Maintenance of Optimum Level of Investments in Stores by Ascertaining Reorder Point and Stockout Cost

Dr. R. Nalini, Dr. R. Amudha, T Vaishnavi

Abstract— **The handling of materials with the right quantity, the right cost, and the right time is vital for the manufacturing company. This study is about the optimum level of investments that are made in stores, where the quantity and cost of materials should also be optimal. Nowadays, the majority of firms either spend too much money on overstocking or lose customers as a result of understocking. Thus, the issue has been addressed, and there is a need to examine the stocks in the manufacturing company. This study is being carried out based on the past 20 years of demand data at the store of Jeevan Solvent Extracts Private Limited, basically a rice bran oil manufacturing company, in an effort to stop overstocking and understocking of materials, which results in various consequences and expenses. In order to avoid this, stockout cost and optimum level of safety stock can be examined through various analyses, such as finding out the annual daily demand, reorder point, probability of the number of times the quantity was demanded, additional carrying cost, additional stockout cost, and total relevant cost. By examining those analyses, we can identify the optimum level of safety stock, and a new reorder point can be obtained. This will assist the company in determining at which point the minimum level of investments should be made, and this method will also be helpful for all manufacturing companies in figuring out their ideal safety stock level, their optimum reorder point and when to bare the minimum level of investments that are made in stores.**

Index Terms— **Cost control, Reorder point, Safety Stock level, Stockout cost.**

I. Introduction

The proper flow of raw materials from suppliers to manufacturing and, subsequently, to customers are the result of the efficient handling of materials by the organisation. It emphasis the planning of materials, procurement of raw materials, and control to ensure that the right material is available at the right time, in the right quantity, and at the right cost. An essential component of material operations is the store. The store maintains the accessories in such a way that they are reasonably priced, kept secure, and readily available when needed. Store operation is a technical function that can greatly impact the overall effectiveness of the operating function. Effective store system management offers adaptability to handle demand and stock variations and makes it possible for purchasing to make advance plans. Since materials have costs associated with them, the organisation must manage the materials in-store in a way that keeps the overall cost of material maintenance at an optimal level. By preventing material overstocking or understocking, it helps to minimise waste and cut expenses. The appropriate quantities are a prerequisite for effective stores management. For optimum material purchasing behaviour, proper maintenance of the safety stock level is crucial. These methods are essential for promoting cost-efficiency in a variety of businesses. The application of EOQ determines the ideal order quantity. EOQ also reduces carrying costs and guarantees a continuous supply of raw materials, which promotes successful inventory turnover and economical stock management. Reorder point computation is essential for continuous manufacturing operations. Precisely predicting reorder points is essential to avoid stockouts during times of high demand, enabling efficient inventory management and satisfying customer demands. Determining the ideal safety stock levels is important for all industries because it involves striking a careful balance between minimising surplus inventory and preventing stockouts and waste. Economic Order Quantity (EOQ) implementation, stockout cost optimisation, reorder point computation, and optimal safety stock level determination stockout cost optimisation are the finest practices having different opportunities on an industrial scale. Optimising these factors is essential to managing seed stocks, fertilisers, and equipment effectively in agriculture; just-in-time systems and timely component availability are essential in the automotive industry; and perishable items in the food and beverage industry. The implementation of these techniques has also been applicable in other sectors, such as health, automotive, and technology sectors, etc., but different practices are followed and there are more variations when compared with manufacturing sectors.

The study aims at food and beverage industry. Nowadays, the rice bran oil market is extremely competitive and has several small and regional players. From 2017 to 2022, the rice bran oil market grew at a compound annual growth rate (CAGR) of 2.74%, reaching a market value of US$ 6.67 billion. It is expected that the market will grow at a CAGR of 9.09% from 2023 to 2033, from US$ 7.94 billion in 2023 to US$ 18.95 billion. This study was made in the stores of Jeevan Solvent Extracts Private Limited, a rice bran oil producing company located in Melnariappanur, Kallakuruchi District. Analytical research on the secondary data of JSE Pvt Ltd., focusing on the annual demand data of rice bran bags over the past 20 years, involves a systematic process utilising components such as Economic Order Quantity (EOQ), Reorder Quantity,

Manuscript received April 16, 2024

Dr. R. Nalini, Assistant Professor, School of Management, SASTRA Deemed University, Thanjavur – 613401

Dr. R. Amudha, Associate Professor, School of Management, SASTRA Deemed University, Thanjavur – 613401

T Vaishnavi, Master of Business Administration, School of Management, SASTRA Deemed University, Thanjavur – 613401

lead time, prediction of safety stock, and consideration of stockout costs to predict a new reorder point and determine the optimum investments and safety stock level in the store. Focusing on this sector by maintaining the optimum stock level and making investments in the stores may increase the value of the particular company and cause tremendous growth in the global market.

II. REVIEW OF LITERATURE

The Economic order quantity, reorder point, Safety stock level, Stockout cost techniques are the techniques followed in research models that are integrated in the conceptual framework. A detailed analysis reveals that techniques can be assist in predicting the new reorder point and also studies have shown reduction in wastage, cost control, optimum investment in inventory. According to Nyoko, A. E., et al (2023), the importance of safety stock as a crucial factor in upholding a lean supply chain by averting interruptions. The research presents a cost minimization safety stock model that optimises safety stock levels. As per FoEh, J. E., et al (2021), the reduction of inventory costs by using the Economic Order Quantity (EOQ) method. This method is to determine the best raw material order quantities and this study aims to improve raw material supply management efficiency. According to Nobil, A. H., et al (2020), the computation of an ideal reorder point and offers insights into system control in a variety of scenarios. According to Teplicka, K., & Culkova, K. (2020), the efficient inventory control is essential to a business's seamless supply chain and manufacturing. Stock level optimisation is achieved by a variety of techniques, such as deterministic models such as the Economic Order Quantity (EOQ) and quantitative analysis. Wanti, L. P., et al intends to give company leaders decision support for accurate decision-making and discussed about the efficient production planning, precise stock inventory control, and quick response to market demand. In order to reduce the expenses associated with inventory management, the authors Vasilev, J., & Milkova, T. (2022) investigated the delivered quantities and stock management expenses based on the time series data. The author Li, K. (2023) highlighted the necessity for a careful balance between satisfying consumer demand and limiting holding costs. In order to manage stockouts and improve customer happiness, HR, G., & Aithal, P. S. (2020) experiments helps to assess the impact on overall store profitability and inventory-related key performance indicators. Irmayanti, H., et al (2019) highlighted the importance of the EOQ approach in reducing losses brought on by over purchasing raw materials and offers insightful information to businesses looking at optimising the dynamics of their ordering and storage costs. Riza, M., (2018) addressed the ideal order quantity to reduce holding and ordering expenses. EOQ models, a traditional production scheduling model, are used in operations management to determine the ideal inventory levels. Mirzaee, A. (2017) introduced a different approach for improved service levels and tackles safety stock levels in the manufacture of several commodities across many sites. This provides important new information for maximizing safety stock in multi-item production scenarios. Jiraruttrakul, R., (2017) looked into ABC Company's ineffective management and excessive inventory expenditures and showed that there was a 50% chance of cost savings, which underscores the necessity for ABC Company to put the EOQ model into practice in order to improve customer satisfaction and accomplish effective inventory management. As per Mekel, C. et al (2014), the organisation uses demand forecasts, reordering time, and safety stock levels to handle any stock-outs over long lead periods in order to avoid shortages or surplus inventory. Sarjono, H. (2014) studied about Rajalu Ltd., an aluminium smelter in Surabaya, is to establish the best timing for raw material arrivals based on estimates of stock out costs (SOC) and extra carrying costs (ECC). This study shows that it is in line with the company's plan and has the lowest overall cost. According to Silver, E. A., et al (2009), a useful order-up-to-level, reorder point, and periodic review methods are easy to use, produces acceptable outcomes, and provides useful information for efficient inventory management. Cicek, M. (2007) explained the importance of inventory models in inventory management is emphasized in this study, which also highlights their theoretical foundation and role in improving overall business performance. Ramakrishnan. RV, Tony Arnold. JR (2007) explained about the essential topics in the field, emphasizing the significance and objectives of material management. It includes Inventory Management encompassing optimal order quantity, EOQ, and various models. The author explores Value Analysis, Stores Management, and the role of computers in Material Management.

III. NEED FOR THE STUDY

In the changing environment of the manufacturing sector, significant investments made in stores have become a prevalent practice within organizations. Unfortunately, the manufacturing sector often grapples with the challenge of not concentrating on the right level of safety stock maintenance, leading to detrimental consequences. The significant effect of inadequate safety stock management is the risk of stock outs or excess stock. Maintaining an excessive level of safety stocks, while seemingly a precautionary measure, results in a substantial financial commitment for manufacturing companies. These investments, often substantial, are tied up in inventory, posing financial challenges and hindering the overall efficiency of capital utilization within the organization. Conversely, stockout conditions arising from the failure to maintain the right safety levels can have severe consequences. The timely unfulfillment of customer demands, leads to a potential loss of customer loyalty, but it also diminishes the likelihood of securing future orders, customer dissatisfaction, and the company's reputation, impacting its competitiveness in the market. This problem heightened in store management is primarily driven by the critical role and this study will be required and helpful in finding out the minimum level of investment in stores and an optimal balance between maintaining sufficient stock levels and avoiding the pitfalls of either stockouts or excess stock.

IV. OBJECTIVE

To identify the new reorder point of the JSE Pvt Ltd. by obtaining the optimum level of safety stock and analysing the minimum stock-out costs to reduce the holding and ordering costs and to prevent the overstocking and understocking condition, capital loss from inventory that has become unavailable for the customer to purchase.

V. RESEARCH METHODOLOGY

The research project is dependent on secondary data that was acquired from JSE Pvt. Ltd., a manufacturing company that specialises in rice bran oil. In this study, the secondary data particularly relates to JSE Pvt Ltd.'s yearly demand for rice bran bags for the previous 20 years. This study falls within the category of economic analysis under this analytical research. Analysing past data is helpful in forecasting future needs. By examining the yearly demand for rice bran over the previous 20 years, the computation of the optimum safety stock level, new reorder point, and optimum level of investment can be determined. This study is able to create a solid basis for forecasting and improving inventory management techniques. The implementation of EOQ, reorder points, safety stock, and stockout costs all work together to optimise the flow of goods, reduce holding costs, increase customer satisfaction, and mitigate the risks of stockouts and excess holdings. To improve JSE Pvt Ltd.'s efficiency and competitiveness going forward, the historical dataset's insights will guide the estimation of reorder points, ideal safety stock levels, and optimum investment levels.

VI. DATA ANALYSIS AND INTERPRETATION

Annual demand =24000 tonnes
No of working days =300 days
Lead time =3 days
Company ordering quantity at a time= 2000 tonnes
(Source: Secondary data)

A. Annual daily demand $= \frac{\text{Annual demand}}{\text{No of working days}}$
=80 tonnes

B. Reorder point =Annual daily demand*lead time
=240 tonnes

Table:6.1

Demand during lead time	No of times the quantity was demanded
200	10
220	20
240	150
245	12
250	6
255	8
260	16
265	6
270	8
275	4

(Source: Secondary data)

From the above table 6.1, the demand data for the previous 20 years is shown. The demand during lead time is 200,220,240,245,250,255,260, 265,270, and 275 tonnes and the number of times the quantity was demanded is 10, 20, 15, 150, 12, 6, 8, 16, 16, 6, 8, 4 times respectively

C. Probability= $\frac{\text{NO OF TIMES THE QUANTITY WAS DEMAMDED}}{\text{TOTAL NO OF TIMES THE QUANTITY WAS DEMANDED}}$

For instance,
=10/240
=0.042 and so on

Table:6.2

Demand during lead time	No of times the quantity was demanded	Probability
200	10	0.042
220	20	0.083
240	150	0.625
245	12	0.050
250	6	0.025
255	8	0.033
260	16	0.067
265	6	0.025
270	8	0.033
275	4	0.017
Total	240	1.000

D. Additional carrying cost:

Table:6.3

ADDITIONAL CARRYING COST		COST
RAWMATERIAL COST	(PER TONNE)	₹15000
LABOUR, ELECTRICITY, GODOWN		₹200
TOTAL COST		₹15,200.00

(Source: Secondary data)

The table 6.3 above indicates that the cost of raw materials for one tonne of rice bran bags is ₹15,000, while the expenses of labour, power, and go-down are ₹200. Consequently, the additional carrying costs for one tonne of ricebags amount to ₹15,200.

E. Input cost:

Table:6.4

INPUT		COST
RAWMATERIAL COST	(PER TONNE)	₹15000
PROCESSING COST		₹4000
TOTAL COST		₹19,000

F. Additional stockout cost:

Table:6.5

Output	Rice bran oil	De-oil
1 tonne (1000 kgs)	125 kgs	875 kgs
1 kg	₹80	₹12
COST	₹10000	₹10500
TOTAL COST		₹20500
TOTAL STOCKOUT COST		₹20,500

(Source: Secondary data)

From the above table 6.4 shows that the cost of raw material is ₹15,200, while the processing cost is ₹4000.Consequently, the input cost for producing for 1 tonne of rice bran oil is ₹19,000. From the above table 6.5 indicates that the processing one tonne of rice bran, 125 kg of rice bran oil and

875 kg of de-oiled rice bran are acquired. Each kilogramme of de-oiled rice bran costs ₹12, whereas each kilogramme of rice bran costs ₹80.Hence rice bran oil costs ₹10,000, and rice bran de-oiling costs ₹10,500. The entire cost of production for one tonne of rice bran is ₹20,500. Therefore, the stockout cost for one tonne of rice bran is estimated to be ₹20,500. When stock runs out, a tonne of rice bran costs Rs. 20,500. A loss of sales opportunity and associated costs result from this stock out situation. If a stockout situation occurs and the customer is a first-time customer, it could be extremely detrimental to your business.

G. Relevant stock cost:
Relevant stock cost = Stockout in units* Stock out cost

For instance,
Safety stock level = 0, stock out units may be 5,10,15,20,25,30,35 tonnes whereas stockout cost for all level of safety stock always remains same (₹ 20,500)

Relevant safety stock for the level 0, stock out unit=5 tonnes
= 5*20500
= ₹102500
and so, on
Since the safety stock level is irrelevant for the calculation of relevant stockout cost

H. Number of orders:

$$No\ of\ orders = \frac{Annual\ demand}{Ordering\ quantity\ at\ a\ time}$$

Since the annual demand is 24000 tonnes whereas company ordering quantity at a time is 2000 tonnes

No of orders = 24000/2000
= 12 times

As a result, the company places orders twelve times a year to meet the yearly demand.

I. Expected stockout cost:
Expected stockout cost= Probability of stockout * Relevant stockout cost* No of orders

For instance,
If the demand realisation resulting in stock out is 245,
Probability of stockout=0.05
Relevant stockout cost= ₹102500
No of orders =12
Expected stockout cost =0.05*102500*12
=₹ 61500
and so, on

J. Total expected stockout cost:
Total expected stockout cost is the addition of all expected stockout cost for the individual safety level

Total expected stockout cost = Summation of all expected stockout for the individual safety level

If the safety level 0, the demand realisation is 245,250,255,260, 265,270, and 275.

Safety stock level	Demand realisation resulting in stockouts	Expected stockout cost	Total expected stockout cost
0	245	61500	
	250	61500	
	255	121770	
	260	329640	
	265	153750	
	270	243540	
	275	146370	1118070

K. Relevant carrying cost:
Relevant carrying cost = Safety stock level * Additional carrying cost
For instance,
If Safety stock level = 0, additional stockout cost for all level of safety stock always remains same (₹ 15,200)
Relevant carrying cost = 0 * ₹ 15,200
= ₹ 0
and so, on

L. Total relevant cost:
Total relevant cost is the summation of total expected stockout and the relevant carrying cost
Total relevant cost= Total expected stockout + Relevant carrying cost
For instance,
Safety stock level = 0, whereas the total expected cost = ₹ 0 and relevant carrying cost = ₹1118070
Total relevant cost = 0 + 1118070
= ₹11,18,070
and so, on
Hence the total relevant cost for the safety stock level is ₹11,18,070.

M. Overall analysis:
These overall analysis table calculates the relevant stockout cost, expected stockout cost, total expected stockout cost and the total relevant cost

Table: 6.6

Safety stock level	Demand realisation resulting in stockouts	Stockout in units	Probability of stockout	Relevant stockout cost	No of orders	Expected stockout cost	Total expected stockout cost	Relevant carrying cost	Total relevant cost
0	245	5	0.05	102500	12	61500			
	250	10	0.025	205000	12	61500			
	255	15	0.033	307500	12	121770			
	260	20	0.067	410000	12	329640			
	265	25	0.025	512500	12	153750			
	270	30	0.033	615000	12	243540			
	275	35	0.017	717500	12	146370	1118070	0	1118070
5	250	5	0.025	102500	12	30750			
	255	10	0.033	205000	12	81180			
	260	15	0.067	307500	12	247230			
	265	20	0.025	410000	12	123000			
	270	25	0.033	512500	12	202950			
	275	30	0.017	615000	12	125460	810570	76000	886570
10	255	5	0.033	102500	12	40590			
	260	10	0.067	205000	12	164820			
	265	15	0.025	307500	12	92250			
	270	20	0.033	410000	12	162360			
	275	25	0.017	512500	12	104550	564570	152000	716570
15	260	5	0.067	102500	12	82410			
	265	10	0.025	205000	12	61500			
	270	15	0.033	307500	12	121770			
	275	20	0.017	410000	12	83640	349320	228000	577320
20	265	5	0.025	102500	12	30750			
	270	10	0.033	205000	12	81180			
	275	15	0.017	307500	12	62730	174660	304000	478660
25	270	5	0.033	102500	12	40590			
	275	10	0.017	205000	12	41820	82410	380000	**462410**
30	275	5	0.017	102500	12	20910	61500	456000	517500
35	275	0						532000	532000

able 6.6 above illustrates that for safety stock levels of 0, 5, 10, 15, 20, 25, 30, and 35 tonnes, the corresponding total relevant costs are ₹1118070, ₹886570, ₹716570, ₹577320, ₹478660, ₹517500, and ₹532000.Thus, it indicates that the minimal stockout cost is ₹462410, while the appropriate carrying cost and the total expected stockout cost are similarly minimum. Thus, the safety stock level that equates to the minimal relevant cost has been determined. Hence, 25 tonnes are the ideal level of safety stock.

N. New Reorder point:

New Reorder point is the combination of both reorder point and the safety stock level. Since the old reorder point is 240 tonnes and safety stock level are 25 tonnes.

New reorder point = Reorder point + Safety stock level

= 240 + 25

= 265 tonnes

As a result, the analysis above can be used to determine the new reorder point for the Jeevan Solvent Extracts Private limited, and 265 tonnes can be obtained as new reorder point for maintaining the company's ideal investment level.

VII. FINDINGS, SUGGESTIONS & CONCLUSION

A. Findings

The study of the maintenance of the optimum level of investment in stores by ascertaining the new reorder point and stockout cost in Jeevan Solvent Extracts Private Limited and acquisition of various data as well as examining the secondary data provided by the company related to the raw material purchases and stocks. The different outcomes are annual daily demand, lead time, reorder point, probability of the number of times the quantity was demanded, additional carrying cost, total relevant cost, and the new reorder point. Through the analysis of the previous chapter, Jeevan Solvent Extracts Private limited needs 80 tonnes of annual daily demand, which is the company's daily requirement to fulfilling their customer demands. The reorder point for the company is 240 tonnes, which represents the quantity will replenish every three days. From the table 6.2 shows that the demand during lead time is 200,220,240,245,250,255,260, 265,270, and 275 tonnes and the probability for the number of times the quantity was required is 0.042 ,0.083, 0.625, 0.050, 0.025, 0.033, 0.067, 0.025, 0.033,0.017 respectively. From table 4.3 to 4.5, the additional carrying costs for one tonne of

ricebags amount to ₹15,200. When stock runs out, a tonne of rice bran costs ₹20,500. Therefore, the additional stockout is Rs. 20,500. The company places orders twelve times a year to meet the yearly demand

The main aim of this study is to determine the new reorder point for the company by finding out the minimum stockout cost, at which point the safety stock has the minimum stockout cost. By finding out the relevant stock out cost, the demand realization for the safety stock level 0 tonnes, resulting in stockouts are 245, 250, 255, 260, 265, 270, and 275 tonnes. The demand realization for safety stock level 5 tonnes, resulting in stockouts are 250, 255, 260, 265, 270, and 275 tonnes. The demand realization for the safety stock level 10 tonnes, resulting in stockouts are 255, 260, 265, 270, and 275 tonnes. The demand realization for safety stock level 15 tonnes, resulting in stockouts are 260, 265, 270, and 275 tonnes. The demand realization for safety stock level 25 tonnes, resulting in stockouts are 270 and 275 tonnes. The demand realisation for safety stock level 30 tonnes, 275 tonnes alone resulted in stock out. For safety stock levels of 0, 5, 10, 15, 20, 25, 30, and 35 tonnes, the corresponding total relevant costs are ₹1118070, ₹886570, ₹716570, ₹577320, ₹478660, ₹517500, and ₹532000.If the safety stock increases, in tandem with an increase the expected stockout cost, relevant carrying cost and also the total relevant cost. When finding out ideal safety stocks level, at one point of time, the total relevant cost decreases and then increases. The lowered point is considered as the minimum stockout cost and their respective safety stock should be taken Thus, it indicates that the minimal relevant cost is ₹462410, while the appropriate carrying cost and the total expected stockout cost are similarly minimum. Thus, the safety stock level that equates to the minimal relevant cost has been determined. Hence, 25 tonnes are the ideal level of safety stock. In added to that ascertaining the new reorder point by adding the previous reorder point and the obtained safety stock. As a result, the analysis above can be used to determine the new reorder point for the Jeevan Solvent Extracts Private limited, and 265 tonnes can be obtained as new reorder point for maintaining the company's ideal investment level.

B. Suggestions

The primary goal of this study is to provide an optimum level of investment in stores of Jeevan Solvent Extracts Pvt Ltd by examining the safety stock level and their stockout cost and obtaining new reorder point. With the analysis over the past 20-years data, demand of the company during their lead time, could be able to analyse the demand realization resulting in stockout for seven different safety stock levels such as 0,5,10,15,20,25,30,35. Out of these seven safety stock levels, the lowest total relevant cost is the one for which there is an optimum safety stock level. That minimum cost equates to a specific safety stock level. That specific safety stock level is recommended for the company to maintain in its stores, where the expected stockout cost and the relevant carrying cost is also minimal. The optimum safety stock level and the previous reorder point can be used to determine the new reorder point, which is suggested for the company. The recommended new reorder point is 265 tonnes of rice bran bags, which the company needs to be replenished from the suppliers.

CONCLUSION

The analysis of the various data can be able to determining the new reorder point ensures that Jeevan solvent extracts private limited can effectively meet out the customer demand while efficiently managing their inventory levels with minimum level of investment in stores .By the efficient management of inventories, unnecessary investments in stores can be prevented .The unnecessary investments which could be used in other functional department such as marketing ,HR and focuses on research and development .If this is done, other functional department can be able to increase revenue from operations and also it impacts in the increase of profit margin of the company .Henceforth this study provides valuable insights for the company to improve it stores management practices ensuring operational efficiency and cost effective in maintaining the stock level by incorporating the suggested recommendation Jeevan Solvent Extracts Private Limited can be able to improve overall performance and competitiveness in the market.

REFERENCE

[1] Amirjabbari, B., & Bhuiyan, N. (2014). Determining supply chain safety stock level and location. Journal of Industrial Engineering and Management (JIEM), 7(1), 42

[2] Aro-Gordon, S., & Gupte, J. (2016). Review of modern inventory management techniques. *Global Journal of Business & Management*, *1*(2), 1-22.

[3] Beutel, A. L., & Minner, S. (2012). Safety stock planning under causal demand forecasting. *International Journal of Production Economics*, *140*(2), 637-645.

[4] Cicek, M. (2007). *Construction an inventory management and stock control system by means of forecasting techniques* (Order No. 28523773)

[5] FoEh, J. E. H. J., & Ali, Y. (2021). Application of Economic Order Quantity Method in Controlling Raw Material Inventory. *International Journal of Social Science and Human Research*, *4*(08), 2181-2186.

[6] Gonzalez, J. L., & González, D. (2010). Analysis of an economic order quantity and reorder point inventory control model for company XYZ.

[7] HR, G., & Aithal, P. S. (2020). Integrated inventory management control framework. *International Journal of Management, Technology, and Social Sciences (IJMTS)*, *5*(1), 147-157.

[8] Irmayanti, H. (2019, November). Analysis of raw material ordering with economic order quantity method. In *IOP Conference Series: Materials Science and Engineering* (Vol. 662, No. 3, p. 032011). IOP Publishing.

[9] Jiraruttrakul, R., Smutkupt, S., Marksin, W., Liu, L., & Thanathawee, C. (2017). Applying an EOQ model to reduce an inventory cost. *Journal of Supply Chain Management: Research and Practice*, *11*(1), 46-55.

[10] Karimi, A., Mishra, A., Natarajan, K. V., & Sinha, K. K. (2021). Managing commodity stock-outs in public health supply chains in developing countries: An empirical analysis. *Production and Operations Management*, *30*(9), 3116-3142.

[11] Li, K. (2023). *Inventory management for supply chains with uncertainty* (Order No. 30567455).

[12] Mekel, C., Anantadjaya, S. P., & Lahindah, L. (2014). Stock out analysis: An empirical study on forecasting, re-order point and safety stock level at PT Combiphar, Indonesia. *RIBER: Review of Integrative Business and Economics Research*, *3*(1), 52-64.

[13] Mirzaee, A. (2017). *Alternative methods for calculating optimal safety stock levels* (Order No. 11015364).

[14] Munyaka, J. B., & Yadavalli, V. S. S. (2022). Inventory management concepts and implementations: a systematic review. *South African Journal of Industrial Engineering*, *33*(2), 15-36.

[15] Nyoko, A. E., Fanggidae, R. P., & Marawali, Y. Y. (2023). THE FORECASTING OF RAW MATERIAL INVENTORY IN SUPPORT OF THE CONTINUITY PRODUCTION PROCESS. *Journal of Management: Small and Medium Enterprises (SMEs)*, *16*(3), 517-530.

[16] Nobil, A. H., Sedigh, A. H. A., & Cárdenas-Barrón, L. E. (2020). Reorder point for the EOQ inventory model with imperfect quality items. *Ain shams engineering journal*, *11*(4), 1339-1343

[17] Radasanu, A. C. (2016). Inventory management, service level and safety stock. *Journal of Public Administration, Finance and Law*, (09), 145-153.

[18] Ramakrishnan. RV, Tony Arnold. JR (2007). "Introduction to Materials Management Pearson

[19] Riza, M., Purba, H. H., & Mukhlisin, (2018). The implementation of economic order quantity for reducing inventory cost. *Research in Logistics & Production*, *8*(3), 207-216.

[20] Sarjono, H. (2014). The Calculation of Extra Carrying Cost (ECC) and Stock out Cost (SOC) to Determine the Raw Material's Optimal Arrival Lead Time. *Applied Mathematical Sciences*, *8*(83), 4115-4124

[21] Silver, E. A., Naseraldin, H., & Bischak, D. P. (2009). Determining the reorder point and order-up-to-level in a periodic review system so as to achieve a desired fill rate and a desired average time between replenishments. *Journal of the Operational Research Society*, *60*(9), 1244-1253.

[22] Teplicka, K., & Culkova, K. (2020). Using of optimizing methods in inventory management of the company. *Acta logistica*, *7*(1), 9-16

[23] Wanti, L. P., Maharrani, R. H., Prasetya, N. A., Tripustikasari, E., & Ikhtiagung, G. N. (2020). Optimation economic order quantity method for a support system reorder point stock. *Int. J. Electr. Comput. Eng*, *10*(5), 4992-5000.

[24] Witthayapraphakorn, A., & Jaijit, S. (2023). USING SIMULATION TO DETERMINE THE REORDER POINT UNDER UNCERTAINTY OF A RETAIL STORE. *International Journal of Simulation Modelling (IJSIMM)*, *22*(2)

[25] Vasilev, J., & Milkova, T. (2022). Optimisation Models for Inventory Management with Limited Number of Stock Items. *Logistics*, *6*(3), 54.