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Using Inventory Management and Control as a Tool for Cost Reduction in an Oil and Gas Fabrication Project

Badeji, A. S. [1], Isaac, O. E. [2], Ndor, M. V. [3], And M.T. Lilly [4]
[1234] *Department of Mechanical Engineering, Rivers State University, Port Harcourt, Nigeria*
**Corresponding Author: Badeji A. S.*

ABSTRACT: *The aim of this research is to use Inventory Management and Control as a tool to Reduce the Cost of an Oil and Gas Fabrication Project and it is based on studying and assessing the inventory management and control process of oil and gas fabrication projects and the impact of inventory management and control on the cost of oil and gas fabrication projects. In this study, semi structured interviews with personnel and managers that are involved with the inventory process of an oil and gas fabrication company was conducted and the inventory data for a specific oil and gas fabrication project was obtained. The inventory items were classified using one of the most common inventory management and control technique, the ABC analysis. After the ABC analysis was done using MatLab, the inventory items were taken up to check for quantity variance and the quantity cost variance. Also, the problems affecting the effective management and control of inventory for oil and gas fabrication projects were identified and measures to correct them were suggested. For the ABC analysis, 28 items were found to be in category A which represents 68.68% of the financial investment value, 85 items are in category B which represents 17.62% of the financial investment value and 1115 items in category C which represents 13.70% of the financial investment value. The quantity cost variance analysis of the classified items was done and it revealed that there is a quantity cost variance of ₦3,211,884,277 for class A and class B items and this ₦3,211,884,277 would have been saved if ABC analysis of the project materials was done before initiating the purchase process.*

KEYWORDS: *Inventory Management and Control, ABC(Always Better Control) Analysis, Cost Variance Analysis.*

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I. INTRODUCTION

Inventory in a production context are idle resources, though the resources are idle does not mean it is not serving any purpose; rather it should be available when needed [9]. Inventory occupies a very significant position in the overall assets of a company and it accounts for about 50% – 60 % of the total cost of a project. They are also described as idle stock of physical goods that have economic value which are held in various forms by an organization in its custody waiting to be packed, processed, transformed, used or sold in future [13]. Inventory control covers all the items in stock at every stage of the production process which starts with purchasing and delivery of the item, to usage and re-ordering the item and inventory control system ensures having the required quantity of inventory at the right time and at the right place. It also ensures that capital is not tied up unnecessarily and protects production if problems arise with the supply chain [7].

Inventory management and control helps to ensure that materials are available all the time for production or sales. It involves controlling the purchase, storage and usage of the items in inventory. If the items in inventory are not properly controlled and well managed, it will affect the organization adversely as the cost associated with keeping inventory, such as ordering cost, holding/carrying cost and shortage cost may increase as the case may be. Inventory management system provides enough information to efficiently manage the flow of materials, effectively utilize man and equipment, organize internal activities and communicate with customers. It does not only make decisions or manage operations but provides information to managers who use this information to make more accurate and timely decisions to manage their operations and a successful business relies on many factors, one of which is a reliable inventory management system [16].

There are different techniques which can be used for inventory management and control. By using inventory management techniques, it will help in getting the materials at the right cost, right quality and at the right time [15]. The inventory control technique used by various organizations differs and this depends on the raw materials used for the products and the best model suitable for an organization needs to be determined and adopted [3].

ABC analysis is very simple method for classifying the inventory items and it provides a very large control over a company's total inventory cost [3]. ABC analysis is the process of classifying the items in inventory in decreasing order of annual monetary value. The items are split into three class, called A, B and C. Class A items (which are mostly few) contains items which have the highest annual financial value and require the most attention (i.e. a high degree of security). Class C items have low financial values, but they are usually numerous and require the least attention. Class B contains all the other items in-between class A and class C [9]. ABC analysis helps to understand the problems that occur due to purchasing, inventory status and safety stock quantity [18]. Cost variance analysis is the most common performance evaluation tool and it is used to compare actual costs and budgeted cost [1]. Project costs can be controlled by taking corrective actions towards the cost variance [5].

1.2 The Aim of This Research Work

The aim of this research is to use inventory management and control as a tool to minimize the cost of an oil and gas fabrication project.

1.3 Objectives of This Work

Since the aim of this research work is to use inventory management and control as a tool to minimize the cost of an oil and gas fabrication project, the objectives that will be used to achieve this aim are;

i. To apply inventory management and control technique as a tool to reduce the total cost of an oil and gas fabrication project.

ii. To check for cost variance of the oil and gas fabrication project.

iii. To determine the nature and extent of problems affecting the effective management and control of inventory in oil and gas fabrication projects.

iv. To provide measures that will help to achieve effective management and control of inventory in oil and gas fabrication projects.

1.4 Inventory and Oil and Gas Fabrication Projects

In a fabrication industry, different items are brought together to arrive at the end product. These items include raw materials, bought-out parts and consumables. Fabrication of oil and gas structures are project specific and these projects are mostly named after the oilfield that is to be developed, improved, needs capacity increase or requires life extension. All the items used for fabrication are the inventory items and the items are kept for each specific project until they are needed. Since oil and gas fabrication are project based, each project has its own inventory items and it is worthy of note that the inventory items can either be client provided or fabricator provided depending on the contract signed, but it is important that the items are available at the fabricators yard as at when needed.

The list of items to be used or bought is generated from engineering drawing and listed in the bill of materials (BOM). The BOM consists of the item description and size, quantity required and the items part description/code. With this information available, the question of what to buy and how much to buy is answered but there are situations where modifications are made on the drawing there by leading to increase or decrease in the quantity of a particular item. The problem of not finishing the design before commencing fabrication or making modifications on a drawing during fabrication leads to having insufficient or plenty of materials in inventory at a fabrication site. Having more materials in inventory can be used to meet unexpected demand which is as a result of this change or modification in design but on the other hand, these inventories also have their negative impact by increasing the costs associated with storing of the excess material until they are needed and if these excess materials turns out not to be used, capital is tied up and space is occupied. Overstocking of materials is a waste of capital because it increases the costs of procurement and leads to having idle materials [4].

Much consideration has not been given to inventory management and control in oil and gas fabrication projects and this has led to late delivery of fabricated items and structures due stoppage of production as a result of stock out situations. Also, having excess materials on site after completion of fabrication activities with no intention of using these excess materials in a period of 2 to 3 years can lead to deterioration, theft, damage and obsolesce. Thus there is a need to provide the best inventory management and control practices that will be best suited for the oil and gas fabrication industry.

II. LITERATURE ASSESSMENT

Pearce et al. (2012) [12] in their work on materials management as a gold mine for upstream oil and gas mentioned that the availability of materials plays a vital role in the oil and gas industry as it prevents delays even at the risk of incurring higher cost. According to them, only few companies have spent time to optimize their materials management system and from history, the initial focus has been to make materials available for production without considering the cost factor. They went further to state that the availability of necessary materials at project sites is very crucial since the cost of a missed day of production or delay in the first oil date are significant but there is also room to reduce the cost of project execution without compromising material availability.

Wafula (2016) [17] investigated the inventory management and performance of oil marketing companies in Kenya. In his findings, he noticed there is a positive correlation between inventory management and operational performance of oil marketing firms. He also identified some problems that affect inventory management which include unfavorable policies by the government, lack of proper employee training, inability to predict demand accurately and poor coordination in supply chain. Finally, he mentioned the benefits of inventory management which are enhanced profitability, optimal utilization of resources, cost reduction and effectiveness in sales.

Salunke and Verma (2015) [14] in their work on optimization of inventory level at oilfield services analyzed the inventory data of an oil field service company and they performed ABC analysis on the inventory data collected. The result of the ABC analysis showed that 13% of the inventory item belongs to class A, 28 % belongs to class B and the remaining 59% of the items belongs to class C. Also, with the inventory data they were able to establish the minimum, maximum and target level for reordering of the inventory items by using a Min-Max model and they said that the Min-Max model can help to reduce holding cost, capital cost and cost of obsolescence.

Sayali and Raju (2017) [15] in their study highlighted that the cost of material on the average is about 55 -60% of the total cost of the project. They proceed to say that in practice most organization puts more effort in reducing labor cost rather than putting more efforts to reduce material cost since materials contributes greatly to the total cost of projects. They mentioned that by using inventory management techniques, it will help in getting the materials at the right cost, right quality and at the right time. They used three different inventory management and control techniques which are the ABC analysis, VED analysis and SDE analysis to analyze the inventory data and they found out that ABC analysis is the most economical method because it gave the least financial investment value and with the ABC analysis, the inventory value was reduced by 31%.

Yogesh et al. (2016) [18] in their study stated that ABC analysis is the most common technique used for inventory management. They carried out ABC analysis of the inventory data obtained from a sponge iron plant and found out that 3 items are in class A and they occupy 49.46% of the financial value, 6 items are in class B and they occupy 27.35% of the financial value and 11 items were found to be in class C and they occupy 23.19% of the financial value. Their analysis was able to help the manager of the sponge iron industry to manage the raw materials inventory items effectively and that of the finished goods as well. They concluded by saying that every organization have a need to strike a balance between stock- outs of critical items and minimizing inventory costs and that ABC analysis helps to understand the problems that occur due to purchasing, inventory status and safety stock quantity.

Kiyak et al. (2015) [8] in their work on inventory classification with ABC analysis highlighted that managing a large inventory is a serious problem for most big organizations and one of the methods to overcome this problem is to classify the inventory items based on some criteria and to manage them based on the classification. After carrying out the ABC analysis, 8 of the items were classified as A, 6 of the items as B and the 36 remaining items were classified as C. They concluded by saying that most of the organizations effort must be focused on the Class A items, some of its effort on the Class B items and little of its effort on the Class C items. They also said that using this type of management system will increase the productivity of the organization.

Zairra and Narimah (2017) [19] in their work on factors affecting materials management in construction projects mentioned that construction projects are most times affected by delays, low productivity, cost overrun, compromised quality and construction wastes. They also said that the factor which contributes greatly to poor project performance is the ineffectiveness of materials management at construction sites. They identified 47 factors which affect materials management and these factors were categorized into 8 groups which are (1) site condition; ; (2) contractual; (3) management (4) supplier and manufacturer default; (5) planning and handling on site; (6) materials; (7) transportation and (8) governmental interferences.

Anup et al. (2015) [2] in their study on material management in residential projects mentioned that materials for projects are very important resource and if properly managed and handled, can reduce the cost of the project to a large extent. They used ABC analysis to group the client's free issue items and found out that 4

items belongs to Class A and they occupy about 70% of the annual usage value, 9 items belongs to Class B and they occupy about 25% of the annual usage value and 20 items belongs to Class C and they occupy the remaining 5% of the annual usage value. They further analyzed the Class A items to check for the cost variance and cost performance index.

Lourenço and Castilho (2006) [10] in their work explained that most organizations work with a large variety of products and this makes it difficult to maintain proper inventory control. Therefore to give the same degree of attention to all items in inventory is not a good practice, since each item has its own peculiarity such as cost, rate of demand, delivery and supply alternatives. Thus a type of control suitable for a product may be inappropriate to another and this may cause lack of materials or excess items in stock. To avoid this, materials classification becomes important for proper inventory management. They used ABC analysis to classify the 1938 items in inventory and found out that 35% (67) of the items belonged to Class A which represents about 50% of the cost, 33% (205) of the items belonged to class B which represents about 30% of the cost and the remaining 32% (1666) of the items belonged to class C which represents the remaining 20% of the cost. They further subdivided the class A items to identify which of the items contributes greatly to the cost and they recommended that the ABC curve must be reviewed yearly since the unit cost of purchase and quantities used may change and this will automatically affect the shape of the ABC curve.

Patil and Pataskar (2013) [11] highlighted in their study that efficient materials procurement plays a major role in completing a project successfully. They went further to say that poor planning and control of inventory, lack of material when needed and poor identification of materials can indirectly increase the total cost of a project and that effective management of materials can reduce these costs associated with materials. They used S-Curve for comparison between the cumulative cost of planned materials and that of actual materials. They noticed that the cost was less at the start of the project but as the project progresses the cost of materials increased and the increase was very much. They mentioned various causes of variation in a project which includes administrative causes, contractors rework, delays in material delivery, consultant inefficiency and client reasons.

III. MATERIALS AND METHODS

3.1 Data Collection

Inventory data which is for a specific oil and gas fabrication project was collected from Aveon offshore Limited. Aveon Offshore limited is a fabrication company located in Port Harcourt, Nigeria, and they have executed different fabrication projects since their inception since 1999. The inventory data collected is for Egina SPS project which is one of the biggest and most recent fabrication project handled by the company and the inventory items were client provided. Also, semi-structured interviews with managers and personnel in charge of inventory in the oil and gas fabrication company was conducted. This involved asking questions about the inventory management and control process of the organization in order to get an in-depth knowledge and information for the study.

3.2 Data Analysis

The inventory data for the Egina SPS project collected was analyzed using ABC analysis which is one of the most common inventory management and control techniques. Also, Cost variance analysis of the data was also carried out. MatLab software version 9.0 (2016a) was used for analyzing and processing of the inventory data and graphs were plotted where applicable.

ABC analysis was used to classify the inventory items based on their financial investment value. After the ABC classification of the inventory items has been done; cost variance analysis for the project items was carried out. The cost variance analysis was used to compare the planned cost for each material based on the quantity purchased with the actual cost based on the quantity used. The difference between the planned cost and the actual cost was analyzed and conclusions were drawn.

3.2.1 ABC Analysis

ABC analysis utilizes the financial investment value of each of the items in inventory i.e. the unit cost of each item multiplied by the total quantity. After the annual usage value has been computed for all the items, they were arranged in the descending order of the financial investment value. The items are then grouped into three classes namely Class A, Class B and Class C. The grouping helps to know which items requires the highest attention, the item that requires medium attention and the items that requires the least attention. The Steps used for the ABC analysis is outlined below.

Steps Adopted for ABC Analysis

i. Prepare a list of all the materials purchased for the project.
ii. Input the unit price (P) of each item and the quantity purchased (QS) for each item.

iii. Sum up the total quantity of all the items to obtain the overall quantity (OQ) of items used.
iv. Multiply the quantity of each item by its respective unit price. This gives the Financial Investment Value (FIV) for each of the items.
Financial Investment Value (FIV) = P x QS (3.1)
where,
P = Unit price
QS = Total Supplied Quantity of each item in inventory
v. Sum up all the values obtained for the FIV to obtain the Overall Financial Investment Value (OFIV).
vi. Arrange the materials based on the Financial Investment Values (FIV) in descending order.
vii. Calculate the FIV percentage for each item. This is done by dividing FIV by Overall Financial Investment Value (OFIV) then multiply by 100.
viii. Compute the cumulative FIV percentage.
ix. Calculate the percentage of the quantity for each item in the overall quantity. This is done by dividing the total quantity of each item by the overall quantity of all the items in inventory then multiplied by 100.
x. Compute the cumulative percentage of the quantity.
xi. Assign the values A, B and C based on the Financial Investment Value (FIV) for each item.
xii. Plot the graph of cumulative FIV percentage against cumulative percentage of quantity.

3.2.2 Cost Variance Analysis

In construction project operations, there is often a cost variance associated with the project which can be in terms of materials, equipment, manpower, subcontractor, and overhead cost but since material is the main component when it comes to construction projects, if these materials are not properly managed, it will create a project cost variance (CV) [5].

Variance analysis of cost is carried out by the comparison of actual costs and budgeted cost and when there is sufficient data, the variance may be separated into price variance and quantity variance [1]. For this work, quantity CV of the project items was carried out. Quantity CV is the variance as a result of the difference between the actual quantity used and the budgeted quantity [1].

Steps Adopted for Cost Variance Analysis

i. Prepare a list of all the materials used on the project.
ii. Input the standard prices (P) of each item.
iii. Input the budgeted/supplied quantity (QS) for each item.
iv. Input the actual/used quantity (QA) for each item.
v. Calculate the difference between the budgeted/supplied quantity and actual quantity for each of the item.
vi. Multiply Quantity difference (QD) by the Price to get the quantity cost variance QCV for each item.
Quantity Cost Variance (QCV) = P x (QS – QA) (3.2)
where,
P = Unit Price
QA = Quantity Used
QS = Quantity Supplied
vii. Sum the quantity cost variance (QCV) of all the items to get the total quantity cost variance for the project.

IV. RESULTS AND DISCUSSIONS

4.1 Result for ABC Analysis

From the Egina SPS inventory data collected, there are 1228 items. These items were analyzed and using ABC analysis. MatLab software version 9.0 (2016a) was used for the analysis and this was done by writing a MatLab code. The result obtained revealed that 4.5% (28) items occupies 68.68% of the financial investment value and these 28 items are grouped as class A items. 21.72% (85) items in inventory occupies 17.62% of the financial investment value and these 85 items are grouped as class B items. For the remaining 74.03% (1115) items, they occupy just 13.70% of the financial investment value and they are grouped as class C items. Figure 1 shows the ABC analysis graph obtained and the summary of the ABC analysis result is shown in Table I.

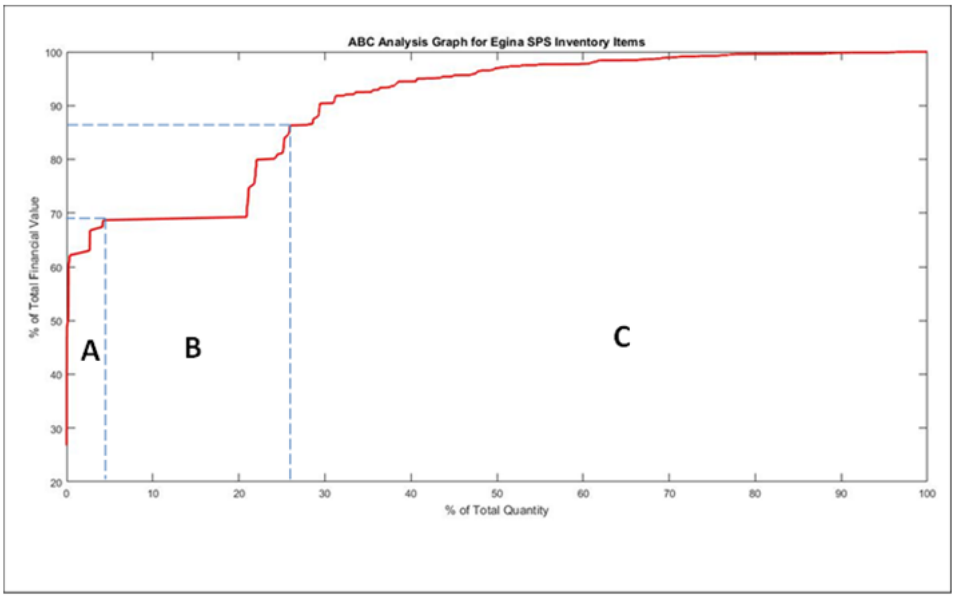

Figure 1: ABC Analysis Graph for Egina SPS Inventory Items

Table I: Result of ABC Analysis for Egina SPS Inventory Items

S/N	CLASS	% FIV(%)	% QUANTITY (%)	NUMBER OF ITEMS
1	A	68.68	4.25	28
2	B	17.62	21.72	85
3	C	13.70	74.03	1115
	Total:	**100**	**100**	**1228**

Table I is the summary of the ABC analysis result obtained. The 28 items grouped under class A are high cost and they require rigid control because of their high cost. For the 1115 items categorized under class C, it means that the items require little attention and since they are numerous they do not require tight control and monitoring. Also, for items under class C since they do not cost much surplus of these items can be allowed. Finally, for the intermediate class B items, 85 items fell into this class and these items require strict monitoring and tight control but not as much as Class A items. Figure 2 and Figure 3 shows the percentage FIV of Class A, B and C items and the percentage Quantity of Class A, B and C Items respectively.

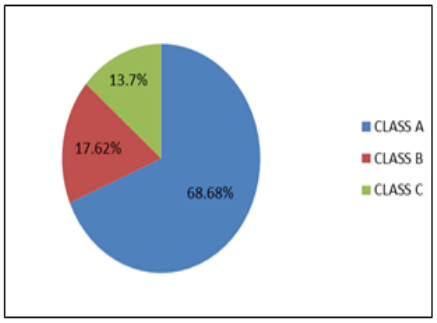

Figure 2: Percentage FIV of Class A, B and C Items

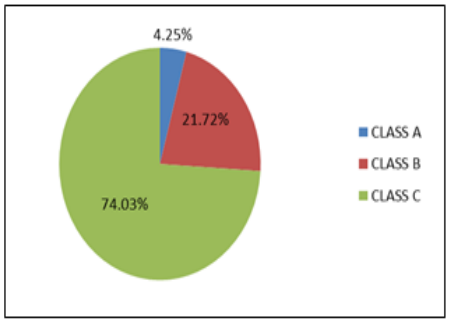

Figure 3: Percentage Quantity of Class A, B and C Items

4.2 Result Quantity Cost Variance Analysis

From the result of the ABC analysis of the inventory data carried out, 28 of the items fell into Class A and since these class A items are seen to be high cost items, there should be no quantity cost variance for this class because it is expected that the exact quantity needed is what should have been purchased and keeping of safety stock is also not allowed due to the high cost of the items. Also, 85 items fell into Class B and since this class is an intermediate class some items may tend to evolve towards class A or on the contrary towards class C so it is important that when purchasing these items, the right quantity is purchased but little safety stock can be allowed if the cost impact is minimal. For the Class C items, it is known that the items in this class are low cost items therefore having quantity cost variance will have little or no impact on the cost, so items under class C can be ordered in larger quantities and have higher safety stocks (Dhal, 2016) [6].

The quantity cost variance analysis (QCVA) of the inventory data was also done using MatLab software. The result shows that 425 out of 1228 items have quantity cost variance of which Class A items and class B items are included. It was found that 10 items in class A have QCV of ₦2,149,250,104, 16 items in class B have QCV of ₦1,062,634,173 and 399 items in Class C have QCV of ₦1,247,283,807. Table II shows the summary of the cost variance analysis.

Table II: Result of QCV Analysis for Egina SPS Inventory Items

S/N	Class	Number of Items	Quantity Cost Variance (₦)
1	A	10	2,149,250,104
2	B	16	1,062,634,173
3	C	399	1,247,283,807
	Total:	**425**	**4,459,168,084**

Table II shows that 10 items out of the 28 items in class A have quantity cost variance, 16 items out of the 85 items in class B have quantity cost variance and 399 items out of the 1115 items in class C have quantity cost variance. Also, due to the high cost of Class A items, its QCV is the highest as shown in Figure 4 which is ₦2,149,250,104, Class B has a QCV of ₦1,062,634,173 and Class C has a QCV of ₦1,247,283,807.This means that ABC analysis was not carried out on the Egina SPS project items before purchasing. If ABC analysis was carried out, QCV will only be seen for the class C items and little amount for Class B items.

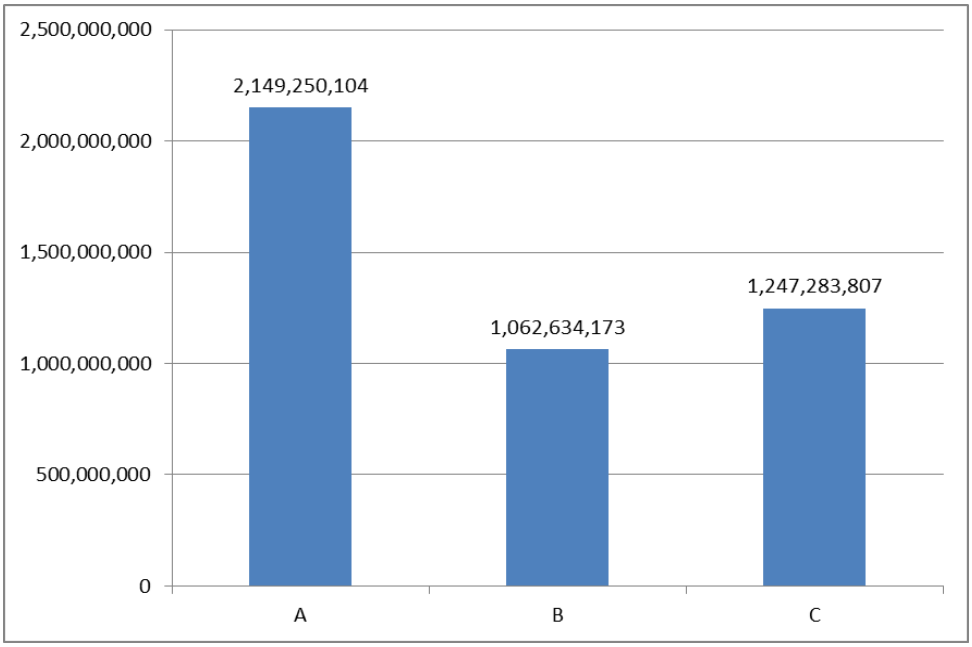

Figure 4: Quantity Cost Variance for Class A, B and C Items

4. 3 Problems Affecting the Effective Management and Control of Inventory in Oil and Gas Fabrication Projects

From the interviews conducted with the Engineering Manager, Purchasing Manager, QC Material Inspector, Construction Manager, Fabrication Superintendent, Material Controller and the Inventory Controller, it was gathered that there are certain problems that affects the effective management and control of inventory of

in oil and gas fabrication project. These problems lead to having excess inventory, shortage of materials, delays in fabrication and increased inventory holding costs and they are:

i. Incomplete design before commencement of fabrication: the problem of not completing the design before commencing fabrication is a great one because it brings about assumptions as to the quantity of materials that will be needed for fabrication. Since most materials for fabrication have a lead time of about 3 months and to prevent fabrication activities from being delayed, the quantity of materials needed is assumed and this may be in excess of what will be needed after completion of design.

ii. Error/Changes in drawings: Sometimes there are errors in drawings and most times materials would have been purchased based on the drawing. Any changes made to the design would lead to either an increase or decrease in the quantity of materials needed and either case has an adverse effect.

iii. Change in scope of work: when the scope of work is changed it affects effective inventory management and control of oil and gas fabrication projects. This is so because; a change in the scope of work may result in having surplus materials in inventory and also having to buy more materials where necessary. It is worthy of note that most fabrication materials are being purchased before fabrication commences because of the lead time and also because all the materials are important.

iv. Inadequate material specification: Also, not providing sufficient information about an item may lead to purchasing the wrong material. In a situation where the material has been purchased and it was later found to be the wrong one based on the fact that the material specification was incomplete, the correct material will need to be purchased if it is not available on site and this may cause stoppage of fabrication activity.

v. Issuing of materials without stores requisition: this is another important issue because issuing materials without store requisition due to urgent need of such an item can lead to lack of traceability of such item and eventual denial by the person whom the material was given to since there is no official document to show such item was given out. Also, giving items without requisition can lead to having false information about the items in inventory as those item released may not be captured as issued.

vi. Wrong information on inventory record: this arises when the inventory record shows an item is available but such an item is no longer in stock and vice versa. It occurs when an item has been issued but it was not inputted in the record that such item has been issued and this will give false information about the actual quantity available. This may lead to stoppage of work or having to buy such an item at a higher price based on its urgency.

vii. Mistakes during fabrication: Mistakes made during fabrication also affects effective management and control of inventory because it mostly leads to need for material than the actual required quantity. When a mistake is made during fabrication either a rework or a replacement of such part is done (where rework is not possible). This leads to increased scrap and increased investment in materials.

viii. Changes in type of material/specification: when there is a change in the type of material or specification, it leads to having excess materials on site and this is because the materials earlier purchased will no longer be used and a new material will have to be purchased. This change can lead to increase in capital invested in materials, space that can be used for other purposes occupied due to unused materials.

ix. Misplacement of material: There have been instances where materials issued for fabrication gets missing and this as a result of mishandling the materials and negligence on the part of the fabrication team. Materials also gets missing when in a bid to cover up a mistake made, a worker walks up to where materials (mostly structural materials) are stacked and picks up the item he needs instead of such a person to report what happened and the normal process of issuing a new material will be followed. This act also affects the inventory record since an item has been taken without a stores requisition. Also, when offcuts are not being returned to the materials department they may be used for other purposes and when an item is nested on such an offcut material it will not be found. The item will have to be re-nested on another material available.

x. Lack of codification of materials for items supplied by clients: For clients provides items, when the client do not have a codification for their supplied items, it makes inventory management and control difficult as there may be items with same description but different grade. This may pose difficulty for the fabricator's materials department to differentiate which item is which. When the clients codify their items before bringing it to the fabricator's yard, it will be easy to differentiate/segregate the inventory items.

xi. Mixing up of items with the same part description: there are instances where materials with same part description are mixed up. The reason for the mix-up is because the items have the same part description. Most times, the grades of the materials are different but due to the ignorance on the part of the workers in the materials department, they assume the items are the same. This happens mostly when the client does not have a codification for the items supplied. Also mixing up of items happens when traceability of the items is lost and this makes the store workers to assume which item suits the description of the one being requested.

xii. Different information on Client's inventory list: There are also instances where the client's inventory list shows that the quantity of an item supplied is greater/smaller than that stated in the fabricators list. This is as a

result of the clients material controller relying on the information about quantity expected and not the actual quantity received on site as per the approved MRR. Also, sometimes when an item arrives, Clients issue directly to production without going through the normal process of the materials department receiving it.

4.4 Measures to Achieving Effective Management and Control of Inventory in Oil and Gas Fabrication Projects

Since the problems affecting the effective management and control of inventory in oil and fabrication projects has been identified and evaluated, the following measures can be used as a tool to correct and eliminate the problems.

i. Codification of materials by both Client and Fabricator should be practiced. When there is proper codification of materials by both the client and the fabricator, it will be easy to trace and differentiate the items in inventory. The client can trace the items with their own code (part number) while the fabricator will be able to differentiate which items are the same in terms of size and grade based on the code provided by the client and they will also be able to trace the items based on their own code, provided the client's code is lost.

ii. Materials must only be issued by the presentation of stores requisition. In situations where the material is needed urgently, an official notification (mail) must be sent to the stores and engineering department so that on receipt of the mail, the engineering department will prepare a stores requisition for the item(s) specified in the mail, while the stores department issues the material. This helps to ensure production is not delayed and issue record is kept.

iii. Engineering design must be completed (if possible) before the materials are being purchased. But in situations where the engineering design is not completed, the materials for the extent of design completed can be purchased. But before purchasing, when the prices for these items are gotten, ABC analysis can be performed on the item. This will guide in knowing which of the items will not impact negatively on cost when buying surplus.

iv. As soon as an item is issued, the inventory list must be updated. By doing this, the inventory controller will know exactly the status of the items in inventory and the issue of wrong information on the inventory record will be eliminated. Also, counting of the inventory items should be done periodically as it will help to compare what is in the inventory list with the actual quantity in stock and any variation which may affect production activity negatively can be addressed immediately.

v. Material reconciliation should be done either monthly or quarterly depending on the duration of the project. When this is done, everyone will know the status of the items received and those that are yet to be received and other necessary decisions need to be taken shall be made in the process.

vi. Regarding materials supplied by clients, the quantity of materials their system has a quantity to be received may not be the actual quantity received on site therefore, in such cases since there is a material receiving report (MRR) signed by all parties including the client, they should use this MRR to update their record so that the issue of variation between the client's record and fabricator's record can be curbed. Also, Client's must ensure that all items supplied goes to the material department before it is being given out for fabrication.

vii. As much as possible the scope of work must not be reduced, rather it should be increased there by surplus materials available can be used to complete the new scope.

viii. Training of personnel in the material department is another way to achieving effective inventory management and control. When personnel are trained, it helps them to be abreast of the evolving trends in managing inventory and also they implement what they have learnt while carrying out their work.

V. CONCLUSION

This study has shown the importance of inventory management and control of oil and gas fabrication projects starting from the design stage to the fabrication stage. It has also shown that when effective and efficient inventory management process is in place; material for projects are properly planned, controlled and utilized and this leads to cost reduction, enhanced productivity and helps to deliver the project according to schedule.

Inventory management and control of fabrication projects is very essential as it can reduce the cost of a project to a large extent especially when inventory management and control techniques such as the ABC analysis is used to categorize the fabrication materials before procuring them. Also, this study has shown that special attention needs to be given to the high cost items which are the Class A materials.

The greatest problem affecting the effective management and control of inventory in oil and gas fabrication projects is attributed to not completing/ agreeing on the final design before materials are being procured since it leads to procuring materials based on uncertainty. Also, material codification is necessary for client supplied items as it helps in proper identification, monitoring and control of the items in inventory.

For the Egina SPS fabrication project, if an inventory management and control technique like the ABC analysis was used to classify the items before procurement was made, a sum of ₦3,211,884,277 could have been saved

which is about 17.85% of the total financial investment value of the inventory items.

REFERENCES

[1]. Accountingverse. (2018). Cost variance analysis. Retrieved from https://www.accountingverse.com/managerial-accounting/responsibility-accounting/cost-variance-analysis.html

[2]. Anup, W., Deepak, M., Shivaram, N., Nataraj, M., & Yaseen, K. (2015). An empirical case study of material management in residential project. International Research Journal of Engineering and Technology, 2(1), 1 – 4.

[3]. Bijal, P., & Hemant, T. (2016). A review on inventory management control techniques: ABC-XYZ analysis. REST Journal on Emerging trends in Modelling and Manufacturing, 2(3) 82-86.

[4]. Chen, C., Tsai, L., Chin, J., & Lu, Y. (2011). Application of regression trees in inventory predictions for emergency rooms. Journal of Health Management, 9(2), 218-235.

[5]. Deepak, M. (2015). An empirical case study of material management in residential project. Manipal University, Karnataka, India, Department of Civil Engineering.

[6]. Dhal, S. (2016). *What is ABC analysis & its importance in inventory management*. Retrieved From https://www.linkedin.com/pulse/what-abc-analysis-its-importance-inventory-management-dhal

[7]. Info Entrepreneurs (2009). Stock Control and Inventory. Retrieved from http://www.infoentrepreneurs.org/en/guides/stock-control-and-inventory/

[8]. Kiyak, E., Timuş, O., & Karayel, M. (2015). Inventory classification with ABC analysis. Journal of Naval Science and Engineering. 11(2), 11-24.

[9]. Lilly, M., Ogaji, S., & Probert, S. (2015). Manufacturing: Engineering, management and marketing. South Africa: Partridge

[10]. Lourenço, K., & Castilho, V. (2006). ABC supplies classification: A management tool of costs in nursing. Brazilian Journal of Nursing, 59 (1), 52-55.

[11]. Patil, R., & Pataskar, V. (2013). Analyzing material management techniques on construction project. International Journal of Engineering and Innovative Technology. 3(4), 96-100.

[12]. Pearce, J., Richard, D., Etheredge, K., Livitsanis, C., Easton, E., Brande, A., … Re, G. (2012). Materials management: A gold mine for upstream oil and gas. Korea: A. T Kearney Inc.

[13]. Prachi, J. (2018). Inventory Management. Retrieved from https://www.managementstudyguide.com/inventory-management-concepts.htm

[14]. Salunke, H., & Verma, P. (2015). Optimization of inventory level at oilfield services: Case study. International Journal of Scientific & Engineering Research. 6(4), 308-313.

[15]. Sayali, S. & Raju, N. (2017). Use of various techniques of material management for construction of industrial building. International Journal of Innovative Research in Science, Engineering and Technology. 6(2), 2550 – 2555.

[16]. Singh, J., & Singh, R. (2014). Inventory management delivering profits through stock management. International Journal of Research and Applications, 1(10), 751-757.

[17]. Wafula, A. (2016). Inventory management and operational performance in the oil marketing companies in Kenya. University of Nairobi, Kenya, School of Business.

[18]. Yogesh, K., Ashok, L., Amit, S., Bhushan, L., & Yushwant K. (2016). ABC analysis for inventory management-case study of sponge iron plant. International Journal for Research in Applied Science & Engineering Technology. 4(III), 32-36.

[19]. Zairra, M. & Narimah, K. (2017). Influential factors affecting materials management in construction projects. Management and Production Engineering Review. 8(4), 82 – 90.

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