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Research Article

Measures That Enhance Demand Planning in Oil and Gas Private Companies in Sudan: Focus On Dynamic International Oil Well Services Company-A Haggar Group Company

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Abstract: This study aims to identify the measures that enhance demand planning in oil and gas private companies in Sudan and it was undertaken in Khartoum state from August 2018 to March 2019 in Dynamic International Oil Well Services Company. The objectives of the study were to identify measures that enhance demand planning, with focus on Oil and Gas private companies in Sudan, to identify measures that mange overstock of raw materials, and to identify measures that mange stock out of raw materials. The chosen strategy for this study is the mixed research method. Two types of data have been utilized; primary and secondary. Primary data has been acquired through focus group discussion and Historical data Analysis. Secondary data has been acquired from books, references company publications, previous studies and internet websites. The study revealed that there is no measures that enhance demand planning on the targeted company. There is a lack of understanding of demand planning concept. The company have high level of over stock of raw materials. The company faces a challenge in stock out of raw materials. Therefore, the study calls for some recommendations to the targeted company. The Procurement and Inventory Department is recommended to focus on internal causes that are causing the miss-planning issue, the Procurement and Inventory Department is recommended to focus on external causes that are causing the miss-planning issue, on a senior level to think through implementing Collaborative Planning, Forecasting and Replenishment (CPFR) strategy. The most important among them is the developed Demand Planning Measures Model.

1. Introduction

David Closs (2016) stated that the success of a supply chain is often linked to its efficiency, which can be traced back to the ability of managers to conduct accurate forecasting when it comes to revenue and inventory. Those two facets of a business are tied to a crucial process in the world of supply chain: demand planning. According to the Institute for Supply Management (ISM) Glossary 6th edition, demand planning is defined as "the function of identifying demand for products and services to support the marketplace. Demand planning encompasses the activities of forecasting, order planning, and determining outside warehouse requirements, production balancing, and spare parts." Demand planning uses analytics that examine historical sales data, customer orders, shipments, current sales and market indicators to better predict demand patterns based on market changes, enabling firms to make smart decisions about inventory and production level (David Closs, 2016). Over stocks has been defined by the American Production and Inventory Control Society (APICS) as "An excessively large inventory of goods". Luanne Kelchner (2018) stated that companies with an inaccurate inventory database causing excessive purchases can result in excess

inventory. Businesses may also purchase excess inventory to act as protection against stock outs or inadequate inventory to meet customer demand. However, storing excess inventory as well as inadequate supplies can cause problems for the business. Developing an accurate inventory database and forecasting method can help the organization purchase and store appropriate levels of inventory. Excess inventory, while it may provide a cushion against stock outs, is not a desirable condition for a company. There several effects of overstocking or excessive buying which are the cost, adolescence, quality and decreased flexibility. While stock out has been defined by APICS as "A lack of materials, components, or finished goods that are needed."

Martin Murray (2018) reported that one of the worst things that can happen to a business is to have a stock out. This means that with no inventory of a certain item, production has to be stopped or a customer order will not be fulfilled. For a warehouse or inventory manager it is a scenario that they most dread and with it comes a significant cost to the company. The basic scenario for a stockout is when an item that is to be used for a customer order or for a production order is not in stock when required. If an item is not available for manufacturing then it may be possible to change the production schedule, although there is a significant cost in this due to the changes in a machine, teardown costs, resource changes, plus the time involved in carrying out all the changes. If an item is not available for a customer order then four possible effects can occur: Customer agrees to wait for the item, Customer back orders the item, Customer cancels the order and Customer cancels the order, and is no longer a customer. Martin Murray (2018) did not mention the above only, but also highlighted the effects of stock out as follows: Cost of Back Ordering, Cost of Cancelled Orders, and finally Cost of Losing a Customer.

1.2 Statement of the problem

Some external and internal environmental factors are causing the misplanning issue which in return affects the firm's performance. Demand planning is one of the concerns that is affected by those factors. For instance, an uncertainty of the plan leads to stock-outs or overstock. Historically, the effect of stock out on the firm leads to loss of sales opportunity and revenues, red money and increase of risk on business, while the overstocks leads the firm's to warehouse rent costs, expiration cost and the effect of Return on Capital (ROC), working capital and inventory turnover. Thus, this study comes to identify measures that enhance demand planning, with focus on Oil and Gas private companies in Sudan.

1.3 Objectives of the study

The overall objective of this study is to identify measures that enhance demand planning in Oil and Gas private companies in Sudan.

The specific objectives are:

1) To identify measures that mange overstock of raw materials
2) To identify measures that mange stock out of raw materials

1.4 Study questions

1) What are the measures that enhance demand planning in oil and gas private companies in Sudan?
2) What are the measures that affect overstock of raw materials?
3) What are the measures that affect stock out of raw materials?

1.5 Study Methodology

Methodology is defined by Irony and Rose, (2005) as the systematic theoretical analysis of the method applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge.

1.6. Place and time of the study

This Study was undertaken in Khartoum State, in the period from August 2018 to March 2019.

1.7 Study Strategy

The chosen strategy for this study is the mixed method. "Mixed methods research is a methodology for conducting research that involves collecting, analyzing and integrating quantitative (e.g., historical data, experiments, surveys) and qualitative (e.g., focus groups, interviews) data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either approach alone" (Hui Bian, 2011).

1.8 Study Population

The targeted population for this study is the oil and gas private companies in Sudan.

1.9 Sample and Sampling

Due to the limitations in accessing information on the topic and time limitations, the researcher decided to use the purposive sampling technique. Purposive sampling technique (also known as judgment, selective or subjective sampling) is a sampling technique in which researcher relies on his or her own judgment when choosing members of population to participate in the study.

It is also defined as a non-probability sampling method and it occurs when elements selected for the sample are chosen by the judgment of the researcher (Black, 2010).

The company that has been selected is Dynamic International Oil Services Company–A Haggar Group Company to represent the population of the study. This company has been selected for a number of reason; the company is Sudanese and private in addition to that the company is willing to share data in order to support this study.

1.10 Unit of Analysis

The units of analysis in this study are companies, specifically Dynamic International Oil Well services.

1.11 Data Sources

The research uses two sources of data; primary and secondary data. Kothari (1985) defined primary data as original information collected for the first time. Primary data has been collected through focus group discussions and meetings with senior managers and officers, and the historical data of Dynamic International Oil Well Services. While secondary data are obtained from books, references company publications, previous studies and internet websites. Secondary data has been defined as information that has been collected previously and that has been put through the statistical process (Kothari, 1985).

1.12 Data Analysis Technique

1.12.1 Qualitative analysis

There are different strategies for qualitative data analysis such as analytic induction, thematic analysis, grounded theory, etc. The researcher decided to use the thematic analysis as a general strategy of qualitative data analysis. According to Bryan (2012) the general strategy of analysis simply means a framework that is meant to guide the analysis of data. Bryan (2012) defined 'theme' as a category identified by the analyst through his/her data, that:

- ✓ Relates to his/her research focus,
- ✓ That builds on coders identified in transcript and/or field notes,
- ✓ That provides the researcher with basis for a theoretical understanding of his/her data which can make a theoretical contribution to the literature relating to the research focus.

1.12.1.1 Focus group discussion analysis

Focus group discussions recordings were transcribed and passed through several stages of analysis. Bryman stated that the focus group session will work best if it is recorded and subsequently

transcribed (Bryman, 2012). A preliminary stage was data grouping; group answers of both focus groups (for each question, what have participants thought). Next, a more detailed analysis was done, and information was labeled into themes that reflect specific topic of discussion and experiences of participants (answers have been classified into categories). Third stage, the researcher critically discussed the detailed analysis referring to the previous literature and researcher own interpretation. And at the final stage of this process of analysis lists of implications were generated and were labeled as key findings.

Bryman (2012) stated that although the use of focus group method may be appropriate and even advantageous, since it allows participants' perspectives to be revealed in ways that are different from individual interviews; it also involves number of limitations. The chief limitations of focus group methods are:

1) The researcher probably has less control over the proceedings than with the individual interview.
2) The data from focus group are difficult to organize and analyze.
3) The recordings are probably more time-consuming to transcribe

1.12.2 Historical data analysis

There many ways of analyzing historical data**.** The researcher chose the Pareto Law and the Materials Requirement Planning (MRP) to analyze the stock levels.

2.1 Basic Concepts and Terms

2.1.1 Supply Chain Management (SCM)

According to Christopher (2000) SCM is a "Network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer"

2.1.2 Measures

"A plan or course of action taken to achieve a particular purpose" (OXFORD Dictionary)

2.1.3 Enhance

Cambridge dictionary defined "Enhance" as to improve the quality, amount or strength of something.

2.1.4 Demand Planning "Using forecasts and experience to estimate demand for various items at various points in the supply chain." (APICS)

2.1.5 Demand Management

"Is a planning methodology used to forecast, plan for and manage the demand for products or services" (APICS)

2.1.6 Inventory

"A term used to describe: all the goods and materials held by an organization for future sale or use a list of items held in stock." (APICS)

2.1.7 Inventory Planning

APICS defined Inventory Planning as "the activities and techniques of determining the desired level of items, weather raw materials, work in process, or finished product"

2.1.8 Inventory Management

According to Relph (2015) described inventory management as "all the goods and materials that an organization owns or holds, and to which a business intends to add value before selling".

2.1.9 Inventory Control
APICS explicate "Inventory Control" as the consists of all the activities and procedures used to control and maintain the right amount of each item in stock or to provide the required level of service at minimum cost.

2.1.10 Stock Out
A lack of materials, components, or finished goods that are needed. (APICS)

2.1.11 Overstock
"An excessively large inventory of goods". (APICS)

2.1.12 Forecasting
APICS defined "Forecasting" as the business function that attempts to predict sales and use of product so they can be purchased or manufactured in appropriate quantities in advance.

2.1.13 Demand Forecasting
Forecasting the demand for a particular good, component or service.(APICS)

2.1.14 Service
Is used to describe those activities that support the production or distribution functions in an organization, such as customer service and field service. (APICS)

2.1.15 Collaborative Planning, Forecasting and Replenishment (CPFR)
APICS dictionary defined **"CPFR"** as "supply chain strategy in which members of the supply chain work towards best practice in planning the flow of production from the first link in the chain to the last link the chain."

2.2 Importance of Demand Planning
Oskar Blomgren and Sandr Eriksson (2016) reported that Demand planning becomes easier to plan for changes in demand if companies understand the demand and the expectations of the customer. Kotler (2003) defines demand management as the responsibility of the marketing organization which means demand forecast is the result of a planned marketing effort. Planning should not only simulate demand but also influence demand in order for companies to achieve their objectives (Crum, 2003). When evaluating demand planning, two main aspects need to be considered: materials and resources. The relation between these two sets the limit of how to priorities and influence demand. Crum (2003) stated that "if companies better can understand what drives the market and customer expectations of products, services and pricing requirements, companies can progress a more correct forecast". Sales and market departments can also benefit from this when positioning the company on the market. A broader view of the demand makes the company a stronger competitor.

2.3 Managing uncertainties in demand
According to Gupta (2003) it is important to add the uncertainty into the planning decisions. This can be derived back to the core function of planning models, to allocate resources for the future based on past data and current demand to be able to estimate for the future. To integrate uncertainties into planning decisions, the most important part to consider is the determination of the most suitable representation of these uncertainty parameters. Ashayeri (2006) means that a demand forecast would never be perfect due to market dynamics and forecast errors that are unpredictable. That is the reason for not only including historical data in the forecast (Ashayeri, 2006). To avoid uncertainties in demand, a company can cope with two strategies. It can either position itself as an adapter or shaper. In the shape strategy, the aim is to restructure the distribution of demand in order to limit the associated downside risk while the potential of benefits are taken. This can be achieved through agreements and contracts with customers, who could include an agreed quantity offer of supply with a minimum/maximum amount to the customers and in return they get offer of a price discount of the

products. The adapter strategy, on the other hand, does not influence the uncertainty level in the market. It only controls the risk exposure of this to happen, such as profit

2.4 Forecasting and demand management

Bona (2014) mentioned "that planning for variations in demand and the prediction of future demand is an important phase in the resource planning since it supports other planning functions such as production planning and material requirement planning as well". Since markets are today chaining in a rapid pace, it requires supply chains to be flexible and efficient. This can be derived to the uncertainty of customer's demand but also the increased customer expectations. To cover and plan for uncertainties in demand is crucial for an organisation to not lose customers (Gupta, 2013). There are different kinds of uncertainties in demand, both in a long time horizon but also in the short run (Gupta, 2013). Short term uncertainties could include day-to-day variations in processing, cancelled or rushed orders, equipment failure etc. In long term the uncertainties can be referred to price fluctuations in raw material/final product units, seasonal demand variations or production rate changes. Underestimating the impact of uncertainty can lead to situations where decisions regarding planning don't secure a company against the threats only use the benefits of the opportunities provided by higher levels of uncertainty. An example of this could be the uncertainty of product demand in a production-distribution system. If the fluctuations in demand are not considered it can lead to unnecessary high inventory holding costs or unsatisfied customers due to loss of market share and risk of backlog. Both of these scenarios are highly undesirable in current market settings since margins for profit are very tight. The statistical forecasting is the first and most critical step in demand planning, which is a complex process. The effectiveness of traditional methods depends a lot on the variations in different organisations and their economical environments (Bona, 2014). Lack of planning systems that consider the uncertainties in future demand forecasts can expect to result in poorer planning decisions compared to models that account for the uncertainty (Gupta, 2003).

Figure 2.1 shows a broad view of demand management

Source: A Study on Improving Demand Planning and Inventory Management.

By integrating the elements and include information about processes, a comprehensive view of demand can be achieved. When the broader view of demand management is used, it is important to consider that as an on-going process repeated in time. The accuracy of demand forecasts will be improved if understanding the four elements included and the interaction of the components (Crum, 2003).

Phase one: The first step is to plan for the demand, including data collection and a review of what the customer wants. Planning for variations in demand is crucial according to Ashayen (2006) to involve the whole organisation in decision-making.

Phase two: By communicating the demand internally and externally, a better plan can be estimated and the errors in the forecast can be reduced if the awareness of the changes are brought up (Crum, 2003).

Phase three: The influence of demand is being evaluated to clarify the impact and effects and how they can possibly be manage the best way.

Phase four: The final step in Figure (2.1) includes prioritizing the demand, and if it is not considered as an important issue to highlight the forecast will be less accurate since it is needed to prioritize and carefully adapt and manage the demand variations.

2.5 Measures of demand planning

Harmut Stadtler, Christoph Kilger and Herbert Meyr (2015) reported that the demand planning process consists of multiple phases; figure (2.2) below, shows a typical demand planning process that is used in many industries. The time scale shows the number of days needed to update the forecasting

a monthly rolling forecasting process. The process starts in a central planning department with the preparation phase. In this phase the demand planning structures are updated by including new products, changing product groups, deactivating products that will no longer be sold (and therefore will not be forecasted anymore).

The historic data is prepared and loaded into the demand planning module of the shipments and customer orders. The accuracy for previous forecasts is computed. In certain cases it is necessary to correct historic data before they may be used as input to demand planning.

Section 2.6 gives an introduction into statistical forecasting methods. When it comes to statistical methods and their application one typical question arises: How is the software able to make better forecasts than a human planner with years of experience in demand planning? The simple answer is that mathematical methods are unbiased. But that's only half of the truth, because information on specific events or changes (e.g. promotional activities, customer feedback on new products etc.) can lead to significant changes in demand patterns which might not be considered in standard time series analysis models. Therefore, it is necessary to combine the advantages of both worlds in an integrated demand planning process.

Figure 2.2 represents typical of demand planning measures
Source: Supply Chain Management and Advanced Planning

2.6 Demand planning methods

2.6.1 Quantitative method: Statistical Forecasting Techniques

Harmut Stadtler, Christoph Kilger and Herbert Meyr (2015) stated that forecasting methods were developed since the 1950s for business forecasting and at the same time for econometric purposes (e.g. unemployment rates etc.). These methods incorporate information on the history of a product/item in the forecasting process for future figures. There are two different basic approaches—time series analysis and causal models. The so-called time series analysis assumes that the demand follows a specific pattern. Therefore, the task of a forecasting method is to estimate the pattern from the history of observations. Future forecasts can then be calculated from using this estimated pattern. The advantage of those methods is that they only require past observations of demand.

2.6.2 Qualitative method: forecasting techniques

According to Harmut Stadtler, Christoph Kilger and Herbert Meyr (2015) there are different qualitative forecasting techniques such as "Market Research" Firms often hire outside companies that specialize in market research to conduct this type of forecasting. You may have been involved in market surveys through a marketing class. Certainly you have not escaped telephone calls asking you about product preferences, your income, habits, and so on. Market research is used mostly for product research in the sense of looking for new product ideas, likes and dislikes about existing products, which competitive products within a particular class are preferred, and so on. Again, the data collection methods are primarily surveys and interviews. Another one is the Panel Consensus in a panel consensus, the idea that two heads are better than one is extrapolated to the idea that a panel of people from a variety of positions can develop a more reliable forecast than a narrower group. Panel forecasts are developed through open meetings with free exchange of ideas from all levels of management and individuals. The difficulty with this open style is that lower employee levels are intimidated by higher levels of management. In addition to the "Historical Analogy" In trying to forecast demand for a new product, an ideal situation would be where an existing product or generic product could be used as a model. There are many ways to classify such analogies. Lastly Delphi Method as mentioned under panel consensus, a statement or opinion of a higher-level person will likely be weighted more than that of a lower-level person. The worst case is where lower-level people feel threatened and do not contribute their true beliefs. To prevent this problem, the Delphi method conceals the identity of the individuals participating in the study. Everyone has the same weight. Procedurally, a moderator creates a questionnaire and distributes it to participants. Their

responses are summed and given back to the entire group along with a new set of questions. The Delphi method was developed by the Rand Corporation in the 1950s.

2.7 Over stock: Luanne Kelchner (2017) stated that companies with an inaccurate inventory database causing excessive purchases can result in excess inventory. Businesses may also purchase excess inventory to act as protection against stock outs or inadequate inventory to meet customer demand. However, storing excess inventory as well as inadequate supplies can cause problems for the business. Developing an accurate inventory database and forecasting method can help the organization purchase and store appropriate levels of inventory. Excess inventory, while it may provide a cushion against stock outs, is not a desirable condition for a company. There several effects of overstocking or excessive buying which are the cost, adolescence, quality and decreased flexibility.

Cost: Excess inventory ties up funds the business could potentially use in other areas. The organization misses an opportunity to purchase and sell other products or materials when the business ties funds up in excess inventory. The larger stores of materials also consume warehouse space, which could require the company to rent additional storage space. Companies that finance the inventory will pay additional costs until the business uses or sells the material.

Obsolescence: The company can risk excess inventory becoming obsolete or out of fashion while sitting on a warehouse shelf. Manufacturing companies risk wasting the value of the stored material if customers change specifications or the required materials in products.

2.8 Stockout

Martin Murray (2018) stated that one of the worst things that can happen to a business is to have a stockout. This means that with no inventory of a certain item, production has to be stopped or a customer order will not be fulfilled. For a warehouse or inventory manager it is a scenario that they most dread and with it comes a significant cost to the company. The basic scenario for a stockout is when an item that is to be used for a customer order or for a production order is not in stock when required. If an item is not available for manufacturing then it may be possible to change the production schedule, although there is a significant cost in this due to the changes in a machine, teardown costs, resource changes, plus the time involved in carrying out all the changes. If an item is not available for a customer order then four possible effects can occur:

Customer agrees to wait for the item: If the item is vital to the customer, then they may be prepared to wait. Despite the goodwill of the customer, there may be significant damage to the customer's satisfaction level.

Customer back orders the item: Not as ideal as the customer agreeing to wait for the order to be complete, but the order is still being fulfilled. Nevertheless, the customer's satisfaction level is still significantly reduced.

Customer cancels the order: If the customer is able to obtain the item from another vendor or does not need the item immediately, then the customer can cancel the order. It is still possible that the customer will order from you in the future, but their customer satisfaction level has been damaged.

Customer cancels the order, and is no longer a customer: this is the worst case scenario of a stockout. However, if a customer is unhappy with the communication or information supplied by the vendor then they may be willing to cut all ties and work with another vendor.

Martin Murray highlighted the effects of stock outs as follows:
Cost of Back Ordering If a customer is unwilling to wait for their order to be fulfilled then they could backorder the item. This will mean that the vendor will incur some costs due to the stockout.

There are increased order processing costs as the customer service staff amends the order to create a new suitable delivery date. In addition, there may be additional shipping charges if the order was part of a larger delivery, then the backorder will require special transportation.

As a means of stimulating some much-needed customer satisfaction, the vendor can also agree to expedite shipping at their expense or offer the customer free shipping or a discount on the order.

Cost of Cancelled Orders: If a customer decides to cancel their order due to the stockout then they have probably found an alternate vendor for the item. Many companies will ensure that they have more than one source of supply for their key items; therefore, it may be easier to order from the alternate than to wait for the order to be completed.

For the vendor, a canceled order can be costly, not only in lost profit but in the purchase of raw materials or parts that were brought in or on order for the customer's order. Obsolete, slow-moving or unusable inventory costs money not just due to its purchase price, but also in inventory carrying costs. There is also the cost involved in trying to minimize customer dissatisfaction, either by offering incentives for them to order from the vendor again or in marketing to reduce any negative press that may have been made on social media.

Cost of Losing a Customer Losing a customer to a stock out is the worst outcome, and comes with it the highest cost to the vendor. By a customer no longer placing any order with a vendor, every order is a cost that has to be considered. If a customer was a major purchaser of goods then the cost could be severe and put the vendor in financial difficulty. There is also the cost of trying to find new customers to replace the order that would have been placed.

2.9 CPFR

Hokey Min and Wenbin Yu (2004) reported that CPFR is evolved from traditional collaborative tools, such as: Electronic Data Interchange (EDI), Vendor Managed Inventory (VMI), and Efficient Consumer Response (ECR), it differs from others in that it brings mutual benefits to all the supply chain partners involved by utilizing more interactive, broader communication processes throughout the supply chain rather than relying on limited transaction-level automation. Other benefits of CPFR include: higher inventory turnover, lower stock-out rate, improved order fill rate, improved cash flow; more accurate production scheduling, more amicable business relationships among supply chain partners, reduced cycle time, reduced order picking/receiving costs, reduced labor costs, and quicker response to customer needs. They also stated that in general, CPFR is referred to as a nine-step joint demand planning process that aims to enhance supply chain visibility by improving order forecasts and fulfillment through continuous communications among multiple supply chain partners.

The nine-step process is comprised of:
(1) Develop front-end agreement
(2) Create joint business plan
(3) Create sales forecasts
(4) Identify exceptions for sales forecasts
(5) Resolve/collaborate on exception items
(6) Create order forecasts
(7) Identify exceptions for order forecasts
(8) Resolve/collaborate
(9) Order generation

2.10 Economic Order Quantity (EOQ)

Max Muller (2003) indicated that in 1915, F.W. Harris of General Electric developed the EOQ formula to help stock keepers in determining how much product to buy. This formula and its variations allows to determine the optimal quantity to order when it should be ordered, the total cost,

the average inventory level, how much should be ordered each time and the maximum inventory level. The EOQ model is based on several assumptions:
the demand rate is constant (no variations), recurring, and known, the carrying cost and ordering cost are independent of the quantity ordered (no discounts), the lead time is constant and known. Therefore, the ordering times given result in new orders arriving exactly when the inventory level reaches zero.

The limitations of the formula is that it can handle only one type of item at a time and orders arrive in a single batch (no vendor stockouts or backorders).

2.11 Previous studies

2.7.1 Study (1): How Can You Improve Your Demand Planning with Process Diagnostics (2018)

Key points of the study: Demand plans have a major impact on the entire supply chain. Errors in planning trickle right down to the bottom line Sustained process improvement can only be achieved by looking at the entire process and the associated components that go into demand planning. A process maturity demand planning diagnostic tool can help organizations assess and improve their processes A diagnostic tool helps organizations to direct their efforts towards initiatives that present the best chance of profitability and long-term sustainability, methodology used is a diagnostic tool can be used in tandem with the five stages of demand planning findings and recommendation: By using the right diagnostic models, WNS helped the company identify critical gaps in the forecasting process, developed and executed a forecasting process improvement roadmap which included important aspects of demand planning such as forecast ability analysis and demand segmentation, statistical forecast generation, exception alert generation, and review and revision process among others. WNS was able to help the company achieve sustained gains in forecast accuracy to the tune of 7-10 percent (2018).

2.7.2 Study (2): Forecast and analysis of demand for petroleum products in India– RD Rao (1996)

Abstract: This paper analyses the demand for petroleum products in India. For this purpose, econometric models based on time series data are generated for individual products so as to capture product specific factors affecting demand. The models generated follow the non-homothetic translog functional form. The models are validated against historical data by testing them for ex post forecast accuracy. Demand forecasts till the year 2010 are obtained for the various petroleum products using these models. The forecasts indicate a high rate of growth in demand for motor gasoline, high speed diesel oil, kerosene, liquid petroleum gas and aviation turbine fuel. However, the demand for fuel oils, light diesel oil, naphtha and lube oils is expected to grow at a relatively lower rate. To arrive at an optimal refinery process configuration, an analysis of alternative means of satisfying the demand, which include product import options and domestic refining options with alternative process configurations, need to be done. Thus, investment plans for augmenting domestic refining capacity will have to take into account the future pattern of demand, to arrive at an optimal product mix. Forecasting demand forms a crucial aspect in the overall policy analysis of the oil and gas sector.

Case study Analysis

Dynamic International Oil Well Services Company–A Haggar Group Company

3.1 Overview

Dynamic International Oil Well Services was founded in 2005, Dynamic International Oil Well Services has evolved into one of the leading oilfield service provider in Africa, offering multiple top-notch services and solutions. The company caters to the needs of the ever-demanding oil and gas exploration and production industry to optimize drilling and production performance for clients in the field. The company has established a significant presence and has also built a credible reputation within the sector by consistently and efficiently delivering an array of high-quality specialized services paired with expert advice.

3.2 Vision
The company visualized to be the preferred integrated oil well services provider in the region.

3.3 Mission
The mission of Dynamic International Oil Well Services is to act in their stakeholders' best interest by meeting and exceeding their clients' expectations while assuring a pleasant and safe working environment for their staff.

3.4 Core Values
The company strive for perfection in everything they do, and their values are built around this goal. These values are:
- ✓ People and passion
- ✓ Environment and Safety
- ✓ Responsibility and empowerment
- ✓ Faith and respect
- ✓ Excellence and quality
- ✓ Creativity and adaptability
- ✓ Teamwork and communication
- ✓ Integrity and ethics
- ✓ Ownership and accountability
- ✓ Nice and enjoyable

3.5 Services
With the clients precise needs in mind, Dynamic offers international-standard bespoke services and solutions geared towards exceeding expectations. Their comprehensive range of high-end services and solutions is designed to help their clients grow, fulfill their missions and build a profitable business while we take care of the rest.

3.6 Well Cementing
As the first provider of cementing services in Africa, Dynamic offers state-of-the-art equipment, and a range of primary and remedial cementing services associated with onshore/offshore operations, oil & gas wells, HPHT wells, vertical & horizontal wells, stimulations and pumping through coiled tubing. They also utilize the latest technology and software to design and plan cementing jobs.
Their range of cementing equipment includes, but not limited to:
- ✓ High-pressure twin pump units
- ✓ Bulk system for conventional or special cement
- ✓ Cement batch mixers

3.6.1 Cement lab
Dynamics uses some of the best laboratory equipment and technologies to test, analyze and simulate cement and additives, ensuring smooth operations and exceptional output. These technologies blend different-sized cement particles together with additives in order to develop special cement slurries used in solving drillings problems. These include:
- ✓ DynaLiteCEM (Light-weight cement)
- ✓ DyanSQUEEZE (Microfine Cement)
- ✓ DynaTHermoSEAL (For thermal wells/Steam Injection)
- ✓ DynaNet (Fibers used to cure losses)
- ✓ Slag Cement (For CO2 presence treatment)
- ✓ GasBLOK (to control gas migration)

3.7 Procurement and Inventory Department Structure
Figure (3.1) represents the structure of the Procurement and Inventory Department Data analysis, discussion and findings

4.1 Analysis

4.1.1 Analysis of Qualitative Data

Theme 1: Measures that enhance demand planning in oil and gas private companies in Sudan

The procurement and inventory supervisor of the targeted company, indicated that demand planning is submitted from the client yearly and that the company has different clients (three to four) that request different services. Based on the request submitted by the clients, then the company breaks down the requested service into materials.

All sampled employees mentioned that there are number of challenges facing Dynamic International Oil Well Services.

First, the clients plan is unreliable therefore the company keeps a safety stock to start with in case of emergency services requested by clients, then the procurement orders a new stock so that the production does not stop. The second challenge pointed by the participants is the liquidity problem; as clients do not pay in advance while suppliers expects a payment in advance.

Third, is the standard of oil and gas field globally, the procurement officer specified that measures that enhance demand planning depends on a strong collaboration between the company and the client so that the client submits accurate and reliable plan which in return makes the demand planning easier to plan.

Furthermore, this global design was implanted in Sudan until 2006 before the division of south Sudan, after the division of Sudan and South Sudan the case became different because now days the public sector is responsible for distributing the clients to the companies, due to the short notice the company is not able to fulfil the request of the client since the procurement process of purchasing required time and the lead time of transit. He added that it is not an internal problem but more of an external problem and the standards of the oil and gas field in the country.

The fourth challenge mentioned by the procurement officer is that the company can purchase a stock based on the given plan by the client but the client can simply not implement the submitted plan, that's why the company does not purchase based on the clients plan. At the end of each year the actual plan doesn't match the planned demand. He added that experience of employees plays a major role in understanding the clients plan.

Finally, all participants approved that in order to enhance the demand planning measures the company needs an accurate reliable plan from its clients.

Harmut Stadtler, Christoph Kilger and Herbert Meyr (2015) reported that the demand planning process consists of multiple phases; the process starts in a central planning department with the preparation phase. In this phase the demand planning structures are updated by including new products, changing product groups, deactivating products that will no longer be sold, then the next phase is to prepare the historic data and loaded into the demand planning module of the shipments and customer orders. After that the accuracy for previous forecasts is computed. In certain cases it is necessary to correct historic data before they may be used as input to demand planning.

Theme 2: Measures that affect overstock of raw materials

The purchasing officer of the targeted company said "bulk purchasing is one of the measures that effects the over stock in terms of cost and expiry date, in addition to the uncertainty of the clients plan unclearness and the cash of flow". All participants agreed that the fluctuations in the dollars rate leads into a decline in the value of raw material. The assets supervisor mentioned that the minimum order required by suppliers is one the measures that affect the overstock of raw material. Luanne Kelchner (2018) stated that companies with an inaccurate inventory database causing excessive purchases can result in excess inventory. Businesses may also purchase excess inventory to act as

protection against stockouts or inadequate inventory to meet customer demand. However, storing excess inventory as well as inadequate supplies can cause problems for the business. Developing an accurate inventory database and forecasting method can help the organization purchase and store appropriate levels of inventory. Excess inventory, while it may provide a cushion against stockouts, is not a desirable condition for a company. There several effects of overstocking or excessive buying which are the cost, adolescence, quality and decreased flexibility.

Theme 3: Measures that affect stock out of raw materials

The assets supervisor, pointed that the uncertainty of the clients plan leads to a shortcut in materials in addition to the lead time, as the clients requests a job and expects the material to be in stock, while usually the materials required to start the job needs to be purchased and the purchasing process requires time and the clients are not willing to wait therefore it leads to unsatisfied customers. The previous warehouse controller and current procurement officer stated that the un-satisfaction of customers leads to loss of sales opportunities and clients swap to competitors in the market, due to the short notice by clients, the company cannot fulfill clients request because, purchasing orders and transportation of materials (lead time) takes time and the unavailability of cash flow.

Martin Murray (2018) reported that one of the worst things that can happen to a business is to have a stockout. This means that with no inventory of a certain item, production has to be stopped or a customer order will not be fulfilled. For a warehouse or inventory manager it is a scenario that they most dread and with it comes a significant cost to the company. The basic scenario for a stockout is when an item that is to be used for a customer order or for a production order is not in stock when required. If an item is not available for manufacturing then it may be possible to change the production schedule, although there is a significant cost in this due to the changes in a machine, teardown costs, resource changes, plus the time involved in carrying out all the changes. The effects of stock outs are cost of back ordering, cost of cancelled orders and cost of losing a customer.

4.1.2 Quantitative Analysis: Historical data analysis

4.1.2.1 Pareto Law for SKU's The researcher started with the Pareto law. According to Wikipedia the free encyclopedia, the Pareto principle (also known as the 80/20 rule, the law of the vital few, or the principle of factor sparsity) states that, for many events, roughly 80% of the effects come from 20% of the causes. This Management philosophy was found by the management consultant Joseph M. Juran and he named it after Italian economist Vilfredo Pareto.

First, to reach the 80/20 rule in the stock levels of the company the searcher followed the following process:

- ✓ Summed the opening stock of each SKU for the year 2016 and 2017
- ✓ Organized it from highest to lowest
- ✓ Accumulated the SKUs
- ✓ Divided each accumulated SKU by the Total of accumulated SKU's and timed it by 100 in order to reach the percentage
- ✓ Selected all the SKU with 80% or less in order to be analyzed

After applying this philosophy the researcher analyzed the following raw material: DY-85, DY-71, DY-131, DY-22, DY-51, DY-35, DY-41, and DY-33.

4.1.2.2 Stock Level Data Analysis

The researcher analyzed the stock level using the MRP, according to Max Muller (2004) controlling not only what item is purchased and in what quantities, but also the timing of its arrival is called MRP. This concept of the right item, in the right quantity, and at the right time was first introduced by Joseph Orlicky in 1975.

To reach the closing stock per year the following formula has been used:

Opening Stock + Orders In – Consumption= Closing stock

The researcher analyzed the selected SKU's one by one in order to visualize the stock trends of the selected SKU's during two years.

The researcher collected the historical data of the stock levels of the year 2016 and 2017, then analyzed each selected SKU of the year 2016 per month, after that the each selected SKU of the year 2017 per month using the sated above formula, in order to analyze the stock levels of those raw materials. To achieve the above the researcher analyzed the historical data using the excel sheet and finally graphs to further explain the stock levels.

Figure (4.1) shows the stock level of the item DY-85 in 2016
Source: Dynamic International Oil and Well Services Company
Figures (4.1) shows that the item DY-85 SILICA FLOUR had an opening stock of 17,600.00 Lb and it has been consumed one time during the year and the closing stock was 16,500.00 Lb in December 2016.

Figure (4.2) shows the stock level of the item DY-85 in 2017
Source: Dynamic International Oil and Well Services Company
Figure (4.2) shows that the item DY-85, SILICA FLOUR had an opening stock of 16,500.00 Lb in January 2017, it has not been consumed during the year and it shows a closing stock of 16,500.00 Lb in December 2017.

Figure (4.3) shows the stock level of the item DY-71 in 2016
Source: Dynamic International Oil and Well Services Company

Figures (4.3) shows that the item DY-71, Spacer had an opening stock of 16,500.00 Lb in January 2016. It received two orders in and has been consumed ten times during the year. It shows a closing stock of 11,550.00 Lb in December 2016.

Figure (4.4) shows the stock level of the item DY-71 in 2017
Source: Dynamic International Oil and Well Services Company
Figures (4.4) shows that the item DY-71, Spacer had an opening stock of11,550.00 Lb in January 2017. It received two orders in and has been consumed seven times during the year. It shows a closing stock of 21,685.00 Lb in December 2017.

Figure (4.5) shows the stock level of the item DY-131 in 2016
Source: Dynamic International Oil and Well Services Company
Figures (4.5) shows that the item DY-131, DynaNet had an opening stock of 10,383.00 Lb in January 2016. It did not received orders in and has been consumed eight times during the year. It shows a closing stock of 9,046.00 Lb in December 2016.

Figure (4.6) shows the stock level of the item DY-131 in 2017
Source: Dynamic International Oil and Well Services Company
Figures (4.6) shows that the item DY-131, DynaNet had an opening stock of 9,046.00 Lb in January 2017. It did not received orders in and has been consumed twice during the year. It shows a closing stock of 8,914.00 Lb in December 2017.

Figure (4.7) shows the stock level of the item DY-22 in 2016
Source: Dynamic International Oil and Well Services Company
Figures (4.7) shows that the item DY-22, Dispersant Solid had an opening stock of 10,562.00 Lb in January 2016. It received two orders in and has been consumed twelve times during the year. It shows a closing stock of 10,458.00 Lb in December 2016.

Figure (4.8) shows the stock level of the item DY-22 in 2017
Source: Dynamic International Oil and Well Services Company
Figures (4.8) shows that the item DY-22, Dispersant Solid had an opening stock of 10,458.00Lb in January 2017. It received two orders in and has been consumed eight times during the year. It shows a closing stock of 13,316.00Lb in December 2017.

Figure (4.9) shows the stock level of the item DY-51 in 2016
Source: Dynamic International Oil and Well Services Company
Figures (4.9) shows that the item DY-51, Calcium Chloride had an opening stock of 8,270.00Lb in January 2016. It did not received orders in and has not been consumed during the year. It shows a closing stock of 8,270.00Lb in December 2016.

Figure (4.10) shows the stock level of the item DY-51 in 2017
Source: Dynamic International Oil and Well Services Company
Figures (4.10) shows that the item DY-51, Calcium Chloride had an opening stock of 8,270.00Lb in January 2017. It did not received orders in and has been consumed five times during the year. It shows a closing stock of 8,216.00Lb in December 2017.

Figure (4.11) shows the stock level of the item DY-35 in 2016
Source: Dynamic International Oil and Well Services Company
Figures (4.11) shows that the item DY-35, Micro Retarder MRS had an opening stock of 7,315.00KG in January 2016. It did not received orders in and has not been consumed during the year. It shows a closing stock of 7,315.00KG in December 2016.

Figure (4.12) shows the stock level of the item DY-35 in 2017
Source: Dynamic International Oil and Well Services Company
Figures (4.12) shows that the item DY-35, Micro Retarder MRS had an opening stock of 7,315.00KG in January 2017. It did not received orders in and has not been consumed during the year. It shows a closing stock of 7,315.00KG in December 2017.

Figure (4.13) shows the stock level of the item DY-41 in 2016
Source: Dynamic International Oil and Well Services Company
Figures (4.13) shows that the item DY-41, Fluid Loss had an opening stock of 14,332.00Lb in January 2016. It did not received orders in and has been
monthly consumed during the year. It shows a closing stock of 1,735.00Lb in December 2016.

Figure (4.14) shows the stock level of the DY-41 item in 2017
Source: Dynamic International Oil and Well Services Company
Figures (4.14) shows that the item DY-41, Fluid Loss had an opening stock of 1,735.00Lb in January 2017. It received two orders in and has been consumed four times during the year. It shows a closing stock of 10,371.00Lb in December 2017.

Figure (4.15) shows the stock level of the item DY-33 in 2016
Source: Dynamic International Oil and Well Services Company
Figures (4.15) shows that the item DY-33, Retarder High had an opening stock of 6,445.00Lb in January 2016. It did not received orders in and has been monthly consumed during the year. It shows a closing stock of 5,144.00Lb in December 2016.

Figure (4.16) shows the stock level of the item DY-33 in 2017
Source: Dynamic International Oil and Well Services Company
Figures (4.16) shows that the item DY-33, Retarder High had an opening stock of 5,144.00Lb in January 2017. It did not received orders in and has been consumed four times during the year. It shows a closing stock of 5,023.00LB in December 2017.

4.2 Discussion

4.2.1 Qualitative Analysis Discussion

When participants have been asked about the measures that enhance demand planning, the researcher noticed a lack of understanding between the demand planning and demand forecasting terms. However, there is a major difference between both terms, APICS dictionary defined the term "Demand Planning" as using forecasts and experience to estimate demand for various items at various points in the supply chain. While APICS dictionary defined the term Demand Forecasting as "Forecasting the demand for a particular good, component or service".

Furthermore, and from the responses of all participants regarding the same question, they all pointed, that the company's demand planning comes from the company's clients, from the stated definitions above the clients of the company submits the demand forecasting to the company and not demand planning.

Participants pointed that to enhance the demand planning measures in oil and gas private companies in Sudan it depends on the external factors, the researcher disagrees to that point because in order to enhance or improve a process it starts from within in other words it is supposed to enhance internally first, then externally.

Finally, the procurement officer stated that the standards of the country does not support the enhancement of the measures (process) that enhance demand planning in oil and gas private companies in Sudan, due to all the external factors related to government policies and political issues, the researcher pointed out during the discussion that the three of them mentioned "that when the company cannot fulfill the client's needs at the right time, clients jumps to competitors in the market" due to this statement the researcher asked another question to further understand the statement related to the standards of the country, which was "how do competitors manage to meet the clients requested service while the standards of the country does not support such enhancement, the answer was "competitors have the financial capabilities to meet the clients needs" this responds says more about an internal issue rather than an external one.

Participants were asked about the measures that affect overstock of raw materials t "Bulk purchasing is one of the measures that affects the over stock in terms of cost and expiry date" As purchasing methods and inventory control are improving globally there are many methods that could be applied in order to minimize purchasing cost while maintaining the optimum level of inventory putting into consideration lead time of materials and safety stock levels such as the EOQ. Max Muller (2003) reported that in 1915, F.W. Harris of General Electric developed the EOQ formula to help stock keepers in determining how much product to buy. This formula and its variations allows to determine the optimal quantity to order when it should be ordered, the total cost, the average inventory level, how much should be ordered each time and the maximum inventory level. The EOQ model is based on several assumptions: the demand rate is constant (no variations), recurring, and known, the carrying cost and ordering cost are independent of the quantity ordered (no discounts), the lead time is constant and known. Therefore, the ordering times given result in new orders arriving exactly when the inventory level reaches zero.

The limitations of the formula is that it can handle only one type of item at a time and orders arrive in a single batch (no vendor stockouts or backorders). The second responds by the procurement officer was "the uncertainty of the clients plan" clients usually requests jobs through a yearly plan and do not implement the requested jobs this results in overstock of raw materials, in typical scenarios the researcher suggests strict agreements in the penalties of such situations, regarding the material purchased to meet their requested services. The final response by all participants regarding the measures that affect overstock of raw materials is the fluctuations in the dollars rate leads into a decline in the value of raw material and the minimum order required by suppliers is one the measures that affect the overstock of raw material.

To end with, the measures that affect stock out of raw materials, the respondents indicated that "the uncertainty of the clients plan leads to a shortcut in materials in addition to the lead time, as the clients requests a job and expects the material to be in stock while usually the material required to start the job needs to be purchased and the purchasing process requires time and the clients are not willing to wait therefore it leads to unsatisfied customers, the un-satisfaction of customers leads to loss of sales opportunities and finally clients swap to competitors in the market, due to the short notice by clients, the company cannot fulfill clients request because, purchase orders, transportation of materials (lead time) and the unavailability of cash flow" As mentioned in the previous question the EOQ formula could help in reducing the stock out of materials as well. Regarding the short notice the company could follow a minimum days order which means the company can inform their clients to submit the services request before minimum days that are enough to manage their operations, stocks and cash flow in order to meet clients requirements and decrease the case of losing sales opportunities.

4.2.2 Quantitative Analysis Discussion

4.2.2.1 Analysis and Discussion of Historical Data

Historical data of inventory level and consumption of raw material of the years 2016 and 2017 were collected from the targeted company. However the data was not completed nor cleansed. That is why the researcher suggested the Demand Planning Measures Model. The researcher observed from the historical data analysis that the company had high levels of overstock of raw materials. In addition, not all raw materials in stock were consumed. The company received orders in of some raw materials during both years and it was not fully consumed.

4.3 Findings

Based on the discussion of the data (qualitative & quantitative), the study revealed the following:

1) There are no measures that enhance demand planning on the targeted company.
2) There is lack of understanding of demand planning concept among the procurement and inventory department staff.
3) The company have high level of over stock of raw materials.
4) The company faces a challenge in stock out of raw materials.

Conclusion and Recommendation

5.1 Conclusion

As a final point, it becomes easier to plan for changes in demand if companies understand the demand and the expectations of the customer. Planning should not only simulate demand but also influence demand in order for companies to achieve their objectives. When evaluating demand planning, two main aspects need to be considered: materials and resources. The relation between these two sets is the limit of how to priorities and influence demand. If companies better can understand what drives the market and customer expectations of products, services and pricing requirements, companies can progress a more correct forecast. Sales and market departments can also benefit from this when positioning the company on the market. A broader view of the demand makes the company a stronger competitor. To sum up, demand planning is just one piece of the puzzle. Once companies understand their demand realities, it will be easier for them to manage the supply side. In other words, they will be aware of their current capabilities, and will help them procure the input products and services, in order to ensure their output products and services can be manufactured and created timely in a way that assures customers satisfaction.

5.2 Recommendation

Based on the findings, the study calls for number of recommendations to Dynamic International Oil Well Services:

1. The Procurement and Inventory Department is recommended to focus on internal causes that are causing the misplanning issue through:

- ✓ The continuous sharing of data/information among the internal stake holders, with focus on any demand changes that might have negative impact on the inventory (over stock & stockout).
- ✓ Focusing on finding internal mechanisms for cash flow challenges, due to delay in collection of receivables from clients,
- ✓ Keeping records of historical data and to continuously adequate historical data to be analyzed this could be a strong base for the demand planning measures.
- ✓ Promoting to the clients and operations, the benefits of consistency on supply, in order to avoid the greatest risk of supply chain (disruption of supply).

2. The Procurement and Inventory Department is recommended to focus on external causes that are causing the misplanning issue through:

- ✓ Focusing on obtaining clients up-to-date plans continuously, this will help the plan to be relevant and reliable in order to always run optimal operations that avoids short of supply or costly supply excess.
- ✓ Taking benefit from the supplier innovations, new inventions that could either improve the quality or reduce the cost of operations.
- ✓ Managing the lead time carefully through agreeing with suppliers on the actual and realistic lead times. Then to carefully monitor/track the transit inventory (throughput) without failing.

3. On a senior level to think through implementing Collaborative Planning, Forecasting and Replenishment (CPFR) strategy

- ✓ To consider the CPFR as a future initiative to be discussed with all the stakeholders in the near future. To examine the technological requirement that could make it happen successfully.
- ✓ The CPFR is a supply chain strategy in which members of the supply chain work towards best practice in planning the flow of production from the first link in the chain to the last link the chain.
- ✓ CPFR is evolved from traditional collaborative tools, such as: electronic data interchange (EDI), vendor managed inventory (VMI), and efficient consumer response (ECR), it differs from others in that it brings mutual benefits to all the supply chain partners involved by utilizing more interactive, broader communication processes throughout the supply chain rather than relying on limited transaction-level automation.
- ✓ There are number of benefits when implementing the CPFR such as higher inventory turnover, lower stock-out rate, improved order fill rate, improved cash flow; more accurate production scheduling, more amicable business relationships among supply chain partners, reduced cycle time, reduced order picking/receiving costs, reduced labor costs, and quicker response to customer needs.

4. On strategic level to implement the Developed Demand Planning Measures and to take it as a strategic project and to hire a demand planner for the implementation. The developed demand planning model includes:

- ✓ Analyze demand
- ✓ Agree on assumptions
- ✓ Produce demand planning,
- ✓ Make adjustments,
- ✓ Demand review meeting
- ✓ Sensing the demand.

5.3 Suggested Demand Planning Measures Model

This model was developed after the researcher noticed the gap of the demand planning measures and the challenge of applying international demand planning measures models in the domestic market, due to the country's limitation. This model is based on two international models, the first model developed by Harmut Stadtler, Christoph Kilger and Herbert Meyr in figure (2.2). The second model

is the "Steps in the Demand Planning Process". The researcher customized the below model for the enhancement of demand planning measures intended for Oil and Gas private companies in Sudan putting into consideration the country's limitations.

Figure (5.1) shows the Developed Demand Planning Measures Model

5.3.1 Model Description

Phase one: Analyze Demand

To analyze the demand, the items that may be under analysis include Stock Keeping Unit (SKU), division requirements, displays, spare parts, and samples.

A: Review Sales History

The first step in phase one is to review the sales history through analyzing the historical data of the sales history in order to reach clarity about the previous operations volumes.

B: Data Cleansing

The second step in phase one is the cleansing of the review of the sales history data, the purpose is to reflect actual sales, through detecting, correcting, removing corrupt, inaccurate records or irrelevant parts by replacing, modifying or deleting the coarse data.

C: ABC Analysis

The thirds step in phase one is the ABC analysis. ABC analysis is an inventory categorization technique that determines the value of items in an inventory which are grouped into three categories (A, B and C). It is used in isolating the most important items that need analysis for each item, the team conducts an analysis of demand by reviewing the past demand history. For SKUs, best practices the researcher suggests to collect actual point-of-sale data rather than sales orders or shipments. Sales orders and shipment data can be flawed because orders may be cancelled and shipments may be partially filled, delayed, or returned. Shipments actually reflect operations' response to clients demand rather than actual clients demand. Unfortunately, sales orders and shipment data are often used by organizations as a substitute for point-of-sale data, so it may need to be "cleansed" to reflect actual sales.

Phase Two: Agree on Assumptions

This phase includes agreeing on assumptions of the demand forecasting submitted by clients in order to analyze the demand, create a model and consider the events that could occur.

A: Analyze the demand

To analyze the demand there are two methods. First, the quantitative method through statistical forecasting techniques such as time series. Second, method is the qualitative method such as judgmental analysis…etc.

B: Events

To consider future events that are expected to have an impact on the forecasts, such as seasonality, discounts, change in demand…etc.

Phase three: Produce Demand Planning

Produce a range of demand planning using a variety of demand planning methods depending on where the SKU under review is in its product lifecycle. However, comparing historical data to the results of each of these models will help planners choose the most accurate plan.

A: MRP

MRP allows purchases to be made as and when needed to ensure that items will arrive when needed. It accomplishes this by setting up time phasing charts within the computer system.

MRP Formula: Opening Stock + Orders In – Consumption= Closing stock

B: EOQ

EOQ is a formula to help stock keepers in determining how much product to buy. This formula and its variations allows to determine the optimal quantity to order, when it should be ordered, the total cost, the average inventory level, how much should be ordered each time and the maximum inventory level.

EOQ Formula = 2AR P2K

To calculate EOQ, assume:

A = Total Value of SKU Per Year

K = Carrying Cost (The K Factor)

R = Replenishment Cost (The R Factor)

P = Price Per Unit

Phase Four: Make Adjustments

Fourth, the demand planning created in phase one, should be adjusted for any planned end-of-life materials issues, or other events.

A: Review Sales History

Reviewing the reviewed sales history made in phase one

B: Data Cleansing

Reviewing the cleansed data made in phase one

C: ABC Analysis

Reviewing the ABC analysis made in phase one

Phase Five: Demand Review Meeting

The team then holds a demand review meeting of key stakeholders including all operational departments.

A: Consensus

The purpose of consensus is to gain agreement regarding the suggested demand plan and develop a final demand plan.

B: Contingency plan

Is developed to account for future risks in the environment. Once agreement has been obtained, the production schedule and purchasing schedule can be developed.

Phase Six: Demand Sensing

Demand sensing, is a modeling technique, to “sense” any changes in demand and why they are occurring.

A: Assessing plan

By continuously assessing the plan, it will help planners determine if any changes are arising (Some reasons behind demand changes include, but are not limited to adjustments to the product base price, quantity changes, foreign exchange market (Forex)...), which will lead to faster response to the changes arising and keep records for future planning.

B: Reviewing plan

By continuously reviewing the plan, planners determine if any modifications are to be introduced to the plan (such as cancelled/delayed orders, seasonality), why they occur, when they occur, and what’s the course of action to be undertaken.

Keeping records of the above is a must, in order to be used on the future planning.

Conflicts of interest

There is no conflict of interest of any kind.

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