

**H0<sub>2</sub>:** The collective effect of the identified factors on the timely delivery of natural gas pipeline projects in Niger Delta zone of Nigeria is not significant.

The construction companies in the oil and gas sector would greatly benefit from the recommendations this study is planned to make for improving the execution of natural gas pipeline projects in the Niger Delta region.

In order to prevent or minimise delays in engineering, procurement, and construction projects, the project's results will shed light on the most common issues that affect efficient project time management in natural gas pipeline projects. This work will be extremely helpful to contractors and consultants because it will provide them a better understanding of how natural gas pipeline projects are planned and carried out, which will enable them to bid on and schedule projects fairly and avoid losing money.

Ultimately, it will be of great use to project management students. Future research in this area will use this project as a source of information, as the impact of project delays cannot be overstated.

## **2.0 Conceptual Review**

It is important to understand that understanding the fundamentals of projects and project management is a must in order to completely comprehend the concept of project time management and its restricting constraints. The administration of projects, which are one-time, non-routine tasks intended to produce a particular good or offer a unique service, is known as project management. Although it was first publicly used in corporations as a management tool in the 1950s, project management is a thousand-year-old tradition that stretches back to the Egyptian era, according to Azzopardi (2009). Two separate planning

and control problems that originated in the United State can be linked to the origins of project management. This was the first time working on a project like this that had never been done before. The project was engulfed in a great deal of ambiguity since time and cost could not be accurately estimated. Nagarajan (2020) defines project management as a collection of instruments, tactics, ideas, and practices for effectively organizing and carrying out project work with the aim of completing the project on schedule, within budget, and in compliance with the established specifications. A project has a technical point, as well as a defined start and finish. Project management is therefore said to have developed in reaction to the growing complexity of cross-disciplinary interactions inside organizations.

### **Factors Influencing Effective Time Management in Public Sector Projects**

Projects in the public sector are vulnerable to a number of delays. The following traits, according to Shezard (2015), Obodo and Chikasa (2016), and Nwosu (2019), have an impact on project time management in oil and gas construction projects:

#### **a.) Management/Administrative Related Factors**

Daily administrative chores that are finished either before or during the project's execution are included in these components. Their primary role is to ensure that the project is managed appropriately by offering support services at all levels and acting as checks and balances (Barati, 2015). Project team, planning and scheduling, government interferences, political instability, host community difficulties, dispute and conflict, and incentives are the issues listed under management/administrative factors.

#### **b.) Design Related Factor**

Designing and building new pipelines, compressor stations, and metering stations is a difficult task that requires a team of specialists and consultants. Usually, the assignment begins with the collection of vital information to guarantee that the needs of the end users are satisfied in a manner that is safe and ecologically conscious. A thorough feasibility analysis is necessary to determine the viability of initiatives. The purpose of this form of research is to ascertain whether a proposal is financially, legally, and technically feasible. It indicates the value of an endeavour (Zadeh, Dehghan, and Ruwanpura, 2016).

### **Front End Engineering Design (FEED)**

Following the completion of the feasibility study or conceptual design, basic engineering, also referred to as FEED (Front End Engineering Design), is conducted. Before Engineering, Procurement, and Construction (EPC) activity begins, a number of studies are carried out to identify technical obstacles and estimate initial investment costs. The

"FEED Package," the result of the activity, is a collection of numerous files that will be utilised in bids for EPC contracts (Zadeh et al., 2016). It is imperative that the FEED Package incorporates the client's objectives and project-specific needs without fail in order to minimise significant changes throughout the EPC Phase. The FEED Work takes around a year for a large-scale project, like an LNG station. It is customary for contractors to station themselves in the client's office during the completion of the job, as maintaining a tight relationship with clients is crucial.

### **c.) Contract Action Related Factors**

The pertinent rules and regulations that control procurement in Nigeria specify the policies for public procurement. All Federal Ministries, Extra-Ministerial Offices, Departments, Agencies, Parastatals, Corporations, and other public entities established by the Constitutions or Acts of the National Assembly are covered by the Nigeria Procurement Procedure Manual (2011) when it comes to procurement guidelines and direction. This includes entities whose funding comes from the Federation Account, their own internal revenue, the Federation's share of the consolidated revenue fund, and special allocations in the federal budget, in whatever form this may take. Even in cases where it is clear that a project must be completed on time, delays are inevitable since every contract that a public sector organization issues must comply with all relevant regulations.

### **d.) Construction works Related Factors**

There are several different types of delays that have been found to be associated to contraction actions. Determining whether the delay is critical or not is essential because it enables you to take the appropriate action at the appropriate time. The delay may be compensable (caused by the client), in which case the client will bear responsibility, or non-excusable (induced by the contractor), in which case the client and contractor would need project management tools to successfully manage the delay. An unreasonable project scope, inadequate early planning, and a deficiency in a risk management approach are the primary reasons for the delay. Due to inadequate task description, delays in design and approval, and client influence during the decision-making process, contractors also contribute to delays (Shaikh, 2009).

Some causes of project construction delays include: Low labour productivity of workers on site; Inadequate control over the allocation of site resources; Skilled labour shortage; Subcontractor underperformance; and Delays in fabrication and inspection. Project team members are expected to follow the project schedule to ensure timely completion of work and that all project tasks are correctly scoped.

### **e.) Finance/Economics Related Factor**

The four main financial factors that cause delays in building projects are financial market instability, insufficient financial resources, late payment, and poor cash flow management (Hamzah, Roshana, and Wong, 2009). Other concerns included the unstable financial backgrounds of the contractors, the unsound financial and commercial management of the clients, the difficulty in getting bank loans, and inflation (Hamzah et al., (2009)). The most important factor in reducing the influence of money worries on the length of project delays is the clients.

All of the aforementioned elements are known to make financial problems worse for a lot of contractors, especially when clients make changes, expenses increase, and contractors have to spend money they don't normally have on supplies and equipment. Since many suppliers and subcontractors are having financial difficulties, delays in payment to contractors affect their cash flow and cause delays on the project site.

### **f.) Statutory Laws and Regulations Related Factor.**

Statutory law is defined as written legislation passed by a legislature or, in the event of an absolute monarchy, by a single legislator. This is in opposition to common law, judicially or officially published regulatory legislation, oral or customary law, and all three. Legislation may originate from municipal, state, or federal legislatures (Adesanya, 2018). It is anticipated that every deal will abide by all relevant laws. When new laws are passed that an ongoing project breaches, it is sometimes difficult for it to continue successfully. Aghogho and Temitayo (2007) state that the Federal Republic of Nigeria's 1999 Constitution serves as the foundation for Nigeria's environmental policy. Section 20 of the Constitution gives the State the authority to protect and develop Nigeria's land, water, air, forest, and wildlife.

### **g.) Safety Procedure and Rules**

The United States enacted its first law governing factory labour conditions in the 19th century, which is when industrial safety practises and rules originated. In order to determine the level of industrial safety, they have since evolved through voluntary organisational safety efforts, federal and state laws, and investigations (ISPON Act, 2014). Successful organisational workplace activity management necessitates a significant emphasis on health and safety. No matter what kind of work needs to be done on a project, safety protocols have to be adhered to. According to such a guideline, the task's completion date may be affected by delay.

## **h.) Natural Causes Related Factor**

Events that could upset the project's regular flow and cause time and cost overruns are examples of natural causes that affect project time management. It is necessary to give natural events sufficient consideration when planning and budgeting for projects. These kinds of events are predictable, and risk management techniques can be used to contain them. Unexpected events of this nature often lead to lawsuits, which postpone or end the project completely. Together with unanticipated events like fire and explosion, there are predictable natural causes like weather, floods, hurricanes, and others. Written contracts should make sure that each party understands their responsibilities to each other (Stuart, 2009).

## **i.) Force Majeure**

A contract clause gives a party the right to suspend or cancel their obligations when events beyond their control make performance unsafe, impractical, illegal, or impossible. The clause states that if the incidence of force majeure lasts for a predetermined period of time, the contract may be temporarily stopped or cancelled. The events that should be on the list must be decided upon by the parties. Force majeure events include things like war, riots, fire, flood, hurricane, typhoon, earthquake, lightning, explosion, strikes, lockouts, slowdowns, prolonged shortages of energy supplies, and actions taken by the state or government that forbid or hinder any party from carrying out its obligations under the contract. Including a standard clause in construction and supply contracts that releases the contracting parties from fulfilling their contractual commitments due to unforeseen and/or uncontrollable events is the best way to handle the issue of force majeure (Sampson, 2013).

## **Conceptual Framework**

The cause-and-effect relationship, or the relationship between independent and dependent variables, is the foundation of the conceptual framework taken into consideration in this work. The seven main variables taken into account are the independent variables that have the potential to influence the dependent variables, project time management. Based on the issues raised in this study, effective time management can be attained if due consideration is given to the seven key components that have been covered thus far. These are depicted graphically in Figure 1. The seven primary independent variables (x1, x2, x3, x4, x5, x6, x7) can be effectively managed to impact the dependent variable; efficient project time management (y).



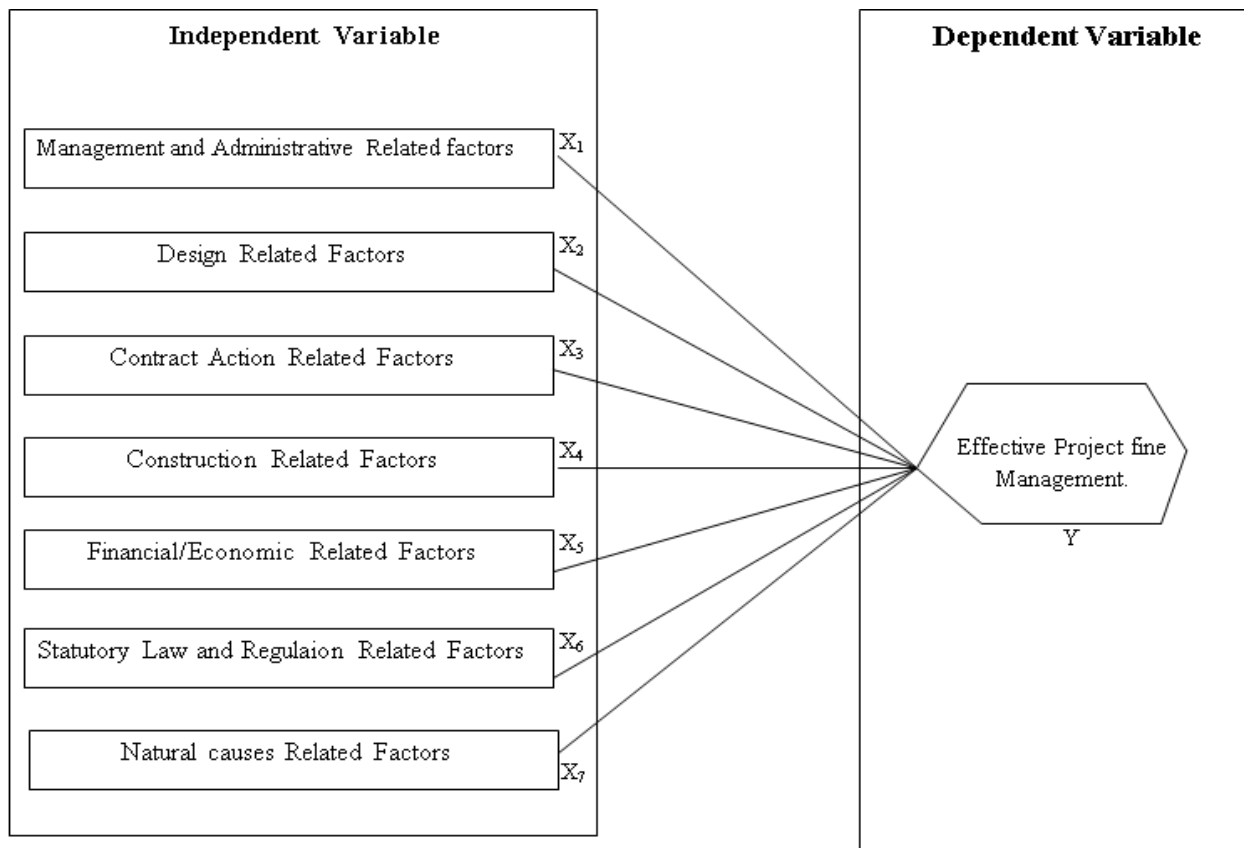


Fig. 1: Conceptual Framework of major factors that delays project in public sector.

It then implies that for an effective project time management to be achieved, the following are properly considered:

- All management/administrative set up of the organisation should be done in such a way that project delay does not arise from them.
- All design related issues are to be streamlined and carefully checked to ensure smooth completion of projects to client desired objective.
- Contracts are to be awarded in line with all known rules and regulations and any change along the line are not supposed to delay the process.
- Construction works should be executed in accordance with scope of work and strict adherence to schedules in order to avoid repeat of work and unnecessary waste of time.
- Client and contractors should ensure that lapses are always not created by making fund available.
- Laws and regulations are to be carefully studied and followed to avoid any form of penalty.

- g) Contract terms and risk management procedure should be drafted with good understanding of the project terrain so that parties involved can accommodate any unforeseen events.

When all these issues are carefully considered with minimal interference from other issues not mentioned that may arise, timely completion of project will be achieved thereby preventing time and cost overrun.

### **Theoretical Review**

The theory of constraints is adopted by the study as the most relevant theory for its investigation. This is so that while solving issues, the theory of constraint takes the constraining variables into account. Thus, Eliyahu M. Goldratt introduced the concept of theory of constraints (TOC) in his book "the aim" as a management tool. The foundation of the concept of constraint is the idea that every complex system, similar to a chain with a weak link, has a single component or restriction that limits its ability to accomplish more of its goal at any given time. For the system to make significant progress, the restriction needs to be found and fixed (Schwalbe, 2006). The method reorganised to address the restriction after identifying it using a concentrating procedure. Finding the weakest link and lowering its susceptibility is one of the theory's primary uses. According to Trojanowska and Dostatni (2017), this can be applied to policies, groups, team members, or anything else that could jeopardize the project's outcome.

Peter (2018) claimed that prior to achieving any goal, a number of conditions must be met, such as those pertaining to quality, safety, legal requirements, and so forth. He continued by suggesting that the concentrating method may be used to identify limitations, and that once limitations are identified, they can be addressed. It serves as a guide for handling the limitations when they have been located using the five steps listed below:

- i) **Identify the Constraint:** Before you can strengthen the weak link in the chain, you must find it.
- ii) **Decide How to Exploit It:** Make quick improvements with existing resources.
- iii) **Subordinate everything to the Above Decision:** Make sure all other activities in the process are aligned with the resolution of the constraint.
- iv) **Alleviate the Constraint:** If the constraint remains, think about what else can be done to address it, such as adding resources.
- v) **Repeat as Needed:** This process is a cycle; in that it begins but does not end. One must always be vigilant about addressing the constraint, wherever it might show up.



**Fig. 2:** The Focusing Process

**Source:** Peter, 2018. The Theory Constraint (A Guide for Project Managers).

The conceptual framework outlines seven fundamental limits to successful time management. By taking these constraints into consideration, the focusing process may be used to determine the weakest link in each of the leading causes of project delivery delays. The project manager needs to apply the concentrating approach if they are to scale through. Taking into account the aforementioned, effective project time management can be attained by putting these concepts into reality and making sure that all stakeholders—internal and external—get adequate attention. By carefully taking into account the seven main constraints mentioned in this project, they can be achieved. Project managers need to carefully review each stakeholder's obligations in order to produce effective results.

### Empirical Review

Thirty-one (31) time management parameters were found to effect project delivery, according to Shehu (2021) in his study "A review of Time Management in Construction Project Delivery in Nigeria." The study divided the components into influencing processes, principles, and methods utilizing a qualitative research design and content analysis. According to the study's hypothesis, the dependent variable of construction project delivery time will be influenced by independent variables such as processes, principles, and procedures related to time management. In order to ensure timely completion, the study generally suggests a diverse approach to tackling time management variables in Nigerian construction project delivery. In addition, a total of thirty-one (31) factors were found, consisting of ten (10) sub-factors for principles, seven (7) for processes, and fourteen (14) for practices.

The study's final finding was that, in order to avoid delays during the construction project delivery phase, stakeholders needed to work together and closely follow the suggested time management practices, concepts, and processes. The report suggested putting in place a system to hold construction stakeholders accountable for subpar performance, checkmate and punish negligent contractors who collude with customers' representatives.

The research paper on the evaluation of time factors affecting the construction of oil and gas projects in Yemen by Kassem, Khoiry, and Hamzah (2020). The objective is to pinpoint and evaluate the relative significance of the important time element causing delivery delays in Yemen's oil and gas construction projects. To determine the impact of time considerations, a survey technique was used that included the client, contractors, consultants, project managers, and engineers. The consultant, tendering and contract, project management, locals, security, feasibility study and design, resource and material supply, economic, political, environmental, and force majeure are all found to be at fault, according to the literature review and content analysis. Relative importance index method (RII) and Spearman's rank correlation were used to analyze the responses which showed that Fifteen (15) out of the Fifty-One (51) factors identified have high influence on oil and gas project delivery in Yemen. The conclude that overall construction project works were affected by the time factors that directly or indirectly affect the oil and gas project delivery hence every effort should be made by project stakeholders to address them.

**Table 1: Content Analysis of the Related Factors from Past Research Works**

S/ N	Factors	Kassem, Khoiry, and Hamzah (2020)	Nwosu (2017)	Obodo and Chikasa (2016)	Alaibe, (2016)	Shehzad (2015)	Okeke et al: (2016)	Barati (2015)	Shehu et at (2021)	Zadeh et al (2016)
1	Design Related issues	√	√	√	√	√	√	√	√	√
2	Contract Actions	√	√	√	√	√	√	√	√	√
3	Construction Execution	√	√	√	√	√	√	√	√	√
4	Natural Causes/ Environmental factor	√	√	√	√	√	√	√	√	√
5	Financial/ economic factor	√	√	√	√	√	√	√	√	√
6	Management and	√	√	√	√	√	√	√	√	√

	Administrative issues									
7	Statutory law and Regulation related factor	√	√	√	√	√	√	√	√	
8	Political Will Related Issues	√				√				√
9	Project Risk Related	√		√						
10	Tendering Related Issues	√			√					
11	Host Community Issues	√						√		
12	Project Culture Related	√	√							
13	Security Challenges	√	√							
14	Force Majeure Issues	√	√	√						
15	Equipment Related Issues									√

Out of the 15 listed categories of factors, only seven (7) has 50% and above authors representation, that is, only 7 factors (Design Related issues, Contract Actions, Construction Execution, Natural Causes/Environmental factor, Financial/economic factor, Management and Administrative issues, Statutory law and Regulation related factor) were identified as influencing factor

### 3.0 Methodology

Because it uses a research questionnaire to collect data from field respondents, this study used a survey research design. It is suitable since the respondents have extensive experience with the issue being studied. They have held positions as managers, supervisors, senior officers, junior employees, and subcontractors for many years. The respondents received copies of the questionnaire, which was created using the Likert five-point rating system.

## Population of the Study

A variety of Oilserv Nigeria Limited employees who work in the departments responsible for managing engineering, procurement, and construction projects as well as a small number of carefully chosen subcontractors made up the study's population. The study population is divided into:

Managers	14
Supervisors	35
Senior Staff	60
Junior staff	11
Sub-contractors	11
<b>Total</b>	<b>131</b>

However, the sample size was statistically determined using the formula of Taro Yamane and the stratified simple random sampling technique.

The Taro Yamane formula is stated below:

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

Where:

N = Population size

e = Level of significance (0.05)

n = sample size.

Thus:

$$n = \frac{131}{1 + 131x (0.05)^2}$$

$$n = 98$$

To ensure that the sample is an accurate representative of the required population, devoid of error and systematic variation, and that all elements are included, the stratified random sampling technique was employed. Simple random sampling was used in each stratum to achieve this. (manager, supervisor, senior staff, junior staff and sub-contractors).

Every respondent was given an equal chance to voice their opinions, and the veracity of the data collected was guaranteed. We can completely eliminate any bias towards a certain set of people thanks to the randomization sampling technique that was employed to extract information from the sample.

Each stratum size was formed using the stratified random sampling technique formula:

$$n_h = \frac{N_h}{N} \times n$$

- $n_h$  = Stratum size (Company's part of sample distributed)
- $N_h$  = Strata (Size of the group)
- $N$  = Population Size
- $n$  = Sample size

**Table 2: stratified random sampling technique**

Level	Stratum	Sample size
Manager	14	10
Supervisor	35	26
Senior staff	60	45
Junior staff	11	9
Sub-Contractors	11	8
Total	131	98

Data was sourced using both primary and secondary sources. The primary data were obtained via questionnaire while secondary data were derived from internet, journals, textbooks, etc.

### Reliability Test

The instruments were tested for dependability using the test-retest procedure. A smaller study population was given the questionnaire, and the procedure was repeated a week later. The Cronbach's Alpha test was used to examine the results for consistency, and a reliability value of 0.7 for acceptance indicated that the results were reliable. An attempt was made to confirm that the questions posed were pertinent to the study's goals and that their language accurately reflected the study's intent. Although suggestions, comments, and changes were provided, the responses were translated accurately to prevent errors in commission or omission. That being said, the respondents' information was kept anonymous and only used for analytical purposes due to ethical considerations.

### Method of Data Analysis

Descriptive statistics and the multiple regression analytical technique were used to evaluate the acquired data. The t-test was used to evaluate the hypotheses at the 5% significance level.

### Dependent Variable

Y = Timely Delivery of Natural Gas Pipeline Projects.

### Independent Variables

- X<sub>1</sub> (Management and administrative issues)
- X<sub>2</sub> (Design related issues)
- X<sub>3</sub> (Contract actions)
- X<sub>4</sub> (Construction execution)
- X<sub>5</sub> (Financial/economic factors)
- X<sub>6</sub> (Statutory law and regulation related factor)
- X<sub>7</sub> (Natural causes/environmental factor)

### 4.0 Result and Discussions

The results and discussions were presented based on the set objectives of the study.

**Objective One:** To determine if there is any variation in the time objectives of gas pipeline projects executed by Oilserv Nigeria limited,

**Table 3: Analysis of Time Variation of EPC Projects of Oilserv.**

S/No	Project Name (Engineering, Procurement and Construction Projects)	Project planned duration (in weeks)	Project actual duration (in weeks)	Time Variation (in weeks)	% Variation	Remarks
1	EPC of Obiafu/Obrikom to Oben (OB3) Gas transmission Pipeline system LOT B (67 km x 48-inch)	104 (2016-2018)	258	154	148.1%	Completed
2	24"x20km Owaza Pigging station (IPS) pipeline and 18"x4km IPS to Alaoji Pipeline, in Abia State.	32	56	24	75%	Completed
3	EPC of Oando 128km x 18-inch South-South gas transmission pipeline system from Ukanafun in Akwa Ibom State to Unicem Plant at Calabar, Cross River State	34 (2008-2009)	39	7	20.6%	Completed



4	23km x 6-inch Cawthorne Channel Cryogenic NGL product pipeline	48 (2003-2004)	128	80	166.6%	Completed
5	OTAKIKPO Onshore terminal & export Pipeline Project	20 (2019-2020)	64	24	120%	Ongoing

Source: Field Survey Reports, 2023.

Table 3 lists a few EPC projects that Oilserv Limited completed that experienced delays. There are several restricting factors described in this research work that contribute to the time variation concerns. Schedule adjustments are typically the outcome of normal scope variation brought on by changes that justify scope creep and are justified by the parties involved. However, if one is unaware of what happened throughout the period owing to uncertainties and only looks at the initial intended completion time, one might be forced to assume that thorough work was not done during timetable preparations. Even with all of the project management procedures in place to guarantee that projects are finished on time, delays are difficult to totally eradicate. While clients may not always request adjustments in project costs, the primary problem with these types of projects is that the anticipated revenue is not realised on time. Even if a project may occasionally be partially completed, there may still be operational problems since the primary project goals are not entirely met. Even after the project's goals are fully achieved, there are still indirect costs associated with the project team members' oversight. Because of the administrative setup and rented machinery and equipment that will be maintained on site until the project is finished, the contractors typically incur higher costs. However, in an attempt to save money, the quality of work may suffer. Due to this, a questionnaire had to be created in order to ascertain the nature and impact of the seven primary elements that were identified and discussed in the literature review, as well as the most effective strategy to deal with them in order to avoid going over budget.

However, objectives two and three were obtained using hypotheses testing.

**Research Objective Two:** To examine the individual effect of the identified factors on timely delivery management of the natural gas pipeline projects in the Niger Delta Zone of Nigeria.

**Hypothesis One: H0<sub>1</sub>:** The individual effect of the identified factors is not significant to timely delivery of natural gas pipeline projects in Niger Delta zone of Nigeria.

**Table 4: Coefficients<sup>a</sup> for y**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	14.392	5.038		2.857	.005
Design Related issues	.334	.166	.171	2.012	.037
Contract Actions	.284	.108	.235	2.639	.010
Construction Execution	.642	.142	.416	4.537	.000
Natural Causes/Environmental factor	-.107	.136	-.072	-.783	.046
Financial/economic factor	-.419	.142	-.286	-2.953	.004
Management and Administrative issues	-.452	.123	-.341	-3.685	.001
Statutory law and Regulation related factor	.231	.170	.136	1.361	.039

From Table 4, the significance value of each of the factors is less than 0.05. The implication is that the individual effect of each identified factor critical to the successful delivery of natural gas pipeline projects. Hence, null hypothesis is rejected and the study concludes that the individual effect of the identified factors is significant to timely delivery of natural gas pipeline projects in Niger Delta zone of Nigeria.

**Research Objective Three:** To ascertain the collective effect of identified factors on timely delivery of the natural gas pipeline projects in the Niger Delta zone of Nigeria

**Hypothesis Two H0<sub>2</sub>:** The collective effect of the identified factors on the timely delivery of natural gas pipeline projects in Niger Delta zone of Nigeria is not significant.

**Table 5 Analysis of Variance (ANOVA)<sup>b</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	492.167	7	70.310	7.152	.000 <sup>b</sup>
	Residual	2988.494	91	7.643		
	Total	3254.697	98			

Table 5 indicates that the F-value of 7.152 is significant at 0.000 level of significance. The indication is that at 0.05 asymptotic level, the null hypothesis is rejected with a conclusion

that the collective effect of the identified factors on the timely delivery of natural gas pipeline projects in Niger Delta zone of Nigeria is significant.

## **Discussion of Results**

The results gotten from the analysis in Table 3 show that most natural gas pipeline projects undertaken by Oilery firm suffer fatigue based on the level of time overrun incurred. Literature indicates that Design Related issues, Contractors Actions, Construction Execution, Natural Causes/Environmental factors, Financial/economic factors, Management and Administrative issues, Statutory law and Regulation related factors are culpable.

Delays in construction were caused by the fact that subcontractors and foreign representatives of original equipment manufacturers (OEMs) performed the majority of the work during this period. Even after the contractor has done the typical due diligence to determine their level of expertise before employing them, the majority of them are not as skilled as they claim to be. At this level, purchasing machinery, supplies, and services is typically fraught with uncertainty. Other sub factors under construction related issues are low labor productivity; delay in fabrication together with problems of mistakes and defective works; unforeseen ground condition which were not considered during FEED process; statutory inspections by regulatory agencies; conflict among client, contractors, sub-contractors and other Stakeholders. Nonetheless, this result is consistent with research by Shehu et al. (2021) and Kassem, Khoiry, and Hamzah (2020). The work schedule is typically modified, and the critical path and critical tasks may also change as a result of the current circumstances. These modifications typically have a negative impact on the project completion timeline.

According to Obodo and Chikasa's (2016) findings, administrative and management-related factors primarily stem from host community issues, conflict, and other external issues in addition to bureaucratic bottlenecks that typically impede the smooth operation of project works in public sector projects. Based on all available evidence, the management is making every effort to address these issues.

Since contracts are issued with appropriate budgetary provisions, financial or economic related concerns shouldn't have been a part in the decision. This element typically causes delays when payment terms are not agreed upon by contractors and project team members due to ambiguous milestones and changes that could cause payment delays. Nwosu (2017) supports the idea that overall job performance is impacted by delayed payment. Contractors face some of the financial issues that were previously discussed in this research.

The main causes of contract-related issues are confusing contract terms, numerous re-negotiations with subcontractors, ambiguous contract terms, and delays in getting management approvals for variations from customers. But in their separate investigations, Shehu et al. (2021) and Alaibe (2016) both supported this conclusion. Once more, a major factor in the delay was outside influence from senior government officials when a natural gas pipeline project was involved.

Natural gas pipeline projects are often delayed by design-related issues since parameters for design information are frequently not easily accessible. According to Shehu et al., (2021); Okeke et al. (2016); Nwosu (2017), feasibility studies and front-end engineering designs are faced with uncertainties when a new terrain is involved, resulting to constant scope modification.

The final two main factors contributing to project delays are statutory laws and regulations and natural causes. Because Oilserv uses skilled staff to produce their proposal document and negotiate contracts with clients, their contribution is less than that of other elements. The enactment of rules and regulations is given due consideration. Natural factors are typically adequately taken into account in project planning and scheduling, which reduces their contribution to project delays. These seven variables were generally thought to be the most effective approach to categorise the reasons behind delays in the timely completion of natural gas pipeline projects in the Niger Delta. All of these are consistent with Shehu's (2020) research, which divides the independent variables influencing the time it takes to complete building projects into three categories: processes, principles, and procedures.

## **5.0 Conclusion**

After looking over the important concerns that the respondents brought up, it is clear that the points listed above shouldn't be disregarded. In fact, it is crucial to carefully analyze the main limiting variables influencing project time management in order to ensure the success of gas pipeline projects.

The findings from secondary and primary data in tables 3 showed clearly that Oilserv projects suffers time overrun due to Design Related issues, Contractors Actions, Construction Execution, Natural Causes/Environmental factors, Financial/economic factors, Management and Administrative issues, Statutory law and Regulation related factors. These factors have been negatively affecting both client and contractors.

Even if a project is comparable to one that has already been completed, a detailed work breakdown structure should be taken into account for construction-related difficulties in order to prevent errors. To make sure that objectives are correctly matched, contractors, subcontractors, and clients should all be included in the comprehensive work schedule

drawing process before construction work begins. Any project's duration should involve the customer making sure that their objectives and the contractors are appropriately aligned. Agency loss will be less of a problem as a result. Planning, scheduling, and project scope definition are all areas in which project managers should receive training. Activities on critical paths in project schedule are supposed to be monitored properly and any measure necessary to correct deviations should be adopted as soon as possible.

The management of Oilserv and other oil and gas companies are expected to assess all of the major limiting factors that have been identified along with the sub factors, with a focus on issues related to construction, administration, and management, finance and economics, contracts, and design. To ensure that the weak connections within each factor are always addressed when executing a project, the focusing approach employed in theory of constraints (theoretical review) should be applied to each one.

This research proposes for administrative reform from both the Oil and Gas Firms and the Government agencies, maintaining good relationship with regulating authorities, familiarizing with approval procedures, local laws and regulations, partnering with major project stakeholders, engaging experienced design organizations, translating owner's ideas clearly to design, hiring of competent consultants to evaluate design works, training project people, appropriate staffing, emphasizing on teamwork, enhancing of project planning and scheduling practices in contract evaluation and project execution.

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## About the Author



**Ibeawuchi I. Echeme, PhD**

Owerri, Nigeria



**Ibeawuchi Ifeanyi Echeme** is a lecturer in the department of Project Management Technology, Federal University of Technology, Owerri. Echeme has a B.Tech, MSc, and PhD in Project Management Technology. He has published more than fifteen (15) articles in both international and national reputable journals and a textbook on Project Time, Cost and Quality Management. He is a Certified Project Director (CPD) and a member of International Project Management Professionals (IPMP). Dr. Echeme has presented papers in conferences and workshops within and outside Nigeria. He can be contacted through; [ibeawuchi.echeme@futo.edu.ng](mailto:ibeawuchi.echeme@futo.edu.ng) and [ibeecheme@yahoo.com](mailto:ibeecheme@yahoo.com);

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