INVENTORY MANAGEMENT ANALYSIS OF THE MANUFACTURING INDUSTRY

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ABSTRACT

Inventory is storing the finished goods and materials. Inventory management is a component of supply chain management that involves supervising non-capitalized assets. Inventory management is a critical process because inventory is a major asset that remains an investment until the products sell. This paper focuses mainly on inventory management techniques and analyses such as ABC classification analysis, FSN (Fast, Slow, and Non-moving) analysis, EOQ Model, Minimum Safety Stock, Turnover ratios, and Vendor Rating analysis. The Data of the inventory is collected from a private manufacturing industry located in Tamilnadu and the analysis is carried out and then the results are obtained. From the obtained results the important raw materials based on the value of money are classified and listed, raw materials are classified based on utilization, and the classification of suppliers with the help of vendor ratings is done and are taken into consideration.

KEYWORDS: Inventory, ABC classification, FSN analysis, Safety stock, Vendor rating

INTRODUCTION

Inventory is the term for the goods available for sale and raw materials used to produce goods available for sale. Inventory represents one of the most important assets of a business because the turnover of inventory represents one of the primary sources of revenue generation and subsequent earnings for the company's shareholders. The scope of inventory management concerns the balance between lead time, carrying costs of inventory, asset management, inventory forecasting, inventory valuation, future inventory price forecasting, physical inventory, available physical space, quality management, returns and defective goods, and demand forecasting.

A large inventory requires less replenishment and may reduce ordering costs because of economies of scale. Questions must be constantly answered as to when and how much raw material should be ordered when a production order should be released to the plant, what level of safety stock should be maintained at a retail outlet.

Inventory management is a very important function of the financial health of the company. Every organization constantly works to maintain optimum inventory to be able to meet its requirements and avoid over or under inventory that can impact financial losses to the company.. As a part of the supply chain, inventory management includes controlling and maintaining purchases from suppliers, maintaining the storage of stock, controlling the number of products for sale, and order fulfillment.

ECONOMIC PARAMETERS

ORDERING OR REPLENISHMENT COST

Ordering costs are essentially costs incurred whenever an order is placed. There are many kinds of clerical costs, such as invoice processing, accounting, and communication costs. Cost of finding suppliers and expediting orders – Costs spent on these will likely be inconsistent, but they are important expenses for the business such as Transportation costs, and receiving costs.

HOLDING COSTS

Holding costs are costs involved with storing inventory before it is sold. Inventory financing costs, Storage space costs, Inventory services costs, Inventory risk costs

SHORTAGE COST

These costs also called stock-out costs, occur when businesses become out of stock for any reason.

PURCHASE COST

It is the unit price of an item obtained either from an external source or from the unit replenishment cost of internal production. It is not necessarily constant. The unit purchasing price depends on the quantity procured happening in many practical situations.

COMPANY PROFILE

India's leading manufacturer of Diesel Fuel Injection Equipment for Cars, Sports Utility and Multi Utility Vehicles, Light Commercial Vehicles, Tractors, Single & Two Cylinder engines is located at Tamilnadu. It has been established in the year 1989.

PRODUCTS

1. Medium Duty Common Rail System for Heavy Duty Application
2. Light Duty Common Rail for Car /MUV'S /SUV'S
3. Unit Pump Common Rail for small/LTV'S
4. Fuel injectors

Ratios in the Inventory

Raw material turnover ratio

- Raw material turnover ratio is the velocity at which raw material is converted into goods ready for sale. If the raw material turnover ratio is high then the company is efficiently converting raw material into finished goods.
- Formula: Raw Material Price / Average raw material

Table 1 Raw material turnover ratio

Year	Raw material cost	Avg R.M	Ratio
2017	515,200,000	46,814,504	11.1
2018	576,400,000	53,608,082	10.75
2019	371,200,000	36,137,261	10.27

Inference

Form the table 1 we can see that the raw material turnover ratio is decreased from 11.1 in 2017 to 10.75 in 2018 which is then further decreased to 10.27 in 2019. It indicates that the company is not converting raw material into finished goods quickly.

.Holding period of raw material

- It refers to the number of days taken for the production unit to convert raw material to finished goods
- Formula: 365 /Raw material turnover ratio

Table 2 Holding period of raw material

Year	Total Days	Ratio	Days
2017	365	11.0	33
2018	365	10.75	34
2019	365	10.27	35

Inference

In 2017 conversion period was 33 days but it was increased to 34 days in 2018 and then further increased to 35 in 2019. As the raw material turnover ratio is increasing it indicates that the company is taking more days for conversion

Work in Process Turnover ratio

- Work in process turnover ratio is the velocity at which W.I.P converted into goods ready for sale. If the W.I.P turnover ratio is high then the company is efficiently converting into finished goods.

• Formula: Cost of production / Average W.I.P

Table 3 Work in process turnover ratio

Year	Cost of production(Rs)	Avg W.I.P	Ratio
2017	772,610,000	21,949,147	35.2
2018	849,050,000	36,720,702	23.12

Inference

From the table 3, Work in Process turnover ratio is decreased from 35.2 in 2017 to 23.12 in 2018 which indicates the company is converting the Work in Process goods into finished products quickly.,

Finished goods turnover ratio

- The finished goods turnover ratio is the velocity at which finished goods converted for sales. If the finished goods turnover ratio is high then the company is efficient
- Formula: Cost of goods sold / Total Finished goods

Table 4 Finished goods turnover ratio

Year	Cost of goods sold	Avg F.G	Ratio
2017	772,610,000	26,211,877	29.4
2018	849,050,000	26,243,339	32.3

Inference

Form the table 4, Finished goods turnover ratio is increased from 29.4 in 2017 to 32.3 in 2018 which indicates the company is converting more finished goods into sales quickly.

Inventory Turnover Ratio

- The inventory turnover ratio is an efficiency ratio that shows how effectively inventory is managed by comparing the cost of goods sold with an average inventory
- Formula: Cost of Goods Sold / Average Inventory

Table 5 Inventory Turnover Ratio

Year	Cost of Goods	Average	Ration
2017	772,610,000	576,400,000	1.34
2018	849,050,000	693,700,000	1.22
2019	555,090,000	478,600,000	1.15

Inference

From the analysis, it is found that in the 2017 year the inventory is sold completely for 1.34 times, in 2018 the inventory is sold completely for 1.22 times which is further decreased to 1.15 times in the year 2019. This indicates that the amount invested in the inventory is increasing year by year.

LITERATURE REVIEW

Qing et al.[1] discussed the modified Data Envelopment Analysis (DEA) model to address the ABC inventory classification. The result is compared with that of the traditional Analytic Hierarchy Process (AHP) methodology.

Qizhi et al.[2] discussed the in-depth analysis of models derived from the economic order quantity (EOQ) model to

reduce high inventory costs. An EOQ model is created with consideration such as lots ordered and delivered independently.

Zhang et al.[3] discussed a series of measures like total inventory management, strengthening production management and lowering product inventory, strengthening the marketing management to reduce inventory, strengthening the whole coordination of enterprise, and countermeasures to improve the management inventory level.

Ding et al.[4] discussed Inventory classification using ABC analysis. In this paper, a better inventory classification model for multiple criteria ABC analysis was proposed. The proposed model not only incorporates a linear programming model but also contains a nonlinear model. The proposed model is more flexible and representative, which can provide a better decision-making basis for inventory managers.

Gao et al.,[5] discussed a classification model and its application for inventory management of spare parts based on Analytic Hierarchy Process (AHP).The methodology used here is data collection, data normalization, data analysis, and finally it is evaluated and classified.

Nemtajela et al.,[6] discussed the use of inventory models to control the material flow and purchased inventory items in manufacturing companies. The objectives of this paper are to assess the effects of demand uncertainty on inventory management and to evaluate the difference in uncertain demand subject to demand controls as determined and the models used. Three inventory management models are studied; the Economic Order Quantity (EOQ), Activity-Based Costing (ABC), and Just-in-time (JIT).

ZhannaZenkova et al.,[7] discussed the combination of ABC-XYZ analytical technique for the case of the presence of outliers in the data. The modification of the method allows the identification of the outlier utilizing the Grubbs' test. After excluding the outliers, the mean and the standard deviation of the sample are used to re-estimate average sales, and recalculate revenue.

WanthaneePrachuabsupakij.,[8] discussed the ABC Classification in Spare Parts for Inventory Management with the help of data mining techniques such as Random Forest, Bagging, Adaboost, Dagging, and Decorate. The data were collected from real-time data in a company's inventory from the year 2015-2019. The results of the study are compared for precision, recall, f-measure, and accuracy and then it is classified as ABC Classification. The proposed model will be used to reduce the cost of storing and procuring spare parts, therefore the productivity of the factory can be improved.

OBSERVATION FROM LITERATURE REVIEW

- ✓ Different types of Primary Data Collection techniques, data normalization, and data mining techniques are understood. The Questionnaire model used to collect data using the weighted average method is used for the best results.
- ✓ Classification of the materials based on ABC Analysis is most predominantly used for the easy and best classification.
- ✓ The importance of the EOQ and the suited method for calculating the safety stock is also important in the inventory is calculated.
- ✓ Importance of inventory management analysis.

PROBLEM DESCRIPTION

The problem arises when the company receives an order or demands the raw material required for the fulfillment of the demand is not available in the inventory at that time, which thus leads to a delay of time for starting the manufacturing process which results in the shortage of time for delivery of finished products which can finally lead to the customer dissatisfaction, change of the value of the finished product in the market and reduced value of profit. Lack of optimization is also a problem that makes it more difficult to accurately plan and forecast future inventory needs.

OBJECTIVE

Effectively manage the Inventory with the consideration of inventory analysis and techniques which can increase the profit level of the company.

METHODOLOGY

Data Collection

Data is collected utilizing primary data collection i.e., the data is collected directly with the help of in-field observation and surveys in the reputed manufacturing company.

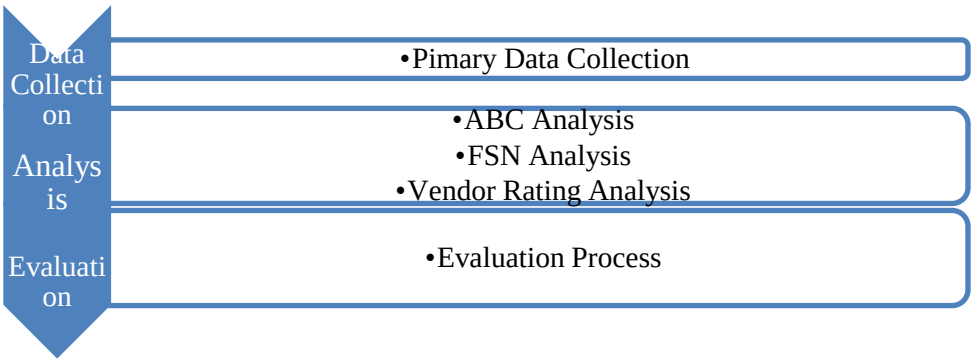

Figure 1: Flowchart of methodology

Data Analysis

ABC Classification Analysis

ABC analysis is an approach for classifying inventory items based on the items' consumption values and price of the component. Consumption value is the total value of an item consumed over a specified period. ABC analysis works towards this goal by letting management focus most of their attention on the few highest value goods and not on the low-value goods.

Item A:

- Items categorized under A are goods that have the highest value in terms of annual consumption. It is interesting to note that the top 70 to 75 percent of the yearly consumption value of the company comes from only about 10 to 20 percent of the total inventory items. Hence, it is crucial to prioritize these items.
- These items are kept as a priority item and efforts are made to avoid unavailability or stock-out of these items. These are also items that require frequent reorders on a daily or weekly basis.

Item B:

- These are items that have a medium consumption value. This amounts to about 30-40percent of the total inventory in a company which accounts for about 15 to 20 percent of annual consumption value.

Item C:

- The items placed in this category have the lowest consumption value and account for 10 percent of the annual consumption value which comes from about 50 to 60 percent of the total inventory items.

Steps in ABC Classification

Step 1 – The Raw materials required for manufacturing are listed with their annual demand and then the unit price of the material

Step 2 – Then the annual consumption value is found by multiplying the demand and the unit price of the material.

Step 3 – The percentage of the annual consumption of the corresponding item is calculated by dividing the annual consumption of that item by the cumulative total of annual consumption and then multiplied by 100 to obtain the percentage.

Step 4 –Then arrange the items based on the descending order of the percentage of annual consumption and the first 70% of the percentage of annual consumption is classified as an items and remaining are B and C items with B having 20 % and C having 10% of the percentage of annual consumption respectively.

Step 1 The Raw materials required for manufacturing are listed with their annual demand and then the unit price of the material.**Table 6: Few Notable items**

SL.NO	Item Code	Demand	Price per unit(Rs)	SL.NO	Item	Demand	Price per unit(Rs)
1	20FI101	14,000	200	16	20FI307	15,000	100
2	20FI102	12,500	100	17	20FI308	15,000	100
3	20FI103	6,000	50	18	20FI309	16,000	150
4	20FI104	12,000	200	19	20CRL01	8,000	200
5	20FI105	12,000	100	20	20CRL02	6,000	100
6	20FI106	6,000	150	21	20CRL03	6,000	50
7	20FI107	10,000	100	22	20CRL04	8,500	200
8	20FI108	12,000	100	23	20CRL05	10,000	100
9	20FI109	13,000	100	24	20CRL06	9,000	150
10	20FI301	17,000	200	25	20CRL07	10,000	100
11	20FI302	17,000	150	26	20CRL08	10,000	100
12	20FI303	8,000	70	27	20CRL09	5,000	100
13	20FI304	10,000	250	28	20CRL10	10,000	6500
14	20FI305	18,000	200	29	20CRL11	12,000	500
15	20FI306	8,000	200	30	20CRL12	9,000	1200

Step 2– Then the annual consumption value is found out by multiplying the demand and the unit price of the material

Table 7 Annual consumption

SL.NO	Item	Demand	cost per unit(Rs)	consumption value(Rs)
1	20FI101	14,000	200	2800000
2	20FI102	12,500	100	1250000
3	20FI103	6,000	50	300000
4	20FI104	12,000	200	2400000
5	20FI105	12,000	100	1200000
6	20FI106	6,000	150	900000
7	20FI107	10,000	100	1000000
8	20FI108	12,000	100	1200000
9	20FI109	13,000	100	1300000
10	20FI301	17,000	200	3400000
11	20FI302	17,000	150	2550000
12	20FI303	8,000	70	560000
13	20FI304	10,000	250	2500000
14	20FI305	18,000	200	3600000
15	20FI306	8,000	200	1600000
16	20FI307	15,000	100	1500000
17	20FI308	15,000	100	1500000
18	20FI309	16,000	150	2400000
19	20CRL01	8,000	200	1600000
20	20CRL02	6,000	100	600000
21	20CRL03	6,000	50	300000
22	20CRL04	8,500	200	1700000
23	20CRL05	10,000	100	1000000
24	20CRL06	9,000	150	1350000
25	20CRL07	10,000	100	1000000
26	20CRL08	10,000	100	1000000
27	20CRL09	5,000	100	500000
28	20CRL10	10,000	6500	65000000
29	20CRL11	12,000	500	6000000
30	20CRL12	9,000	1200	10800000

Step 3 – The percentage of the annual consumption of the corresponding item is calculated by dividing the annual consumption of that item to the cumulative total of annual consumption and then multiplied by 100 to obtain the percentage. And similarly, the percentage of total units is found out by dividing that item with the cumulative total of units and then multiplied by 100

Table 8 Percentage of annual consumption

SL.NO	Item	Demand	Price per unit(Rs)	consumption value(Rs)	% of total consumption	% of total units
1	20FI101	14,000	200	2800000	1.02	2.52
2	20FI102	12,500	100	1250000	0.45	2.25
3	20FI103	6,000	50	300000	0.11	1.08
4	20FI104	12,000	200	2400000	0.87	2.16
5	20FI105	12,000	100	1200000	0.44	2.16
6	20FI106	6,000	150	900000	0.33	1.08
7	20FI107	10,000	100	1000000	0.36	1.80
8	20FI108	12,000	100	1200000	0.44	2.16
9	20FI109	13,000	100	1300000	0.47	2.34
10	20FI301	17,000	200	3400000	1.24	3.06
11	20FI302	17,000	150	2550000	0.93	3.06
12	20FI303	8,000	70	560000	0.20	1.44
13	20FI304	10,000	250	2500000	0.91	1.80
14	20FI305	18,000	200	3600000	1.31	3.24
15	20FI306	8,000	200	1600000	0.58	1.44
16	20FI307	15,000	100	1500000	0.55	2.70
17	20FI308	15,000	100	1500000	0.55	2.70
18	20FI309	16,000	150	2400000	0.87	2.88
19	20CRL01	8,000	200	1600000	0.58	1.44
20	20CRL02	6,000	100	600000	0.22	1.08
21	20CRL03	6,000	50	300000	0.11	1.08
22	20CRL04	8,500	200	1700000	0.62	1.53
23	20CRL05	10,000	100	1000000	0.36	1.80
24	20CRL06	9,000	150	1350000	0.49	1.62
25	20CRL07	10,000	100	1000000	0.36	1.80
26	20CRL08	10,000	100	1000000	0.36	1.80
27	20CRL09	5,000	100	500000	0.18	0.90
28	20CRL10	10,000	6500	65000000	23.62	1.80
29	20CRL11	12,000	500	6000000	2.18	2.16
30	20CRL12	9,000	1200	10800000	3.92	1.62

Step 4 –Then arrange the items based on the descending order of the percentage of annual consumption and the first 70% of the percentage of annual consumption is classified as A items and remaining are B and C items with B having 20 % and C having 10% of the percentage of annual consumption respectively.

Table 9 Percentage of annual consumption

SL.NO	Item	Demand	Price per unit (Rs)	consumption value(Rs)	% of total consumption	% of total units
1	20CRM10	10,000	8000	80000000	29.07	1.80
2	20CRL10	10,000	6500	65000000	23.62	1.80
3	20CRU08	11,000	1500	16500000	6.00	1.98
4	20CRM12	8,500	1400	11900000	4.32	1.53
5	20CRL12	9,000	1200	10800000	3.92	1.62

6	20CRM11	11,000	600	6600000	2.40	1.98
7	20CRL11	12,000	500	6000000	2.18	2.16
8	20CRM13	8,500	700	5950000	2.16	1.53
9	20CRL13	9,000	500	4500000	1.64	1.62
10	20CRU10	8,000	500	4000000	1.45	1.44
11	20FI305	18,000	200	3600000	1.31	3.24
12	20FI301	17,000	200	3400000	1.24	3.06
13	20FI101	14,000	200	2800000	1.02	2.52
14	20FI302	17,000	150	2550000	0.93	3.06
15	20CRU09	8,500	300	2550000	0.93	1.53
16	20FI304	10,000	250	2500000	0.91	1.80
17	20FI104	12,000	200	2400000	0.87	2.16
18	20FI309	16,000	150	2400000	0.87	2.88
19	20CRM04	9,000	250	2250000	0.82	1.62
20	20CRU11	9,500	200	1900000	0.69	1.71
21	20CRL04	8,500	200	1700000	0.62	1.53
22	20CRM05	8,500	200	1700000	0.62	1.53
23	20CRM06	8,500	200	1700000	0.62	1.53
24	20FI306	8,000	200	1600000	0.58	1.44
25	20CRL01	8,000	200	1600000	0.58	1.44
26	20FI307	15,000	100	1500000	0.55	2.70
27	20FI308	15,000	100	1500000	0.55	2.70
28	20CRU01	10,000	150	1500000	0.55	1.80
29	20CRM01	7,000	200	1400000	0.51	1.26
30	20CRL06	9,000	150	1350000	0.49	1.62

Then by the ABC classification, the materials are classified into 3 categories they are as follows

Table 10 Summary of ABC classification

Items	% of total consumption	% of total units	Classification
20CRM10,20CRL10, 20CRU08, 20CRM12 20CRL12,20CRM11	69.33	10.70	A
20CRL11,20CRM13, 20CRL13,20CRU10 20FI305, 20FI101, 20FI302, 20CRU09 20FI304, 20FI104, 20FI309, 20CRM04 20CRU11, 20CRL04,20CRM05	20.04	37.77	B
20CRM06,20FI306, 20CRL01, 20FI307 20FI308, 20CRU01, 20CRM01,20CRL06	10.63	51.53	C

A Class Items

- There are a total of 6 items under this A Classification which contributes about 69.33 % of the total consumption value with the stock level of 10.70 % of the total stocks.
- Items are goods where annual consumption value is the highest. These comprise a relatively small number of items but have a relatively high consumption value. So it's logical that analysis and control of this class are relatively intense since there is the greatest potential to reduce costs or losses.
- These are subjected to strict inventory control and are given highly secured areas in terms of storage.
- These are also items that require frequent reorders on a daily or a weekly basis.

- They are kept as a priority item and efforts are made to avoid unavailability or stock-out of these items

B Class Items

- There are a total of 19 items under this B Classification which contributes about 20.04 of the total consumption value with the stock level of 37.77% of the total stock.
- B items are interclass items. Their consumption values are lower than A items but higher than C items.
- These are subjected to moderate inventory control and are given moderate preferences in terms of storage in the inventory.
- These are also items that require moderate reorders every week.

C Class Items

- There are a total of 30 items under this C Classification which contributes about 10.63% of the total consumption value with the stock level of 51.53% of the total stock.
- C items have the lowest consumption value. This class has a relatively high proportion of the total number of lines but with relatively low consumption values. Logically, it's not usually cost-effective to deploy tight inventory controls, as the value at risk of significant loss is relatively low and these items would typically yield relatively low returns.
- Since these are low demand goods with a comparatively higher risk of cost in terms of excessive inventory.

FSN Analysis

FSN analysis in inventory management deals with the classification of items based on usage, consumption rate, and quantity.

The usual classification of Items at Inventory can be classified based on the following criteria

- Fast Moving (F): This refers to materials that have a high usage frequency
- Slow Moving (S): This refers to materials that have a slow usage frequency
- Non-Moving (N): This refers to materials that have a very low usage frequency
-

Steps in FSN Analysis

Step 1 – The items in the inventory are listed along with the consumption rate.

Step 2 – Then the % of the annual consumption is calculated by dividing the consumption of the item to the consumption of all units.

Step 3 – Then the items are arranged in the descending order and then the cumulative consumption percentage is found out.

Step 4 – Then the items are classified as cumulative % less than 60 are considered F, cumulative %61- 90 are considered as S, cumulative % more than 91% are considered as N.

STEP 1 and 2- The items in the inventory are listed along with the consumption rate and percentage of annual consumption.

Table 11 Data for FSN analysis

SL.NO	Item code	Annual Consumption	% of annual Consumption
1	20FI101	14,000	2.52
2	20FI102	12,500	2.25
3	20FI103	6,000	1.08
4	20FI104	12,000	2.16
5	20FI105	12,000	2.16
6	20FI106	6,000	1.08
7	20FI107	10,000	1.80
8	20FI108	12,000	2.16
9	20FI109	13,000	2.34

10	20FI301	17,000	3.06
11	20FI302	17,000	3.06
12	20FI303	8,000	1.44
13	20FI304	10,000	1.80
14	20FI305	18,000	3.24
15	20FI306	8,000	1.44
16	20FI307	15,000	2.70
17	20FI308	15,000	2.70
18	20FI309	16,000	2.88
19	20CRL01	8,000	1.44
20	20CRL02	6,000	1.08
21	20CRL03	6,000	1.08
22	20CRL04	8,500	1.53
23	20CRL05	10,000	1.80
24	20CRL06	9,000	1.62
25	20CRL07	10,000	1.80
26	20CRL08	10,000	1.80
27	20CRL09	5,000	0.90
28	20CRL10	10,000	1.80
29	20CRL11	12,000	2.16
30	20CRL12	9,000	1.62

STEP3-Then the items are arranged in the descending order and then the cumulative consumption percentage is found out

Table 12 Data arranged in based on consumption

SL.NO	Item	Annual consumption	% of annual consumption	cumulative %
14	20FI305	18,000	3.24	3.24
10	20FI301	17,000	3.06	6.3
11	20FI302	17,000	3.06	9.36
18	20FI309	16,000	2.88	12.24
16	20FI307	15,000	2.70	14.94
17	20FI308	15,000	2.70	17.64
1	20FI101	14,000	2.52	20.16
9	20FI109	13,000	2.34	22.5
2	20FI102	12,500	2.25	24.66
4	20FI104	12,000	2.16	26.82
5	20FI105	12,000	2.16	28.98
8	20FI108	12,000	2.16	31.14
29	20CRL11	12,000	2.16	33.3
7	20FI107	10,000	1.80	41.22
13	20FI304	10,000	1.80	43.02
23	20CRL05	10,000	1.80	44.82
25	20CRL07	10,000	1.80	46.62
26	20CRL08	10,000	1.80	48.42
28	20CRL10	10,000	1.80	50.22
24	20CRL06	9,000	1.62	67.67
30	20CRL12	9,000	1.62	69.29
22	20CRL04	8,500	1.53	75.67

Step 4 – Then the items are classified as cumulative % less than 60 are considered F, cumulative %61- 90 are considered as S, cumulative % more than 91% are considered as N

Table 13 Item classification

SL.NO	Item	Annual consumption	% of annual consumption	cumulative %	Class
1	20FI305	18,000	3.24	3.24	F
2	20FI301	17,000	3.06	6.3	F
3	20FI302	17,000	3.06	9.36	F
4	20FI309	16,000	2.88	12.24	F
5	20FI307	15,000	2.70	14.94	F
6	20FI308	15,000	2.70	17.64	F
7	20FI101	14,000	2.52	20.16	F
8	20FI109	13,000	2.34	22.5	F
9	20FI102	12,500	2.25	24.66	F
10	20FI104	12,000	2.16	26.82	F
11	20FI105	12,000	2.16	28.98	F
12	20FI108	12,000	2.16	31.14	F
13	20CRL11	12,000	2.16	33.3	F
14	20CRU04	12,000	2.16	35.46	F
15	20CRM11	11,000	1.98	37.44	F
16	20CRU08	11,000	1.98	39.42	F
17	20FI107	10,000	1.80	41.22	F
18	20FI304	10,000	1.80	43.02	F
19	20CRL05	10,000	1.80	44.82	F
20	20CRL07	10,000	1.80	46.62	F
21	20CRL08	10,000	1.80	48.42	F
22	20CRL10	10,000	1.80	50.22	F
23	20CRM03	10,000	1.80	52.02	F
24	20CRM10	10,000	1.80	53.82	F
25	20CRU01	10,000	1.80	55.62	F
26	20CRU03	10,000	1.80	57.42	F
27	20CRU06	10,000	1.80	59.21	F
28	20CRM07	9,500	1.71	60.92	S
29	20CRM08	9,500	1.71	62.63	S
30	20CRU07	9,500	1.71	64.34	S

F Class Items

- From the analysis, there are a total of 27 items which are fast-moving items.
- These are the items that have the highest usage frequency in the inventory.
- A strict level of inventory control is required for this type of item.
- The management should give most priority to these items in terms of storage in the inventory.
- These items should be reordered regularly since this has the highest usage in the inventory.

S Class Items

- From the analysis, there are a total of 19 items which are slow-moving items.
- These are the items which have the slow frequency of usage in the inventory
- A moderate level of inventory control is required for this type of item.

- The management should give priority for these items after the F Class items to the inventory.
- These items should be reordered on a moderate basis since this has the lowest usage in the inventory.

N Class Items

- From the analysis, there are a total of 9 items which are Non- moving items.
- These are the items that have a low usage frequency in the inventory.
- A very low level of inventory control is required for this type of item.
- The management should give the least priority to these items in terms of storage in the inventory.

Advantages of FSN

- An easy way to find dead stock and reduce its accumulation in the inventory.
- This also enables to keep fast-moving products at the location in the more accessible warehouse
- An effective way to categorize inventory in a way that the categories in which the products are kept say a lot about the behavior of the product in a supply chain.

Safety Stock

Safety stock is a term used to describe a level of extra stock that is maintained to mitigate the risk of stock outs caused by uncertainties in supply and demand. Adequate safety stock levels permit companies to proceed according to their plans.

Reasons for Carrying Safety Stock

1. Protect against inconsiderable variations in supply/demand.
2. Compensation for forecast inaccuracies
3. Prevent disruptions in manufacturing or deliveries
4. Avoid stock-outs to keep customer service and satisfaction levels high

Reorder Level

Reorder level in a company is a level of stock or inventory at which the company should place a new order with its suppliers to obtain the delivery of raw materials inventory at the right time. With an accurate reorder point, the company will be able to have enough stock on hand to satisfy customer demand without tying up excess capital in inventory.

Vendor Rating Analysis

Vendor rating is the result of a formal vendor evaluation system. Vendors are given performance ratings based on the delivery time, quality of the product, and price of the material. The vendor rating may take the form of a hierarchical ranking from poor to excellent and whatever rankings the firm chooses to insert in between the two. Most firms want vendors that will produce all of the products and services defect-free and deliver them atthe right time at the right price. To accomplish the rating of vendors certain criteria are used. The Vendor Rating is to be done based on three criteria they are as follows

1. Quality of material: Based on the Quality of Products that the vendor supplied.
2. Delivery Time of material: Based on Delivery Time of the products the vendor supplied.
3. Price of material: Based on the Prize of the material that the vendor-supplied

Determination of Vendor Rating

The Vendor Rating is carried out by the weighted-average method in which each criterion is given certain weightage and then evaluated respectively and a rating/score is given for the vendor. Out of the Score, the vendor with the highest score is considered and utilized. For the Vendor rating classification, the weightage of the criteria are as follows

1. Quality of material: 50%
2. Delivery Time of material: 30%
3. Prize of material: 20%

The overall Vendor Rating will be the weighted average of the three parameters indicated above. Accordingly, Overall Vendor Rating (VR) is to be determined based on the following formula:

VR=(50*QR+30*DR+20*PR)

Where QR= Quality Rating
DR= Delivery Rating
PR= Price Rating

After the determination of the vendor rating, the vendor with the highest score between the vendors who supply the same raw material to the company is selected for the order.

The main advantage of the vendor rating is that it is easy to figure out the best vendor out of all vendors because the vendor rating gives scores for each and every criteria and the criteria have certain weightage given by the company itself.

VENDOR	QUALITY (WEIGHTAGE=50)	DELIVERY (WEIGHTAGE=30)	PRICE(WEIGHTAGE=20)	TOTAL SCORE
a1	(3/5)X50 = 30	(4/5)X30 = 24	(2/5)X20 = 8	30+24+8 =62
a2	(4/5)X50 = 40	(3/5)X30 = 18	(2/5)X20 = 8	40+18+8=66
b1	(3/5)X50 = 30	(2/5)X30 = 12	(3/5)X20 = 12	30+1212=54
b2	(3/5)X50 = 30	(3/5)X30 = 18	(5/5)X20 =20	30+18+20=68
c1	(4/5)X50 = 40	(4/5)X30 = 24	(2/5)X20 = 8	40+24+8=72
c2	(2/5)X50 = 20	(1/5)X30 = 6	(4/5)X20 = 16	20+6+16=42
d1	(4/5)X50 = 40	(4/5)X30 = 24	(4/5)X20 = 16	40+24+16=80
d2	(3/5)X50 = 30	(4/5)X30 = 24	(2/5)X20 = 8	30+24+8=62
e1	(2/5)X50 = 20	(2/5)X30 = 12	(3/5)X20 = 12	20+12+12=44
e2	(2/5)X50 = 20	(2/5)X30 = 12	(2/5)X20 = 8	20+12+8=40
f1	(3/5)X50 = 30	(3/5)X30 = 18	(2/5)X20 = 8	30+18+8=56
f2	(4/5)X50 = 40	(3/5)X30 = 18	(1/5)X20 = 4	40+18+4 =62
g1	(3/5)X50 = 30	(2/5)X30 = 12	(4/5)X20 = 16	30+12+16=58
g2	(3/5)X50 = 30	(4/5)X30 = 24	(2/5)X20 = 8	30+24+8=62
h1	(2/5)X50 = 20	(3/5)X30 = 18	(3/5)X20 = 12	20+18+12=50
h2	(4/5)X50 = 40	(2/5)X30 = 12	(3/5)X20 = 12	40+12+12=64
i1	(3/5)X50 = 30	(2/5)X30 = 12	(2/5)X20 = 8	30+12+8=50
i2	(5/5)X50 = 50	(2/5)X30 = 12	(1/5)X20 = 4	50+12+4=66
j1	(3/5)X50 = 30	(3/5)X30 = 18	(2/5)X20 = 8	30+18+8=54
j2	(3/5)X50 = 30	(3/5)X30 = 18	(3/5)X20 = 12	30+18+12=60
k1	(3/5)X50 = 30	(3/5)X30 = 18	(3/5)X20 = 12	30+18+1=60
k2	(3/5)X50 = 30	(3/5)X30 = 18	(4/5)X20 = 16	30+18+16=64

Table 14 Vendor rating

Inference

1. From the suppliers a1 and a2, a2 is selected because of having more score than a1
2. From the suppliers b1 and b2, b2 is selected because of having more score than b1
3. From the suppliers c1 and c2, c1 is selected because of having more score than c2
4. From the suppliers d1 and d2, d1 is selected because of having more score than d2
5. From the suppliers e1 and e2, e1is selected because of having more score than e2
6. From the suppliers f1 and f2, f2 is selected because of having more score than f1
7. From the suppliers g1 and g2, g2 is selected because of having more score than g1
8. From the suppliers h1 and h2, h2 is selected because of having more score than h1
9. From the suppliers i1 and i2, i2 is selected because of having more score than i1
10. From the suppliers j1and j2 , j2 is selected because of having more score than j1
11. From the suppliers k1 and k2, k2 is selected because of having more score than k1

RESULTS

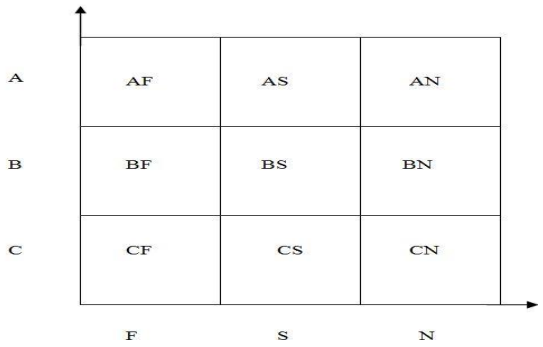

Figure 2 Combinations of ABC and FSN

AF Class

a. There are 4 items under this classification. They are 20CRM10, 20CRL10, 20CRU08 and 20CRM11.
b. These are the Fast-moving and high consumption revenue items. So these items are given priority in terms of inventory physical space and kept in the first row of the inventory for easy recognition and monitoring.
c. These items should be very regularly monitored and reorder of these materials should be done daily and periodically.

AS Class

a. There are 2 items under this classification. They are 20CRM12and 20CRL12.
b. These items are Slow-moving and high consumption revenue items. So these items are given priority less than the AF Class items for inventory space and are placed next to the AF Class items.
c. These items should be regularly monitored and reorder of these materials should be done every week.

BF Class

a. There are totally 8 items under this class. They are 20CRL11, 20FI305, 20FI301, 20FI101, 20FI302, 20FI304, 20FI104 and 20FI309.
b. These items are Fast-moving and medium revenue consumption items. So these items are given priority less than the AF and AS Class items for inventory space and are placed next to them for easy recognition.
c. These items should be monitored periodically and reorder of these materials should be done every week since these are fast-moving items.

BS Class

a. There are totally 10 items in this class. They are 20CRL13, 20CRL13, 20CRU09, 20CRM04, 20CRU11, 20CRL04,20CRM05,20CRM06,20FI306 and 20CRL01.
b. These items are Slow-moving and medium revenue consumption items. So these items are given priority less than the AF, AS and BF Class items for inventory space and are placed next to them.
c. These items should be monitored less often and reorder of these materials should be done on twice a month.

CF Class

a. There are totally 15 items under this classification. They are 20FI307, 20FI308,20CRU01,20FI109,20FI102,20FI105,20FI108,20CRU04,20FI107,20CRL05,20CRL07,20CRL08,20CRM03,20CRU03 and 20CRU06.
b. These items are Fast-moving and low revenue consumption items. So these items are given priority less than the AF, AS, BF, and BS Class items for inventory space and are placed next to them
c. These items should be monitored very less and reorder of these materials should be done once a month.

CS Class

a. There are a total of 7 items in this class. They are 20CRL06, 20CRM09, 20CRM07, 20CRM08, 20CRU07, 20CRU02 and 20FI303.
b. These items are Slow-moving and low revenue consumption items. So these items are given priority

less than the AF, AS, BF, BS, and CF Class items for inventory space and are placed next to them.

c. These items should be monitored very less and reorder of these materials should be done once a month.

BN Class

a. There is 1 item in this class. The item is 20CRU10
b. These items are Non- moving and medium revenue consumption items. So these items are given priority less than the AF, AS, BF, BS, CF, and CS Class items for inventory space and are placed next to them.
c. These items should be monitored very less and reorder of these materials should be done once a month

CN Class

a. There are a total of 8 items under this class. They are 20CRM01, 20CRM02,20FI106, 20CRU05,20CRL02,20CRL09,20FI103 and 20CRL03.
b. These items are Non- moving and low revenue consumption items. So these items are given the least priority than all Class items for inventory space and are placed at the last.
c. These items are the least monitored items.

2. The safety stock has been evaluated and the class of items in the safety stocks should be as follows

Sl.No	Class	Total Units
1	AF	139
2	AS	69
3	BF	276
4	BS	344
5	CF	518
6	CS	242
7	BN	36
8	CN	276

CONCLUSION

Inventory Management is very important for any company since a large value of the amount is used in the inventory for storing goods required for fulfilling the company's demand. Thus with the help of the ABC Analysis, FSN Analysis, EOQ, and vendor rating the inventory is managed effectively in the consideration of profit for the company. By these inventory management techniques, the company might be reducing a large number of losses which is incurred in the inventory of the company by easily differentiating the items which have more revenue and the items with less revenue. So, the company can concentrate more on the items with the most profit and manage these items in effective ways for making more profits.

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