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INVENTORY FORECAST AND ORDERING PROCESS IMPROVEMENT IN A SUPPLY CHAIN. CASE STUDY: KISTAL EQUIPMENT SUPPLIES LIMITED, NIGERIA.

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ABSTRACT

With the increasing level of focus and attention shifted to inventory in the supply chain industry recently, and together with the pressure to reduce the level of stock-out for products demanded by customers, thereby improving the supply chain of manufacturing equipments and spares in a sustainable manner, the theme about improving customers and consumers satisfaction in the first moment of truth is garnering unprecedented attention. The result is the subsequent increasing interest in researching the issue, with the aim of providing sustainable solutions. The study of inventory forecasting and the improvement of ordering processes in supply chain is therefore of great importance to supply chain organisations and industries seeking to increase the effectiveness and productivity level of their operations while reducing/eradicating all cost related losses.

By improving the ordering processes to as close as 100% waiting time eradication, huge cost savings is realisable in the form of shorter delivery lead-time within the supply chain operations, thereby improving supply chain productivity and effectiveness through out-of-stock reduction and obsolete inventory reduction and eradication.

The case study is the supplies of equipments and spares by kistal equipment supplies limited to its customers in the manufacturing operations in Nigeria.

Keywords: Supply chain Management, out of stock, ordering process, inventory management, forecasting methods, inventory management, supply chain and order management systems.

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LIST OF ABBREVIATIONS

ABC – Activity-based costing

CPA – Customer profitability analysis

CRM – Customer relationship management

EDI – Electronic data interchange

EOQ – Economic order quantity

EWMA – Exponential weighted minimum average

MA – Moving average

OMS – Order management system

OOS – Out of Stock

RFID – Radio frequency identification

RFQ – Request for quotation

SC – Supply chain

SCM – Supply chain management

1. INTRODUCTION

Inventory and its management has become a very crucial factor demanding for utmost attention in the supply chain organisations and industries. Focus and attention is being moved to inventory because of its significant financial implications in the Industry. Previous research work has described the control of inventory as a quantitative control technique with strong financial implications. Iwu, Ogbonna, Jude and Onuma (2014) described Inventory control as the single most essential control technique, having direct relationships with production, purchasing, marketing and financial policies. In this regard, there is need to focus on inventory management to ensure sustainability in supply chain.

1.1. Background

Kistal Equipment Supplies Limited is a supply chain organisation established since April 1998. The organisation is a known accredited distributor of SKF, Esbelt SA, and Lincoln Lubrication SA. The company deals with the sales and supplies of different types of bearings, seals for different applications, SKF power transmission products (V-belts, timing belts sprockets, flexible couplings, pulleys and chains), SKF special purpose lubricants for low, medium, high and extremely high temperature applications, SKF special purpose tools for mounting/dismounting bearings, pullers, induction heaters and other preventtive and predictive equipments. They also render on-site trainings for organisations and as well organised training at the SKF facility in Lagos state Nigeria. Their services also include the sales and distribution of Esbelt conveyor belts and other Esbelt related products.

Kistal Equipment supplies Limited having operated in a diverse and widespread market as a supply chain organisation for over 15 years, and rendering sales and services to fast moving consumable goods (FMCGs), such as Procter and Gamble Nigeria (P&G), West African Portland cement company (LAFARGE), UNILEVER, organisations in the Oil and Gas, Food, Printing to Mining, constructions and quarries in Nigeria. The need for a stable, continuous effective and efficient supply chain process has become imperative, hence the call for a keen look at the inventory process of the establishment.

Kistal equipment supplies Limited aimed at achieving an integrated value-added supply chain through effectively collaborating with their suppliers upstream and their customers downstream, therefore birthed this research.

1.2. Problem Definition

Without adequate attention on what, how, where and when items are stocked in a supply chain, there is bound to be difficulty in satisfying customers thereby leaving the supply chain an incomplete process. This could result to a significant loss of customers to competitors in the industry. The issue of dis-satisfied customers as a result of missing items on the shelf could cost an organisation a fortune in terms of reputation and trust which in turn could result in loss of sales. Moreover having slow moving items constituting the larger part of the inventory could further result in a high cost for the organisation, in-terms of cost of managing the inventory and the organisation capital used to procure the slow moving items. This research is to investigate the causes and the effects of out of stock, and all its inter-related factors, thereby proposing improvements. It explicitly focuses on the areas of inventory and its

forecasting process, why an effective inventory forecasting should exist and how to achieve a suitable model for the case company. It further proffers sustainable counteractions that resolve these problems in form of improving the ordering process of the case company.

1.3. Purpose Statement

The purpose of this research is:

- To understand the processes involved in items ordering,
- To understand what forecasting is and the processes involved,
- To be able to accurately predict what to stock and when to stock at every point in time,
- To examine and analyse the various factors that affect ordering processes and present useful tools and techniques that can be employed in order to improve it,
- To investigate loss areas and know what forecasting and ordering process improvement is and their importance,
- To improve the inventory forecasting processes and reduce its related losses,
- To improve the ordering process and reduce its related losses and
- Deploy improvement for reapplication.

These entire study at Kistal equipment and supplies limited, Nigeria is aiming at contributing to the body of knowledge by thoroughly studying this case using methods and techniques that will equally make this case applicable to other related operations.

1.4. Research Questions

This research has focused on the two below major problems, and they will be guided by the sub-questions listed below it.

This research work intends to provide solutions to the below problems:

A. How can Inventory forecasting model reduce the OOS level at Kistal and to what level of reduction will Kistal equipment and supplies experience?
B. What impacts will the ordering process improvement at Kistal make in supply chain productivity?

These above research problems will be guided with the below listed sub-questions:

i. What is OOS and what level is it in the case company?
ii. How can OOS impact operational productivity and efficiency of the case company?
iii. How can the OOS be managed?
iv. What linkage exists between inventory forecasting and order process in kistal?
v. How can the order process be improved and to meet up with the best in class?
vi. What are the impacts of the order process improvement and how can the impacts be quantified?

These research questions are well suited for this study in order to achieve my study goals and that of the case organisation through a careful understanding

of the present situation in Kistal equipments supplies Limited and the provision of suitable solutions in the course of Improving their processes.

1.5. Focus and Limitation

The focus of this research work is to carefully understudy the ordering process at Kistal equipment supplies limited with the intention of understanding the major causes of the out of stock, and with the aim of proferring solution that will reduce the OOS level. The long-term hope is that the systems to be designed will totally eradicate the OOS related problems at the case company. Lasting solutions to improving the ordering processes shall be discussed and simulated.

The major limitation on this research work is the financing of the research work. Also, lack of basic facilities such as regular Internet access in Nigeria is seen as another limitation to this work. Despite these facts, the thesis was conducted and it was a successful research experience.

1.6. Thesis Structure

This research work is structured as shown in figure 1 below. The major problem is stated in the topmost orange rectangular box, with the spherical shaped showing sub-problems and the dashed orange boxes showed relationships. The black boxes has shown how to solve the problems and the results were in the blue.

The report is structured such that chapter one consists of the introduction, where the origin of this research, the problem statement and research questions were discussed. It is followed by the literature review, where a more detailed

explanation of the research from previous and existing research materials was done. Detailed definitions of terms were made for improved understanding. Chapter three discusses the research methodology. Chapter four discusses the research results while chapter five summarises the research results with conclusions and suitable recommendations. Figure 1 below is a structured sketch showing the flow of the research work.

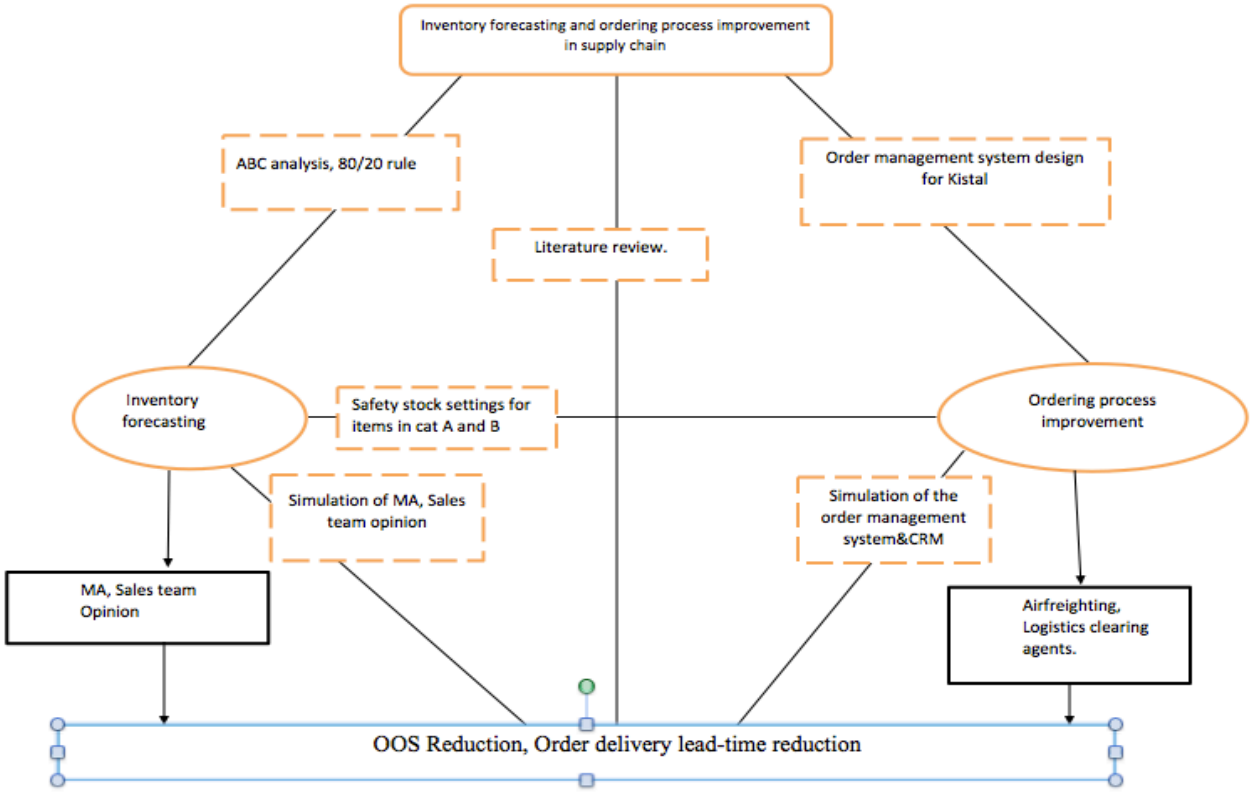

Figure 1. Thesis structure

The structure presented the major problem, with Inventory forecasting and ordering process improvement being the sub problems. ABC analysis, and the 80/20 rule explains inventory forecasting with respect to the research problem. Minimum average calculation and the sales team opinion explains how the inventory forecasting problem will be solved, with the safety stock settings and

the simulation of the safety stocks being the pointer to the reduction in the out of stock. Ordering process improvement is another sub-problem, with order management system design for the case company relating the ordering process improvement with the research problem. Customer relationship management and simulation of the order management system leads to the order delivery lead-time reduction result through the airfreighting and logistics clearing agents to be assigned by the case company.

2. LITERATURE REVIEW

2.1. Supply Chain Management

Supply chain and supply chain management are two different terms that can be mis-used for each other if not carefully understood. Severally, supply chain must have been wrongly put in place for supply chain management at one time or the other. For the purpose of clarification and to reduce the rate at which the two words are being swapped for one another, supply chain and supply chain management will be carefully and separately defined in this report.

Supply Chain is defined as ‘‘a system of organizations, people, activities, information, and resources involved in the planning, moving, or storage of a product or service from supplier to customer.’’ (Myerson 2015: 4.) Supply Chain is a connection of entities with the flow of materials, which may encompass suppliers, manufacturing sites, distribution centers, retailers and consumers. This is a phenomenon that converts materials and its constituents into an approved product for the purpose of satisfying the end users and their needs. It is an entire process that involves getting product from its production till it gets to the point of use.

Supply chain can be typically illustrated in the production of toilet paper, which is a finished product in the paper goods industry. The toilet paper production extends from stump to rump. The raw material is the stump, and it goes through all the supply chain processes as illustrated in figure 2 below and the end stage is the rump which is the left over after being used by the consumers. Products of supply chain are not limited to production alone, it extends to services distribution as well.

On the other hand, According to Myerson (2015: 4), Supply Chain Management ''encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management. It also includes the crucial components of coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers and customers.''

Its design are of smooth and continuous value added processes across organisation boundaries to meet the actual need of the end user.

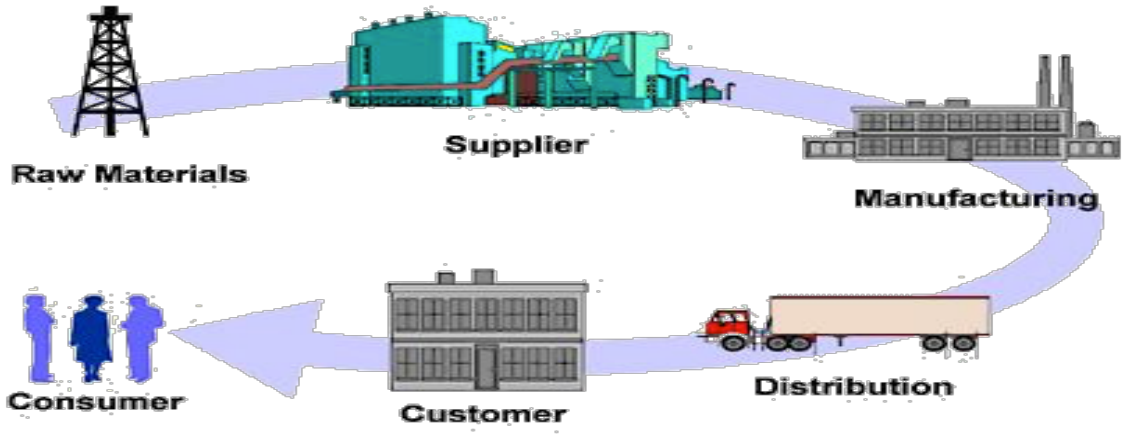

Figure 2. A simple supply chain illustration. (Global economy case study)

The figure above illustrates the stages that occur in a supply chain. Starting from the raw materials to the suppliers that supply it to the manufacturers. The manufacturers are expected to process the raw materials to products of different kinds based on the brands and specialisation for which the manufacturers are known. Once the raw materials are processed to the finished

state, the distribution is the next stage. The distribution stage encompasses the storage and the supply of the products to the retailers and customers.

In some cases, the customers are the same as the final consumers while in some situations they differ.

Robert Handfield, a professor of supply chain management, in his supply chain resource cooperative article library based SCM on two core ideas. He stated that practically every product reaching out to the end user is a representation of multiple organisations collective effort. He gave the multiple organisations a collective name called supply chain. Moreover, his second idea was that, while supply chains have existed for long, most of the organisations involved only focused on what happened within their jurisdiction, they have understood few businesses and the activities delivering the products to the final customers have not been properly managed. This has often resulted in an ineffective supply chain. On this basis, Handfield in his blog defined supply chain management as an ‘‘active management of supply chain activities for the purpose of maximising customer value and achieving a sustainable competitive advantage.’’

2.2. Overview of Inventory Management

Inventory or Stock as defined by the business dictionary is an itemised catalog or list of tangible goods or properties, or the intangible attributes or qualities. It is seen as the value of materials and goods held by an organisation to support production, sales or customer services or other support activities. In production, inventory can be in the form of raw materials, sub-assemblies or work-in-

progress while it can be in the form of merchandise, spare parts, finished products or rather as consumables, maintenance or repair items for sales and other support activities respectively.

In an organisation, Inventory needs to be controlled, and this is because it is strongly attached to the organisation financially. It also has a direct link with production, purchasing and even marketing. On this basis, controlling stock is essential for protection against stock-out which is same as out of stock (OOS) and as also for the purpose of the economy which in turn refers to the total annual inventory cost, which should always be minimised.

An organisation starts to experience either overstocking or understocking of items if inventories cannot be properly controlled. When items are understocked, there are missed deliveries, sales loss and the inability to properly serve the customers right. This leaves the customers dissatisfied and hence, supply chain motives jeopardised.

When inventory is overstocked on the other hand, capital that could be useful in some other arms of the organisation get tied down unnecessarily, and the cost of maintaining the inventory could be alarming.

Therefore, Inventory management can be seen as the processes involved in the actualisation of keeping an effective and efficient stock at the lowest possible cost at all times. It can be referred to as ''a financial trade-off between inventory costs and stock-out costs.''(Vermorel, 2012). It was further explained thus, the higher the stock goes, the higher the working capital and the higher the depreciation value recorded with relation to the stock.

On this basis, there is need for an effective inventory-forecasting model. This will assist the organisation in setting the right inventory to be kept at every

point in time without the fear of holding the organisation's capital down or the fear of not meeting up with customers demand at all times.

2.3. Information Systems in Supply Chain and Inventory determination

Information system in supply chain could be simply put as the system involved in disseminating information within the supply chain for the purpose of an active and effective supply chain and its activities.

Information flow in supply chain permits the partners involved in supply chain to actively regulate and control their day-to-day activities relating to the movement of goods and services up and down the chain, harmonising their long-term plans towards a sustainable supply chain.

An effective information system within the supply chain organisation serves as a guide to inventory managers and supply analysts in the determination of stocks to be kept for items at a particular point in time. The essence of an effective information system is to minimise the risk of stock out when demand for such items could be very high.

2.4. Forecasting

Forecasting refers to the process of estimating the need for the near future. The ability to predict what will be used-up in an anticipated period of time. Inventory forecasting therefore refers to the process of estimating the quantity of stocks to be kept for the purpose of meeting with customers' demand within

a particular period of time. The ability to predict accurately what to be stocked over an estimated period of time could be an antidote to items running out at any particular point in time. A halt in the supply chain is usually the result, when the inventory forecasting process is not effective.

Inventory forecasting can be done using several methods. The use of excel sheets is enough to meeting the basic needs of forecasting, but for the sake of growth and a bit more of accuracy in supply chain management, forecasting should be done with focus on strategy. The Pareto principle and the ABC analysis are key principles to always consider in forecasting. These principles will be useful in identifying the fast moving inventory items from the slow movers.

Previous research has shown forecasting as coming to limelight about two decades back, and it has since been a very crucial step in every organisations' planning and scheduling process for goods and services. Forecasting the inventory simply indicates what to keep as inventory, where to keep and when to keep the inventory. It is also an indicator to what to buy in-terms of replenishment. The concept of forecasting is aimed at consolidating and combining processes such that the difference between the actual and the target is reduced.

It is a known fact that forecasting cannot be totally error-free, and a good way to it, is by making an inventory forecast on the basis of what was demanded by the customers rather than relying on what was sold previously. This is because, it is very possible for a customer to demand for about ten pieces of an item, but the availability at that point in time was two, hence two pcs was sold out. If there is a record of what customers has demanded for within a particular period, it is on a better note to use such demand record to forecast for the

inventory rather than the sales record. Also, a forecast to cover for a shorter period of time is better compared to forecasting for a long-term. A lot of things could have happened that might affect situations when forecast is on a long-term.

For an improved inventory forecasting, the ABC analysis and the Pareto principle will be useful to position the items in the right order as mentioned above.

2.4.1. ABC analysis

Several organisations monitor their inventory generally, whereas a careful look at the activities per item could have brought about a better performance in the course of planning the inventory.

ABC analysis as an inventory method, allows an organisation to categorise its inventory into three different groups named A, B and C on the basis of importance and priority. These bases are to be defined with focus on the demand level and how often they are being sold.

A-group are the most important items. The demand is high and days on hand for items in this category are very short. Items in this group constitute about 10-20% of the organisation's inventory but its consumption makes about 70-80% of the entire sales of the organisation. Items belonging to this group should always be available since it generates the larger share of the revenue for the organisation. In a case where OOS is rampant for items in this category, the organisation experiences reduction in sales, likelihood to loose much of their customers, hence a reduction in performance and growth of the organisation.

The B-group items are the medium rated items. The rate of consuming items in this category is on the average. They constitute about 30% of the inventory, and the rate of consumption is about 15-25% of the entire sales.

The C-group of items are the slow-movers, whereas they constitute a larger part of the inventory. The items in the C-group constitute about 50% of the inventory and consumption rate is about 5%.

In view of the above explanation, the ABC analysis should guide inventory managers on where to keep focus. There is no point keeping 50% of items that doesn't move regularly while the organisation is recording number of misses on the fast moving items because of their inavailability. The capital involved is to be considered and the fact that it is not moving demands for a deeper consideration. Once the inventory is properly classified as A, B and C respectively, inventory managers can increase the stock level of group A and sometimes B, and as well keep a close look at the replenishment process for these groups.

2.4.2. Pareto Principle

Pareto principle and ABC analysis work on the same principle. Pareto principle is also being referred to as the 80:20 rule. The principle as explained by Kalid Azad in his blog, where he generally explained that 20% of the input could create 80% of the result. In this context, it means that 20% of the items stocked makes about 80% of the organisation's income. For this reason, better focus can be put on those items such that the availability of these items will be improved to match up with its need timely. Kalid Azad further explained that Pareto principle has observed that most things in life are not distributed evenly. He further clarified that it is not necessary that the numbers 20 and 80 must add up to 100 at all times.

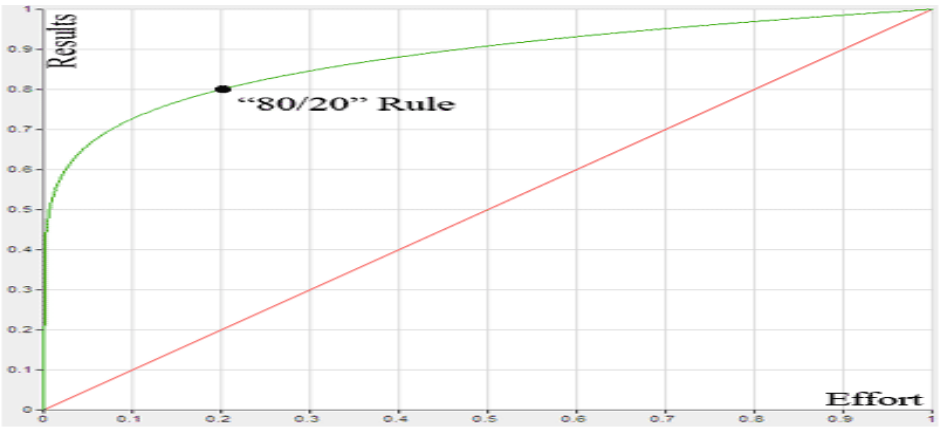

Figure 3. Graphical illustration of the Pareto principle (Understanding the Pareto principle [the 80/20 rule])

2.5. Inventory Forecasting Process

Inventory forecasting refers to the process of estimating the quantity of stocks to be kept for the purpose of meeting with customers' demand within a particular period of time. It is worth noting that forecasting for the inventory is for the essence of meeting up with the demand by customers for items/products as the need arises. In this vein, Inventory forecasting can be referred to as demand forecasting in some context, although it can be seen as more of a preparation for the demand, but an important thing to note is that inventory should be kept at the minimum cost possible and still ensuring that stock out is minimized if not totally eradicated. In the light of this, stakeholders in a supply chain organisation should understand thus, the need for an organisation to stock items for an X period of time is to be able to have what to offer his/her customers at a Y period of time based on the customers' request. This means that a customer make a demand for a product, a supplier makes the product requested for available for the customer as soon as possible. Therefore, I will be

concluding that steps involved in a demand forecasting process, should be applicable for an inventory forecasting process.

An effective and efficient inventory forecasting process needs the below steps to actualise the intent of the process. The steps involved are illustrated in the below figure.

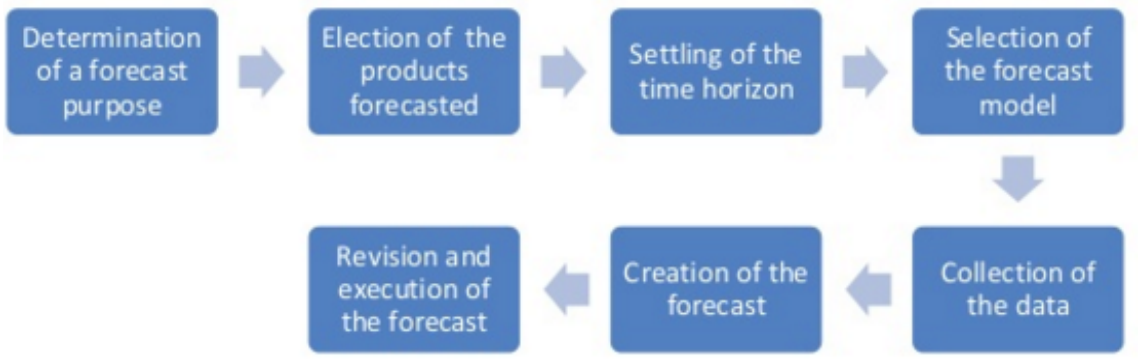

Figure 4. Steps involved in a forecasting process. (LinkedIn slide share)

The need for the forecast should be established. This should be done such that there is a clear reason to forecast, and those involved should know this before the process can be started. This follows by identifying and specifically chosen the items to be forecasted. It should be known to all wheather there is forecasting for the entire inventory or just for selected items in the inventory.

Also, the time frame for forecasting needs to be ascertained. Is the forecasting going to be for a short-term perhaps 1-12 months time frame, medium-termed or long-termed forecasting? These time frames must be determined before going into the process. After the time frame has been determined, the forecast model and methods must be chosen. Here, the choice can be made either on the

existence of a previous history of data/stable situation as regards the products to be forecasted or the situation is a bit obscure. An obscure situation exists when there is little or no past information about a particular item and there must be a forecast for such products. In this vein, if the item to be forecasted has an existing historical data, the quantitative model can be chosen, else the qualitative method. It is pertinent to note that having chosen one forecasting method does not stop the usage of the other method.

Once the model and method(s) have been chosen, the necessary data that will be useful for the actualisation of the forecast needs to be assembled. Data to be gathered could be the point of sales data (POS data) or demand compared to sales in a set period of time. The gathered data must be carefully checked ascertained, after which it becomes a useful data to work on. At this point, all the needed steps have been taken, and the next to do is triggering the forecast itself. After the forecast has been generated, it is an excellent practice if the generated forecast is been tested for errors, the results revised and as well compared with previous historical data. This affords the stakeholders the opportunity to certify the forecast or as well try other models that could also be suitable for the same intended purpose.

2.5.1. Inventory Management at Case Company

Kistal equipment supplies limited came into existence in April 1998, and ever since has been doing their best to satisfying the need of their customer at every point in time.

Inventory management at Kistal has not experienced a defined management process. There are some items that are ordered based on request, while some are being procured to stock. The procurement based on request has resulted in

customers' dis-satisfaction on series of occasion as a result of urgent need for some of these spare parts. Machines and equipments at the end of the case company's customers sometimes demand for unforeseen maintenance, which when not done, will make the machines to malfuction or not to work at all. In such cases, customers cannot wait for the delivery lead times given by Kistal equipments and will need to look else where for such supplies.

Moreover, recently at Kistal, an obsolete inventory of about 12-15 million naira, which is an equivalent of about 65, 000 U.S. dollars according to the exchange rate on xe.com as at the 17th day of April 2015, was scrapped out of the inventory. This huge loss was simply as a result of items stocked, but customers were no more demanding for them, and they have spent about 2.5 years in the inventory.

To avoid the re-occurrence of customers' dis-satisfaction as a result of out of stock and huge accumulation of obsolete inventory that will eventually be scrapped, Kistal equipments supplies limited gave the allowance of this research work, thereby the emanation of this thesis report.

2.6. Forecasting Models and methods

Inventory forecasting methods are based on two major criteria. The criteria being either an existing historical data for items/products to experience forecasting or an obscure situation exists. An obscure situation mostly occurs when there is a new product or technology to be forecasted. In situations when there is an historical data to study, the method is said to be QUANTITATIVE and when there are no existing data to observe, but rather forecasting on the basis of human premonitions and emotions, the method is QUALITATIVE.

Quantitative methods can be categorised into either time series model or associative model, while the qualitative methods can be divided into Opinion polling/knowledge of products, jury of executive opinion, Delphi method and market surveys/sales team opinion.

Nevertheless, '' the selection of the most suitable forecast model does not need to be based solely on either quantitative or qualitative; a combination of models from both approaches is often the most effective one''. (LinkedIn SlideShare).

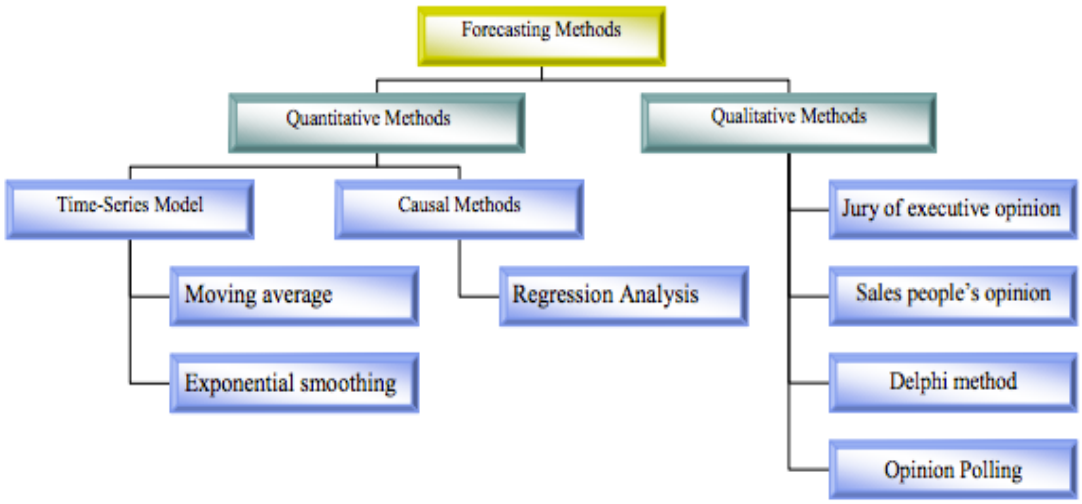

Figure 5. Forecasting methods and models (Sundberg 2009, 11)

In the illustration in Figure 5 above, the forecasting methods can be categorised majorly into two (2), and the existing divisions under each of the methods are shown.

As earlier mentioned, quantitative method of forecasting relied solely on previous historical data, it uses variety of mathematical techniques and

consistencies. It can be majorly divided into time series method and the causal or associative methods.

Time series model of forecasting as described by Myerson 2015 uses a set of evenly spaced numeric data that is obtained by observing response variable at regular time periods. He further described the forecast as based on past values and with the belief that there will be continuation in the factors that has influenced the past, present and future values. On this basis, time series model is seen as being naive. This is because it does not pay attention to the major reasons behind the changes that have occurred. Time series model, as being described from previous research, is one of the cheapest and fastest ways to conduct forecasting. If this model is chosen, a continuous monitoring of how the data is progressing is very important. This allows the deviations to be observed and subsequent actions be taken.

According to Jacobs, Berry, Whybark and Vollmann (2011: 74) ''the use of forecasts requires a heavy dose of common sense with the application of techniques''. This could be measured by the standard of any forecasting method chosen by an organisation on the basis of its output over time.

2.7. Order Management

The concept of managing order(s) in supply chain is an improvement system that is designed to improve the flow of information in the entire process. It is a concept that informs the stakeholders of the necessary updates related to a particular order(s) in the organisation as a whole.

Paul A Myerson (2015) a professor of practice in supply chain management refers to order management as '' a set of activities that occur between the time a

company receives an order from her customer and the time a warehouse is notified to ship the goods to fill that order''.

According to the Supply chain resource cooperative of the North Carolina State University, Order management is a smooth and continuous merger of orders from several channels with inventory databases, data collection, orders processing, fulfillment systems and returns across the entire fulfillment network.

The Business dictionary defines order management as a process that involves taking, organizing, tracking and satisfying a company's purchase request for her products or services. It is further described as an electronic system that assist securities and commodity brokers in accepting and filling orders placed in the markets by customers.

Order management has been useful to the entire supply chain as it stands as a tool that does the structuring in an organization's order fulfillment process. It should be seen as an important tool that requires adequate focus and monitoring.

Organisations with careful monitoring on her order management has a high tendency of identifying loop holes which when attended to timely, will eradicate future issues that could negatively impact the efficiency of the supply chain. It allows for real-time visibility in the entire order fulfillment process, thereby allowing stakeholders the chance to track the actual inventory levels for every particular products or items, opportunity to see if an order has been placed or not, shipment status and the ability to identify the likely delays and its causes in any order fulfillment process.

With respect to these, any particular order that will not be delivered before the safety stock goes to zero, which in turn increases the level of out of stock can be carefully taken care of using the emmergency action plans that might have been created for such occurences by the organisation.

Order management is primarily made up of four stages namely: order placement, order processing, order preparation & loading and order delivery. (Myerson 2015:148)

Order Placement: This can be simply put as a set of sequential happenings between the time of placing order by the customer and the time the seller receives the order. It can as well be seen as a notification from the customer to the seller that an item/product is needed. This can be done via telephone, internet, customer going to the seller in person or electronic data interchange (EDI).

Order Processing: This refers to the occurrence between the moments of receiving the order by the seller till an authorised filling by a custodian of the requested item(s). Series of activities like accuracy and completeness check, credit checks, proper records and data entry, item(s) location and pick up, payments and products shipment occur during order processing. The time involved in the entire order processing can be referred to as Lead-time to delivery.

Several factors can be attached to this order processing such that when not properly monitored, it may negatively impact the delivery lead-time of products and vice-versa. Such factors could be level of importance/priorities, order batching, order-filling accuracy, Lot-sizing and shipment consolidation.

When orders are being processed, for example orders with the shortest lead times processed first, first-come, first-served, in the right priorities, it affects the order processing rightly. Furthermore, when orders are accurately filled with fewer mistakes recorded, there will be improvement in the processing time thereby improving the order processing time.

Moreover, wave picking, which is a process of putting orders in groups and eventually released together, increases the efficiency of the supply chain. This means that when orders are batched for picking, it increases the efficiency of the supply chain.

Order Preparation and Loading: This involves all form of actions and activities carried out from the point of identifying and authorising where an order is to be filled till the point of loading the particular order.

In several situations, the point of preparing and loading an order has been seen as a point to improving the order cycle. Improved technologies and systems such as using pick by voice (PBV) to prepare the orders, handheld scanners and radio frequency identification (RFID) for items/products identification, its appropriate locations and as well for taking inventory.

Order Delivery: The moment an order is being picked up by a shipper till it is delievered to the customer, the order delivery process is said to have commenced. The method of delivering an order varies from the type of products shipped to another. This stage in the order management should be well monitored as well. This is because when orders are rightly prepared and located, the shipper picks the right shipment and improves the arrival. Costs are saved when a shipper is not meant to experience an un-necessary waiting time during the course of loading or preparing the order.

Order management as a system in the supply chain deserves proper monitoring and should be subjected to a periodic measurement. This helps the entire supply chain to properly understands what happens in the entire stages of ordering, bottle-necks can be identified and measures to resolving and eradicating the bottle-necks can be put in place to ensure smoothness in ordering. This will eventually save costs, reduce out-of-stocks and eventually improve the efficiency of the entire supply chain.

2.7.1. Ordering Process

Ordering can be referred to as a systemic process involved in replenishing products or items that are consumed due to sales in terms of finished products, consumed for production purposes in terms of raw materials or consumed for maintenance in terms of spare parts.

Ordering process can also be referred to as order replenishment or order fulfillment process. This process starts from the point of identifying an item as going below the safety stock for existing items, and from the moment a product is identified as needed for non-existing items. Once an item is said to have gone below the safety stock, this is a signal that the organisation will soon be exposed with respect to that particular item(s). Therefore, the replenishment process should commence immediately. On the other hand, for new items, once an item has been identified as needed for a particular purpose in the organisation

The processes involved in ordering include, sourcing for an item, requesting for quotes, purchase order issuance and its acknowledgement, order processing, order preparation and loading, order delivery, goods receipt, invoice submission and payment processing and customer relationship management.

Item sourcing: This occurs when the organisation or the entire supply chain has no registered supplier for a particular item(s). The search for a suitable and reliable supplier(s) for items with the aim of procuring the items could be referred to as sourcing. When a preferred supplier is reliable and dependable, contracts and agreements can be made for subsequent supply of items whenever the need for such items arises. Factors like quality of products and services, good customer services, attention to details, swift responses, quality prices to mention but few could be part of the requirements for a preferred supplier contracts and agreements. The advantage of having registered suppliers for item(s) in the supply chain could be to eradicate the fear of where to procure such particular items whenever the need arises. This will in-turn save time, making the delivery lead-time shorter and when properly managed, it reduces stock outs and eventually save costs.

Requesting for Quotation (RFQ): When a supplier to an item is identified, the entire details of the items to be supplied are shared, and a formal request for quotation is made. In the quotation, mention is made of the prices, terms of trade, delivery lead time and all other necessary information needed by the customer to issuing a purchase order.

Purchase order issuance and its acknowledgement: A purchase order is an official document that binds a buyer and a seller to a particular transaction, showing all the required details to enhance a smooth ordering. When a PO is issued and delivered to the suplier, it should be acknowledged in other to show that the order processing will commence as agreed by both parties.

Once the PO is acknowledged, the entire activities in order management such as order processing, order preparation and loading and order delivery as discussed in 2.7 swings to action.

Goods receipt: This is an act that happens when a purchased order is being delivered. Goods receipt for items are done against an existing purchase order. Delivered orders can be received depending on the products ordered. Goods can be received as unrestricted, restricted or to undergo quality inspection. Issues related to delivered goods are to be detected at the goods reception point, this is necessary because the goods receiver can immediately notify the deliverer or supplier so as to make proper arrangements depending on the terms and conditions of agreement before the purchase order was issued.

Once the goods receiving process is complete, i.e., the goods are physically okay and the documents are correct, the system receipt can as well be done and the invoices can be submitted to the accounting section for the payment to be processed.

Invoice submission and payment processing: After the goods receiving process is completed, the paper works involved are to be perfected and submitted to the accounting unit of the organisation. Here, the documents are verified with the received goods and also with the purchase order issued. Once the required are met, the payment can be processed in accordance with the company's policy and the terms in the agreement.

2.8. Customer Relationship Management (CRM)

Supply chain management, inventory management, order management and virtually all other supply chain activities involve and support different forms of

bodies, organisations, units and structures. This can vary from suppliers to manufacturers, distributors, wholesalers, retailers and even the consumers. On this basis, the word customer cannot be overemphasised. It is dependent of your position in the chain. The well-known part of it is that, the consumers are the final customers in the supply chain. At the same time, the customer is seen as the next step of the supply chain. Example, a vendor's customer is the manufacturer, while the distributors, retailers or even the consumers may be the customers to a manufacturer depending on the production size and capability.

Customer relationship management is a strategic move by which customers are positioned such that the organisation's profitability is made better and as well elevating the organisation's relationship with the customer base. Customer profitability analysis and the activity-based costing are useful tools in the identification of occurrences in the organisation such that, the cost associated to each occurrence is allocated with the item(s) produced and service(s) rendered with respect to the actual consumption.

A successful CRM strategy requires customers' motivation such that the customers continue to be loyal. This motivation can be inform of systems designed to elevate customers' values to the organisation. When relationships existing within the organisation, and as well between customers and the organisation's representatives are properly and effectively managed, loyalty continues and an improved profitability level can be achieved.

3. METHODOLOGY

The needed information and data used for the purpose of this research has been gathered via several ways, one of which included interviews and opinion sharing, e-mails and previous records were extracted. The needed data and information were gathered and analysed to identify fast moving items from the slow and average moving items. Suitable forecasting models were proposed and experimented. The results of the experiments eventually aided the conclusion on the particular forecasting model to be used at Kistal equiment and supplies Limited.

3.1. Procedures

Sales records over a period of time was checked in July 2015 at the case company head office located in Alakia area of Ibadan, Nigeria. We went through past sales record from July 2014 to June 2015. After careful consideration of the size of the excel sheet, myself and the stakeholders of the case company agreed to analyse sales data from January 2015 till July 2015. These were further analysed and the items were categorised using the ABC analytical technique. Also, the record of OOS during these periods was also collected.

The result of the ABC analysis was presented at the next meeting in the company's Lagos office. This enabled us the opportunity to understudy the ordering process at Kistal with respect to clearing of goods with the Nigerian Customs Service.

The items as categorised were shown in the table 1 below:

Sales period (M/Yr)	Number of sales	Number of items sold	Number of items in Cat. A	Number of items in Cat. B	Number of items in Cat. C
Jan - 15	100	80	9	22	49
Feb – 15	86	54	7	15	32
Mar – 15	120	92	11	15	66
Apr – 15	61	32	6	9	17
May – 15	143	92	9	19	64
Jun – 15	57	28	4	5	19
Jul – 15	77	55	12	7	36

Table 1. Record of sales and ABC analysis for the selected cat. A items

3.2. Participants

This research work involved the author of this report and stakeholders from Kistal equipment supplies limited. Representatives from the case company's major customers participated in meetings that concerns their organisation and at some milestone reviews.

3.3. Activities, Analysis and Measures

Five major items were selected from the category A of the ABC analysis results. These items were carefully studied and the below chart displayed the total quantity sold for each these items between January and July 2015. Table 2 below

shows the selected category-A items from Kistal and the quantities sold between January and July 2015. The table has been visually displayed in figure 6 below. For clarification and a well-visualised result, figure 7 is a display of 3-month sales for the items selected in table 2.

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Items	Jan - 15	Feb - 15	Mar-15	Apr-15	May-15	Jun-15	Jul-15
6205-2z	153	98	298	166	181	65	213
6202-2z	150	115	78	122	100	100	130
608-2z	160	86	103	99	104	0	110
6204-2z	83	69	55	101	9	0	80
6203-2z	77	48	65	98	16	58	50

Table 2. Record of sales for five category A items from January - July 2015

These above items are ball bearings that are used by manufacturing companies on their equipments and machines for the purpose of maintenance through reduction of rotational friction.

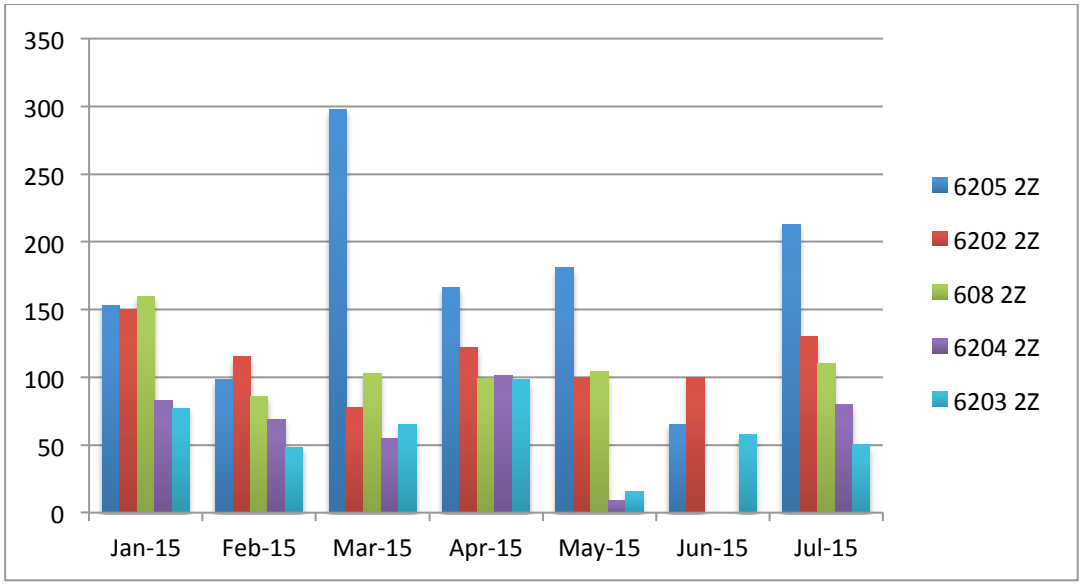

Figure 6. Sales chart from Jan-Jul 2015

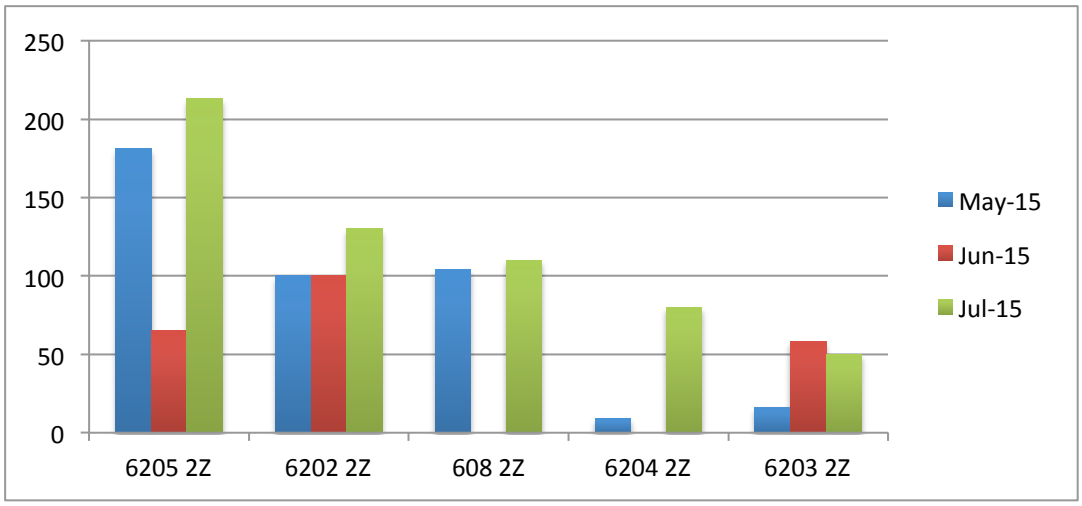

Figure 7. Sales chart for the months of May – July 2015

On the other hand, there were cases during the extracted sales period where requests were made for these selected items and the quantity at hand at Kistal was zero. This brought about the out-of-stock table shown below.

Items	Jan- 15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15
6205-2z	15	8	0	11	0	10	20
6202-2z	0	20	6	15	18	14	11
608-2z	5	2	10	23	20	40	0
6204-2z	0	6	3	8	40	45	0
6203-2z	11	20	7	18	12	3	9

Table 3. Record of Out of stock between January and July 2015

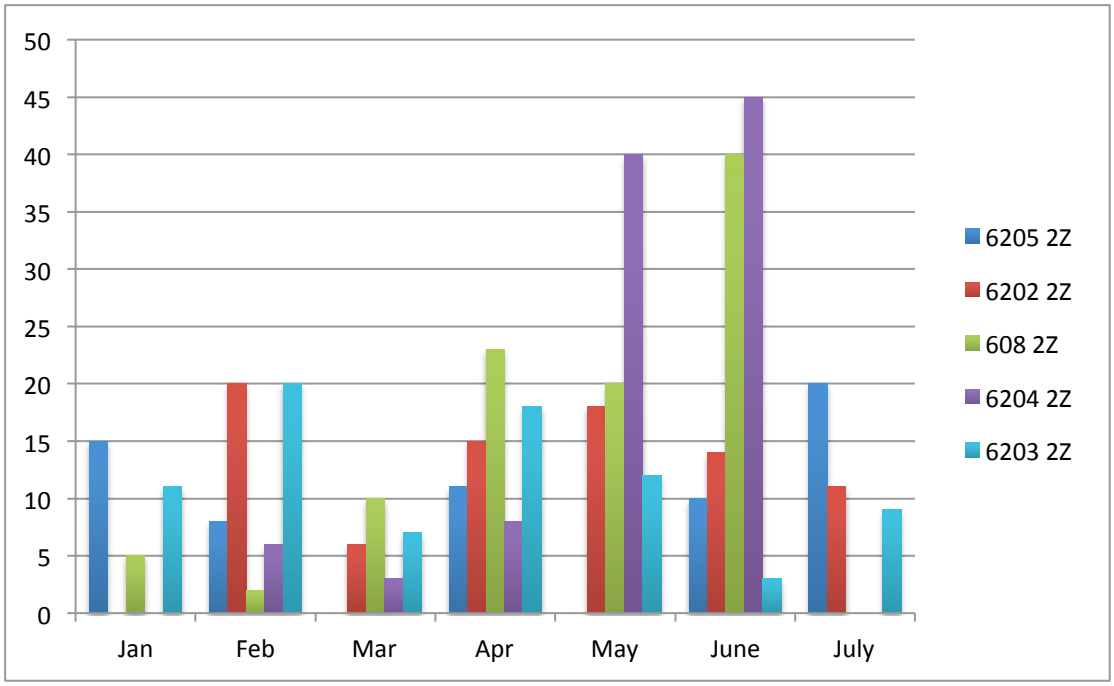

Figure 8. OOS chart between January and July 2015.

As visualised in the chart in fig. 8 above, the quantity of out of stock recorded for some of the items were zero.

Orders for each of these items and the quantities were also considered during this research work. Table 4 below has shown the quantities ordered for each of the selected items during the months of January and July 2015.

Items	Jan- 15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15
6205-2z	150	100	300	165	200	50	210
6202-2z	160	105	80	120	100	100	130
608-2z	160	86	103	99	104	0	125
6204-2z	87	65	56	100	10	0	80
6203-2z	77	50	65	100	16	58	50

Table 4. Record showing ordered quantities between January and July 2015.

The quantities tabulated in table 4 above can be visualised as presented in bar chart shown in figure 9 below.

Bearings 608-2z and 6204-2z were not delivered in June 2015 as a result of a bottleneck in the ordering process. On this basis, the quantities recorded as OOS for these two items were high. This is because there were no items in the inventory to be sold, thereby the reason behind the sales record for these items in this particular month to be zero.

In this regards, there is a need for the improvement of the ordering process at the case company.

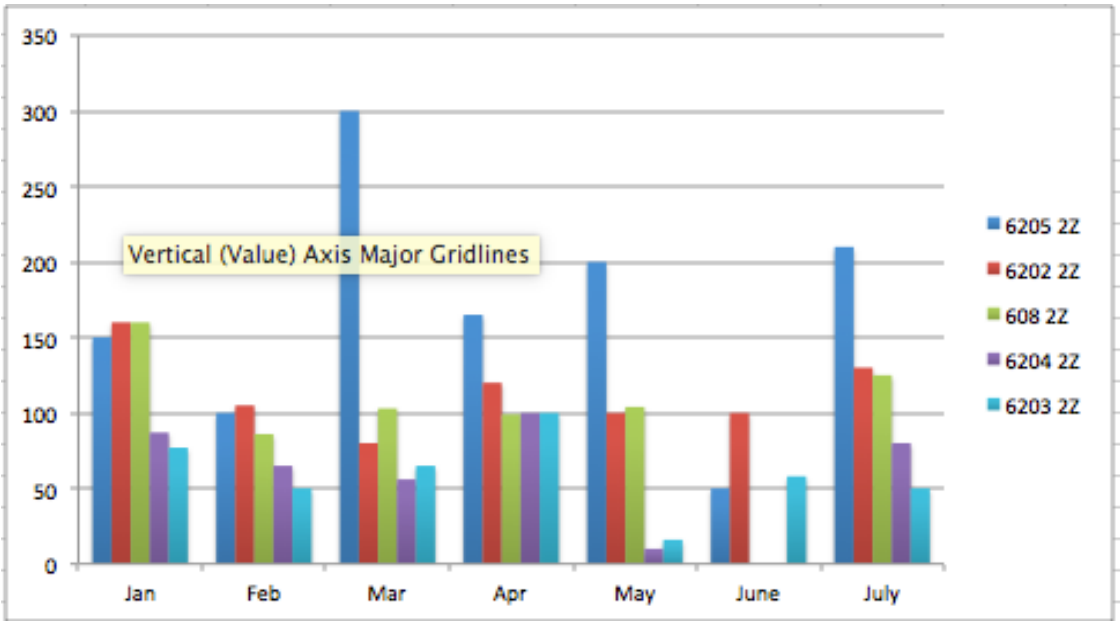

Figure 9. Chart showing ordered quantities between Jan. and Jul. 2015

3.4. Analysis

The quantities sold for each of the selected items were compared with the out of stocks recorded for each of the months.

It was observed during the months that the out of stock rates compared to sales for the selected items fell between 0 and 75%. For example, in February 2015, 48 pieces of bearing 6203-2z was sold and 20 pieces of the said item was recorded as out of stock. This amounted to 41.67% of the total sales for this item in that month. It was also observed that this particular item has got the highest OOS versus sales, and this was as as a result of the items scrapped in the previous years due to obsoleteness. The quantity of 6203-2z was high during the scrapping exercise becasuse sales of the item went completely off for over two years. The case company has got only two customers placing request for this item at the moment.

The out of stock recorded was compared with the quantities sold and the irregularities were observed. There is need to propose a stable quantity to be stocked for each of the items. It was also observed that bearings 608-2z and 6204-2z respectively had sales record of zero in the month of June 2015. This made the highest percentage of OOS recorded at Kistal equipment supplies, and it was as a result of the bottlenecks in the ordering process of the case company. These bottlenecks led to the ordering process improvement part of this research work. The ordering process was carefully studied and some improvements were proposed.

3.5. Measures

Based on the current issues at the case company, the use of safety stock for the selected items was initially proposed. This safety stock was generated using a formula-embeded excel sheet design on Lokad.com. The reorder point was generated and discussed while moving average was also proposed and calculated. After a careful consideration of several factors and the environment at the caase company, the use of the moving averages was agreed and it was calculated with respect to the sales data made available between January and July 2015.

To further strenghten the forecast, the sales team opinion was also adopted. It was agreed at a milestone review between the author and the stakeholders that the safety stock for each of the above items will be generated from the moving averages and the sales team opinion. This was done and simulated for a period of three months between January and March 2016.

The moving averages was calculated using the below:

$$M.A = {\Sigma(demand\ in\ previous\ months)}/{n}\,. \qquad (3.5)$$

Where n = number of months.

4. FINDINGS

Safety stock refers to the quantity of an item an organisation keeps in its inventory to reduce the risk associated with such items running out of stock. As defined by the accounting coach blog, safety stock is an additional quantity of an item held in the inventory in order to reduce the risk that the item will be out of stock. The blog further referred to it as a buffer in case the sales of an item are greater than planned, and/or the supplier is unable to deliver additional units at the expected time. This quantity serves as a trigger to the procurement department that a new order must be placed. With respect to this, it can as well be referred to as the re-order point.

4.1. Safety stock and reorder point

Safety stock could be a useful method to minimising the crisis regarding the out-of-stock at Kistal equipment supplies Limited. A formulated excel sheet was designed on Lokad.com which has made the safety stock and reorder points calculation simpler and easier. The shortcomings of this formulated excel sheet is that formula cells can be deleted mistakenly or the sheet can be corrupted thereby rendering it useless. The safety stock can be calculated by multiplying the values for the standard deviation of the previous sales data in a stipulated period with the service factor and lead-time factor.

The service factor refers to the inverse of the normal distribution, while the lead-time factor refers to the square root of the lead-time to forecast ratio. This lead-time is usually in months.

Safety stock $= STDEV(n) * NORMSINV(D) * SQRT\ (LT)$. (4.1A)

Where n= sum of records of sales in certain periods

D = normal distribution, and LT = lead time (in months)

Calculating the safety stock for bearing 6205-2z, using the previous data, with the formula 4.1A above,

Where: LT = 3 months, D = service level of 0,9

n=(153+98+298+166+181+65+213)

Safety stock = STDEV(153+98+298+166+181+65+213)*NORMSINV(0,9)*SQRT(3)

= 169,12 $\approx 169\ pieces$.

On the other hand, the reorder point which according to Vermorel is the amount of stock that should trigger an order. This is in a case where future demand can be known perfectly and supply is perfectly reliable. It can thus be calculated as:

Reorder point = the lead time demand + safety stock

The leadtime demand refers to the known future demand multiplied by the leadtime. To calculate the reorder point for bearing 6205-2z with a suggested future demand of 192 pieces, the below is the reorder point in pieces.

Where leadtime = 3 months, and a future demand of 192 pieces,

The leadtime demand = 192 *3 = 576 pieces.

Since the safety stock calculated above is 169 pieces, therefore the reorder point for bearing 6205-2z = 576 + 169 =745 pieces.

In the below tables, the calculated safety stock and the reorder points for the analysed items were shown applying the above-mentioned safety stock and reorder point formulas. See tables 5 and 6 respectively.

Selected Items	Calculated safety stock (pcs)
6205 2z	169
6202 2z	52
608 2z	106
6204 2z	85
6203 2z	57

Table 5. Calculated safety stock for each of the selected items

Reorder points below were calculated by adding the projected leadtime demand to the above calculated safety stock. Note that since the future demand cannot be known perfectly and supply cannot be perfectly reliable, the below quantities have been suggested and used for the reorder points calculation.

6205-2z = 192pcs, 6202-2z, 110pcs, 608-2z = 100pcs, 6204-2z = 100pcs and 6203-2z = 85pcs. These values were multiplied by 3 months leadtime and the values gotten were added to the above-calculated safety stocks to arrive at the values in table 6 below.

Selected Items	Calculated reorder point (pcs)
6205 2z	745
6202 2z	382
608 2z	406
6204 2z	385
6203 2z	312

Table 6. Calculated reorder points for each of the selected items

4.2. Moving Average calculation

The moving average for each of the selected items were calculated on the basis of the sales record for each of the items between January and July 2015 following the formula in 3.5 above.

For example, taking from the sales record in table 2 above for bearing 6205-2z from January to July 2015, add the quantities sold during this period together and find the average. This is illustrated thus:

Note that M.A = $\Sigma\,(demand\ in\ previous\ months)/_{n}$

Where n = 7.

$$M.A = (153 + 98 + 298 + 166 + 181 + 65 + 213)/_{7}$$

$$M.A = 1174/7 = 167.7$$

$$M.A \approx 168.$$

This M.A calculation was applied to the rest of the items. See table 7 below for the approximated values.

Selected Items	Calculated moving average (pcs)
6205 2z	168
6202 2z	114
608 2z	95
6204 2z	57
6203 2z	59

Table 7. Calculated moving average for each of the selected items

With these quantities calculated, it is believed that the risk of running out of these items will be minimised. In view of this, the minimum averages calculated is seen by the case company, as the safety stock for each of the items and it is as well the re-order point for each of these items. The moment the quantities at hand reach the calculated M.A, a new order should be placed immediately. On the other hand, to determine the quantities to be ordered, the values gotten for each of the items were balanced up with certain quantities to meet up with the highest sales for each of the items within a six months sales period, while the moving averages calculated will be same as the re-order point for each of the items. In cases where the sales did not consume the quantities during the month, a new order will be placed to balance up to the agreed quantity based on the sales team's opinion. In table 8 below, the agreed ordering quantities for each of the items were tabulated and this was a unanimous agreement at a milestone review in December 2015.

Selected items	Agreed ordering quantity (pcs)
6205 2z	168+100= 268
6202 2z	114+46= 150
608 2z	95+65=160
6204 2z	57+30= 87
6203 2z	59+30= 89

Table 8. Table showing the agreed ordering quantity for each of the items

This was done and simulated between January and March 2016 and the out-of-stock recorded during the three (3) months period was greatly reduced.

See the table 9 below.

Items	Jan-16	Feb-16	Mar-16
6205 2z	4	2	1
6202 2z	1	2	1
608 2z	1	1	2
6204 2z	1	0	2
6203 2z	1	0	0

Table 9. Record of OOS between January and March 2016

The sales records for this three (3) months period are shown above. There was an improvement in the sales as compared to the 2015 records. Table 10 below shows the sales recorded between January and March 2016.

Items	Jan-16	Feb-16	Mar-16
6205 2z	188	153	321
6202 2z	150	147	94
608 2z	180	122	106
6204 2z	111	89	78
6203 2z	103	67	93

Table 10. Record of sales between January and March 2016

When the OOS recorded in the 3 months simulation period was compared to the records before this research, it was shown that a reduction in the level of the OOS recorded was not less than 50%. For several items in the months compared, record showed an improvement of as high as 90% for bearing 6202-2z when comparing February 2015 and February 2016 records.

4.3. Justification for the chosen forecasting method

Safety stock calculation and reorder points are suitable methods to forecast for the inventory at Kistal equipment supplies Limited. But, on the basis that the sales at the case company cannot be specifically categorised as either seasonal, cyclic or peak values, the quantities calculated as the safety stock is a little closer to the quantities arrived at when using the MA with the sales team opinion, but the complexity involved in arriving at the safety stock, and also the limitation relating to the Lokad excel sheet makes the MA calculation preferable. The values gotten for bearing 6202-2z does not appear realistic and can pose continous issues related to out of stock if embraced. Moreso, a personel can mistakenly delete a formula cell on the Lokad sheet/any formula

embeded excel sheet, even when passworded, the sheet can get corrupt. Hence, prone to a wrong forecast value.

The reorder points based on previous data are too high compared to the MA with the sales team opinion. Moreso when the future demand cannot be certainly known and the supply is not being perfectly reliable. The high quantity will tie-down a huge sum of the company's capital. Also, referring to the high cost involved managing the inventory, the space it will occupy and the potential risk relating to depreciation, the minimum average justified by the sales team opinion is better used when compared. Other factors in the case organisation, such as the capabilities of some staffs, exposure level and inadequate trainings, the use of the minimum average was proposed and this was accepted. The basis for this is that it is easy to calculate and the needed values for the calculations can be easily retrieved from the sales record regularly. Also, the organisation has got a regularly updated sales record, which is useful for the M.A calculations. The idea of the sales team opinion adding up to the calculated minimum average is to make balance for the ordering quantities to avoid unwanted excesses and unnecessary below stock. The sales at the case company can be referred to as irregular and it does not accurately fit in any of the known features of demand.

The sales record for 2014 and 2015 were checked respectively, during the first stakeholders meeting in July 27th, 2015 and the sales at this organisation have not been regular on a periodic basis. This was put into consideration while proposing the use of the minimum average with the sales team opinion. This has reduced the crisis related to out of stock in the case organisation and it has actually started giving the major customers to Kistal the hope of a complete eradication of the OOS crisis in the near future to come.

4.4. Ordering Process Improvements

The method of shipment from SKF and Esbelt S.A. that are the major suppliers to the case company was Sea freight. Purchase orders/Requests are being consolidated and sea freight to Kistal equipment supplies Limited through the Lagos seaport. This experiences series of delays in the areas of customs clearance and other logistics involved. This research work has brought about a change to the method of shipment from sea freighting to airfreighting. Kistal equipment supplies limited also out-sourced the clearing responsibilities to two different logistics agents in Lagos state, Nigeria. This enables the right people to handle the clearing and logistics processes involved. Eventually, this will save the case company sometimes as compared to before when any would-be clearing agent was responsible for the clearing and logistics activities.

The human factors involved in the ordering process were improved such that waiting time was drastically reduced. Copies of shipping documents were sent out in parallel with the shipment itself. With this, the clearing and the needed logistics were done ahead of the shipment arriving Nigeria. This has reduced the the clearing days from the Lagos port to 3-4 days as against the 14-18 workings days before this research work. Shipment was delivered to the Kistal facility in Lagos within 5 working days of arrival at the Lagos port in January and March 2016 respectively.

Also, the major customers to Kistal equipment supplies limited has also embraced the stock ownership idea proposed by the author of this report. In this case, a consolidated six (6) months forecast of items needed by these organisations will be done and given to the sales engineer at Kistal, this will allow the case company to properly prepare the shipment ahead of time, and two inventory officers from these organisations will be assigned for monthly

visits at Kistal. This will afford both parties the needed alignment as regards what, when and how orders should be placed. This project is expected to take effect from the beginning of June 2016, and to serve as a support to the inventory management process at Kistal.

5. DISCUSSION

5.1. Overview of the study

This study was conducted such that the entire inventoried items at the case company were observed. It is pertinent to mention the fact that the selected items were selected through the ABC analysis and the Pareto rule. These items experience a very high demand on a regular basis. The research work was agreed upon in the spring of 2015 and the author of the report was present at the case company in July and August 2015 for a careful fieldwork and to conduct meetings with the concerned stakeholders. The agreed methods were simulated only for three (3) months, but will continue to be in use with continuous monitoring of the systems by the parties involved.

5.2. Summary of findings

The findings from this research work have brought a drastic reduction to the OOS level at the case company compared to before. The percentage reduction in the OOS recorded when compared was as high as 90% for some of the analysed items. The order delivery lead-time was improved by about 72% when the lead-time during the sea freight days was compared to present when airfreighting has been adopted as the method of shipment from the major suppliers. Managing the inventory at Kistal equipment supplies Limited became easier as the organisation was able to determine what to stock and when orders will be delivered. This has positively shown impact on the business at the case company.

5.3. Conclusion

After careful observation of the simulation results, it can be concluded that the re-order point system is helpful for the reduction in the OOS level at Kistal equipment supplies Limited. It can further be inferred that the airfreight shipment method has reduced the shipment days from the foreign suppliers to the case company. This reduction has improved product availability at the case company thereby significantly reducing the OOS level.

The assignment of the clearing and logistics activities by the case company to two different clearing and logistics agents in Nigeria has improved the efficiency at the clearing and logistics section of the ordering process. The competition between the two agents has saved costs for the case company by eradicating the cost incurred on demurrage for delay in clearing activities as previously experienced.

Generally, planning for the inventory in supply chain is directly a means to fully understand the financial status of the organisation thereby planning properly. A huge raw material inventory is not advantageous to the business since it is a way of holding down the organisation's capital. Also, a huge Work-in-Process inventory ties down the company's cost. Although, in cases when work-in-progress goods are raw materials to some other organisation, a relatively high inventory will inturn generate revenue once it is sold. A finished good inventory could be better when higher than when it is not available. This is because goods sold generate income for the organisation thereby making more cash available. Conclusively, the costs associated to managing any form of inventory has made it pertinent to always keep inventory costs as low as possible while making products available at the point of demand by the customers. It is pertinent to note that Kistal equipment supplies limited is a

spare parts and equipments supplies organisation, hence they keep only finished goods inventory.

5.4. Recommendations

It is recommended that a follow up action be drawn to monitor the designed systems and a regular stakeholders meeting between the case company and representatives of the major customers should continue. This will improve the timely identification of bottlenecks and necessary solutions will be provided before the eventuality of any crisis.

The stock ownership project embraced by the major customers to the case study company should be followed up. A time-to-time research activity on the case company's processes will also improve its efficiency.

The use of an ERP system to manage the case company's inventory and its entire supply chain processes will improve the entire inventory management process.

5.5. Research Limitations

This research work was limited to the data provided by the case company and its stakeholders. The researcher was unable to be on the site all through the research period for data verification and additional analysis. His presence was on a short period to meet with stakeholders and also the research start-up. This was because this research work has got no financial attachment to it. The rest of

research was completed relying on the data gathered via email conversations, telephone and skype calls.

5.6. Suggestion for Further Study

It is suggested that this research work should be extended to the remaining items at Kistal equipment supplies limited such that an even inventory forecasting system can take effect.

Work processes and activities at the case company can be further studied for areas that can be improved to ensure sustainability in the organisational activities.

Trainings and refresher trainings on a regular basis will be helpful for the sustainability of the supply chain processes at the case company.

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APPENDICES

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