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Inventory Optimization for Manufacturing Industries

Gaikwad Yashh Hemant [1], Najla Shafighi [2]*

bbw University of Applied Sciences, Berlin, Germany

[1] E-mail address: yashh.gaikwad0024@gmail.com

[2] * Corresponding author: Shafighi.naj@gmail.com

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ABSTRACT

Inventory management being the significant part of the supply chain drives the maximum monetary value. The purpose of this study is to optimize an inventory for Vhrushi India Pvt. Ltd. by reducing the inventory cost and developing an inventory management system. The Quantitative approach is used for the research work. The inventory cost reduction is performed by application of EOQ model and excel visual basics is used for Inventory Management system. The author intends to determine the appropriate order quantity and reorder point by implementation of EOQ (Economic Order Quantity) model. As technology advances, businesses must manage their inventories quickly, precisely, and accurately to support their operations. Therefore, the development of inventory management system is the second part of the research which smoothens the material flow and rings transparency in it by tracking the material movement and reducing the human errors. The result of the investigation provides economic order quantities, reorder points for all the items and IMS developed. Furthermore, the regression analysis enhances the value of the findings which shows two independent variables which are unit price and holding cost are significantly correlated with the Inventory cost. In this case, Holding Cost is considered as the most important factor in terms of affecting the Inventory Cost.

1. Introduction

The market's distribution has seen significant changes as a result of the economy's quick development. An important area of expansion for the growth of the national economy is the supply chain logistics sector (Brahme and Shafighi, 2022; Bhujbal and Shafighi, 2022). It can simultaneously boost regional employment, improve the industrial economic structure of the region, and lower operating expenses (YU, HOU and LI, 2019). A supply chain optimization model considers potential changes to the firm's network, such as network growth or contraction. The goal of the optimization is to maximize net revenue or minimize overall costs in order to satisfy anticipated demand. Controlling the flow of materials from suppliers to end consumers has always been a huge

concern (Patil & Shafighi, 2022). Supply chain management's strategic importance has been acknowledged by higher authorities in every firm across all economic areas. The primary characteristics of supply chain management always takes a holistic approach to the supply chain.

Inventory costs include the expenses related to ordering, storing, and managing inventory as well as managing the required paperwork. This cost is taken into account by management when deciding how much inventory to maintain on hand. Currently, the majority of domestic companies determine the inventory safety quantity dependent on the experience value of prior years. In order to guarantee the service level, the inventory safety quantity is typically set higher, which causes issues like high company commodity costs and insufficient cash flow. (Yu, Hou, and Li, 2019) Optimization of inventory cost is a critical factor as inventory is not affordable at both the extreme cases. Excessive inventory or the minimal inventory, both the cases can lead to the business failure. Hence, inventory must be maintained at level which can never led an organization to face excess inventory, low stock, or high inventory cost. Inventory cost is estimated to determine how much a business will benefit. Additionally, it aids in calculating how much more or less inventory you'll need to meet demand. (Tulchinsky, 2017) Various inventory models are in practice by organizations to optimize their inventory cost. An inventory management system optimizes inventory levels and makes sure that products are available through a range of channels. It provides an integrated, real-time view of all goods, stock, and orders across all outlets and sales channels. This allows businesses to have less inventory on hand, which also frees up funds for use in other aspects of the business. An inventory management system helps keep inventory costs low while yet fulfilling customer expectations. Moreover, Inventory management system is a required strategy which every organization should possess. An inventory management system is more comfortable to use, accurate and efficient as compared to the manual one. Numerous pieces of information are used by inventory management to track the products as they proceed through the system, including lot numbers, SKU´s, product costs, product quantities, and the dates on which they do so. Data transparency and the track of material flow are the must have assets for any organization and that is achieved through the efficient Inventory management system. The paper focuses on the optimization of the inventory for the sake of developing an organized and efficient inventory management system and reduction of inventory cost by thorough analysis of the present inventory. The research will deep dive into the inventory optimization models and will do the analysis for selecting the appropriate inventory optimization model.

2. Literature Review

Supply chain management is the process of managing the entire manufacturing flow of a good or service, from the procurement of raw materials to the finished goods being delivered to the client. To transfer the product from suppliers of raw materials to companies that deal with clients directly, a firm sets up a network of suppliers. It is evident that the traditional methods of operation will not be enough in light of the difficulties that supply chains will face in the future. It's unlikely that even best-in-class performance from today will suffice in the future. IDC believes that for the supply chain to be successful, it must be transformed into a "thinking" supply

chain that is closely connected to all data sources, equipped with thorough and quick analytics, openly collaborative through cloud-based commerce networks, aware of cyberthreats, and cognitively interwoven. Technology is becoming a major force for change, notably artificial intelligence, blockchain, and the Internet of Things, according to IDC supply chain research (IoT). So as to compete with the market and generate a good reputation, every startup must adapt with the changing technology and cope up with the pace. Vhrushi India being new in the market, needs the smart inventory models and the technology to speed up the progress and find the right direction for the growth in the market (Badrinarayanan & Shafighi, 2022).

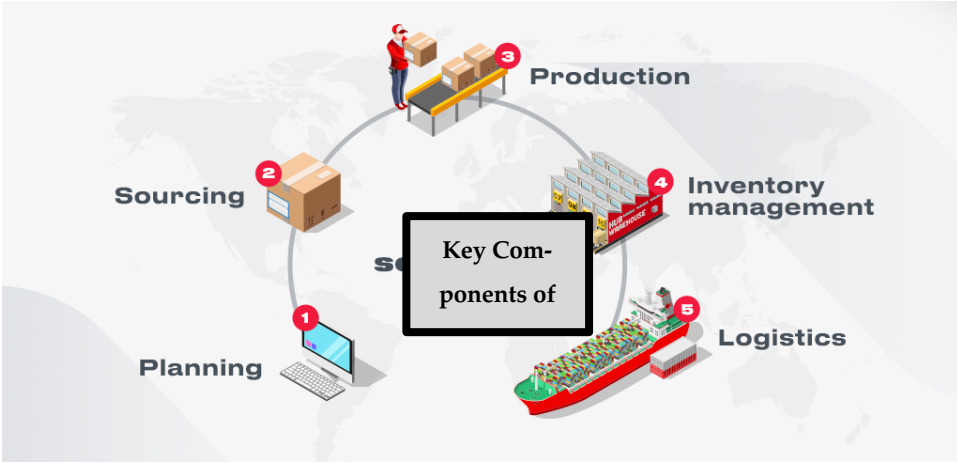

Figure 1: Key Components of Supply Chain Management
Source: (Innovecs 2021)

Inventory Optimization

Inventory optimization is the method of having the right amount of inventory on hand to meet demand, save logistical costs, and avoid common inventory issues including stockouts, overstocking, and backorders. Inventory optimization is an e-commerce best practice and methodology that employs tools, technology, processes, and approaches to track inventories in real-time, more accurately predict demand, and manage storage to ensure that stock control is managed successfully.

ABC Analysis

Organizations with big inventories nowadays do not consider it cost-effective to create policies for the management of specific inventory products. Therefore, managers must categorize these objects based on their relevance and assign each item to a specific asset class. (Abdolazimi et al. 2021) There is a wealth of literature on the topic of categorizing inventory products into predefined and ordered (in terms of proportion) ABC categories. A common classification method is ABC analysis, which relaxes rules on low-value products while tightening controls on high-value items to manage inventory effectively.

Categorization Criteria of the Inventory as per ABC Analysis

Stock-Keeping Units (SKUs), the inventory goods used in inventory management, can be divided into three preset and ordered groups using the ABC analysis technique: The most valuable things, which require strict and rigorous control, are found in Category A. The medium valued items, found in Category B., and the items with the lowest value, found in Category C. This technique's major goal is to handle the vital few items (A-items) carefully while avoiding wasting valuable resources on the management of the inconsequential numerous items (C-items). Additionally, controlling inventory goods according to importance will enable managers to keep inventory-associated costs in check and thereby boost the competitiveness of the organization (Kaabi et al. 2018). Inventory items are classified in the traditional ABC analysis based on the Annual Dollar Usage, a single criterion. However, more recent research has discovered a number of other factors, including Lead Time, Average Unit Cost, Critical Factor, Demand, Turnover, and others, that may have a substantial impact on an item's classification. As a result, the ABC analysis is regarded as an Multicriteria Inventory Classification technique. As a result, in a multi-criteria framework, the weighted scores of the items are used to categorize them. The score for each item is the result of an aggregation function that combines the item evaluations on the various criteria and the criteria weights. Then inventory items are arranged in decreasing order according to their scores. Then, the ABC groups are created utilizing the following popular distribution: The products with the greatest rankings fall under category A (large value items), the products with the least rankings fall under category C (low priced items), and the rest products fall under category B (medium value items). Different proportions may be used in this situation because there is no set percentage for each category, according to the level of significance attached to each inventory item. (Kaabi et al. 2018).

Traditional ABC's approach of grouping and inventory control has several drawbacks. Due to these flaws, a model for optimization was created in the current study to help ABC make better, deciding on grouping and inventory management. Additionally, it simultaneously improves the business relationships between revenue, inventory investment, and customer happiness as well as a company's budgeting for inventory expenses.(Abdolazimi et al. 2021)

Lot Sizing techniques

To maintain the availability of resources, materials management aims to minimize inventory costs. When demand fluctuates, procedures are utilized to calculate lot size in order to lower total holding and ordering expenses. Different methods can be used to calculate lot sizes.

1. POQ
2. Lot for Lot
3. Wagner Within Algorithm
4. EOQ

1. EOQ

In inventory management, the Economic Order Quantity (EOQ) is the quantity of orders that minimizes both the overall holding cost and the booking cost. The EOQ model was one of the first conventional production scheduling models. Under operations management, the ideal inventory level has been determined using the EOQ mathematical formulae. The model that is most usually applied is the EOQ one. Ford W. Harris developed this model in 1913. The Wilson EOQ model is another name for the EOQ model. According to this model, the overall inventory-related cost curve has a minimum point, and some expenses (such as ordering costs) go down as inventory holdings rise, while other costs (such as keeping costs) go up. At this stage, inventory costs are at their lowest point. (Riza et al. 2018) The traditional Economic Order Quantity (EOQ) approach looks to find the optimal order quantity in order to lower total inventory costs, including ordering and holding costs.(Khalilpourazari and Pasandideh, 2019)

Reorder point

For enterprises, the reorder point is an important turning point to determine the best time to place orders so they may prevent overstocking or shortages. (Nobil et al. 2020) Reorder point stock is often taken to mean when to place another order. ROP, then, is a time frame during which orders must be made again. Lead time and safety stock are other factors that affect ROP. The correct lead time is needed to make the ROP when the safety stock is reduced or almost gone. (Wanti, et. al, 2020)

One must know when to order each item in your inventory separately since different goods have varied sell-through rates. To determine the ROP for each item, one must take into consideration the following elements:

1. Lead time: Time taken (in days) for your vendor to fulfill your order.
2. Safety Stock: Safety stock is the quantity of excess stock you keep on hand, if any, to help avoid stockouts.
3. Daily usage: The average daily sales volume for the item.

Importance of Reorder Point

If you own a business, knowing when to order extra goods is essential. If you place an order while you still have a lot of items on hand, it will result in excess stock, which will increase your holding costs. If you place an order while you have no stock, you won't be able to make sales while the product is being delivered. You will lose more sales the longer it takes your vendor to deliver the goods. Having a reorder point enables companies to meet customer expectations without running out of inventory while also maximizing inventories and timely replenishing the stocks of particular items. (Essential Business Guides 2019)

Inventory Management System

Because manual handling might lead to human errors that could reduce accuracy in inventory operations, it is necessary to optimize the inventory. A thorough analysis of the system must be done before the process can be automated. The first step toward implementing an inventory management system is to recognize and reengineer the methods and procedures employed in the storage facility. Next, identify the processes that could be

automated. Understanding the process is made easier by modeling business processes and workflows. Inventory Management Systems are used to manage inventory most effectively in the warehouse. These systems include improving production quality so that raw materials can be ordered in the right quantity without having to order for production, reducing the length of the production cycle to reduce the quantity of the order for raw materials to lower the cost of raw materials for each order, reducing the amount of storage space needed, and reducing inventory levels to the barest minimum while still maintaining a steady level of stock.

As a result, the inventory management system has the following 4 crucial components:

1. Decrease cycle times
2. Improve manufacturing quality
3. Lower the stock position
4. Reduce the delivery period.

The aforementioned factors have an impact on inventory control practices in terms of reducing cycle times, which lowers production costs, and making it possible to sell quality products at a higher price and more profitably. They also have a positive impact on customer satisfaction because they receive quality products at reasonable prices. (Kaewchur, 2021)

Need of Inventory Management System

The primary problems with inventory management are having much more inventory and not being capable of selling it, not possessing enough inventory to fill orders, and not understanding what you have in stock and where it is located. Other challenges include:

- **Getting Accurate Stock Details -** One can't determine when to restock or which merchandise is doing well if company don't have proper stock information.

- **Poor techniques - Using antiquated or manual approaches may cause operations to slow down and work to become more prone to error.**

- **Using Warehouse Space Well -** Staff employees spend time if products are difficult to find. Correct inventory management can aid in resolving this issue.(Jenkins 2020)

3. Methodology

The standard processes in the research study include developing and identifying a subject, reading relevant literature, choosing a strategy, collecting information, data analysis, and writing up have been used in this study. The chart below displays the overview of the structure of this study. The inventory optimization which is the aim of this research paper is divided into two main parts:

I) Inventory Cost Reduction

Optimization is always the form of an improvement, and it is being carried out to increase the efficiency. Efficiency deals with the increase in output in limited input. That is how the resources are used in the best

possible way and up to the fullest. Efficiency is best expressed in terms of the monetary value. Cost cutting without affecting the performance or on the other hand by increasing the performance is the true definition of optimization as per the author. Inventory cost reduction is the first part of the research which includes ABC analysis and the selection of the appropriate lot sizing technique. Proper lot sizing technique streamlines the purchasing plan of the company and eliminates the excessive unnecessary costs involved in inventory and purchasing.

II) Inventory Management System

Moreover, the second part of the research delas with the development of inventory management system to enable a robust software in the company to regulate the material flow. The intention is to tackle the loopholes and disadvantages of the traditional methods such as keeping the inventory record in MS excel manually. Developing an IMS as a software is going to smoothen the material transfer process within the different locations and enhances the transparency in the material movement. Development of IMS involves the formation and execution of the code to build the IMS and cover the required functions by using the program of excel visual basics.

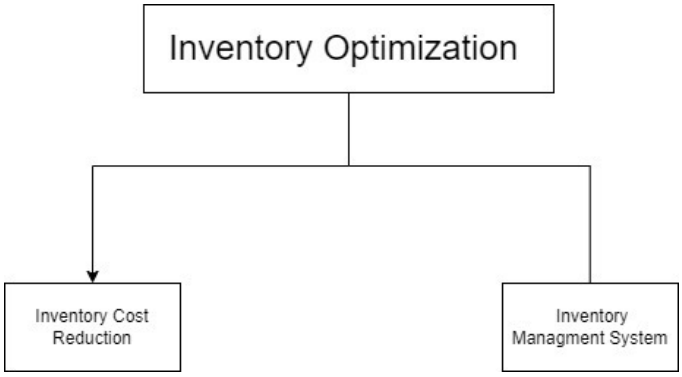

Figure 2: Research Outline
Image Source: Authors Findings

Research Framework

The reader ought to have a clear understanding of the project's scope at this point, as well as any research gaps that must be filled for the project to succeed. To accomplish the goals of the study, this is being carried out. The framework of this research study revolves around dependent and independent variables.

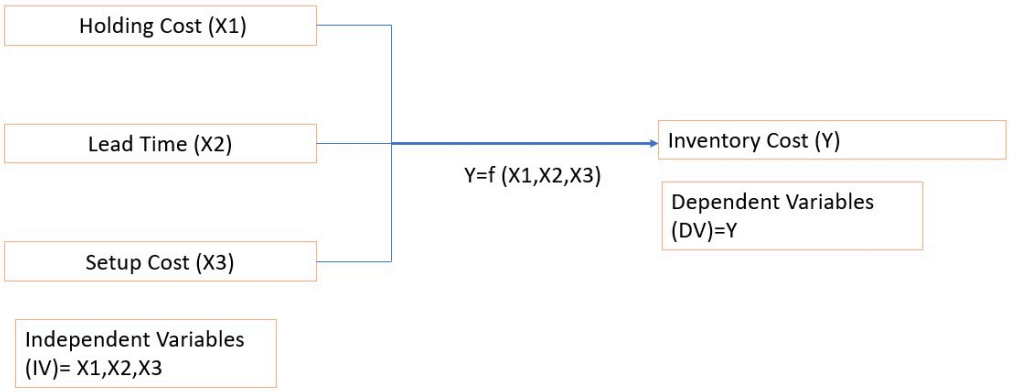

Figure 3: Research Framework
Image Source: Authors Findings

The research of inventory optimization for Vhrushi India Pvt. Ltd. revolves around three independent variables and one dependent variable. Refer to figure 3 the inventory cost is defined as dependent variable of this study and Inventory Holding cost(X1), Lead time(X2), and setup Cost(X3) are independent variables because it is not affected by any other study elements, (Bhandari 2022) . The variables are explained below:

Lead Time:

Lead time is the period between processing an order and getting your items shipped out. It is a crucial tool for applying the right reorder point formula and for estimating safety stock inventory. (Tulchinsky 2017) Overall inventory levels are directly impacted by lead time. Company will need to keep more product on hand in the inventory the longer the lead time is. Deliveries become increasingly unpredictable with longer lead times, forcing businesses to place orders largely reliant on demand estimates. The more stock a company must have on hand and pay to store, the longer the lead time is. Longer lead times also affect how agile and adaptable your business is. It gets increasingly difficult to bring new or enhanced products to your brand when more resources are devoted to buying more of the same things. Thus, cutting the lead time benefits both cost optimization and the effectiveness of the supply chain.

Unit Cost:

Unit Cost refers to the Price offered by the supplier for the product. It varies from supplier to supplier, and it plays an important role in the inventory cost. The value of a company's inventory includes the material's unit cost. In both real life and accounting, inventory and unit cost are directly related. In reality, a business cannot have inventory without also having the proportionate costs necessary to produce that inventory. (Masters 2022)

Holding Cost:

One of the biggest problems businesses have with inventory management is holding costs. These costs comprise storage, labor, transportation, item replacement, shrinkage, and depreciation and are incurred when products

are kept on the shelves in a warehouse, distribution facility, or retail location. Typical holding costs, also known as inventory carrying costs, can range from 20% to 30% of total inventory value and climb the longer an item is kept in storage before being sold. They depend on the industry and size of the business. The proportion will change depending on the volume of goods sold, the inventory turnover rate, the location of the warehouse or store, and the amount of storage needed. (Mccue 2020).

Inventory cost:

Inventory cost serves as the dependent variable for this paper. A dependent variable is one that is changed as a result of a change in an independent variable. Basically, the dependent variable depends on the independent variable, and it is the outcome for which the research aims at. After changing the independent variable, the dependent variable is recorded. By doing statistical studies, this measurement data may be utilized to determine if and how much the independent variable affects the dependent variable.(Bhandari, 2022) The independent variables are intentionally changed by an author or researcher to bring out the intended change or result of the study. It can also be considered as the cause-and-effect equation. Inventory holding cost is directly proportional to the Inventory cost and hence the change in holding cost directly affects the Inventory cost. In order to reduce the inventory cost, an author intends to analyze and implement the techniques which will make the necessary changes in the inventory cost and give the desired result. Along with this, the lead time and unit cost are also the critical factor which has a very high scope to bring out the desired result and get down the inventory cost.

Data Collection Method

Data collection is the deliberate process of gathering facts about the topic of this study. The data collected from the company files, documents and personnel is of qualitative (meaning contextual in nature) and quantitative type (meaning numeric in nature). Different methods can be used to gather both sorts of data, however some are more suitable for one than the other.(7 Data Collection Methods in Business Analytics 2022)

Prior to the data collection, few points were taken into the consideration-

- The research question which research aims to answer.
- The data subjects from which the data can be collected
- The collection time frame
- The data collection method which is best suited for this research.

Research Framework:

Part I: Inventory Cost Reduction

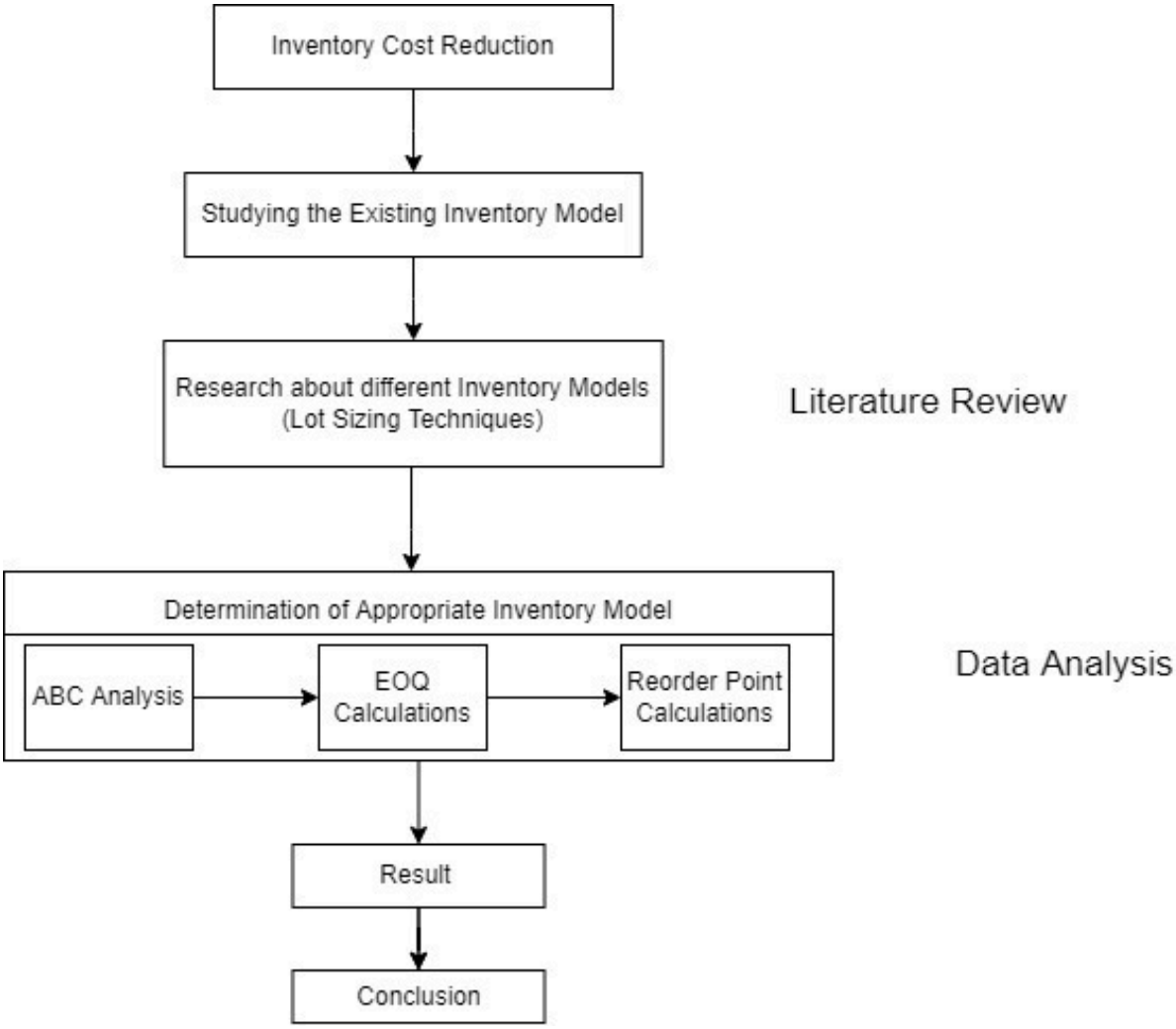

Figure 4: Methodology of Inventory Cost reduction

Image Source: Authors Findings

Part II: Development of Inventory Management System

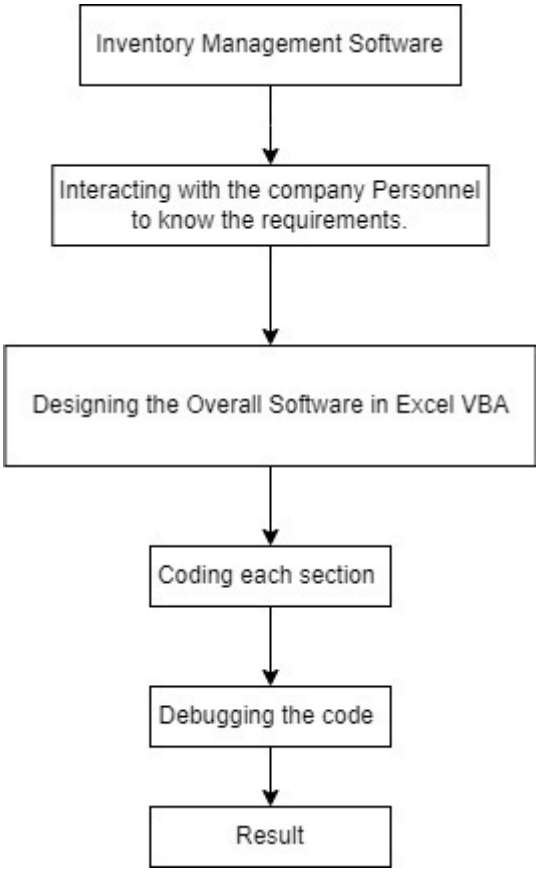

Figure 5: Methodology of Inventory Management System
Image Source: Authors Findings

4. Data analysis:

Data analysis is the methodical application of logical and/or statistical approaches to explain and demonstrate, summarize and assess data. The theories and approaches included for the research in previous chapters are analyzed in detail in data analysis. As the research is based on quantitative method of research, data analysis is all about the numerical data, mathematical calculations, graphical representation, and application of research methodology. Calculations for application of EOQ model and determining the Economic Order quantities and Reorder points for all the items followed by the regression analysis are included in this section. Along with this, the development of IMS is introduced step by step.

Part I: Inventory Cost Reduction

A) ABC Analysis

Table 1: Time and cost analysis of assembly processes

Item	Yearly De-mand (kg)	Cost/unit (INR)	Total Cost	Percentage Cost	Cumula-tive %	Classifica-tion
Oil Resi-due	137590	80	11007200	29.49	29.49	A
Bakery Residue	111740	92	10280080	27.54	57.03	A
Calcium	23260	295	6861700	18.38	75.41	A
Potas-sium	11000	290	3190000	8.55	83.96	B
Vitamin A	14000	240	3360000	9.00	92.96	B
Protein 1	8000	180	1440000	3.86	96.81	C
Protein 2	8000	130	1040000	2.79	99.60	C
Bags	50000	3	150000	0.40	100.00	C
Total	363590		37328980	100		

Table Source: Authors Findings

Further, as per the classification, percentage of classes is calculated out of the whole.

- **Calculation of percentage of Volume:**

  Total No of items= 8

  1. Number of items in Class A = 3

  Percentage = $\frac{3}{8} \times 100$

  Percentage of Class A items = 37.5%

  2. Number of items in Class B = 2

  Percentage = $\frac{2}{8} \times 100$

Percentage of Class B items = 25 %

3. Number of items in Class C = 3

Percentage = $\frac{3}{8} \times 100$

Percentage of Class C items= 37.5 %

So, based on above calculation, 3 items in Category A which are Oil Residue, Bakery Residue and Calcium constitutes for 37.5 % of total items. Category B includes Potassium and Vitamin A which counts for 25%. However, Category C items which are Protein 1, Protein 2 and Bags constitutes around 37.5% which is like the Category A.

Table 2: Total cost of inventory according to class

Categories	Total Cost
Class A	28148980
Class B	6550000
Class C	2630000

Table Source: Authors Findings

- **Calculation of percentage of Cost:**

Total cost of 8 items= ₹ 3,73,28,980

- Items in Class A = ₹ 2,81,48,980

Percentage cost of items in class A

$= \frac{28148980}{37328980} \times 100 = \mathbf{75.40\ \%}$

- Items in Class B = ₹ 6550000

Percentage cost of items in class B

$= \frac{6550000}{37328980} \times 100 = \mathbf{17.54\ \%}$

- Items in Class C = ₹ 2630000

Percentage cost of items in class C

$= \frac{2630000}{37328980} \times 100 = \mathbf{7.04\ \%}$

Table 3: Summary of ABC Analysis

Classification	Percent of products in Inventory	Percent of inventory value in ₹
A	37.50%	75.40%
B	25%	17.54%
C	37.50%	7.04%

Table Source: Authors Findings

Based on the percentage calculated for each category, the graph is generated showing A category with 37.5% of inventory holding the value of 75.40%. While B category with holding for 25% (in graph: 37.5 + 25 = 62.5) of items in inventory is constituting for 17.54% (in graph: 75.40 + 17.54 = 92.94) of total value. Category C items has 37.5% (in graph: 62.5 + 37.5 = 100) of share in the inventory holding 7.04% (in graph: 92.94 + 7.04 = 99.98, Approx. 100) of total value.

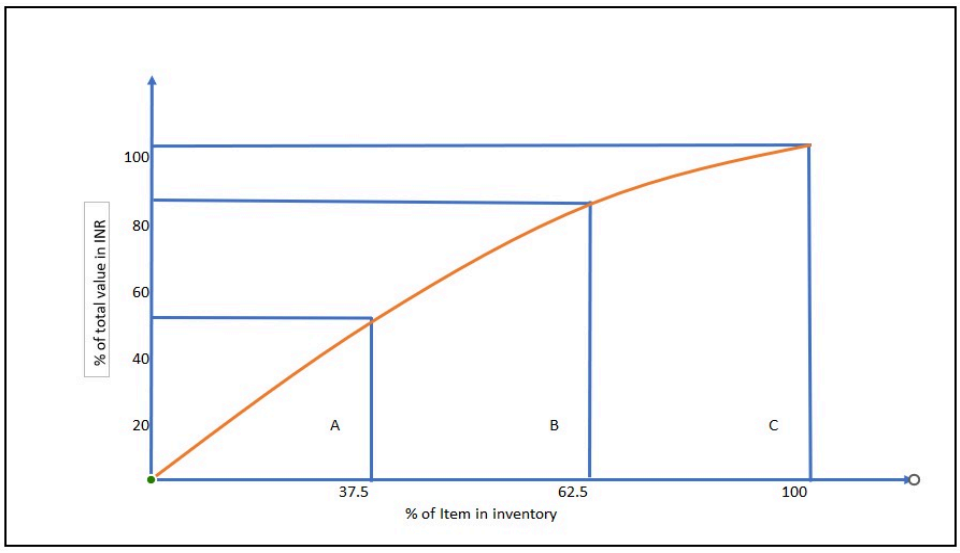

Figure 6: Graphical Representation of ABC Analysis
Image Source: Authors Findings

The initial stage of inventory cost reduction is complete now and the products are categorized according to their contribution in the total inventory based on their cost. Furthermore, research is heading on the selection of the appropriate Lot Sizing technique.

Data for the case study

The company's data of year 2021 (January 2021 – December 2021) is considered for the application of EOQ. Demand for the whole year, unit cost and the quantity purchased are the required entities for stating the existing situation of the company regarding purchasing and inventory. Therefore, these required entities are extracted from the company's data.

Table 4: Raw Material Data of Oil Residue

Sr.No	Product	Demand	Ordered Quantity	Unit Cost	Purchasing Cost
1	Oil Residue				
	January	7144	19319	83	8727699
	February	7424			
	March	9776	24769		
	April	12031			
	May	11288	16483		
	June	18145	16444		
	July	10714			
	August	16483	28138		
	September	8791			
	October	7653			
	November	19388			
	December	8753			
	TOTAL	**137590**	**105153**		

Table Source: Company Data

Table 4 Shows the Demand and Ordered quantity for one of the basic and significant raw material that is oil residue. It is observed that total demand is not matching with the ordered quantity. Similarly, for other raw materials of the company which are Bakery Residue, Calcium, Potassium, Vitamin A, Protein 1, Protein 2, and Bags, it is observed that the ordered quantity and demand is not matching. The huge difference between demand and ordered quantity depicts the occurring of low stock at some times or the excess storage at few.

EOQ Calculation

EOQ =Q*= $\sqrt{\frac{2DS}{H}}$ (Istiningrum et al. 2021)

Where,

D= annual demand (unit per year).

S= Ordering Cost.

H= Holding Cost. (Istiningrum et al. 2021)

1. EOQ for Oil Residue

Here Annual Demand = 137590 kg

Cost of Ordering S = ₹ 3500

Cost of Holding H= Unit price * Holding Rate = 1.20

Therefore, EOQ= $\sqrt{\frac{2\times3500\times137590}{1\cdot20}}$

EOQ = 28330 kg

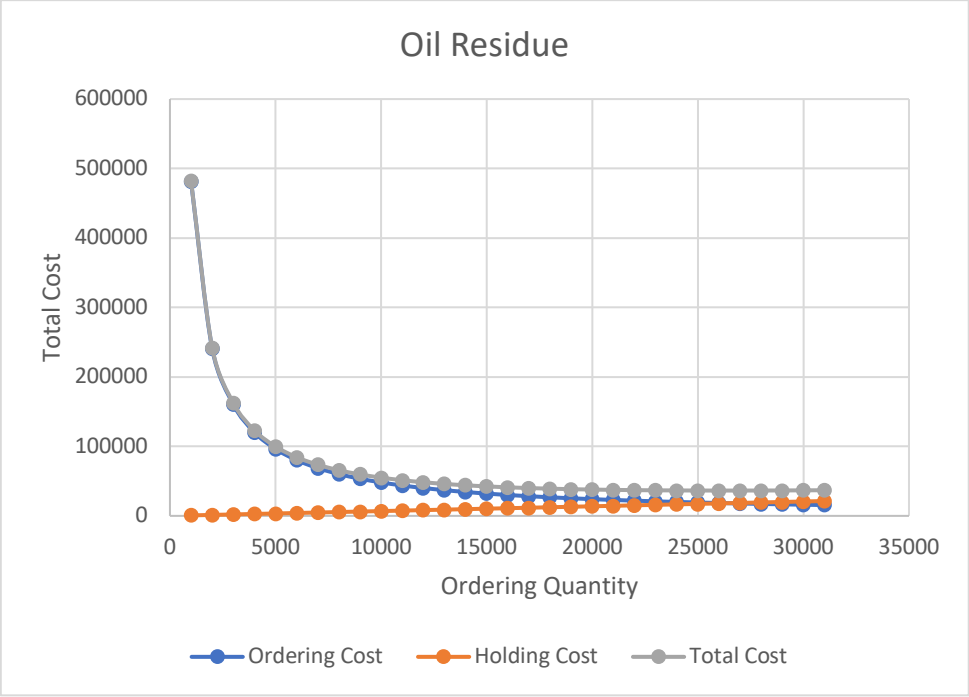

Figure 7: EOQ Chart for Oil Residue

Reorder Point

Formula:

ROP = $\frac{\textit{Annual demand}}{\textit{No.of working days in a year}}$ $\boldsymbol{x\ Lead\ Time}$ (Essential Business Guides 2019)

The equation of Reorder Point has an assumption that demand during the lead time is constant. By dividing the annual demand by the number of working days, the daily demand is then computed.(Essential Business Guides 2019).

Table 5. reorder point

Sr. No	Item	Yearly Demand	Cost/unit	Daily Demand	Reorder Point
1	Oil Residue	137590	80	470	28175
2	Bakery Residue	111740	92	381	11441
3	Calcium	23260	295	79	3572
4	Potassium	11000	290	38	1126
6	Protein 1	8000	180	27	546
7	Protein 2	8000	130	27	1092
8	Vitamin A	14000	240	48	956

Regression Analysis

A regression table that lists the outcomes of the regression will be produced when you run a regression analysis using software (such as R, SAS, SPSS, etc.). Understanding how to read this table will help to comprehend the regression analysis' findings. (Zach 2019).

Table 6: Regression Statistics

Regression Statistics	
Multiple R	0.988626686
R Square	0.977382725
Adjusted R Square	0.960419769
Standard Error	838604.4421
Observations	8

Table Source: Authors Findings

Multiple R

The correlation coefficient is shown here. It evaluates the degree of linear correlation between the dependent variables and the independent variable. The ideal linear relationship is represented by a multiple R of 1, whereas the absence of any linear relationship is represented by a multiple R of 0. R-square square's root is multiple R. The multiple R in this case is 0.98865, indicating a total linear relationship between the response variable's total inventory cost and the variable's unit price, lead time, and year holding cost.

R-Squared

This is written as r^2, and it is called as the coefficient of determination. It is the proportion of variance in the independent variable that can be explained by the dependent variable. R-square value might be between 0 and 1. A value of 0 means that the dependent variable has no effect on the independent variable at all. If the dependent variable has a value of 1, it can completely and error-free explain the independent variable. In this the R-Squared is 0.97744, which indicates 97.74% of variance in the total inventory cost can be explained by the unit price, lead time and holding cost. In the ANOVA Table the Significance F is very important to understand this regression analysis.

Table 5: ANOVA Table

	df	***SS***	***MS***	***F***	***Significance F***
Regression	3	1.21562E+14	4.05207E+13	57.61865496	0.000951878
Residual	4	2.81303E+12	7.03257E+11		
Total	7	1.24375E+14			

Table Source: Authors Findings

Significance F

The p-value for the F statistic is the final item in the table. You may assess the significance of the whole regression model by comparing the p-value to a significance threshold, with the most popular options being.01,.05, and.10. There is enough data to determine that the regression model fits the data better than the model with no dependent variables if the p-value is less than the significance level. This result is advantageous since it shows that the dependent variables in the model really enhance model fit.

The significance level in this case is F, which is 0.00094, below the usual significance levels of 0.01, 0.05, and 0.10. This demonstrates the statistical significance of the regression model, i.e., how well the model fits the data in comparison to the model with no dependent variables.

Table 6: P-Values Table

	Coefficients	**Standard Error**	**t Stat**	**P-value**
Intercept	-810990.0847	938074.1348	-0.864526645	0.436062933
Unit Price	-8557.910119	3086.343306	-2.772831559	0.050185272
Lead Time	5430.517572	29034.57324	0.187036246	0.86073586
Anual Holding Cost	694.4169132	70.48094407	9.852548407	0.000595257

Table Source: Authors Findings

P-values

In this table we can see that the P-value for Unit Price and Annual Holding cost is less than 0.05. Therefore, we can say that the independent variables are significant whereas when we look at the lead time the P-value is 0.860 that is greater than 0.05, so it is not a significant independent variable.

And when we look at the Coefficients, we can see that the coefficient for the Unit price is negative which indicates that when the Unit price increases the Total cost decreases. However, practically it is not possible. Ideally, the unit price is directly proportional to the total cost. Examination of the variability in coefficient estimates should be done rather than just the estimates themselves when assessing the impact of product's constituent parts. Unit price is the entity which shows high variation. When a substantial proportion of the price variation in your product's pricing cannot be well explained, regression modeling of price is not a good fit. Due to its reliance on just two extreme activity levels, the technique does not accurately capture all of the available data. Due to outlier costs that are higher or lower than those experienced by the organization in different products unit cost levels, such cost levels could not be typical of the costs incurred. (Institute, Corporate Finance 2020a) Hence, the unit cost coefficient is showing the negative value in the regression analysis and this method does not justify well, the variable unit cost.

Regression Analysis Summary

1. This model explains 97% of the data which can be calculated from the R Square.
2. This model is good because the Significance F value is less than the common significance level 0.01,0.05 and 0.10.
3. There is positive relationship between the dependent variable (Holding Cost and Lead time) and independent variable whereas it has a negative relationship between the dependent variable (Unit Price) and independent variable.
4. The P-values are less than the 0.05 so they are the good variables, and the regression analysis is also good.

5. Conclusion

Supply chains are under intense pressure to be more productive and efficient—as well as to support new business models in a chaotic world. Inventory is a crucial element of the sector, so the company must understand the effects of good Inventory management practices on the success of project completion. According to the research, synergetic and practice-based approaches, such ABC analysis and EOQ analysis, are more cost-effective and advantageous to construction enterprises than theoretical models. The conclusion drawn from the review of the literature and interpretation of the research is that an organization can use EOQ to make the best material purchases and can keep safety stock in case of material delays. We will be able to maximize profit with reduction in inventory cost if we can accurately implement and adhere to all inventory management procedures.

In summary, we can say that real-time inventory position monitoring is the key to mastering the art of inventory management. Over the past ten years, businesses have come to realize that in order to reduce costs and increase profitability, management practices and processes must alter. Carrying operating stocks is only sensible when the material is required. Obsolete, redundant, or surplus stuff is just money that is lying on a shelf and costs additional money to maintain. The company's performance is determined to be enhanced by the enhanced inventory control management system implemented.

5.1 *Limitations*

• The EOQ model considers that demand is known and constant which cannot be accurate in practical situations. No matter how strong the demand forecast is, there is still some possibility of changes in the demand.

• Future additions to consider include supplier restrictions such lead time is assumed to be uncertain by considering it as a fuzzy or random component in the inventory model. The EOQ model also assumes that Lead time is constant which can be dangerous in reality if completely depended on this assumption. The lead time has many reasons to vary like climatic conditions, pandemic for example COVID-19, unavailability of raw material on suppliers' side, end of life of product and many more. The buffer zone for changing lead times should be introduced in the EOQ model.

5.2 *Managerial Implications*

To increase system efficiency and profit, managers and researchers can use the results of this paper to build their inventory systems taking into account certain rates of imperfect production, lead-time, and system costs.

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