Chemistry International 3(2) (2017) 106-113

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www.bosaljournals.com/chemint/

Effective service delivery through quality management system (QMS) in oil and gas servicing companies, a case study of selected firms, Port Harcourt

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A R T I C L E I N F O

Article type:
Research article
Article history:
Received March 2016
Accepted July 2016
April 2017 Issue
Keywords:
Quality management system
Local content
Failure mode effect analysis
Continual improvement
Port Harcourt
Oil
Gas

A B S T R A C T

This study investigated the impact of Quality Management System (QMS) on effective service delivery in Oil and Gas Servicing Companies in selected firms in Port Harcourt, Nigeria. The opinion of 50 respondents were sampled using questionnaires, interviews as well as observation from journals and texts used in this work to examine the Quality Management System (QMS) of the selected firms. Using simple percentages and the Chi-square (X^2) test of hypotheses, it was hypothetically established that the implementation of QMS practices, has impacted the work process, procedure and improvement on quality over the years in the Oil and Gas Servicing companies in Port Harcourt Nigeria. The research identified an adopted use of Failure Mode and Effect Analysis (FMEA) tool as a continual quality improvement initiative developed in the local content oil and gas servicing operation for equipment handling, management and to drive sustained improved performance quality processes as a key driver of a progressive that will place local content companies as an options for producing companies and at par with multinational oil and gas companies.

Capsule Summary: Holistic implementation of quality management system such as ISO 9001:2008 has resulted in improved service delivery in indigenous oil and gas servicing companies in Port Harcourt, Nigeria.

Cite This Article As: V. O. Izionworu and M. O. Ukeame. Effective service delivery through quality management system (QMS) in oil and gas servicing companies, a case study of selected firms, Port Harcourt. Chemistry International 3(2) (2017) 106-113.

INTRODUCTION

Oil and Gas industry companies in Port Harcourt, Nigeria are rightly positioned to be major key players in the industry world over. In almost a decade now the government and the oil and gas industry practioners in Nigeria have sort to provide quality services and products in the industry that can compete favorably with any other quality service provided by multinationals. To achieve this fit, Quality Management System (QMS) is a general and regular methodology that has become one of the most popular solution strategies for productivity improvement. The implementation of this technique in various industries is driven by the need to increase performances of business units in terms of quality, efficiency, customer's satisfaction and profitability (Sadikoglu & Zehir, 2010). Quality as an integral part of life that contributes positively to the running of the world we live in (ISO 26000 Social Responsibility, 2010). Like other standards QMS ensures vital features such as quality, ecology,

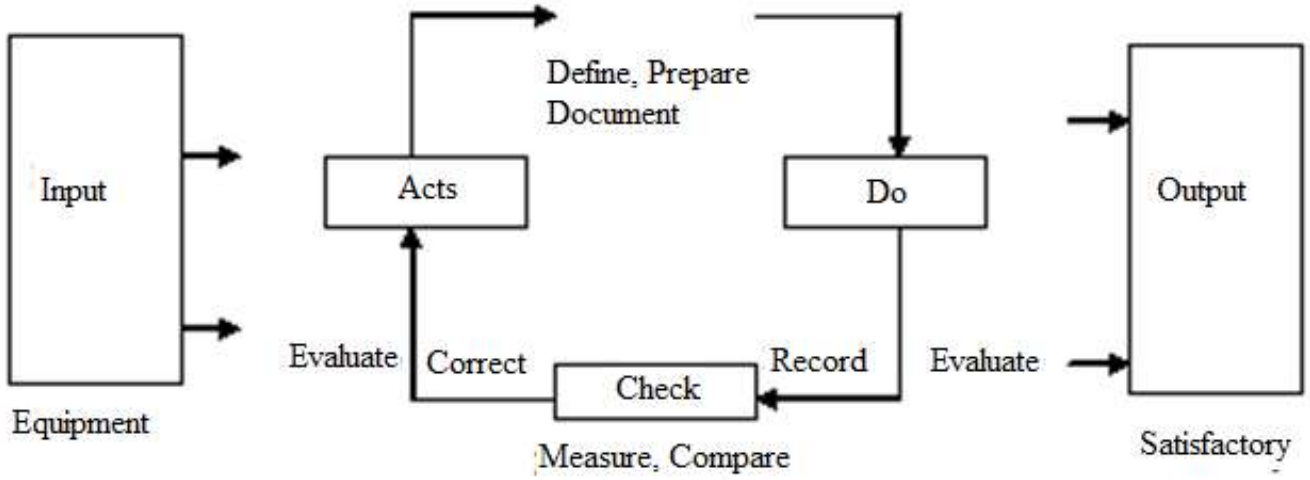

Fig. 1: Edward Deming PDCA Diagram (Movahedi et al., 2013)

safety, reliability, compatibility, interoperability, efficiency and effectiveness. It facilitates trade, spreading of knowledge and sharing of technological progress and good management and leadership practices (ISO, 2010). It is essentially driven by the fundamentals of quality shown in Figure 1.

Quality in services can be assessed both at the macroeconomic level by indicators such as value added tax, investments, employment and at microeconomic level by performance and competitiveness (Craciu, 2003). For oil and gas companies in developing cities such as Port Harcourt, Nigeria, relevance and business sustainability is assessed by these microeconomics indexes highlighting the importance of Service Quality driven by an efficient Quality Management System.

In recent times, various researchers have carried out a lot of studies on quality management systems. Craciun (2013) for instance investigated the improvement of service quality and Pfeifer, Reissiger and Canales (2004) identified that integrating six sigma with quality management systems sigma must be integrated with management systems concepts. They recommended a combination of their common features for maximum profit. Kristina and Peter (2012) researched the integration and implementation of selected management standards into an organization through Integrated Management System Role-Play Simulation (SIMPRO-IMS), Linderman and Schroeder (2012) investigated the moderating role of contextual factors on quality management practices.

Again, Movahedi, Teimourpour and Nahid (2013) carried out a study on effect of performing quality management system on organizational productivity. In that research they agreed with Priede (2012), who explained that quality management, has a significant role in increasing the competiveness of companies and economies over the past 60 years. Priede (2012) reviewed the literature for quality management system and ISO 9001 and concentrated on its requirements. His study like that of Defeo and Juran (2010) revealed that there is a strong correlation between quality and productivity.

The present study evaluates the application of QMS in the Oil and Gas servicing companies in a typical developing economy and it also examines what successful firms in the industry have done to compliment QMS which has distinguished them in terms of quality service delivery.

Today, as a result of high level of competition in the Oil and Gas Servicing companies, availability of electronic devices used to checkmate the accuracy and efficiency of their products and services, and following the set standards especially that of ISO 9001, Oil and Gas servicing companies stand a chance of losing their customers and clients if the production of a certain product or provision of service would not meet specific standards.

The continuous existence and survival of these Oil and Gas servicing companies in the competitive market depends on how much service and products they deliver effectively in line with clients and International standards. The need for this result underscores the need for Effective Service Delivery through Quality Management System (QMS) in Oil and Gas Servicing companies.

It is important to know that the major focus of all the activities going on in the Oil and Gas servicing companies or firms remains the satisfaction of the customers. The responsibility of the Oil and Gas servicing companies are primarily that of assuring high quality of the products and services (i.e. complying with its own set Standards, Clients Standards and that of Governmental Regulatory bodies or Agencies). This can be achieved by the Oil and Gas servicing companies through the establishment of efficient and effective quality assurance standards set in the following key activity areas:

a) The design, formulation and registration of products.
b) In the factories, buildings, machinery and equipment design, installation, manufacturing system and

process controls as well as the identification systems.

Today, Oil and Gas servicing companies that wants to or desire to survive or increase sales and profitability have to analyze and understand every aspect of their operations in terms of their customers' needs. This is essential if they must remain in business. Besides satisfying the customer's needs, planned quality improvement results in higher productivity, efficiency, lower cost and punctuality in the delivery of services. But quality improvement is not something one can just affix to a product, it is all-embracing. In other words, every stage of the production of any product from the raw materials sourcing to the end product as well as the built in services up to the point of delivery has to be taken into consideration with regards to quality improvement. This brings to focus the concept of Total Quality Management (TQM), Quality Control and or Quality Assurance. These concepts must be completely internalized by every segment of any Oil and Gas servicing company before it becomes effective. Major (1995), said Quality Standards and Total Quality Assurance are of great benefit to everybody.

Because product quality and standardization are of great importance to these companies, continual improvement becomes a necessity leading to a research of this kind which is to investigate how effective services are delivered to Clients through Quality Management System (QMS) in selected Oil and Gas Servicing companies in Port Harcourt Nigeria.

The objectives of this research are (1) to ascertain the existence of Effective Management System within the selected Oil and Gas servicing companies in Port Harcourt. (2) To examine the quality management practices of Oil and Gas servicing companies in relation to other operations and the products they offer. (3) To identify any complimentary processes put in place by the selected companies in addition to those set out by Certification bodies. (4) To identify the common quality management standards in use. (5) To make recommendations on the implementation of the practices and procedure of servicing companies. To address these objectives, the following research questions are used, how are quality standards established? Is there conformance appraisal or audits (i.e. assessing whether the process of service delivery meets specifications already set)? Are there systems, methods, procedures and practices in general for all Oil and gas servicing companies, and what quality management system methods, procedures or practices are adopted by Oil and gas servicing companies? Other research questions are, what Quality Assurance measures are put in place? What drives Quality Service Delivery in oil and Gas servicing firms? Is quality practice the business of some selected few?

Oil and Gas servicing companies or firms are part of Engineering community whose establishment is based on Engineering principles and guidelines, nurtured by specific standards accepted and supported by standards in order to accomplish a specific purpose. Be that as it is, they would only survive to the extent they satisfy this purpose. The purpose of an Oil and Gas servicing company clarifies and defines the company economic, social and managerial philosophies. It thus specifies the company criteria for profit making, for business operations and for the quality of products and services rendered. It is generally agreed that three factors determines the acceptability of products and services to a buyer (customer) which ranges from the quality of the product and its reliability, delivery of the product and finally the price of the products respectively.

MATERIAL AND METHODS

The research examined the management system as practiced in some Oil and Gas servicing companies in Port Harcourt and how these practices has greatly enhanced Effective delivery of services to their clients and the general market over the years.

As discussed by Connie (2008), who considered population as the entirety of all items or units being studied from two dimensions, first the target population and then secondly the accessible population. In this study, the Oil and Gas companies are the target population and then the selected Oil and Gas servicing firms in Port Harcourt are the accessible population. For this study, the primary and secondary methods of data collection were used with questionnaire method of survey as the primary source of data. The questionnaires were constructed in such a way that that they elicited the desired response from the respondents. In order to minimize the set back of questionnaire methods, personnel in charge of management system and quality control/quality assurance departments in the selected firms were interviewed. Also secondary method of data collection from text books, journals and pamphlets were consulted. The survey instrument was subjected to face validity, a simple form of validity in which the researcher determines if the test seems to mean what is intended to measure, Anastasi (1988).

Data analysis was done using appropriate statistical tools as tables, simple percentages and the Chi-square $[X^2]$ test of hypothesis. The Chi-square is $[X^2]$ with formulae (Eq. 1)

$$X^2 = \frac{(f_o - f_e)^2}{f_e} \quad (1)$$

Where

f_o = Frequency observed

f_e = Frequency expected and

$$f_e = \frac{(RT)(CT)}{T}$$

RT = Row Total v

CT = Column Total

T = Sample Total

Table 1: Characteristics of quality management system (QMS) (Pfeifer, 2004)

Characters	Definition
Objectives	Customers satisfaction through high quality products
Strategy	Arranging business processes according to requirements of standards
Management	Listing of management responsibilities
Organization	Process owners, management representatives (responsible for QMS)
Regarded resources	Human resources, infrastructure and work environment
Training	Required but not specified
Project Management	PDCA (model for continuous improvement)
Process approach	Model for a process-based QMS no specification
Documentation	Listing or requirements

The test was conducted at 5 percent level of significance with 95 Percent confidence level. At degree of freedom (C-1) (R-1) at 5% level of significance, the Decision critical point was calculated using degree of freedom. Therefore, when Chi-square critical (X^2 Critical) is greater than Chi-square Calculated (X^2 Cal) the null hypothesis was accepted, otherwise the null hypotheses were rejected.

Mathematical proof of the instrument used

The questionnaire used was tested using the Kudar-Richardson method, the degree of standardized test with the formula :

$$K - R\ 20 = \frac{K}{K-1}\left[1 - \frac{\sum Pq}{\sigma^2}\right] \quad (2)$$

or $i = 1$ to k is

$$r = \frac{k}{k-1}\left[1 - \frac{\sum_i^k Pq}{\sigma^2 x}\right] \quad (3)$$

Where in equation (2) the parameters are defined as

$k =$ no of terms in the test

$P =$ proportion of people who answered each item correctly

$\sigma^2 =$ variance of the total test

Recalling the expression, thus

$$q = 1 - p \quad (4)$$

In a test of p and q, the nature of p or q is gotten by imagining that in a test administered to a group of 20 respondents, 8 out of the 20 respondents answered item 1 correctly.

Then Kuder--Richardson said

$$p = \frac{8}{20} = 0.4 \quad (5)$$

Hence from equation (4) it can be stated that

$$q = 1 - p$$

Substituting the solution of equation (5) with equation (4) we have

$$q = 1 - 0.4$$

$$q = 0.6$$

Therefore the accuracy of the instrument is ascertained as the value of q (the proportion of people who answered each item correctly) is found to be greater than p (the proportion of people who did not answer each item correctly.

RESULTS AND DISCUSSION

Response Rate: From Table 2, out of sixty (60) questionnaires distributed, fifty (50) was completed, returned and are useful in this analysis while ten (10) were not returned. By rating the respondents, the average effective response is 83.3% of the total, hence satisfactory.

Data Presentation: The data is presented using the following format

A. Relevance of questions represented on the questionnaire
B. Aim of questions stated
C. Response shown in a tabular form, and
D. Analysis of response

Data analysis

Test of knowledge level of respondents on QMS: The knowledge and qualification of the respondents on QMS is as seen in Table 3 and represented in Figure 2. Indicates that on a five point scale arrangement, intermediate and expert has 26% and 44% respectively showing that for anyone to be compliant with QMS practices, he or she must be trained and equipped knowledge wise. Hence, its only knowledgeable personnel's that minds the QMS activities in oil and gas servicing companies.

Positions and ranks

The result of the ranking of respondents based on their source of training using three key expressions, SON Trained, QMS Officers, for internally trained personnel and QMS Lead Auditor, for those trained in addition by other certified bodies presented in Table 4 shows that the respondents who supplied the needed data for this analysis were basically Officers, SON Trained Personnel's and Lead Auditors as represented in percentage. QMS Audits is the key for quality improvement and quality control.

Table 2: Questionnaire distributed and collected

Response/Optics	Respondent	Percentage
No. of questionnaire Distributed	60	100%
No. of questionnaire returned	50	83.3%
No. questionnaire not returned	10	16.7%

Source: Research Data, 2014

Table 3: Views drawn from question one on competence

Knowledge Level	Respondents	Percentage
None	0	0
Little	5	10%
Average	10	20%
Intermediate	13	26%
Experts	22	44%
Totals	50	100%

Source: Research data, 2014

Table 4: Positions and ranks of respondents

Positions/Ranks	Respondents	Percentage
SON Trained	14	28%
QMS Officers/Staffs	16	32%
QMS Lead Auditors	20	40%
Total	50	100%

Source: Research Data, 2014

Table 5: How QMS practices enhances work process

Enhanced work process	Respondents	Percentage
Negativity	5	10%
Positivity	45	90%
Total	50	100%

Source: Research Data, 2014

Table 6: Impact of QMS practice on duty discharge

QMS Impact	No: of respondent	Percentages
No	0	0%
Yes	50	100%
Total	50	100%

Source, Research Data 2014

Impact of QMS on work processes

Using the question - How has QMS enhanced your work processes? Respondents explained how their functions have been affected either negatively or positively overtime by the implementation of QMS practices. The result seen in Table 5 from the survey showed that the respondents affirmed that QMS practices enhanced their work process positively. The positive enhancement of QMS practices on work process is at 90% against 10% blank pages unanswered with reasons not known. 100% of all respondents agreed that QMS impacts positively on the discharge of their personal duties, Table 6.

Out of all the respondents who made input in this research 100% do agreed that QMS practices and its implementation has impacted on how they discharge their personal duties and jobs (Table 1).

Test of hypothesis

Using the chi-square method, as stated in equation (1) we have

$$X^2 = \frac{(f_o - f_e)^2}{f_e}$$

Where

f_o= Frequency observed

f_e = Frequency expected and

But $f_e = \frac{(RT)(CT)}{T}$ (6)

Where,

RT = Row Total

CT = Column Total

T = Sample Total

Solution, invoking the formula

$$X^2 = \frac{(f_o - f_e)^2}{f_e}$$

$\boldsymbol{f_o = 200}$

$f_e = 310$

Observe that the computed chi-square is greater than that from the chart.

Failure mode, effect analysis and response (FMEAR)

A special case on quality assurance and control in the use of engines and pumps during project execution in a typical Oil and Gas servicing project such as pipeline integrity assessment - using Mechanical and or Foam Pigs, Smart Balls, Intelligent Pigs (IP's) etc., Crude oil well services - Cementing, Gravel packing, Stimulation, etc. is the use of Failure Modes and Effects Analysis (FMEA) table adopted from FMEA used in advanced risk assessment to identify the health and safety hazards resulting from failures in hardware. In health and safety hazards risk assessment the FMEA starts by listing the hardware items and analyzing their possible failure modes and associated risks (Boyle, 2012). Izionworu Vincent Onuegbu in 2013 modified the FMEA to include a column for Action Required/Remarks as seen in Figure 3, Izionworu refers to this modified template as, Failure Mode, Effect Analysis and Response (FMEAR), which provides brief summary of what is to be done before the use of each equipment to prevent breakdown during use to the barest

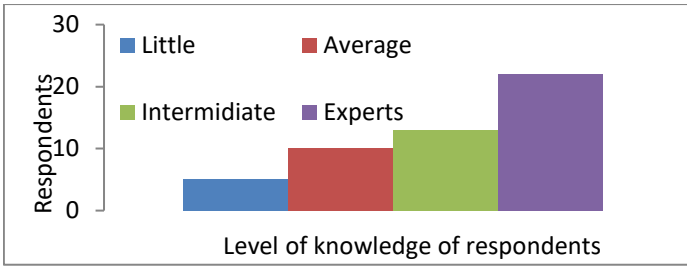

Fig. 2: Distribution of respondents' knowledge

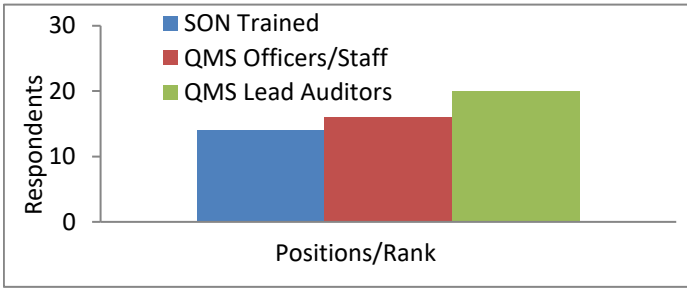

Fig. 3: Position and ranks of respondents

minimum. This is a measure of equipment-engine and pump assessment on ongoing project execution that takes account of items, component, failure modes (signal) failure detection, raising assessment and action required at each instance. Severity category holds from i to iv and effect degrees ranges from minor, critical, major and catastrophe.

At minor degree the description is functional failure of part of a machine in use, critical failure will probably occur without major damage to the system. Major degree would cause major damage to the system and finally catastrophe would lead to complete loss.

Probability level ranges from A to E in order corresponding to frequent, probable, occasional and improbable descriptions. At frequent - level A, it is likely to occur frequently. Probable – level B, the failure mode will occur several times in the life of an item. While at an occasional - level C, the failure mode likely will occur sometimes in the life of an item at level D - remote, unlikely but to occur in the life of an item and level - E, improbable - it's unlikely that occurrence may not be expressed. Hence, on any job done, the measure above tends to ensure that the right preventive actions are taken at the first instance to forestall any possible failure and when such failure occurs they are managed professionally reducing equipment down time hence the customer is satisfied because they were envisaged. This is one action that has resulted from continual improvement as required by QMS. The result of this initiative will be the subject of another research work (Ab Wahid and Corner, 2009; Chavan, 2005; Griffith and Bhutto, 2008; Nwosu et al., 2006; Oke and Charles-Owaba, 2006).

CONCLUSIONS

The major findings in this work are summarized as; the primary reason for the implementation of quality management practices in the oil and gas servicing companies is for the satisfaction of customers or clients. The activities involved in proper implementation of quality practices in the Oil and gas servicing companies is not just the responsibility of some selected few but the duty of all members of the Organization. For the purpose of effectiveness in performance, all personnel in the discharge of individual responsibility or duties should stick to approved job processes, procedures and instructions. Work specifications from clients remains paramount in the minds of service providers and should not be altered for any reason without due permission from customers or clients.

Table 7: Presents the analysis for based decision making

S/N	Table No:	Option	fo	fe	$(f_o - f_e)$	$(f_o - f_e)^2$	$\frac{(f_o - f_e)^2}{f_e}$
1.	3	Little	5	20	5	25	0
2.	3	Average	10	20	-1	100	25
3	3	Intermediate	13	18	-5	25	1.4
4	3	Expert	22	28	-6	36	1.3
5	4	SON Trained	14	16	-2	4	0.3
6	4	QMS Officers	16	20	-4	16	0.8
7	4	Auditors	20	18	2	4	0.2
8	5	Negatively	5	35	-30	900	25.7
9	5	Positively	45	45	0	0	0
10	6	No	0	50	-50	2500	50
11	6	Yes	50	40	10	100	2.5
	$\sum of\ data$		200	310	-81	3710	107.2

Source: Research Data, 2014.

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

ITEM	COMPONENT (FUNCTION)	FAILURE MODES (SIGNAL)	FAILURE EFFECTS	FAILURE DETECTION METHOD	RISK ASSESSMENT			ACTION REQUIRED/REMARKS
					SEVERITY	PROBALBILITY LEVEL	RISK LEVEL	

FMEA no.	**Failure Modes and Effects Analysis**	Page of
PROJECT no.		Date:
SYSTEM:		prepared by:
SUBSYSTEM:	*Risk Level Code 1 = High, 2 = Medium, 3 = Low	Evaluated by:

SEVERITY CATEGORY

Category	Degree	Description
I	Minor	Functional failure of part of a machine or process
II	Critical	Failure will probably occur without major damage to system
III	Major	Major damage to the system
IV	Catastrophy	Failure causes complete loss

PROBABILITY LEVELS

Probability Level	Description	Individual Failure Mode
A	Frequent	Likely to occure frequently
B	Probable	will occur several times in the life of an item
C	Occasional	Likely to occur sometime in the life of an item
D	Remote	Unlikely but possible to occur in the life of an item
E	Improbable	So unlikely that occurrence may not be experienced

Risk Assessment Map

Probability level						
	A			RL1	High risk	
	B		RL2			
	C			Medium risk		RL = Risk Level
	D	RL3				
	E	Low risk				
		I	II	III	IV	
		Severity category				

Fig. 4: Failure mode, effect analysis and response (FMEAR): Adapted from Dolye (2012) by Izionworu, Vincent O.

It was identified that duty discharged by individuals in any project execution is to show respect to facts by keeping accurate and updated records consistently.

Failure cost on wrong work done or failure of work done is minimal as the practice of Quality Control seeks to ensure that whatever should be done, should be done right at the first time and always. Internal and External Audits on work processes remains a key to continual improvement.

Quality management system has been practiced in the selected oil and gas servicing companies and the results indicate that for local content companies that have imbibed the spirit behind the QMS customer satisfaction is at

optimum level. This result supports the fact that Quality Standards are established in order for internal and external parties including the certification bodies to access Organizational ability to meet customers, statutory or regulatory requirements applicable to the product and services as well as its own operational standards. It is only on this ground that the Oil and Gas Servicing companies are able to render quality services that exceed the expectations of their clients and the general market populace which is the only key that keeps them relevant in business. Also noted is the fact that an Oil and Gas servicing company would only survive to the extent at which they are able to meet up the demands of their clients while meeting up requirements of the various Standard bodies. For companies that do not give QMS the priority it deserves, customer service is not only poor but the staff morale is low because of constant failure of operations during execution of projects and customer goodwill is usually lost. Therefore, a firm can only claim effective service delivery to any customer if the work processes, procedures and instructions carried out meet all necessary standards.

Suggested future works include monitoring and measuring the impact of the use of FMEA on quality of project delivery, and attaching a cost component on such seamless services resulting from less failures of equipment.

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