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Inventory Management Framework to minimize supply and demand mismatch on a manufacturing organization

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Abstract: There is a problem of excessive inventory in a Manufacturing Company, situated in South Africa. In this study an Inventory Management Framework (IMF) was developed. Quantitative content analysis was used to collect data. Statistical tools were used to select the fiscal year with the vast data variation for data analysis for this study. The results reveal that uncertainties and lot sizing inventory results in excessive inventory and not having a collaborated and integrated Supply chain Management also results in a mismatch of supply and Demand. IMF is proposed in this paper to minimize the impact of the mismatch.

Keywords: Inventory, Uncertainties, Lot sizing, Inventory Management.

1. INTRODUCTION

Some of the South African organizations have various systems in place for Material Requirement Planning, replenishment strategies and various types of lot sizing techniques to control inventory as well as satisfy customer needs. But they are still experiencing problem of excessive inventory. As we all know system needs people to feed it with accurate information to be efficient. Therefore accurate inventory records and lead times are highly important for stocking required type of component or raw material to produce the finished goods without overstocking wrong quantities or material. The development of Inventory Management Framework (IMF) study was initiated at ABC Engineering division of a bigger company based in South African due to the problem of excessive inventory as shown on figure 1.

The ABC Engineering comprises a group of product focused businesses in manufacturing, maintenance and fabrication of various product groups. ABC Engineering operational model is complex, as the organization internal structure comprises eight businesses. The Four Businesses are the primary customer-facing entities and revenue generators, their manufacturing strategy is make-to-order (MTO) .While the other remaining four operational businesses provide a supportive role within the organization to the customer-facing entities and their manufacturing strategy is make-to-stock (MTS). ABC Engineering operational model is complex because the organization MTO and MTS are always having different demand figures and is using the profit centre model, where each profit centre is given a certain yearly budget or sales target to meet and most of these budget or sales target for supporting businesses are not aligned to the businesses that are customer-facing entities and revenue generators. The organization continuously acquires various businesses in order to expand their foot print; this primarily leads to challenges such as: uncertainties that might lead the supporting businesses to increase their inventory and this has caused difficulty in forecasting accurately because of the high speed of change in the marketplace and ability to predict demand. Inventory is the lifeblood of the supply chain, it is what flows from node to node and at each node it is critical to figure out that perfect balance of supply and demand (Napolitano, 2013).

1.1 Aim of the study

The main focus of the study was on inventory in the form of raw material and components. The aim of the study was to develop an IMF that will manage and reduce excessive inventory. To achieve the aim, the following specific objectives were formulated:

1.To investigate the factors that lead to excessive inventory by collecting Stock Projection Reports for the past fiscal Year (FY) of the Organization and analyze to identify the root cause of the problem.

2. To propose establishment of measures that can be put in place to ensure that inventory is effectively managed.

The consideration of these objectives provided the Author with an understanding of the current status and development of an IMF. Figure 1 below shows ABC Engineering inventory cost from FY (01 April 2010 to 30 March 2014).

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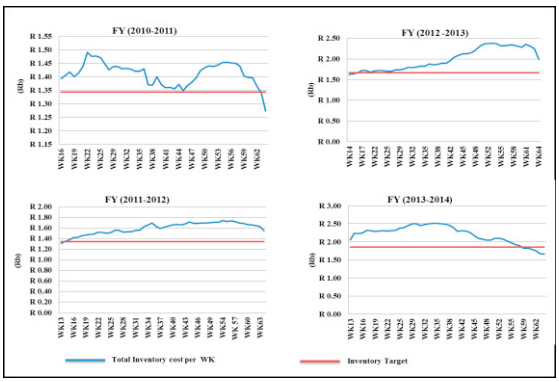

Fig. 1. ABC Engineering inventory cost from FY (01 April 2010 to 30 March 2014).

2. METHODOLOGY

The study focused on inventory in the form of raw material. The criteria of data selection emerged from literature revealed. Thus to be able to analyse data, historical data was retrieved from the organization Enterprise Resources Planning (ERP) system. Quantitative content analysis was used for two purposes namely: selection of reports to be sampled and for analysing the sample. The analysed sample data revealed the factors that lead to excessive inventory.

2.1 Population and sampling

Population is consisted of all Supply Chain reports retrieved from the ERP system at the organization headquarters for one FY, April 2012 to March 2013, focusing on stock projection reports. Non-probability sampling through purposive sampling was used to select a total of 624 reports from a total of 2 912 stock projection reports. Mitchell (2005) described non-probability sampling as the probability that any element (unit of analysis) will be included in a sample. In some instances, certain members may have no chance of being included in such a sample (Mitchell, 2005). Purposive sampling is a non-probability sampling technique in which the researcher decides to involve a small subset of a larger population in data collection based upon a variety of criteria for the purposes of the study (Babbie & Mouton, 2001). In this study purposive sampling was used to select a sample on the basis of the authors own knowledge of the population and the research aims. Content analysis which will be explained in detail in section 2.2 was used to collect data from 624 sampled reports.

According to Leedy and Ormrod (2013) content analysis designs are not necessarily stand-alone designs; for example, a systematic content analysis might be an integral part of data analysis in a phenomenological study. After the content analysis the researcher gathered the data, entered it into computers and analysed it with statistics in the same way that an experimenter or survey researcher would (Neuman, 2000). Historical data was collected from the ERP system. Stock projections reports are drawn and collated on a weekly basis from an ERP system for each FY from April to March. The criteria for selecting the 624 reports were primarily based on the themes that emerged from literature. These themes consisted (i) inventory cost vs sales and inventory classifications, (ii) Supply and demand, and (iii) operation model of ABE Engineering.

The tools used to analyse data were Microsoft excel and sigma excel (sigmaxl). Sigmaxl is a data analysis platform on the six sigma software. By using excel the researcher was able to sort data quickly and in various configurations. Excel helped with formulas of formatting the data and representing it on suitable graphs and charts. Although, excel has a variety of useful statistical tools, it cannot assist with some of the more complex statistical analyses that needed to be performed in this study. To fill this void, Sigmaxl was used to select the FY with the most data variation for further investigation and data analysis to arrive at sound conclusions. Figure 2 depicts the steps followed in analysing data

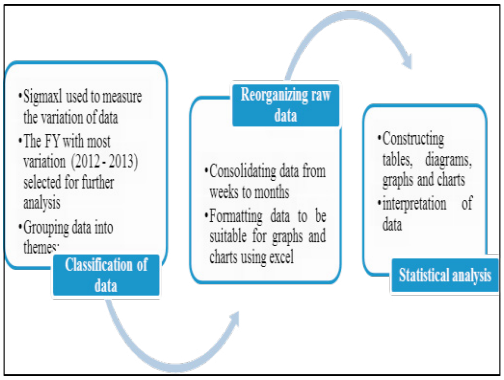

Fig. 2. Data analysis method followed

3. DATA ANALYSIS

For all four graphs shown on figure 1, the trend from week (wk) 1 shows an increase of inventory because it is the start of the new FY. Only in 2010 – 2011 there was a decline from wk 10 until between wk 33 and wk 34 in the middle of the month. These are the last three month of closing the year-end sales. More stock was consumed to meet year-end sales for all four FYs. The graphs also show a similar trend each year, from wk 1 inventory starts increasing and towards the end of a year there is a decline. Except for FY (2010 - 2011), which shows there were two declines in the middle of the year and towards the end of the FY. The annual stock targets were not met after close of annual sales for FY (2012-2013) and FY (2011-2012) which is a major problem. Statistical tools were used to measure the variation of data in a graph and select the year with the most variation for further investigation. For further investigation data analysis focused on one FY and the reports analysed include; Inventory classification and inventory cost vs sales, supply vs demand (orders exceeding demand) and lastly the review of ABC Engineering SC reporting structure.

3.1 Box plot and standard deviation per FY

A box plot on figure 3 shows the range of data falling between the 25th (minimum) and 75th (maximum)