Journal of Business Administration and Management Sciences (JOBAMS)
June 2024 Vol. 06 Issue No. 01 pp. 8-16
e-ISSN: 2663-7073
DOI: https://doi.org/10.58921/jobams.6.1.123

OPTIMIZING INVENTORY MANAGEMENT: A COMPREHENSIVE ANALYSIS OF ECONOMIC ORDER QUANTITY, LOT SIZE, SAFETY STOCK, AND REORDERING QUANTITY STRATEGIES

Mahrukh Siraj* Asad Naseem** Muttahira Maryam** Javeria Asad**

Abstract
Inventory management plays a critical role in business operations by ensuring efficient organization to avoid overtime costs, production rate fluctuations, unnecessary subcontracting, high deal expenditures, and delayed purchase penalties during peak demand periods. This study aims to leverage insights from inventory data to optimize lot sizes for materials procured from vendors, aligning them with the firm's capacity. It also addresses safety stock, maximum inventory level, and reorder quantity. The application of Economic Order Quantity (EOQ) models has proven beneficial across various sectors like marketing, automotive, pharmaceuticals, and retail, offering a comprehensive solution in a simplified format to understand inventory system dynamics. This model enables a straightforward calculation of the most cost-effective order quantity, benefiting both retailers and distribution centers by minimizing overall expenses.
Keywords*:* economic order quantity, costing, inventory.

1. INTRODUCTION

Stocks are costly due to expenditures such as locked-up funds, warehousing, security, deterioration, losses, insurance, packaging, and management. A visible problem, then is 'why do corporations' own stock?' There are various responses to this risk, all of which are dependent on the requirement for a barrier between supply and demand. Risk assessment involves the classification and quantification of outcomes associated with a particular incident. These outcomes may include personal injuries to workers, environmental damages, and degradation of assets, all of which can significantly impact the industry's reputation (Kaka et al., 2024; Kaka et al., 2022 Hussain et al., 2016). Research deems inventory management a critical topic (Kaka et al., 2024; Kaka et al., 2022 Hussain et al., 2016). The volume of inventory on hand impacts or influences the fluidity of the manufacturing process, along with the company's efficacy and its efficiency (Hai et al., 2011). Delays or a lack of inventory affect the process of production, moreover, it will result in diminish these chances for a firm to boost earnings as well. The sum or level of stock expected by an organization is varies from one organization to another, contingent upon the amount of creation, the limits of the production cycles and the plants (Ziukov, 2015; Chaib et al., 2009).

Inventory management is fraught with difficulties; some factors push for a low inventory, for instance the cost of funds, storage, prices, insurance, and loss, while others push for a higher inventory, such as the ordering expense, transportation, the elimination of redundant setups, and efficient of labor (Keskin et al., 2015; Bacchetti et al., 2010). According to Dadouchi and Agard (2018), management of inventories is a repetitive modern issue, and there are some normal options in contrast to these issues, for example, expanding stock to safeguard the organization against an absence of products or executing request estimating to expect the organization's necessities, keeping a satisfactory load of materials. Likewise, Krajewski (2009) make sense of that inventories should be well managed in

**Corresponding Author*, Dawood University of Engineering and Technology Karachi, Pakistan.
Email: mahrukh.siraj.123@gmail.com
**Dawood University of Engineering and Technology Karachi, Pakistan

light of the fact that they cover production issues and, if high, have a negative monetary effect. Stocks retained in inventory are required to satisfy manufacturing orders or customer deliveries, keeping in mind the goal of minimizing the expense of orders that were either not delivered or experienced delays, and providing prompt delivery response (Krajewski, 2009). Darom (2018), demonstrates the effects of stock out points, whereby the stock should be raised at a given risk, which varies depending on the amount of service needs expected by consumer. When the stock supply is disrupted, manufacturing halts, and the lost amounts must be recompensed immediately, risking the company's long-term viability. Through a wide assessment of the essential characteristics, a balance between sustainability and recovery may be achieved, reducing the probability of stock out situations. However, many organizations work experimentally in stock, since they don't utilize mechanical devices and the board strategies (Dadouchi and Agard, 2018). Even those that employ techniques must understand the nature of their demands so that the most appropriate calculating approach for their situation can be applied (Van forest, 2018; Darom et al., 2018; Gianesi and de Biazzi, 2011). Therefore, the purpose of this study is to use indications derived from inventory data to arrange lot sizes of the received material and put them accordingly to availability in a firm, along with safety stock, maximum inventory level, reordering quantity using Economic Order Quantity (EOQ).

2. THEORETICAL FRAMEWORK

2.1. Economic order quantity

Harris (1990) was the earliest to primarily introduce a formal model that optimized lot sizes Wassan et al., 2022; Ramzan, 2019). Harris, in his model, assumed an infinite replenishment rate, overlooking the impact of production on inventory accumulation. This assumption was subsequently revised by Taft et al. (1918), who introduced a finite production rate in the model, now recognized as the EPQ model. In the EPQ model, the goal is to find a production quantity Q that minimizes the combined costs of inventory holding and setup. Moreover, Life Cycle Costing (LCC) emerged in the 1960s within the context of the United States Department of Defense as a strategy to improve cost-effectiveness (Erlenkotter, 1989). Ali highlighted that Life Cycle Costing (LCC) involves aggregating cost estimates related to all activities throughout the entire product life cycle. It aims to pinpoint the optimal value for investment consumption, specifically the lowest long-term cost that meets the necessary performance criteria (Keskin, 2015; Erlenkotter, 1990). In the industrial context, Life Cycle Assessment (LCA) is commonly applied for the design or enhancement of products and processes. The key assumptions underpinning the development of this model are as follows (Akbar et al., 2021; Akbar and Mokhtar, 2017; Taft, 1918).

i. Sole consideration of a single item
ii. Production and demand rates are provided and are one-dimensional.
iii. Cost factors remain constant over time.
iv. Unrestricted lot sizes
v. Elimination of insufficiency
vi. Infinite planning liberties are encouraged.

2.2. Lot size

As inventories are important in the global economy, the ample recognition received by the lot sizing dilemma is not astounding. The inventory administration accounts for the most essential operational tasks of industrial and trading firms. To assess or quantify the extent to which a specific output can be obtained from a given input, the term "productivity" may be utilized. A business can attain peak production by understanding the efficiency levels of other inputs that define the correlation between these inputs and production, including manpower. This involves monitoring the trends of these inputs across different conditions and potentially substituting one or more of these inputs by modifying their qualities and quantities (Daron et al., 2018; Silver et al., 2016; Waters 2008). Customer service especially with respect to product availability and delivery speed, affect both inventory levels as we as structure, which are both crucial for competitive atmosphere of developed economies (Memon et al., 2018). Furthermore, efficient management of inventories aids the deprecation of costs. According to the US Census Bureau (2013), the present inventory value in the U.S. exceeds $1.6 trillion, highlighting the significant impact that reducing inventories can have on individual companies and the overall economy. The Economic Order Quantity (EOQ) model emerges as a straightforward and effective tool to prevent uncontrolled inventory accumulation, with its validity consistently praised in the literature by Dobson (1988) cited by (Shaikh et al., 2022; Wassan et al., 2022). While a comprehensive examination of all existing variations of Harris's (Vago et al., 2013) model is ambitious, current research enables the identification of prevalent research streams. Analyzing and synthesizing these streams can assist researchers in recognizing relevant efforts in the field of lot sizing. This paper represents a tertiary study on the lot sizing problem, reviewing literature related to lot-sizing topics identified through a systematic literature search and assessed with a structured framework. The objective is to showcase the research streams that evolved from Harris's fundamental lot size model, emphasizing key accomplishments in each area. This tertiary study provides an overview to aid primary researchers in contextualizing their work within the literature, understanding the evolution of various lot sizing problems, and finding starting points for new research directions. Additionally, the study offers suggestions for reviewing the literature in the lot sizing domain, providing insights for future secondary research.

2.3. Safety stock

Safety stock is maintained as a safeguard against the risk of stockouts. While excessive safety stock can inflate operational costs, inadequate or no safety stock may result in lost sales and customer dissatisfaction. Effective inventory management involves planning and controlling inventory levels optimally. It aims to establish an appropriate inventory quality that aligns with processing or production needs on a scheduled basis and fulfills customer orders (Vastag and Montabon, 2001). The losses incurred in stockout situations drive manufacturing companies to mitigate the problem by elevating safety stock levels. While increasing inventory levels may seem like a straightforward solution, the challenge lies in reaching maximum inventory levels at minimal cost (Dabson, 1988). Determining the optimal balance of maximum inventory with minimum cost can be achieved through the Economic Order Quantity (EOQ) method. Additionally, safety stock is intricately linked to forecasting and lead time considerations (Bayraktar and Ludkovski, 2010; Stadtler, 2007). Companies must accurately forecast demand to determine future product requirements, while lead time influences the level of safety stock necessary to compensate for potential delays in raising inventory levels.

2.4. Reordering quantity

According to Chen (1998) the inventory level that triggers the initiation of an order for additional units is represented by the Reorder Point (ROP) quantity (Bottani et al., 2013). Conversely, the quantity of safety stock serves as a protective buffer against stockouts or backorders.

In the provided figure, the graph illustrates the relationship between the reorder point, lead time, and quantity as functions of time. When determining the reorder point, three essential factors must be considered:

- Demand – the daily amount of inventory used or sold.
- Lead Time – the duration (in days) required for an order to arrive once placed.
- Safety Stock - the inventory amount on hand in case of unforeseen events, such as delays in lead time or unexpected demand.

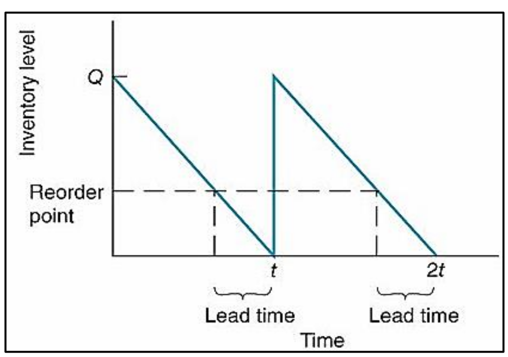
In cases where demand is constant and lead time is known, the reorder point is expressed as follows:

$$Reorder\ Point = Daily\ usage * Lead\ time\ (in\ days)$$

When maintaining a safety stock, the reorder point is expressed as follows:

$$Reorder\ Point = [Daily\ usage * Lead\ time\ (in\ days)] + safety\ stock$$

Figure 2.1: Reorder point



3. RESEARCH METHODOLOGY

3.1. Data Collection and Method

The stages and techniques to be used in data collecting, information gathering to address issues, and research hypothesis testing make up the research methodology. The use of the analytical method as a tool to identify the phenomena is one of the most fundamental aspects of the research practice. Analytical methods are employed to derive precise solutions instead of approximated solutions found in numerical modeling. Analytical models rely on various assumptions, leading to a reduction in model complexity. Analytical models are grid-free representations, characterized by significantly lower computational complexity (Smart, 2008). Finding answers to the research topic is also important so that the outcomes may be scientifically supported. This study used a descriptive, quantitative methodology that involved gathering data through surveys or direct observation and processing it.

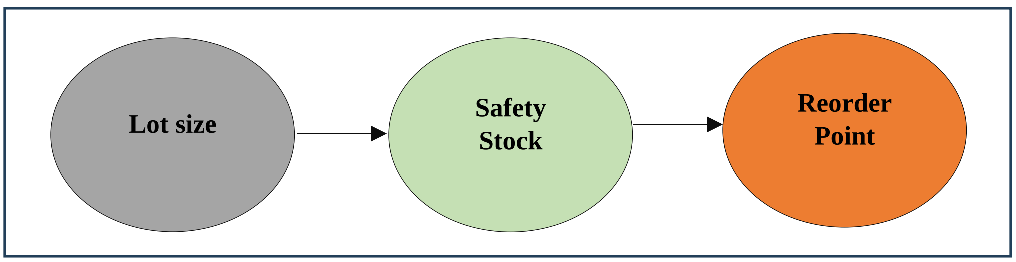
When processed, the data, which might be qualitative or quantitative, will yield the required results. The data is separated into two categories based on the types: primary data and secondary data. While secondary data are gleaned from earlier studies, primary data are those that the researchers or author personally get. Primary and secondary data are the two categories of data that were used in this study. Surveys and direct observation are examples of primary data, but past corporate data such as lead times, demand, and stock outs are examples of secondary data.

This research focuses on making lot sizes in the warehouse. Out of over 581 items currently in progress, certain products stand out due to their significant quantity and rate.

3.2. Research Model

The level of the company's safety stock directly impacts the various lot size scenarios. The Reorder Point is a contributing factor influencing safety stock, as depicted in Figure 3.1.

Figure 3.1: Research model



Nevertheless, lot sizing significantly influences safety stock calculations, as the safety stock level is derived from lot size calculations. Moreover, the safety stock level can also be determined by the reorder point. Drawing insights from the above figure, the author can put forth the following proposition.

P1: lot size can determine safety stock
P2: safety stock can determine reorder point

After opening the packs, the staff there used to write code consequently on all the products. Out of these, there were some items that held great demand, so there were major differences in the issuance data which created great hurdles to suggest the lot size. To overcome this problem, we determined the median of the material so that it could be defined in much better way. The first result which we achieve was the data given was material description and issuance data which was further segregate. We defined the lot size before applying EOQ formula so that we can get the information about safety stock and reordering point. The parameters which we applied in the implementation of the lot size are: Standard Deviation, Median, Customer Demand, Price per Unit, and Issuance Data.

4. RESULTS AFTER IMPLEMENTING LOT SIZES

Table 4.1 presents the outcomes following the implementation of lot sizes, highlighting discrepancies identified in SAP entries. Table 4.2 identifies items requiring changes from the vendor's end, while Table 4.3 specifies items for which the vendor's lot size should be adjusted. In Table 4.4, suggested lot sizes are proposed for the vendor to ensure optimal item delivery, with a commitment to adhere to these recommendations. For items presented in sets or pairs, denoted as 'ST,' Table 4.5 offers a distinct treatment. It underscores the necessity for these items to be delivered and issued as complete sets. The core solution to this challenge is outlined in the subsequent chart, reinforcing the imperative for vendors to deliver items as they are issued. Table 4.6 further categorizes items arriving individually but requiring issuance in individual units, ensuring clarity on items with no lot size issues. Specifically, it delineates items arriving from the vendor individually and being issued in individual units for seamless inventory management.

Table 4.1: Vendor Lot Size

Material	Median	SD.	MAT. DESC	BUN	Unit Price	Vendor Lot Size	Suggestion
0032.0046.0001	-200	95	TIE,CBL:3.6MM, WD,150MM LG,BLK	EA	0.82	1 pack	100
0032.0054.0001	-12	17	Battery Dry Battery Cell	EA	35.40875	1PACK	20
0032.0054.0002	-6	8	Battery Dry Battery Cell	EA	35.40875	1pack	20
0032.0054.0003	-12	7	Battery Dry Battery Cell	EA	35.40875	1pack	40
0032.0054.0004	-20	22	Battery, Dry Battery Cell	EA	10.25	0	10
0032.0180.0023	-100	47	CONN,TERM:LUG	EA	1.32	1 pack	100
0032.0180.0027	-150	50	CONN,TERM:LUG	EA	1.32	1 pack	100

Table 4.2: Items Requiring Changes from the Vendor's End

Material	Median	SD	MAT. DESC	BUN	Unit Price	Vendor Lot Size	Suggestion
0032.0180.0004	-50	10	CONN,TERM:LUG,CU CONNECTOR	EA	5.1	EA	25
0032.0180.0008	-11	5	CABLE LUGS O-TYPE.50-10 mm. COPPER	EA	27.78	EA	10
0033.0123.0002	-4.5	3	Energy Saver, E27-24W/220V, SPIRAL.	EA	180.88	EA	10
0033.0170.0017	-3.5	1	LAMP,HID:220VAC,150W,E40 BASE,SOD VAPOR	EA	736.92	EA	5
0075.0134.0001	-2	0	GSKT:200MM ID X 1135MM OD X 3MM	EA	26165	AE	5
0098.0060.0008	-5.5	1	U Clamp for Conduit 1" GI	EA	21.51	EA	5
0098.0071.0002	-6	4	Connector OD 6MM * 1/4"	EA	368.3	EA	10

Table 4.3: Specifies Items for Which the Vendor's Lot Size

Material	Median	SD	MAT. DESC	BUN	Unit Price	Vendor Lot Size	Suggestion
0033.0016.0012	-5	2	BALLAST:230VAC 50HZ,250W,ELECTROMAGNETIC	EA	1110.38	1 pack	5
0033.0016.0014	-7.5	4	Ballast, Electronic,	EA	685.86	1 pack	5
0045.0113.0002	-165	15	FLTR:	EA	465	1pack	100
0110.0244.0001	-40	7	Tungsten Welding Rod Size 6" X 3/32"	EA	149.39	1pack	50
0110.0277.0005	-10	8	LUBRCT:SPRY,WD40,330 ML	EA	249.96	1pack	12
0110.0291.0001	-13	11	Tape Masking 1-1/2" Length 10 Yards	EA	34	1pack	12
0110.0291.0004	-22	50	Tape, Teflon, Size: 3/4". TBA Make UK	EA	30.01	1crt	50

Table 4.4: Proposed Lot Sizes for Vendor

Material	Median	Stdv	MAT. DESC	BUN	Unit Price	Vendor Lot Size	Suggestion
0069.0031.0003	-50	35	STUD:5/8" DIA,100MM LG,11 UNC,ASTM A193	ST	64.2812	EA	50
0110.0056.0002	-10	5	Chalk Mechanical Consumable Slate	ST	25	1 pack	10
0110.0101.0002	-6	3	ELECTRODE,WELDING:AWS E-7018, AWS A5-1	ST	1290.38	1pack	95
0110.0101.0008	-6	3	ELECTRODE,WELDING:AWS E-7018, AWS A5-1	ST	1290.38	1pack	124
0110.0101.0010	-5	3	WIRE,WLD:AWS A5.18/ER-70S3,2.4MM DIA	ST	2366.59	1 pack	1 Pack = 25kg
0110.0154.0006	-1.5	1	HOSE:3/4" DIA X 21 M LG,FEM	ST	23700.53	EA	1
0110.0271.0001	-3	1	STUD:1/2" DIA,1 M LG,ASTM A193,GR B7	ST	469.82	EA	2

Table 4.5: Vendor Commitment for Items Issued Individually to be Delivered Individually

Material	Median	Stdv	MAT. DESC	BUN	P.P.P	Vendor Lot Size	Suggestion
0033.0262.0002	-3	1	PLG,ELEC:10A,250VAC,THREE PIN	EA	78.25	1 pack	10
0255.0286.0003	-1	0	SUIT:CHEM PROT,GRAY	EA	4204.6	1pack	10
0255.0306.0001	-1	2	Torch Flash light	EA	1752.45	1pack	12

Table 4.6: Items with No Lot Size Issues - Seamless Vendor Delivery and Issuance

Material	Median	Stdv	MAT. DESC	BUN	P.P.P	Vendor Lot Size	Suggestion
0098.0312.0012	-1	1	Seamless Tube OD 8 mm	EA	3733.57	EA	EA
0099.0135.0006	-4	3	GAUGE,PRES:0-10/0-140 KG/CM2,4" DIAL	EA	5552.75	EA	EA
0111.0134.0004	-1.5	1	GSKT:1500MM X 1500MM X 3MM THK	EA	29664.26	EA	EA

4.1. Safety Stock

Safety stock represents the inventory that a company maintains beyond its immediate demand needs during the lead time. This additional stock acts as a precautionary buffer, providing protection against potential stock-outs or disruptions in operations.

4.1.1. Collecting Data

It is evident that utilizing the issuance data from the past is crucial in determining the safety stock. The SAP software, maintained by the firm, has provided us with the issuance data for the preceding 5 months as mentioned in Table 4.7.

Table 4.7: Historical Issuance Data for Safety Stock Definition

Issuance date	Material code	Material description	Quantity	Amount
7/15/2015	0003.0024.0001	BELT,V:3V-800	-7	-4,067
7/29/2015	0013.0024.0001	Belt, V, Size SPA-16572W.	-3	-2,502
7/31/2015	0013.0024.0001	Belt, V, Size SPA-16572W.	-3	-2,502
6/11/2015	0017.0243.0001	O-RNG:P60,FPM,CYCLO DR	-2	-4079.1
6/25/2015	0017.0243.0001	O-RNG:P60,FPM,CYCLO DR	-2	-4079.1
7/15/2015	0017.0243.0001	O-RNG:P60,FPM,CYCLO DR	-2	-4079.1
7/21/2015	0017.0243.0001	O-RNG:P60,FPM,CYCLO DR	-2	-4079.1

The table above provides the following insights:

Item 0003.0024.0001 was issued only once, with a quantity of 7 over the entire 5-month period.
Item 0013.0024.0001 was issued twice, with a quantity of 3 each time, resulting in a total issuance of 6 over the 5-month period.
Item 0017.0243.0001 was issued four times, with a quantity of 2 each time, totaling 8 issuances over the 5-month period.

4.2. Reordering Quantity

We were obligated by the firm to set the reordering level or point at 45 days. However, there was uncertainty regarding the specific quantity to reorder. In essence, the instruction was to replenish the order after consuming 15 days of inventory. The challenge lay in deciding the remaining stock quantity at which the reordering process would initiate. The reordering point was established by multiplying the maximum stock by 75%, and the resulting value became our designated reordering point as mentioned in Table 4.8.

Table 4.8: Determination of Reordering Point Based on Maximum Stock and Firm Specifications

Material code	Maximum stock	Reordering quantity
0032.0046.0001	1200	900
0032.0291.0001	240	180
0110.0066.0001	400	300
0110.0089.0005	400	300

5. CONCLUSION

This research addresses practical challenges in warehouse management through the application of the Economic Order Quantity (EOQ) model. The warehouse was identified to encounter issues related to safety stock, reordering points, and lot sizes. To assist in defining lot sizes, a physical inspection was conducted, supplemented by issuance data provided by the company. Subsequently, refining the reordering point recommendations led to more precise outcomes for safety stock and reorder quantity. Given that the warehouse stocked spare parts for other plants, the provision of safety stock recommendations optimized order quantities for each product during placement, mitigating stock-out concerns. Similarly, offering lot size recommendations yielded improvements in work efficiency, cost reduction, and time savings.

References

Akbar, A., & Mokhtar, A. A. B. (2017). Integrating Life Cycle Costing (LCC) and Life Cycle Assessment (LCA) Model for Selection of Centralized Chilled Water Generation. In MATEC Web of Conferences (Vol. 131, p. 04006). EDP Sciences.

Akbar, A., et al., IMPROVING QUALITY AND EFFICIENCY: A SIX SIGMA APPROACH TO PROBLEM SOLVING IN THE SEWING UNIT OF A GARMENTS MANUFACTURER BASED IN PAKISTAN. 2006.

Akbar, A., Majid, M. A. B. A., & Mokhtar, A. A. (2021). Life cycle costing of thermal energy storage system using CAPEX and OPEX. Journal of Mechanical Science and Technology, 35(7), 3223-3229.

Babar Ramzan, M., Mohsin Qureshi, S., Irshad Mari, S., Saad Memon, M., Mittal, M., Imran, M., & Waqas Iqbal, M. (2019). Effect of time-varying factors on optimal combination of quality inspectors for offline inspection station. Mathematics, 7(1), 51.

Bacchetti, A., Plebani, R., Saccani, N., & Syntetos, A. (2010). Spare parts classification and inventory management: a case study. Salford Business School Working Papers Series, 408.

Bayraktar, E., & Ludkovski, M. (2010). Inventory management with partially observed nonstationary demand. Annals of Operations Research, 176(1), 7-39.

Bottani, E., Ferretti, G., Montanari, R., Vignali, G., Longo, F., & Bruzzone, A. (2013). Design of supply networks with optimized safety stock levels. International Journal of Engineering, Science and Technology, 5(2), 93-109.

Chaib, R., Bouanaka, M. L., Bellaouar, A., Benidir, M., & Verzea, I. (2009). Determination of the efficiency of a means of production application in a chain of production. Management of Technological Changes, 1, 605-608.

Chen, F. (1998). Echelon reorder points, installation reorder points, and the value of centralized demand information. Management science, 44(12-part-2), S221-S234.

Dadouchi, C., & Agard, B. (2018). Lowering penalties related to stock-outs by shifting demand in product recommendation systems. Decision Support Systems, 114, 61-69.

Darom, N. A., Hishamuddin, H., Ramli, R., & Nopiah, Z. M. (2018). An inventory model of supply chain disruption recovery with safety stock and carbon emission consideration. Journal of cleaner production, 197, 1011-1021.

Dobson, G. (1988). Sensitivity of the EOQ model to parameter estimates. Operations Research, 36(4), 570-574.

Erlenkotter, D. (1989). Note—An Early Classic Misplaced: Ford W. Harris's Economic Order Quantity Model of 1915. Management Science, 35(7), 898-900.

Erlenkotter, D. (1990). Ford Whitman Harris and the economic order quantity model. Operations Research, 38(6), 937-946.

Gianesi, I. G. N., & de Biazzi, J. L. (2011). Gestão estratégica dos estoques. Revista de Administração, 46(3), 290-304.

Hai, D., Hao, Z. H. E. N. G., & Ping, L. Y. (2011). Model predictive control for inventory management in supply chain planning. Procedia Engineering, 15, 1154-1159.

Harris, F. W. (1990). How many parts to make at once. Operations research, 38(6), 947-950.

Kaka, S. H. U. A. I. B., Hussin, H. I. L. M. I., Khan, R. A. N. O., Akbar, A., Sarwar, U. M. A. I. R., & Ansari, J. A. N. S. H. E. R. (2022). Fuzzy logic-based quantitative risk assessment model for hse in oil and gas industry. Universiti Teknologi PETRONAS.

KAKA, S., KHAN, D., AKBAR, A., ALI, S., ANSARI, J., SARWAR, U., & KHAN, R. (2024) ENHANCING RISK ASSESSMENT IN THE OIL AND GAS INDUSTRY: A COMPARATIVE ANALYSIS OF MAMDANI AND SUGENO METHODOLOGIES.

KAKA, S., MARI, S. I., PATHAN, S. M., KHAN, R., SARWAR, U., & AKBAR, A. A COMPREHENSIVE ANALYSIS OF RISK ASSESSMENT METHODS IN THE OIL AND GAS INDUSTRY: A REVIEW.

Keskin, G. A., Omurca, S. İ., Aydın, N., & Ekinci, E. (2015). A comparative study of production–inventory model for determining effective production quantity and safety stock level. Applied Mathematical Modelling, 39(20), 6359-6374.

Krajewski, L. (2009). Administração de produção e operações . Pearson Educación.

Memon, M. S., Mari, S. I., Shaikh, F., & Shaikh, S. A. (2018). A grey-fuzzy multiobjective model for supplier selection and production-distribution planning considering consumer safety. Mathematical Problems in Engineering, 2018.

Senapati, A. K., Mishra, P. C., Routra, B. C., & Biswas, A. (2012). An extensive literature review on lead time reduction in inventory control. International Journal of Engineering and Advanced Technology (IJEAT), 1(6), 104-111.

`Shaikh, I. K., Ansari, J., Khan, R., Akber, A., & Rahman, A. (2022). Productivity Enhancement by Employing Change in Plant Layout and Work-Study at a Glass Producing Company, Journal of Tianjin University Science and Technology, Vol 55, Issue 7.

Silver, E. A., Pyke, D. F., & Thomas, D. J. (2016). Inventory and production management in supply chains. CRC press.

Smart, C. N. (2008). The Relationship Between Forecasting and Optimal Stocking Levels. APICS-The Performance Advantage.
Stadtler, H. (2007). How important is it to get the lot size right?. The Journal of Business Economics, 77(4), 407-416.
Taft, E. W. (1918). The most economical production lot. Iron Age, 101(18), 1410-1412.
Vago, F. R. M., Veloso, C., do Couto, J. M., Lara, J. E., Fagundes, A. F. A., & de Oliveira Sampaio, D. (2013). A importância do gerenciamento de estoque por meio da ferramenta curva ABC. Revista Sociais e Humanas, 26(3), 638-655.
Van Foreest, N. D., Teunter, R. H., & Syntetos, A. A. (2018). Base-stock policies with reservations. Omega, 81, 48-56.
Vastag, G., & Montabon, F. (2001). Linkages among manufacturing concepts, inventories, delivery service and competitiveness. International Journal of Production Economics, 71(1-3), 195-204.
Wassan, R. K., Hulio, Z. H., Gopang, M. A., Memon, U. S., Akbar, A., & Kaka, S. (2022). Practical application of six SIGMA methodology to reduce defects in a Pakistani manufacturing company. Journal of Applied Engineering Science, 20(2), 552-561.
Wassan, R. K., Khan, M. T., Chandio, G. S., Haider, Y., Sarwar, U., Akbar, A., & Umair, M. (2022). The current status of lean manufacturing in small, medium and large scale manufacturing companies of Karachi, Pakistan. Journal of Applied Engineering Science, 20(3), 707-715.
Waters, D. (2008). Inventory control and management. John Wiley & Sons.
Ziukov, S. (2015). A literature review on models of inventory management under uncertainty. Verslo Sistemos ir Ekonomika, 5(1).