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Original Research Article

MAINTAIN SPARE PARTS INVENTORY FOR DECISION MAKING BY DEMAND FORECASTING

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ABSTRACT

Given that Satya Spare Parts Stores is a distribution industry in a resource limited setting the study was carried out to investigate the effectiveness of inventory and stores management on turnover for Satya Spare Parts Stores in a resource inadequate setting. The study uses a cross sectional research design methodology where Satya Spare Parts Stores is a case study with an objective of evaluating the effectiveness of inventory monitoring and information management on turnover. Data was collected essentially from primary sources using self-administered questionnaires. The findings arising from this evaluation reveal that inventory management practices are effective on inventory turnover. The established that inventory information management had a strapping effect on demand forecasting and direct effect on turnover. The work also finds that it is possible to improve inventory management and optimize inventory turnover, a number of operational strategies are implemented. The Work therefore recommended that continuous growth in turnover must be implemented through interventions through organizational strategy and operational efficiency affecting inventory management practices.

KEYWORDS: Spare Parts, Inventory, Demand Forecast.

INTRODUCTION

Service parts are important. Many companies are faced with worldwide competition; customer satisfaction has become crucial. An important way to keep customers satisfied is quick repair of a product or system that failed. To this end sufficient service parts have to be

stocked at appropriate points in the supply chain to guarantee a high service level. As most of these parts are costly, this requires large amounts of money to be invested. Three control situations have to be distinguished.

Service parts to maintain own (production) facilities and systems;

Service parts to service (professional) systems installed at customer sites;

Service parts to repair consumer products, at service workshops.

As in any inventory control situation, some basic questions have to be answered. The following apply here:

Which parts have to be stocked?

Where are the parts to be stocked?

How much stock has to be kept for each of these parts (reorder level and reorder quantity)?

That is a difficult task as standard methods for inventory control fall short: consumption is so inconsistent and low that there is no demand process that allows forecasting of future demand, parts are costly and consumers very demanding. Criticality of parts is a useful concept to bring some order in this mess. It expresses the significance of a part in case of system failure. A generally valid definition of "criticality" is tough to find, as local circumstance play an important role. Service parts can be divided into two categories:

Repairable: service parts those are technically and efficiently repairable. In case of failure, such a part is swapped with a new one and sent to a repair centre.

Consumables: service parts those are technically and/or economically not repairable. In case of failure the part is replace by a new one and scrapped.

It describes a solution for the second of the three control situations mentioned at the start of this section, namely the control of service parts for the repair of professional electronic systems at customer sites. The parts concerned are repairable. For obvious reasons, sensitive information about the company, its position in industry, and its operations has been missing out.

BACKGROUND OF WORK

Senior management's concern is managing inventory levels because the impact of shifting the inventory management procedures on turnover is reflected in turnover growth. There is a lot of investigate that has been done in this area by developed countries however, for resource poor settings there is barely any documentation. There is therefore need for study using company in a resource inadequate setting as a case study to establish how inventory management practices affect turnover of an organization.

Satya Spare Parts Stores (SSPS) has the responsibility of delivering automobile component and spare parts supplies to over Bilaspur (C.G) district service center spread throughout the agency. Mountainous terrain throughout the state, the fact that some service facilities are located on district and the poor condition of roads all serve to complicate the distribution operation. Add to this the excessively high cost of fuel and the limited resources of the government's service budget and the need for efficient transport management becomes clear. Satya Spare Parts Stores to undertake an evaluation of their transport and distribution function in order to provide a series of recommendations as to how they could reduce costs, increase efficiency and improve service delivery. [2]

The result of the operational assessment was the development of a report detailing recommendations for improvement of the existing SSPS distribution operation. The recommendations include suggestions for an appropriate policy and system implementation, resolution of organizational process issues, which had been adversely affecting the transport operation, and the subsequent implementation of an outsourcing study to determine an effective solution for ongoing expansion of the delivery network. With the adoption of these recommendations SSPS will be expected to benefit from reduced transport costs, increased vehicle utilization allowing a reduction in fleet size, improved vehicle availability allowing a faster response to vehicle demand, and overall improved vehicle service delivery. At present the tasks of managing the day to day transport operation are taking significant time with the implementation of appropriate processes and systems this work will be greatly reduced freeing the transport and logistics officer to concentrate on upcoming projects to increase the distribution network which SSPS services.[3]

Comparison of the audited accounts for 2013/2014, 2014/2015 and 2015/2016 with the three year corporate plan of Satya Spare Parts Stores indicated that the implementation of the objectives both for its set up and those of corporate plan was done inadequately. The exact figures for turnover were 7,189,877,006, 6,188,066,486 and 7,449,418,322 respectively. This meant that Satya Spare Parts Stores had a shortfall from the targeted sales were 9,528,408,399,718,172,041 and 11,970,611,208 respectively. This meant that Satya Spare Parts Stores had a decline in the targeted sales of 24.5 percent, 42.3 percent, 37.8 percent representing an average shortfall 34.8 percent. It is apparent that decline in sales had negative consequence on inventory turnover. This strongly suggests that inventory and stores management is not effective on the turnover performance in the analyzed phase. This study therefore intends to investigate the effectiveness of inventory and stores management on turnover act and recommend interventions to mitigate the situation.

SIGNIFICANCE OF THE STUDY

To understand the effectiveness of inventory and stores managed practices stretches out study turnover growth. However many companies tend to avoid this practices which slackens turnover growth. This study intends to emphasize the key inventory monitoring and inventory information management indicators to ensure turnover growth. These therefore can be used by companies in resource inadequate settings to carry out interventions as proposed by this study to ensure effectiveness of inventory and stores management practices. [6]

To evaluate the impact of the modulating factors that is to say information monitoring and information management practices to turnover performance.A plan to re-engineer the global supply chain was set up; it is aiming at two key goals: superior financial performance and higher customer satisfaction. To achieve these goals, the company defined four key issues to focus on:

Enhancement of supplier performance;

Speeding up delivery by the logistics organisation;

Enhancement of the field stocking strategy;

Better contract support.

METHODOLOGY

The study uses descriptive research design approach to explain the effectiveness of inventory and stores management on turnover performance for a wholesale delivery company in resource limited setting is based on this study of Satya Spare Parts Stores, a whole organization whose business involves the national procurement, storage and distribution of drugs and medical supplies.

Selection of parts

There are two good reasons of developing *one* optimising mathematical method for *all* spare parts:

Conventional models for inventory control are hardly suitable for spare parts, especially parts with a low frequency of demand.

SSPS wants an instrument for the entire supply chain of spare parts, hence a tool to wrap the whole spare parts assortment. But not all parts are the same, and so a classification is essential.

Instead, a practical method was developed. It gives a performance that satisfies both consumers and organization. In this method *criticality* is the criterion to distinguish important parts from others, with the VED approach (VED = Vital, Essential, Desirable) as point of departure.[2,6] As there are about 50,000 active parts numbers, from the start, it was clear

that the method had to be based on modern IT techniques, easy to implement and to keep. Given the limited amount of time for this job, some more restrictions had to be made:

No changes in the existing division network are allowed. This means that no attempts will be made to define new locations for stocking parts.

Stocks in branches, in technician's cars, and at consumer sites remain out of the scope.

The tool to be developed has to be simple to execute and use. As we will see in Section 6, this has resulted in a spread sheet application.

The VED approach

According to the VED method, there are three types of parts:

Vital parts: Items that cause high losses due to non-availability of tools, in case they are needed while not on stock.

Essential parts: Items that cause moderate losses due to non-availability of equipment, in case they are needed while not on stock.

Desirable parts: Items that reason minor disruptions, in case they are needed while not on stock.

From the point of view of its functional necessity in production or service operations, criticality of a spare part has many faces. However, evaluating the criticality of parts is a complicated task that is often accomplished by using subjective judgments. A systematic procedure that could be helpful here is the Analytic Hierarchy Process (AHP). The decision model is based on the idea of structuring the difficulty into a hierarchy with three levels: the overall objective is at the apex, criteria characterizing the objective are placed in the middle, whereas the decision alternatives can be establish at the bottom.[8] Criteria and alternatives have to be determined by management. In case of SSPS the overall objective is "Evaluation of the criticality of spare parts".

After a thorough explanation of this method, management of SSPS rejected it as a way to classify spare parts. The main cause was this: one of the most important criteria, response time decided upon in service contracts, can vary for the same part from one customer to the other. Consequently, such a spare part cannot exceptionally be assigned to a class. Moreover, management establish the proposed method "too theoretical". Then it was determined to modify the VED method in such a way as to contain local knowledge.

DATA PROCESSING AND ANALYSIS

The study upon gathering data intends to use word processors to enter key words into the text field notes and print them, use statistical package for social scientists (SPSS) correlation analysis to determine the extent and degree of relationship between inventory and stores

management and turnover presentation. The study is carrying out a study on effectiveness of inventory and stores management practices in your organization. In this categories worker have been chosen as one of the respondents of this study to enable us to get representative analysis of the situation in this corporation in as far as the subject of this study is concerned. Recommendations from this study may be beneficial to this organization.

DEMAND CLASSIFICATION

A more formal means of identifying variable demand is utilized, in contrast to the somewhat naive approach of only considered the order frequency. On this occasion, the lead-time demand is decomposed into the constituent causal parts of demand frequency, demand size, and lead-time. With all line items assigned each line in the inventory can be classified by the observed lead-time demand in accordance with equation **Error! Reference source not found.** as introduced. The underlying variance partition equation for the variable lead-time case was defined as:

$$C_{LTD}^2 = \frac{C_n^2}{\bar{L}} + \frac{C_z^2}{\bar{n}\bar{L}} + C_L^2 \qquad \text{……..(1)}$$

Where $\bar{n}$ is the mean number of transactions per unit time,

$\bar{L}$ is the mean replenishment lead-time, and

C_z is the coefficient of variation for the demand size, etc.

An evaluation of the three component parts, previously translated as transaction variability, demand size variability and lead-time variability, led Syntetoset al. to propose a demand classification with four demand patterns, namely smooth, slow-moving, variable and erratic with highly variable lead-time.

Through an initial study of RAF data, it was perceived that the Williams' classifications did not sufficiently describe the observed demand structure. In particular, it was not considered enough to distinguish a smooth demand pattern from the remainder simply on the basis of the transaction variability. as a result, a revised classification scheme sub-divides line items with low transaction variability into smooth and uneven, according to the demand size variability. As an aid to simplification the erratic demand pattern, and the variable with highly variable lead-time demand prototype, have been re-designated as mildly erratic and highly erratic respectively. The revised classifications are presented in Table 1

Table 1 Revised Classification of Demand.

Transaction Variability	Demand Size	Type of Demand Pattern

Transport and logistics	Low	Smooth
Finance and accounts	High	Irregular
Audit	Low	Slow-moving
Marketing and stores	High	Mildly Erratic
Procurement	High	Highly Erratic

RESULT ANALYSIS

This chapter present analysis and argument of findings obtained after collecting data from primary and secondary sources, the findings are coded, edited, existing in form of tables, frequencies and final discussions to give insight in answering the research questions by judgment out how inventory and stores management practices affect turnover performance. The primary data are shown in Fig 1 which indicates that 42 percent of staff was in the Service functional area and the least staff was in the Audit function. This implies that inventory management practices and turnover information was obtained from relevant staff.

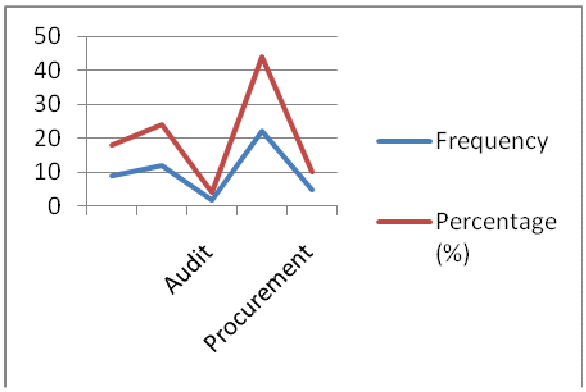

Fig 1 Staff in Functional Areas

Results in Fig 2 indicate that 66 percent of the staff had experience of 5 year and above in the organization implying that they had enough information concerning inventory and stores management practices and turnover performance in Satya Spare Parts Stores

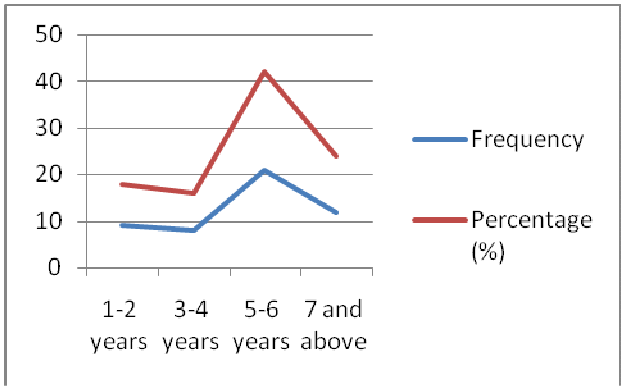

Fig 2 Duration of staff in the organization

EFFECTIVENESS OF INVENTORY MONITORING

In order to establish the effectiveness of stock out warning mechanism in the system of Satya Spare Parts Stores, the following responses were established. There exists a good stock out warning mechanism in the system of Satya Spare Parts Stores portrayed by the results 44 percent of the respondents as shown in Table 2.

Table 2: Effectiveness of stock out warning mechanism

Response	Frequency	Percentage (%)
Large extent	22	44
Small extent	15	30
Moderately	12	24
Not at all	1	2
Total	50	100

Source: Store Keeper

To establish the extent to which stock becomes obsolete in Satya Spare Parts Stores the respondents' answers were as follows. The finding in Table 3 indicates that stock became obsolete at a small extent represented by 34 percent this indicates that there is an efficient system to handle inventory.

EFFECT OF TURNOVER PERFORMANCE ON INDEPENDENT VARIABLES

To establish the extent of change in turnover on inventory the respondents were asked whether the magnitude is bigger when there is change in turnover rate and the following responses were obtained. The results in Fig 3 show that there was a greater change in inventory when the turnover rate changes, reflected in the above results by 48 percent from the respondents who say to a great extent.

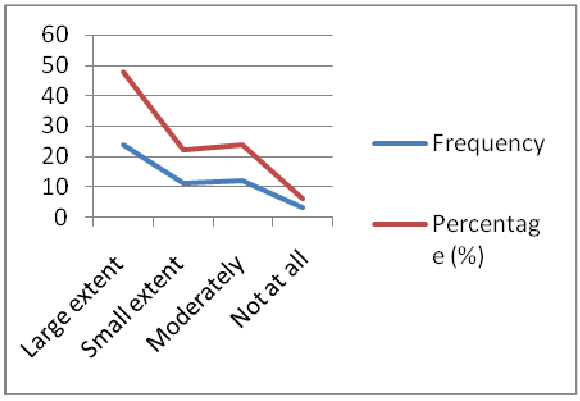

Fig. 3 Change in Turnover on Inventory

DISCUSSION

Inventory management practices are the key factor in ensuring continuous improvement in turnover expansion. In this regard this recommended that distribution companies should carry out efficient inventory monitoring and operate good inventory information management organization to ensure realistic inventory forecasts and high turnover.

Considering the significance of demand forecasting in achieving a good turnover, information that is required as input to demand forecasts must be reliable and based on customer needs. Therefore companies must strive to see that there is continuous monitoring of inventory, such that the decision rules that include safety stock, reorder points and EOQ on which forecasts are based are up to date and are based on historical data from past sales but also analyzed customer based information.

To minimize expertise, SSPS should identify slow moving stock and damages, regular cycle counts should be carried out. This will reduce the cost of stock confirmation at the end of the accounting periods because it may no longer be necessary to close the company for long periods to handle stock reconciliations.

This research also recommends intervention mainly for SSPS optimization of its turnover. This includes automation and instituting an automated consumer relationship management (CRM) module to capture lost sales for accuracy of demand forecasting information.

Finally, the manipulation of information to find patterns is increasingly giving companies a competitive edge over the others. Therefore require to introduce decision support tools that will analyze customer relationship management information and use it to categorize products and services that will improve turnover.

While excluding the original data series from consideration, every alternative method identifies a varying level of autocorrelation in the demand size, ranging from 25.5 percent of line items to about 45 percent. The rank-order method and the two high-low methods tend to indicate higher level of autocorrelation than does the logarithm transformation method. However, the latter method examines the demand sizes, rather than ranks or comparisons against the median, and is therefore considered the more useful method as stock control methods themselves require knowledge about the demand sizes. The logarithm transformation method has been selected as the sole method for further autocorrelation analysis on this basis. In addition, this method benefits from the ease and simplicity of generating results, as well as the ability to produce the required statistics, including the identification of significant autocorrelations as a whole.

CONCLUSIONS

The major aim of the study was to establish the degree effectiveness of inventory monitoring and inventory information management on turnover performance to advice interventions necessary to achieve optional turnover using Satya Spare Parts Stores as a case study. The study further puts insight on high and steadily growing turnovers can be achieved if demand forecasts are capable and timely Economic Order Quantities in line with customer demand cycles, therefore the decreasing demand forecasting time forever yields increases in inventory turnover as long as Economic Order Quantities were accurate. In conclusion inventory monitoring and inventory information management indicated that they were directly prejudiced; turnover performance, but they were essential for demand forecasting system to achieve accurate results and timely forecasts.

For spare parts management, expenditure expressed in *pieces* is more important than consumption expressed in money.

Depends on the criticality of the part, i.e. the consequences to the consumer if a part is needed and not available. This lead to the distinction between Vital, Essential and Desirable parts.

Service response time and functionality primarily determine criticality.

Service response time is not a suitable criterion for classifying parts as vital, essential or desirable, because an item can be part of dissimilar systems each with its own contracted response time.

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