

A STUDY ON MINMAX INVENTORY MANAGEMENT IN FREYER INTERNATIONAL LOGISTICS PVT

Submitted in partial of the requirements for the award of Degree in
MASTER OF BUSINESS ADMINISTRATION

by

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC | 12B Status by UGC | Approved by AICTE

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BONAFIDE CERTIFICATE

This is to certify that this project report is the Bonafede work of **RAMAKRISHNAN.V 41410248** who carried out the project entitled **"A STUDY ON MINMAX INVENTORY MANAGEMENT IN FREYER INTERNATIONAL LOGISTICS PVT"** under my supervision from January 2023 to April 2023.

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DECLARATION

I RAMAKRISHNAN.V (reg no. 41410248) hereby declare that the project report entitled “**A STUDY ON MINMAX INVENTORY MANAGEMENT IN FREYER INTERNATIONAL LOGISTICS PVT**” done by me under the guidance of Dr.JAINBZAREENA is submitted in partial fulfilment of the requirements for the master of Business Administration Degree.

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ABSTRACT

The Procurement process is one of the Key processes, for any Organization. Procurement Process is a method by which items are purchased from external suppliers. The procurement management process involves managing the ordering, receipt, review and approval of items from suppliers. A procurement process also specifies how the supplier relationships will be managed, to ensure a high level of service is received. This is a critical task in Procurement Management. In essence, the procurement process helps to "get what you have paid for". To achieve the Goal, the Mini-Max Technique is implemented in FREYER INTERNATIONAL LOGISTICS PVT .LTD to improve the inventory turns and eliminates waste in procurement process.

CHAPTER-I

INTRODUCTION

INTRODUCTION

1.1 INTRODUCTION OF THE STUDY

This concept is basically a vendor management inventory which helps organization to monitor the Inventory by suppliers and reduce the Inventory monitoring time, re ordering time, eliminate waste in the procurement process & improve inventory turns.

Min-Max is a material replenishment system in which the supplier is responsible for keeping customer on hand inventory levels between predetermined min/max values. Suppliers monitor the Inventory levels of customers and ensure on time delivery of parts as specified qty with control on Inventory. The min/max values need to calculate by using the Min-Max Calculations Template. Once the values have been finalized the values are communicated to the supplier. The supplier review customer's inventory levels on a daily basis via customer's on line portal to determine when and what qty of each part they are going to ship to customer.

The only stipulation in the vendor shipments is that the qty shipped must not increase customer on hand inventory above the max level. Prior to each shipment the vendor notifies the customer of the date/qty of the parts shipping.

Min-max is a decision rule used in decision theory, game theory, statistics and philosophy for minimizing the possible loss for a worst case (maximum loss) scenario.

Alternatively, it can be thought of as maximizing the minimum gain. Originally formulated for two-player zero-sum game theory, covering both the cases where players take alternate moves and those where they make simultaneous moves, it has also been extended to more complex games and to general decision making in the presence of uncertainty.

The Min-max theorem states: For every two-person, zero-sum game with finitely many strategies, there exists a value V and a mixed strategy for each player, such that

- (a) Given player 2's strategy, the best payoff possible for player 1 is V , and
- (b) Given player 1's strategy, the best payoff possible for player 2 is $-V$.

Equivalently, Player 1's strategy guarantees him a payoff of V regardless of Player 2's strategy, and similarly Player 2 can guarantee himself a payoff of $-V$. The name Min-max arises because each player minimizes the maximum payoff possible for the other—since the game is zero-sum, he also minimizes his own maximum loss (i.e. maximize his minimum payoff).

This theorem was first published in 1928 by John von Neumann,[3] who is quoted as saying "As far as I can see, there could be no theory of games without that theorem. I thought there was nothing worth publishing until the Mini-max Theorem was proved".

CRITERIA FOR MIN- MAX SET UP

- Must be DOL Parts need to be selected (No Receiving Inspection).
- Vendor should hold safety stock.
- Forecast visibility is provided to vendor via online portal – supplier must have active online account.

- Accurate internal inventory quantities are required – timely system transactions.
- Part cannot be Dual Sourced or Inter-Company sourced.

PROBLEM ON HAND

Present day as identified buyers are working on following kind of non-value added activities in day to day work its pulling down overall performance and not able to focus on tangible issue with supply chain management.

Procurement process is one of the key processes in any of the company. Supply chain will support manufacturing as well as all other department needs and requirements on time. In the current Material Replenishment process, we have classified the Materials Manually for the Buy parts as A, B and C class items based on the Price and its Lead Time.

- “A” is considered to be the High price with High Lead time Items
- “B” is considered to be Medium price with High Lead Time
- “C” is considered to be the Low Price with Medium/ Less Lead Time

As listed above, the Manual Replenishment systems are followed to meet the key element of supply chain is supports customer requirements on time and monitoring inventory levels, achieve the inventory turns to improve the cash flow to the company, Based on this we could able to track the Inventory and Supplier Delivery on timely base but could not able to “control the Inventory and Supplier Deliver on track”. With the Current process we have some of the Issues which are affecting the Customer Relationship.

IMPORTANCE OF THE PROBLEM

Non-value added (waste) activities in procurement process causes less focus on tangible issues in supply chain management. It's also affecting day to day activity

and pulling down overall performance of the department. Also it leads to makes difficulties to focus on Continuous improvement activities. Increase in inventory value affected the cash flow, Reduce in Inventory turns & space requirements more in stores. Also the time involved on inventory monitoring, reordering, following for materials is high. The Min Max inventory management will eliminate the waste in the procurement process and help the supply chain to procure the components in least waste way and improve inventory turns & cash flow by holding the Control on the Replenishment Process. Min-Max helps to

- Define & Control the current inventory and inventory turns.
- Data analysis and identification of Root cause of the problem on time.
- Determine min max level of Inventory for each part numbers.
- Establish the communication process through customer online portal to maintain the min max level of suppliers in customer end.

The present status and behavior of problem plays a vital role before taking further steps on analysis and action of the problem. For that we have to understand the problem, observe the trend and study the criticality of the problem.

The objective of this project is to improve the Sales and Profit of the Business by reducing the Non Value-Added Activities involved in the procurement process by implementing Min-Max method.

DETAILS OF THE PROBLEM

This Project aims to evaluate different strategies in Procurement process to optimize the Inventories, to Improve Sales and Reduce the Supplier Lead Time, As in the Current state the reorder point of raw material or the minimum order Quantity are not set to support in meeting the Customer requirements, which leads to dip in the on-Time Delivery and reduction in the Sales Perspective and affecting other cost factor in the production process .An optimum order Quantity of Raw Materials are required for each part numbers as a basic to improve the materials flow, reduce the Multiple

Shipments and to reduce the Additional working Hours to track the Multiple Shipments.

HISTORICAL PERSPECTIVE

Manufacturing firms face great pressure to reduce their production costs, and Over Head Cost continuously to reduce the final Product cost to favour Customer delight with 100% On-time Delivery and Quality, for getting new products as a benefit out of it. One of the main expenditure items for these firms are Raw Material Cost, Inventory Carrying Cost and Over Head Cost (Direct and Over time Hrs). This cost which may reach 60–70%, if this trend increases, which in turn can affect the Major Profit to the Company and become a threat to the business.

CRITICALITY OF THE PROBLEM

With the Current Scenario, the Key process or the Critical process of any manufacturing business is the Procurement Process, any Changes in a positive trend can improve the Business in a profitable way, but in uncertainty or wrong decision can become a threat to business.

Every project is different. Some procurement projects are small and every step of a formal process may not be required. Alternatively, some projects are highly complex or regulated and a generic framework will not be appropriate or sufficient. Despite this, every procurement project follows the same broad process. The key thing to remember is to adapt the process to fit the project.



Fig. no. 1.1(Purchasing process)

1. DEFINE THE BUSINESS NEED

Need to understand what the fundamental business requirement is. At this point, it is important to understand the difference between a requirement and a solution. “For example, the business requirement is to source some software to help to get information published on the company intranet”. An item of software to publish information on the company intranet is a solution – not a requirement. The requirement is to be able to publish information on the intranet. It may be that an outsourced solution is a better option.

2. DEVELOP THE PROCUREMENT STRATEGY

Depending on the scale of your project, there could be a very wide range of potential solutions and approaches to your business need and a number of ways of researching the market and selecting a supplier.

3. SUPPLIER SELECTION AND EVALUATION

After researching the market and establishing your procurement approach, you need to evaluate the solutions available. This may involve a formal tender process or an on-line auction. Your criteria for comparing different solutions and suppliers are critical. Weight the key criteria heavily and don't attach too much importance to aspects that will have little impact on the solution.

4. NEGOTIATION AND AWARD

Even when you have selected a supplier it is important that detailed negotiations are undertaken. This is not just about price. Think in terms of Total Cost of Ownership. A cheap product is not so cheap if the carriage costs are huge or if the maintenance contract is onerous. Consider carefully the process by which the goods or services will be ordered and approved; how they will be delivered and returned if necessary; how the invoice process will work and on what terms payment will be

made. Considering the whole Purchase to Pay process (P2P) at the outset can reduce costs and risk significantly

5. INDUCTION AND INTEGRATION

No goods or services should be ordered or delivered until the contract is signed, but this is not the end. It is vital that the supplier is properly launched and integrated. The P2P process needs to be in place and needs to be understood on both the buy-side and the supplier side. Any service levels that have been agreed need to be measured and KPIs put in place. Regular reviews should be established. So any decision should be considered by keeping these entire criteria's in mind.

SAP

SAP enterprise software to manage business operations and customer relations. SAP has positioned Enterprise SOA to deliver the benefits offered by service-oriented architecture, including enabling both flexibility and business efficiency. SAP states that Enterprise SOA provides companies with a "cost-effective blueprint for composing innovative new applications by extending existing systems, while maintaining a level of flexibility that makes future process changes cost-effective".

FOUR APPLICATIONS OF SAP

- Customer Relationship Management
- Product Lifecycle Management
- Supply Chain Management
- Supplier Relationship Management

1.2 INDUSTRY PROFILE

LOGISTICS INDUSTRY In a world where the human race pines to unearth the origin of an Egg – it is obligatory to dig deep into the history of Logistics. As one of the world's largest industries – logistics encompass half-a-dozen sectors starting from the road, rail, air, maritime transport, warehousing, and storage. Logistics experts have defined

it as the cost-efficient process that comprises shrewd planning, implementation, and control over the storage and movement of goods from the manufacturer to the end-user. Logistics, at present, is both an intricate and advanced process. However, its beginning was singular and significantly low-key. Let's unravel the history of logistics and its impact on worldwide trade from scratch. The three-syllable word 'Logistics' originated in the late 19th Century. It was the French term "Logistique" that gained fame through Antoine Henri Jomini's book "The Art of War", making way for its English-translated version to become globally popular in the years to come. The denotation of "Logistique" in Jomini's book referred to the means of supplying a theatre of war with soldiers and ammunition. The French used this term throughout the time of World War and later on, it was re-pronounced as 'Military Logistics'. Equivalent to the numerous logistics specialists working today, the military officers back then were enunciated as 'Logistikas'. They shared similar KRA's, ensuring seamless management of the supply chain, albeit for the soldiers to efficaciously move forward and take charge. Before the inception of the term 'logistics', a related process was used, encapsulating comprehensive supply systems, road transportation, and warehouses. This system was in place long before modernization, specifically during the Middle Ages, which we have studied in school. That time, the forts, and the castles used to serve as warehouses, while horse-drawn vehicles and boats used to act as a means of transportation. The definition of the supply chain consistently evolved from the middle age to the prevailing digital age. However, it is during this transitional phase where logistics dawned and garnered a name for itself.

1.3 COMPANY PROFILE

1 FREYER INTERNATIONAL LOGISTICS PVT. LTD. Freyer International Logistics Private Limited is a 4 years 11 months old Private Company incorporated on 08 Jan 2018. Its registered office is in Bangalore, Karnataka, INDIA. The Company's status is Active, and it has filed its Annual Returns and Financial Statements up to 31 Mar 2021 (FY 2020-2021). It's a company limited by shares having an authorized capital of Rs.1.00cr and a paid-up capital of Rs.1.00cr as per MCA. 5 Directors are associated with the organization. Arun Sharma Akshintala Ramesh, Kalimuthu

Muthukaruppan, Rajan Jagannathan and 2 other members are presently associated as directors. There are 201-500 employees, we're pleased to support the ongoing expansion of our member Freyer International Logistics Pvt. Ltd. as they develop within India and markets to give service to SCN members and others. Today we are happy to announce the incorporation of their branch in Chennai. Freyer International offers International Freight Forwarding and Supply chain solutions. We provide highly customised solutions to customers, meeting their needs – from sourcing and manufacturing to selling around the world. Our offices are strategically located in all Major Airports & Sea Ports, and we can cater to customers' needs all across India. We deploy advanced, innovative supply chain models to enhance operational efficiency, reduce overall costs, and improve response time to markets. There doing six services they are Air services, Ocean services, Custom services, Warehouse, Risk management, Project cargo, there are eleven departments they are, Air Import, Air Export, Ocean Import, Ocean Export, Customs clearness, Finance, Sales, Key Accounting management, Customer Services, Human resources manager (HR). Freyer International Logistics' operating revenues range is INR 100.cr – 500.cr for the financial year ending on 31 March, 2022. It's EBITDA has increased by 43.76 % over the previous year. At the same time, it's book net worth has increased by 223.92 %. Other performance and liquidity ratios are available here.

1.5 NEED OF THE STUDY

- ★ Minimax inventory management is a technique used by businesses to manage inventory levels with the goal of minimizing costs while ensuring adequate inventory to meet customer demand.
- ★ The approach is based on minimizing the maximum cost of inventory a business may incur, which is the cost of running out of inventory and being unable to meet customer demand.
- ★ Benefits of minimax inventory management include reducing overall inventory holding costs, improving demand forecasting accuracy, and reducing the risk of product obsolescence.

- ★ Potential drawbacks of minimax inventory management include the risk of being caught off guard by sudden increases in demand and that it may not be suitable for businesses that rely on just-in-time inventory management.
- ★ It's important to evaluate the risks and benefits of minimax inventory management to determine if it's the right fit for your particular business.

1.6 OBJECTIVES OF THE STUDY

- To identify inventory management fryer logistics International Private Limited
- To analysis stock level in the store to assess cost spend for raw material
- To identify the impact on inventory management to assess ideal time due to storage of material.

1.7 SCOPE OF THE STUDY

- ★ Its helps in understanding inventory terms customer on time delivery services
- ★ To study enable to know time reduction practice in inventory management
- ★ This project is mainly focused on the three major activities which are listed below to improve the sales and profit to the Organization by applying the Min-Max Method to remove the Non Value-Added Activities in the Procurement process.

CHAPTER – II

REVIEW OF LITERATURE

2.1 REVIEW OF LITERATURE

Farzaneh (1997) presented a mathematical model, to assist the companies in their decision to switch from EOQ to JIT purchasing policy. He defines JIT as “to produce and deliver finished goods just in time to be sold, sub-assemblies just in time to be assembled in goods and purchased material just in time to be transformed into fabricated parts”. He highlights that the EOQ model focuses on minimizing the inventory costs rather than minimizing the inventory. Under the ideal condition where all the conditions meet, it is economically better off to choose the JIT over the EOQ because it results in purchase price, ordering cost.

Rich Lavelly (1998) Asserts that inventory means “Piles of Money” on the shelf and the profit for the firm. However, he notices that 30% of the inventory of most retail shops is dead. Therefore, he argues that the inventory control is facilitate the shop operations by reducing rack time and thus increases profit. He also elaborates the two types of inventory calculations that determine the inventory level required for profitability. The two calculations are “cost to order” and “cost to keep”. Finally, he proposes seven steps to inventory control.

Dave Piasecki (2001) He focused on inventory model for calculating the optimal order quantity that used the Economic Order Quantity method. He points out that many companies are not using EOQ model because of poor results resulted from inaccurate data input. He says that EOQ is an accounting formula that determines the point at which the combination of order costs and inventory costs are the least. He

highlights that EOQ method would not conflict with the JIT approach. He further elaborates the EOQ formula that includes the parameters such as annual usage in unit, order cost and carrying cost. Finally, he proposes several steps to follow in implementing the EOQ model. The limitation of this literature is that it does not elaborate further relationship between EOQ and JIT. It does not associate the inventory turns with the EOQ formula and fails to mention the profit gain with the quantity is calculated.

Gaur, Fisher and Raman (2005) In their study examined firm-level inventory behaviour among retailing companies. They took a sample of 311 public-listed retail firms for the years 1987–2000 to examine the relationship of inventory turnover with gross margin, capital intensity and sales surprise. They observed that inventory turnover for retailing firms was positively related to capital intensity and sales surprise while inversely associated with gross margins. They also suggested models that yield an alternative metric of inventory productivity, adjusted inventory turnover that can be used in study of performance analysis and managerial decision-making.

S. Singh (2006) Analyzed the inventory control practices of single fertilizer company named IFFCO. He statistically examined the inventory system with consumption, sales and other variables along with growth of these variables and inventory patterns. He concluded that an increase in components of inventory lead to an increase in the proportion of inventory in current assets. A special focus was made on stores and spares in order to calculate excess purchases resulting in loss of profit.

Pradeep singh (2008) In his study made an attempt to examine the inventory and working capital management of Indian Farmers Fertilizer Cooperative Limited (IFFCO) and National Fertilizer Limited (NFL). He concluded that the overall position of the working capital of IFFCO and NFL is satisfactory. But there is a need for improvement in inventory in case of IFFCO. However inventory was not properly utilized and maintained by IFFCO during study period. The management of NFL must try to properly utilize the inventory and try to maintain the inventory as per the requirements. So that liquidity will not interrupt.

Capkun, Hameri and Weiss (2009) Statistically analysed the relationship between inventory performance and financial performance in manufacturing companies using the financial information of a large sample of US-based manufacturing firms over a 26-year period, that is, 1980 to 2005. They inferred that a significant relationship existed between inventory performance along with the performance of its components and profitability. Raw material inventory performance was highly correlated to gross profit and operating profit. Work in progress inventory was highly correlated to gross profit measures while finished goods inventory performance was more correlated with operating profit measures.

Gaur and Bhattacharya (2011) Attempted to study the linkage between the performance of the components of inventory such as raw material, work in progress and finished goods and financial performance of Indian manufacturing firms. The study revealed that finished goods inventory as inversely associated with business performance while raw material inventory and work in progress did not have much effect on same. They emphasised that instead of focusing on total inventory, an attempt should be made to concentrate on individual components of inventory so as to adequately manage the same. They concluded that managers not paying heed to inventory performance may become weak in combating competitors.

Eneje et al (2012) Investigated the effects of raw materials inventory management on the profitability of brewery firms in Nigeria using a cross sectional data from 1989 to 2008 which was gathered for the analysis from the annual reports of the sampled brewery firms. Measures of profitability were examined and related to proxies for raw materials inventory management by brewers. The Ordinary Least Squares (OLS) stated in the form of a multiple regression model was applied in the analysis. The study revealed that the local variable raw materials inventory management designed to capture the effect of efficient management of raw material inventory by a company on its profitability is significantly strong and positive and influences the profitability of the brewery firms in Nigeria. They concluded that efficient management of raw material inventory is a major factor to be contained with by Nigerian brewers in enhancing or boosting their profitability.

Nyabwanga and Ojera (2012) They Highlighted the association between inventory management practices and business performance of smallscale enterprises (SSEs), in Kisii Municipality, Kisii County, Kenya. They used a cross-sectional survey study based on a small sample size of 79 SSEs. The study inferred that inventory comprised the maximum portion of working capital, and improper management of working capital was one of the major reasons of SSE failures. The empirical results disclosed that a positive significant relationship existed between business performance and inventory management practices with inventory budgeting having the maximum influence on business performance ensued by shelf-space management. The study suggested that by following effective inventory management practices business performance can be enhanced.

Sahari, Tinggi and Kadri (2012) Empirically analysed the relationship between inventory management and firm performance along with capital intensity. For the purpose they took a sample of 82 construction firms in Malaysia for the period 2006–2010. Using the regression and correlation analysis methodsss, they deduced that inventory management is positively correlated with firm performance. In addition, the results indicate that there is a positive link between inventory management and capital intensity.

Soni (2012) Made an in depth study of practices followed in regard to inventory management in the engineering goods industry in Punjab. The analysis used a sample of 11 companies for a period five years that is, 2004–2009 and was done using panel data set. The adequate and timely flow of inventory determines the success of an industry. She concluded that size of inventory enhanced marginally over the period as compared to a hike in current assets and net working capital. Inventories constituted half of the working capital which was due to overstocking of inventory as a result of low inventory turnover especially for finished goods and raw materials. Rise in sales and favorable market conditions lead to a rise in inventory levels. It was also inferred that sales increased more as compared to inventory.

Lwiki et al (2013) A survey conducted on all the eight (8) sugar manufacturing firms in Kenya established that there is generally positive correlation between each of inventory management practices. Specific performance indicators were proved to depend on the level of inventory management practices. They established that Return on Equity had a strong correlation with lean inventory system and strategic supplier partnerships. As such, they concluded that the performance of sugar firms could therefore be stated as being a function of their inventory management practices.

Panigrahi (2013) Undertook an in-depth study of inventory management practices followed by Indian cement companies and its affect on working capital efficiency. The study also investigated the relationship between profitability and inventory conversion days. The study, using a sample of the top five cement companies of India over a period of 10 years from 2001 to 2010, concluded that a considerable inverse linear relationship existed between inventory conversion period and profitability.

Madishetti and Kibona (2013) Found that a well designed and executed inventory management contributes positively to a small or medium-sized enterprises (SMEs) profitability. They studied the association between inventory conversion period and profitability and the impact of inventory management on SMEs profitability. They took a sample of 26 Tanzanian SMEs, and used the data from financial statements for the period 2006–2011. Regression analysis was adopted to determine the impact of inventory conversion period over gross operating profit. The results cleared out that significant negative linear relationship occurred between inventory conversion period and profitability.

Srinivas Rao Kasisomayajula(2014) An analytical study was conducted on "Inventory Management in Commercial Vehicle Industry In India". A sample of five companies' was selected for study. The study concluded that all the units in the commercial vehicle industry have significant relationship between Inventory and Sales. Proper management of inventory is important to maintain and improve the

health of an organization. Efficient management of inventories will improve the profitability of the organization.

Edwin Sitienei and Florence Memba(2015) Conducted a study on Effect of Inventory Management on profitability of Cement Manufacturing Companies in Kenya. The study concluded that Gross profit margin is negatively correlated with the inventory conversion period, Increase in sales, which denotes the firm size enriches the firm's inventory levels, which pushes profits upwards due to optimal inventory levels. It is also noted that firms inventory systems must maintain an appropriate inventory levels to enhance profitability and reduce the inventory costs associated with holding excessive stock in warehouses.

Areti Satoglou (March 2016) Inventory management is one of the cornerstones of supply chain management as inventory consists of a key contributor in all supply chain. In supply chain sector, many inventory management related problems have been broadly investigated and discussed over the years. It is of great importance for the supply chain of a company to make proper decisions when it comes to plan the order quantity or the time of placing an order, the safety stock that should be keep, the optimal location for its warehouse or other related decisions. Further, it is understood that defining "how much to stock" is closely correlated with defining "how much to order". Hence, each firm follows a specific replenishment policy according to its needs.

I M D P Asana, M L Radhitya, K K Widiartha*, P P Santika and I K A G Wiguna (2020) Determination of reorder point aims to meet the safety stock. This is a central parameter of inventory control. This study aims to find reorder point based on goods classification and safe stock. This approach is implemented in retail information systems that have been running. The information system has about 15.000 active items with the number of sales transactions around 1.100 per day. The problem in determining the reorder point is the unavailability of the safe stock reference. Lack of safe stock information triggered the ordering goods error. This error

causes over stock. It can increase the potential of expired goods. In this study the researcher classifies the goods and determines the amount of safe stock to control the inventory. We used ABC analysis method for goods classification. It divides the group of goods into A, B, C, and D. The amount of safe stock is determined based on the goods sale's history using Min Max Analysis method. Classification result is used to determine the limits on the inventory of allowed items to be ordered. Limitation safety stock amount refers to the limits from the min max method result. While, testing is done by comparing cost before and after implementation of this method.

Chapter - III

Research Methodology

1.8 RESEARCH METHODOLOGY

Research methodology is the process of systematic investigation of any method, sampling plan, sampling method.

RESEARCH

Research means a scientific and systematic search for pertinent information on a specific topic. Research is a careful investigation or inquiry especially through search for new facts in any branch of knowledge.

Research comprises of defining and redefining problems, formulating hypothesis or suggested solution; collecting, organizing and evaluating data, making deductions and researching conclusions to determine whether they fit the formulating hypothesis.

METHODOLOGY

Knowledge, it deals with cognitive processes imposed on research to the problem arising from the nature of its subject matter.

RESEARCH DESIGN

Research design is the plan, structure to answer whom, when and how the subject is under investigation. Here plan is an outline of the research scheme & which the research has to work. The structure of the research is a more specific outline and the strategy out, specifying the methods to be used in the connection & analysis of the data.

The study is to measure effectiveness of the training program through performance appraisal system provided by the employees.

MIN-MAX

MIN-MAX is a decision rule used in decision theory, game theory, statistics and philosophy for minimizing the possible loss for a worst case (maximum loss) scenario.

Alternatively, it can be thought of as maximizing the minimum gain. Originally formulated for two-player zero-sum game theory, covering both the cases where players take alternate moves and those where they make simultaneous moves, it has also been extended to more complex games and to general decision making in the presence of uncertainty.

Min-Max decision making is based on opportunistic loss. They are the kind that looks back after the state of nature has occurred and say "Now that I know what happened, if I had only picked this other action instead of the one I actually did, I could have done better". So, to make their decision (before the event occurs), they create an opportunistic loss (or regret) table. Then they take the minimum of the maximum. That sounds backwards, but remember, this is a loss table. This is similar to the maximin principle in theory; they want the best of the worst losses.

GAME THEORY

In the theory of simultaneous games, a MIN-MAX strategy is a mixed strategy which is part of the solution to a zero-sum game. In zero-sum games, the MIN-MAX solution is the same as the Nash equilibrium.

MIN-MAX THEOREM

The MIN-MAX theorem states For every two-person, zero-sum game with finitely many strategies, there exists a value V and a mixed strategy for each player, such that

- (a) Given player 2's strategy, the best payoff possible for player 1 is V , and
- (b) Given player 1's strategy, the best payoff possible for player 2 is $-V$.

Equivalently, Player 1's strategy guarantees him a payoff of V regardless of Player 2's strategy, and similarly Player 2 can guarantee himself a payoff of $-V$. The name MIN-MAX arises because each player minimizes the maximum payoff possible for the other—since the game is zero-sum, he also minimizes his own maximum loss (i.e. maximize his minimum payoff).

This theorem was first published in 1928 by John von Neumann, who is quoted as saying "As far as I can see, there could be no theory of game.

MIN-MAX ALGORITHM WITH ALTERNATE MOVES

A MIN-MAX algorithm is a recursive algorithm for choosing the next move in an n-player game, usually a two-player game. A value is associated with each position or state of the game. This value is computed by means of a position evaluation function and it indicates how good it would be for a player to reach that position. The player then makes the move that maximizes the minimum value of the position resulting from the opponent's possible following moves. If it is A's turn to move, A gives a value to each of his legal moves.

A possible allocation method consists in assigning a certain win for A as +1 and for B as -1. This leads to combinatorial game theory as developed by John Horton Conway. An alternative is using a rule that if the result of a move is an immediate win for an it is assigned positive infinity and, if it is an immediate win for B, negative infinity. The value to A of any other move is the minimum of the values resulting from each of B's possible replies. For this reason, A is called the maximizing player and B is called the minimizing player, hence the name MIN-MAX algorithm. The above algorithm will assign a value of positive or negative infinity to any position since the value of every position will be the value of some final winning or losing position. Often this is generally only possible at the very end of complicated games such as chess or go, since it is not computationally feasible to look ahead as far as the completion of the game, except towards the end, and instead positions are given finite values as estimates of the degree of belief that they will lead to a win for one player or another.

MIN-MAX CRITERION IN STATISTICAL DECISION THEORY

In classical statistical decision theory, we have an estimator δ that is used to estimate a parameter $\theta \in \Theta$. We also assume a risk function $R(\theta, \delta)$, usually

specified as the integral of a loss function. In this framework, $\tilde{\delta}$ is called MIN-MAX if it satisfies

$$\sup_{\theta} R(\theta, \tilde{\delta}) = \inf_{\delta} \sup_{\theta} R(\theta, \delta).$$

An alternative criterion in the decision theoretic framework is the Bayes estimator in the presence of a prior distribution Π . An estimator is Bayes if it minimizes the average risk.

$$\int_{\Theta} R(\theta, \delta) d\Pi(\theta).$$

MAXIMIN IN PHILOSOPHY

In philosophy, the term "maximin" is often used in the context of John Rawls's A Theory of Justice, where he refers to it (Rawls (1971, p. 152)) in the context of The Difference Principle. Rawls defined this principle as the rule which states that social and economic inequalities should be arranged so that "they are to be of the greatest benefit to the least-advantaged members of society". In other words, an unequal distribution can be just when it maximizes the minimum benefit to those who have the lowest allocation of welfare-conferring resources.

Following steps has followed to implement Min-Max Process Flow.

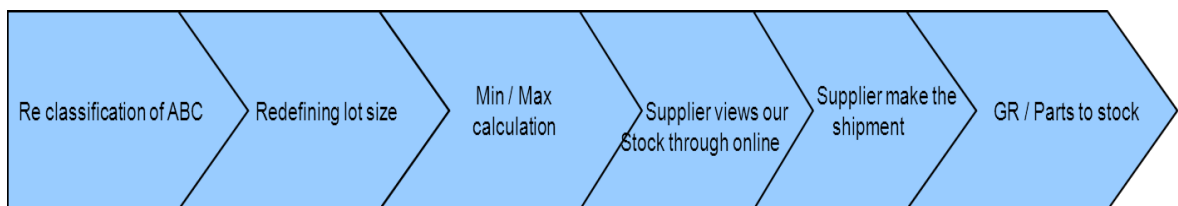


Fig. no. 1.2 (Min-Max process flow)

Step1: As implementation of Min-max need to redefine the ABC classification for all the materials.

(A= 80 %, B = 15%, C=5% of total spend)

Step2: Choose lot size as per ABC classification (Refer Page Number xxxx.)

Step3: Determine Min-Max calculations for each part numbers.

Step4: Implement back office setup to display orders to suppliers thru on line portal.

Step5: Supplier replenishes the stock as per Min max level.

Step6: Parts receive and move to stock room.

SOURCES FOR THE COLLECTION OF DATA

From PMI Global Technological, the Data used are the Metrics flown down by the Customer, all the Data are downloaded using the ERP System, to track the Current Metrics and to improve the Metrics to stand front in the customer requirement and Their Satisfaction.

ERP System-SAP

T-Codes used in the SAP:

- To Track OTD Details

- To check the Work In progress

- To check the Work Order Status

- To Check the Stock Availability and to check the MM

- To Check the Movement of Piece parts and Sub Assembly Parts

DETAILS OF DATA COLLECTED

Following are the collection of data

- On time Delivery Miss (OTD) to Customer

- Line Stoppage

- Not meeting the assemblers Efficiency and Utilization target.

- More no of Shipments- cause increase in Goods Receiving Process

- Less Inventory Turns

- Operation Over time-Due to improper Material Availability

Increase in Non-Value Activity (NVA) for the SCM team to following with Supplier on hourly/daily Basis to meet the Supplier Delivery.

CHAPTER - IV

DATA ANALYSIS AND INTERPRETATION

**LIST OF BUYER ACTIVITIES IN SUPPLY CHAIN FOR EVERY MONTH
IN HRS.**

SI No.	Description of activities	Buyer 1	Buyer 2	Buyer 3	Buyer 4
1	Download precision	0.1875	0.1875	0.1875	0.1875
2	Review precision Conformation	12	12	12	12
3	Pull in	35	35	35	35
4	Push outs	35	35	35	35
5	ME89	0.25	0.25	0.25	0.25
6	Invoice verification	2	2	2	2
7	GR Process	44	44	44	44
8	RI process	44	44	44	44
9	QN Process	2.5	2.5	2.5	2.5
10	PO send to supplier	2.5	2.5	2.5	2.5
11	Configuration changes	1	1	1	1
	Value added activity	153.94	153.94	153.94	153.94
	Non Value added activity Hrs	24.50	24.50	24.50	24.50
Total working time in Hrs/month		178.437 5	178.437 5	178.437 5	178.437 5
Total Hrs available per month		176			

Table no. 2.1(List of buyer activities)

INTERPRETATION

They have to spend 176 hrs available per month for list of buyer activities in supply chain.

MIN-MAX LOT SIZE CALCULATION

To determine the Min or Max qty we need to determine lot size for identified parts.

Lot size calculation:

$$\text{Lot size} = \frac{\text{Annual Demand}}{\text{Number of shipments}}$$

CLASSIFICATION	SHIPMENT OCCURRENCE	NO. OF DELIVERY PER YEAR	\$VALUE PER YEAR	MIN QTY. MAX QTY
A	Weekly	50	\$34,000	Min = .5X lot size demand. Max = 1.5X lot size demand
B	Every 2 weeks	26	\$8,000- \$34,000	Min = .5X lot size demand Max = 1.5X lot size demand
C	Monthly	12	<\$8000	Min = .5X lot size demand Max = 1.5X lot size demand

Table no. 2.2 (Shipment occurrence)

SOLUTION

Annual Demand: 4000 PCS

No. of shipments: 50

Lot size: $4000 / 50 = 80$ PCS

Minimum quantity: $0.5 \times 80 = 40$ PCS

Maximum quantity: $1.5 \times 80 = 120$ PCS

INTERPRETATION

In weekly 50 no. of delivery, Minimum quantity is 40pcs and Maximum quantity is 120pcs to maintain a safety stock level.

MIN-MAX IMPLEMENTATION PLAN

	PHASE I	PHASE II	PHASE III
NO. OF SUPPLIER	3	3	4
NO. OF PART NO.	12	39	35

Table no. 2.3(Minmax implementation plan)

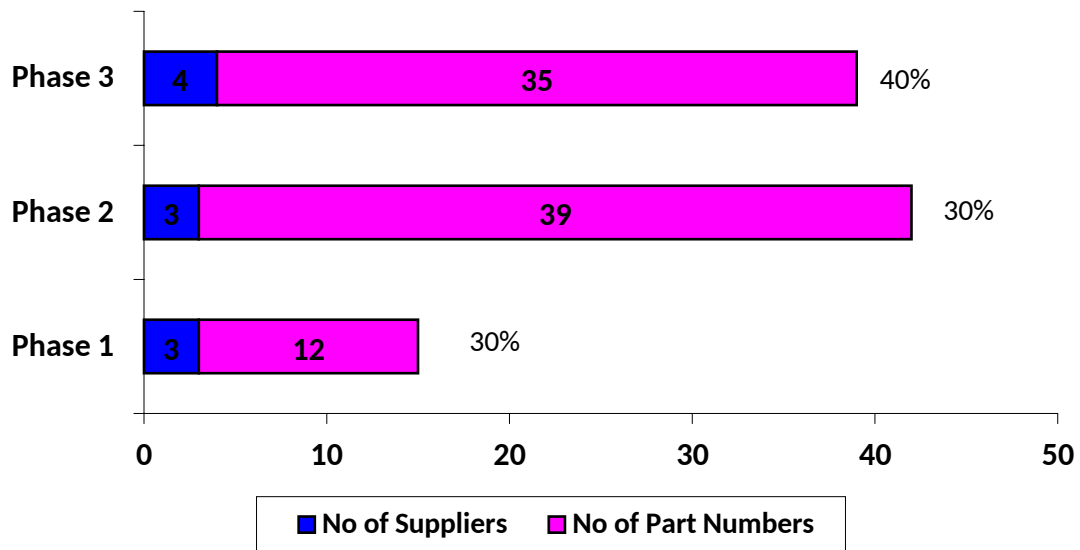


Fig. no.2.1 (Minmax implementation plan)

INTERPRETATION

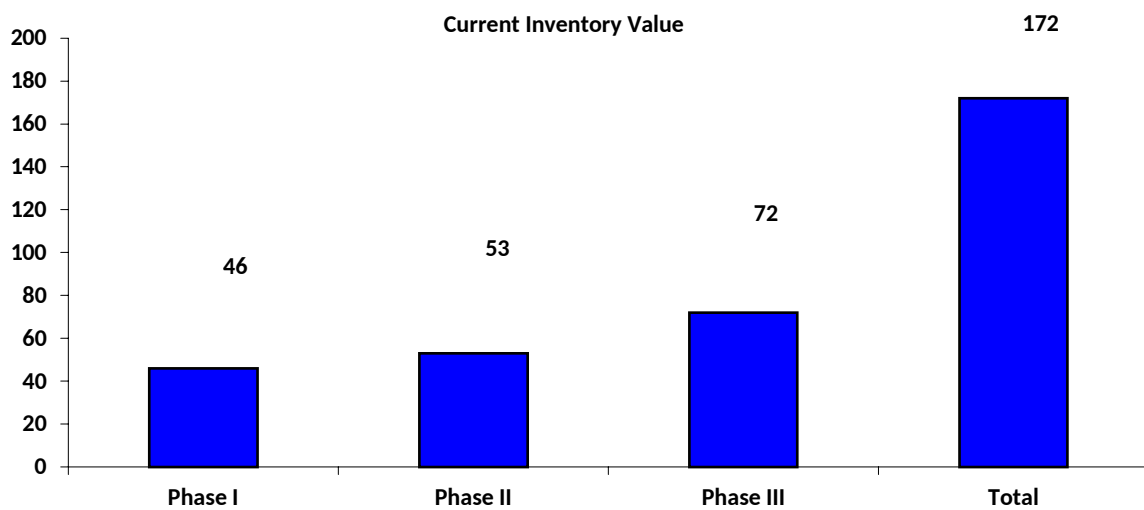
In no. of suppliers and no. of part numbers, phase 1 is 30%, phase 2 is 30% and phase 3 is 40%.

CURRENT INVENTORY IMPACT

	PHASE I	PHASE II	PHASE III
Current inventory value	46	53	72

Table no. 2.4(Current inventory impact)

Fig no. 2.2(Current inventory impact)



INTERPRETATION

The above graph determined the current inventory value for these 86 part numbers.

TIMING PLAN

TRAINING & IMPLEMENTATION PLAN								
Sl no	Supplier	Phase/Month	Phase 1		Phase 2		Phase 3	
		Wk.No	07	08	09	10	11	12
1	Supplier-1	Plan / Part count		10				
		Actual / Part count		10				
2	Supplier-2	Plan / Part count	1					
		Actual / Part count	1					
3	Supplier-3	Plan / Part count	1					
		Actual / Part count	1					
4	Supplier-4	Plan / Part count			7			
		Actual / Part count			7			
5	Supplier-5	Plan / Part count				22		
		Actual / Part count				22		
6	Supplier-6	Plan / Part count			10			
		Actual / Part count			5			
7	Supplier-7	Plan / Part count					2	
		Actual / Part count						
8	Supplier-8	Plan / Part count						2
		Actual / Part count						2
9	Supplier-9	Plan / Part count					10	
		Actual / Part count					10	
10	Supplier-10	Plan / Part count					21	
		Actual / Part count					21	

 Plan
  Task under progress
  Completed

Table no. 2.5(Timing plan)

IMPLEMENTATION PLAN AND INVENTORY

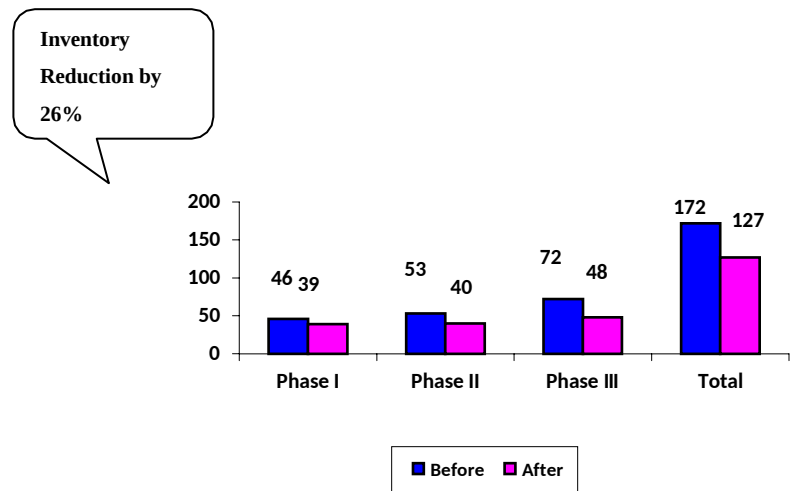
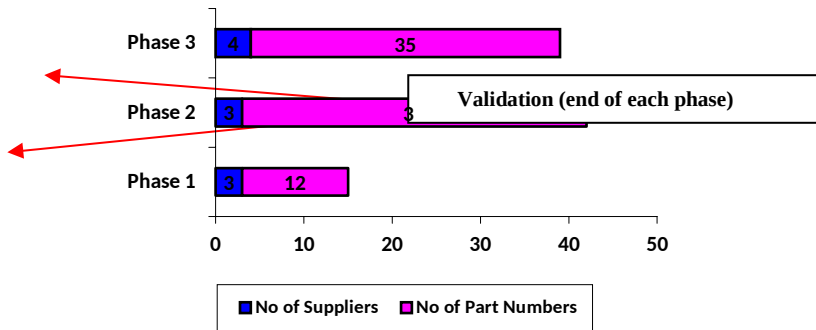


Fig. No. 2.3 (Implementation plan and inventory)

TRAINING AND SAP SETUP PLAN

S.no	Supplier	Commodity	Training & Implementation plan				Phase 2 - Q2 2020			Phase 3 - Q3 2020		
			Phase	Phase 1 - Q1 2020	Phase 2 - Q2 2020	Phase 3 - Q3 2020	Phase 4 - Q4 2020	Phase 5 - Q1 2021	Phase 6 - Q2 2021	Phase 7 - Q3 2021	Phase 8 - Q4 2021	Phase 9 - Q1 2022
			Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21
			Plant / Part Count	10								
1	STERLING SPRING LLC	Machining	Actual / Part Count									
			Plant / Part Count		1							
2	HICAL TECHNOLOGIES PVT LTD	Electronics	Actual / Part Count									
			Plant / Part Count			1						
3	ULTIMATE CONNECTOR, INC	Electrical	Actual / Part Count									
			Plant / Part Count				7					
4	AALARD MACHINE PRODUCTS	Machining	Actual / Part Count									
			Plant / Part Count						22			
5	SANSERA ENGINEERING PVT LTD	Machining	Actual / Part Count									
			Plant / Part Count					5				
6	FMI	Machining	Actual / Part Count									
			Plant / Part Count				2					
7	PREMIER GEAR	Machining	Actual / Part Count									
			Plant / Part Count									
8	COMDEL INNOVATION INC	Machining	Actual / Part Count									
			Plant / Part Count					2		10		
9	ZENITH PRECISION PVT LTD	Machining	Actual / Part Count									
			Plant / Part Count									
10	ATLANTIC SPRING CO	Machining	Actual / Part Count									

Task Completed
 Future Plan
 Task Under progress
 Task Missed deadline

Table no. 2.6(Training and SAP setup plan)

RESULT OF MIN-MAX

Customer On time Deliver Results shows the Progress Growth and Met the Customer Target consistently for 3 months.

OTD 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%
Actual	96%	94%	93%	95%	96%	95%	98%	99%	100%	100%	100%

Table no. 2.7(OTD)

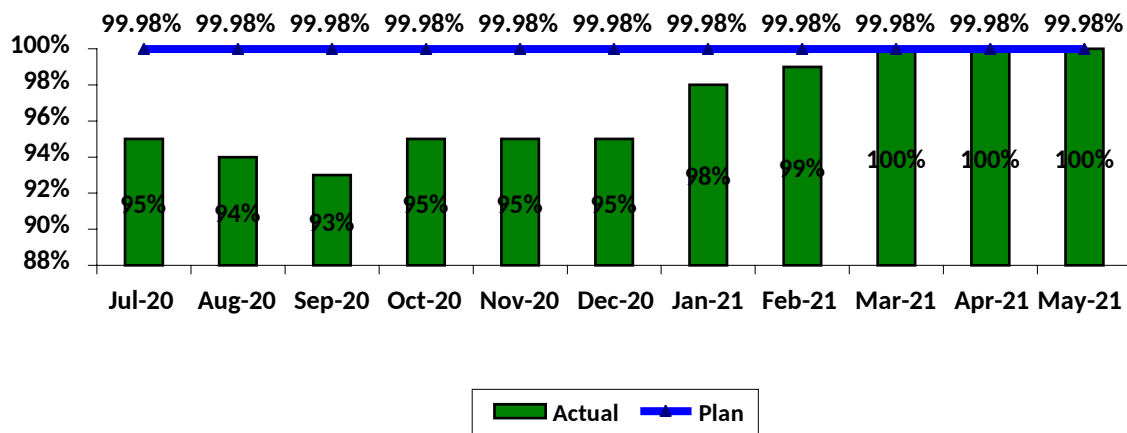


Fig. 2.4(OTD)

INTERPRETATION

In jul-20 we plan 99.98% and get 95%, aug-20 we plan 99.98% and get 94%, sep-20 plan 99.98% and get 93%, oct-20 we plan 99.98% and get 95%, nov-20 we plan 99.98% and get 95%, dec-20 we plan 99.98% and get 95%, jan-21 we plan 99.98% and get 98%, feb-21 we plan 99.98% and get 99%, mar-21 we plan 99.98% and get 100%, apr-20 we plan 99.98% and get 100%, may-21 we plan 99.98% and get 100%.

In-house Line Stoppage Tracker due to Supplier On time delivery Miss

Line stoppage occurrence 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	0	0	0	0	0	0	0	0	0	0	0
Actual	4	3	2	3	2	2	1	0	0	0	0

Table no. 2.8(Line stoppage)

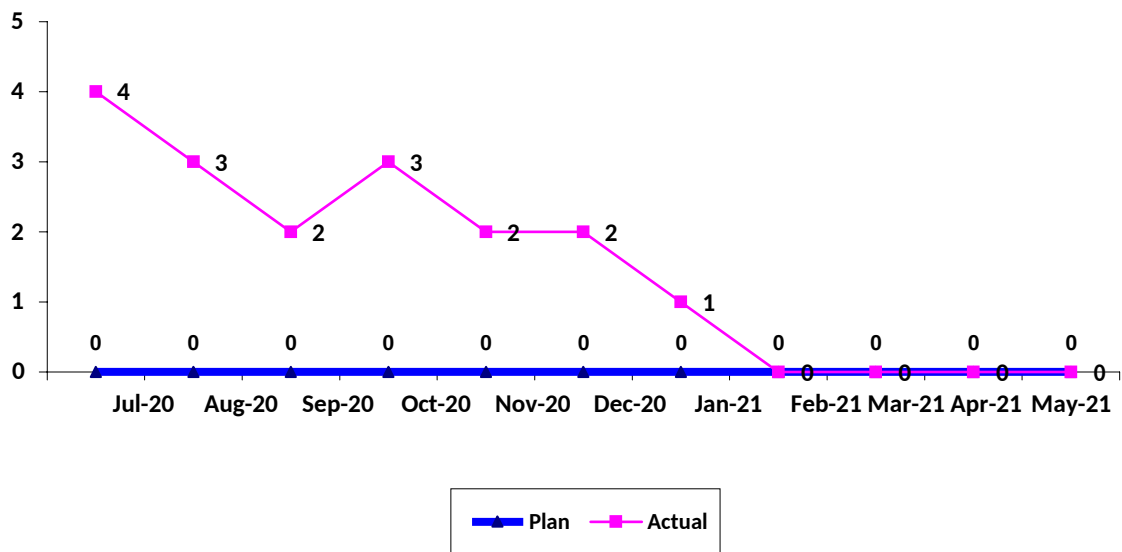


fig. no. 2.5(Line stoppage)

INTERPRETATION

In jul-20 we plan 0 and have to stop 4, aug-20 we plan 0 and have to stop 3, sep-20 we plan 0 and have to stop 2, oct-20 we plan 0 and have to stop 3, nov-20 we plan 0 and have to stop 2, dec-20 we plan 0 and have to stop 2, jan-21 we plan 0 and have to stop 1, feb-21 we plan 0 and have to stop 0, mar-21 we plan 0 and have to stop 0, apr-20 we plan 0 and have to stop 0, may-21 we plan 0 and have to stop 0.

In-House Assemblers Efficiency Tracker and the Improvement Status

Efficiency 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Actual	75%	80%	85%	80%	85%	85%	85%	90%	90%	90%	90%

Table no. 2.9(Efficiency)

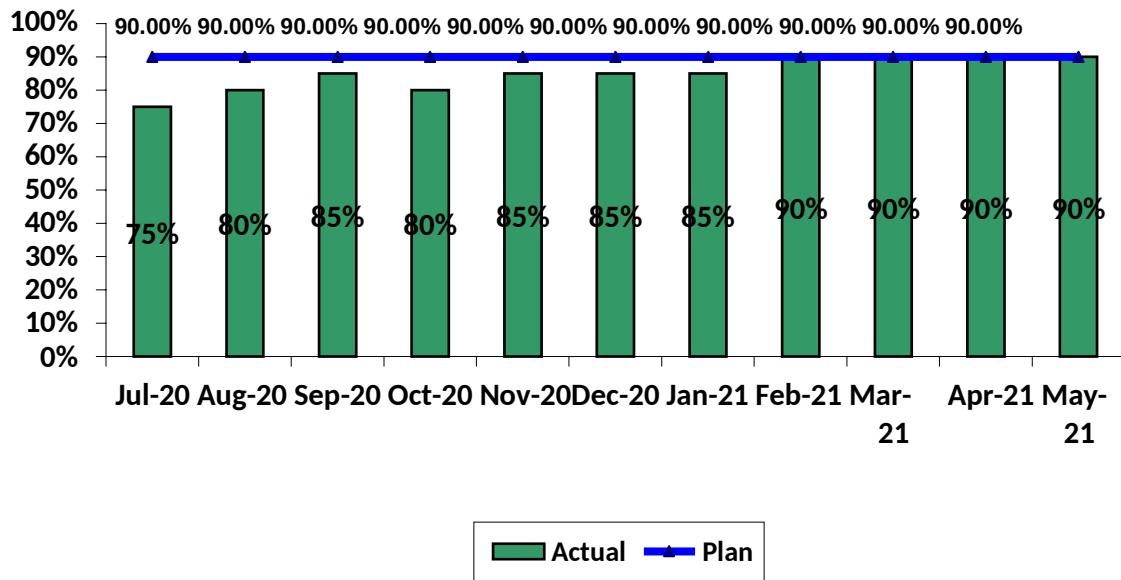


Fig. no. 2.6(Efficiency)

INTERPRETATION

In jul-20 we plan 90% and get 75%, aug-20 we plan 90% and get 80%, sep-20 we plan 90% and get 85%, oct-20 we plan 90% and get 80%, nov-20 we plan 90% and get 85%, dec-20 we plan 90% and get 85%, jan-21 we plan 90% and get 85%, feb-21 we plan 90% and get 90%, mar-21 we plan 90% and get 90%, apr-21 we plan 90% and get 90%, may-21 we plan 90% and get 90%.

Reduction in the Number of Shipment, to reduce the Freight Cost and to improve the Operating Income

No. Of Shipments-Monthly 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	20	20	20	20	20	20	20	20	20	20	20
Actual	49	45	44	43	41	35	37	30	28	24	24

Table no. 2.10(No. of shipments)

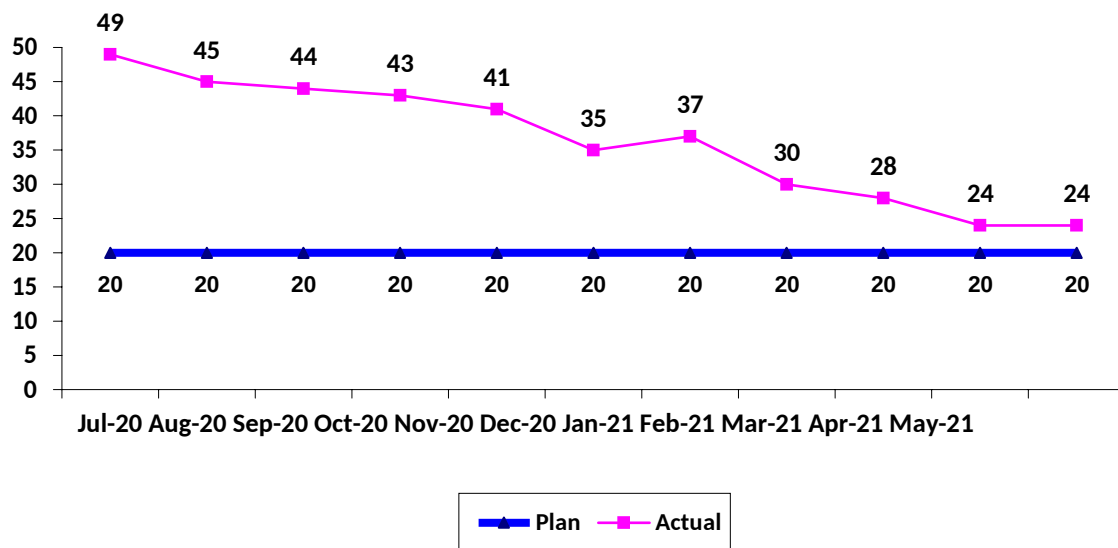


Fig. no. 2.7(No. of shipments)

INTERPRETATION

In jul-20 we plan 20 and have 49, aug-20 we plan 20 and have 45, sep-20 plan 20 and have 44, oct-20 we plan 20 and have 43, nov-20 we plan 20 and have 41, dec-20 we plan 20 and have 35, jan-21 we plan 20 and have 37, feb-21 we plan 20 and have 30, mar-21 we plan 20 and have 28, apr-20 we plan 20 and have 24, may-21 we plan 20 and have 24.

Improvement in the Inventory turns to improve the Cash Flow for the Business and to reduce the Inventory carrying Cost

Inventory 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	9	9	9	9	9	9	9	9	9	9	9
Actual	6.7	7	6.8	7.1	6.9	6.9	7.3	7.8	8.4	8.8	8.8

Table no. 2.11(Inventory)

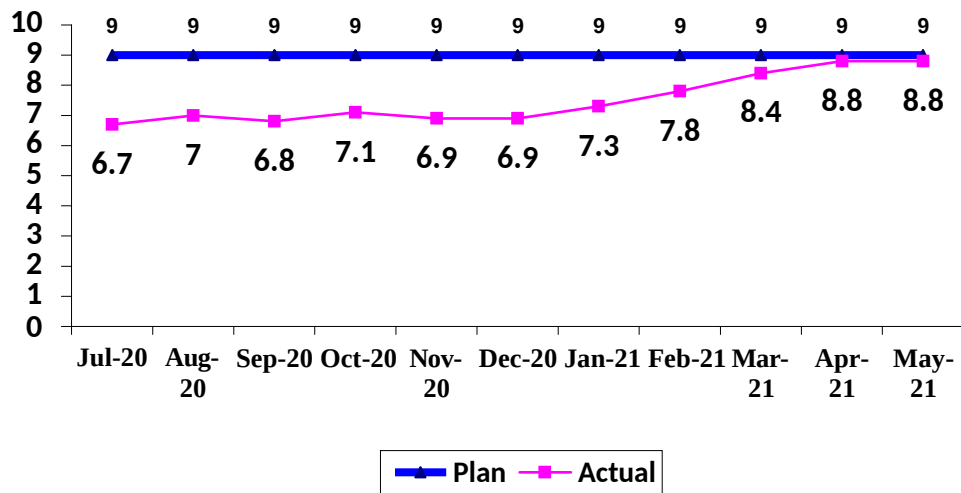


Fig. no. 2.8(Inventory)

INTERPRETATION

In Jul-20 we plan 9 and get 6.7, Aug-20 we plan 9 and get 7, Sep-20 plan 9 and get 6.8, Oct-20 we plan 9 and get 7.1, Nov-20 we plan 9 and get 6.9, Dec-20 we plan 9 and get 6.9, Jan-21 we plan 9 and get 7.3, Feb-21 we plan 9 and get 7.8, Mar-21 we plan 9 and get 8.4, Apr-20 we plan 9 and get 8.8, May-21 we plan 9 and get 8.8.

Reduction in the Overtime, by improving the Efficiency and by Reducing the Line Stoppage.

Overtime (Hours) 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	100	100	100	100	100	100	100	100	100	100	100
Actual	550	690	730	710	400	430	510	310	240	210	220

Table no. 2.12(Overtime)

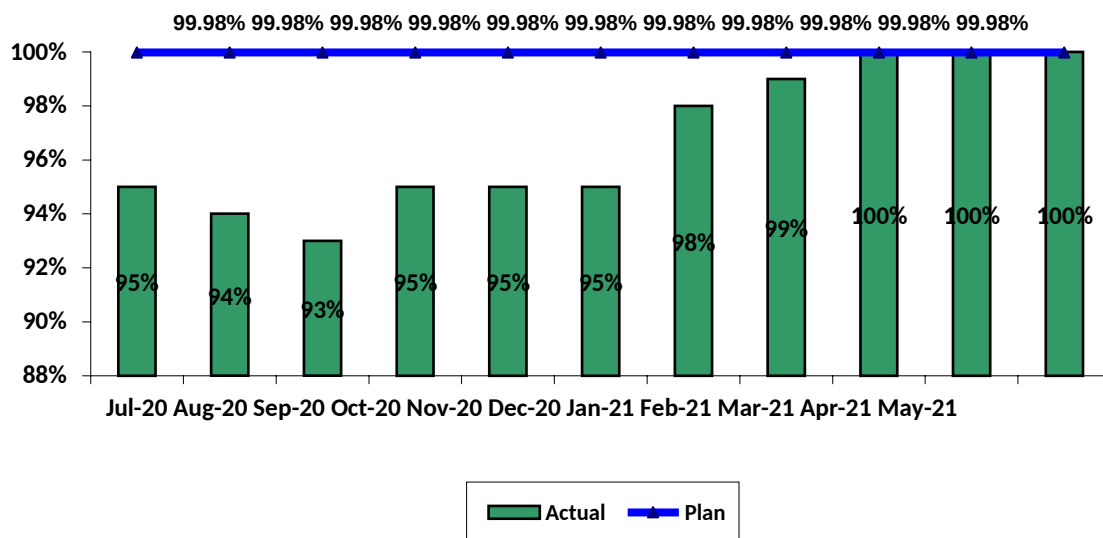


Fig. no. 2.9(Overtime)

INTERPRETATION

In jul-20 we plan 99.98% and get 95%, aug-20 we plan 99.98% and get 94%, sep-20 plan 99.98% and get 93%, oct-20 we plan 99.98% and get 95%, nov-20 we plan 99.98% and get 95%, dec-20 we plan 99.98% and get 95%, jan-21 we plan 99.98% and get 98%, feb-21 we plan 99.98% and get 99%, mar-21 we plan 99.98% and get 100%, apr-20 we plan 99.98% and get 100%, may-21 we plan 99.98% and get 100%.

4.2 LIST OF BUYER ACTIVITIES

Si no.	Description of activities	Buyer 1	Buyer 2	Buyer 3	Buyer 4
1	Download precision	0.1875	0.1875	0.1875	0.1875
2	Review precision Conformation	12	12	12	12
3	Pull in	35	35	35	35
4	Push outs	35	35	35	35
5	ME89	0.25	0.25	0.25	0.25
6	Invoice verification	2	2	2	2
7	GR Process	44	44	44	44
8	RI process	44	44	44	44
9	QN Process	2.5	2.5	2.5	2.5
10	PO send to supplier	2.5	2.5	2.5	2.5
11	Configuration changes	1	1	1	1

SHIPMENT OCCURENCE

CLASSIFICATION	SHIPMENT OCCURENCE	NO. OF DELIVERY PER YEAR	\$VALUE PER YEAR
A	Weekly	50	\$34,000
B	Every 2 weeks	26	\$8,000-\$34,000
C	Monthly	12	<\$8000

MINMAX IMPLEMENTATION PLAN

	PHASE I	PHASE II	PHASE III
NO. OF SUPPLIER	3	3	4
NO. OF PART NO.	12	39	35

CURRENT INVENTORY IMPACT

	PHASE I	PHASE II	PHASE III
Current inventory value	46	53	72

OTD

OTD 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%	99.98%
Actual	96%	94%	93%	95%	96%	95%	98%	99%	100%	100%	100%

LINE STOPPAGE

Line stoppage occurrence 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	0	0	0	0	0	0	0	0	0	0	0
Actual	4	3	2	3	2	2	1	0	0	0	0

EFFICIENCY

Efficiency 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Actual	75%	80%	85%	80%	85%	85%	85%	90%	90%	90%	90%

NO. OF SHIPMENTS

No. Of Shipments-Monthly 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	20	20	20	20	20	20	20	20	20	20	20
Actual	49	45	44	43	41	35	37	30	28	24	24

INVENTORY

Inventory 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	9	9	9	9	9	9	9	9	9	9	9
Actual	6.7	7	6.8	7.1	6.9	6.9	7.3	7.8	8.4	8.8	8.8

OVERTIME

Overtime (Hours) 2020-2021											
Month	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21
Plan	100	100	100	100	100	100	100	100	100	100	100
Actual	550	690	730	710	400	430	510	310	240	210	220

CHAPTER – V

**SUMMARY OF FINDINGS,
SUGGESTION AND CONCLUSION**

5.1 FINDINGS

- ★ Jan 9 and get 6.9, dec-20 we plan 9 and get 6.9, jan-21 we plan 9 and get 7.3, feb-21 we plan 9 and get 7.8, mar-21 we plan 9 and get 8.4, apr-20 we plan 9 and get 8.8, may-21 we plan 9 and get 8.8.
- ★ In jul-20 we plan 99.98% and get 95%, aug-20 we plan 99.98% and get 94%, sep-20 plan 99.98% and get 93%, oct-20 we plan 99.98% and get 95%, nov-20 we plan 99.98% and get 95%, dec-20 we plan 99.98% and get 95%, jan-21 we plan 99.98% and get 98%, feb-21 we plan 99.98% and get 99%, mar-21 we plan 99.98% and get 100%, apr-20 we plan 99.98% and get 100%, may-21 we plan 99.98% and get 100%. They have to spend 176 hrs available per month for list of buyer activities in supply chain.
- ★ In weekly 50 no. of delivery, Minimum quantity is 40pcs and Maximum quantity is 120pcs to maintain a safety stock level.
- ★ In no. of suppliers and no. of part numbers, phase 1 is 30%, phase 2 is 30% and phase 3 is 40%.
- ★ The above graph determined the current inventory value for these 86 part numbers.
- ★ In jul-20 we plan 99.98% and get 95%, aug-20 we plan 99.98% and get 94%, sep-20 plan 99.98% and get 93%, oct-20 we plan 99.98% and get 95%, nov-20 we plan 99.98% and get 95%, dec-20 we plan 99.98% and get 95%, jan-21 we plan 99.98% and get 98%, feb-21 we plan 99.98% and get 99%, mar-21 we plan 99.98% and get 100%, apr-20 we plan 99.98% and get 100%, may-21 we plan 99.98% and get 100%.
- ★ In jul-20 we plan 0 and have to stop 4, aug-20 we plan 0 and have to stop 3, sep-20 we plan 0 and have to stop 2, oct-20 we plan 0 and have to stop 3, nov-20 we plan 0 and have to stop 2, dec-20 we plan 0 and have to stop 2, jan-21 we plan 0 and have to stop 1, feb-21 we plan 0 and have to stop 0,

mar-21 we plan 0 and have to stop 0, apr-20 we plan 0 and have to stop 0, may-21 we plan 0 and have to stop 0.

★ In jul-20 we plan 90% and get 75%, aug-20 we plan 90% and get 80%, ~~sep~~ 20 plan 90% and get 85%, oct-20 we plan 90% and get 80%, nov-20 we plan 90% and get 85%, dec-20 we plan 90% and get 85%, jan-21 we plan 90% and get 85%, feb-21 we plan 90% and get 90%, mar-21 we plan 90% and get 90%, apr-20 we plan 90% and get 90%, may-21 we plan 90% and get 90%.

★ In jul-20 we plan 20 and have 49, aug-20 we plan 20 and have 45, ~~sep~~ 20 plan 20 and have 44, oct-20 we plan 20 and have 43, nov-20 we plan 20 and have 41, dec-20 we plan 20 and have 35, jan-21 we plan 20 and have 37, feb-21 we plan 20 and have 30, mar-21 we plan 20 and have 28, apr-20 we plan 20 and have 24, may-21 we plan 20 and have 24.

★ In jul-20 we plan 9 and get 6.7, aug-20 we plan 9 and get 7, sep-20 plan 9 and get 6.8, oct-20 we plan 9 and get 7.1, nov-20 we p

5.2 SUGGESTION

All procurement (and planning) must conform to the three pillars of Integrity, Transparency and Accountability. These apply to all activities before integrating and PO Release, the actual Process.

Procurement rules exist in most countries and for all the Suppliers, agencies and these must be followed. As part of the preparation work, and before any tender is advertised, the procuring agency requires a realistic estimate (based on a good quality design and costing process) of the cost of the Product and its Lead Time, with a breakdown of significant cost items. To prepare such an estimate, an engineer should be selected and be appointed to not only carry out this preliminary work but continue to supervise the contractor and ensure all works are carried out according to the highest quality possible with less lead time.

This estimate must be kept strictly confidential and there should be no links between personnel having this knowledge and the bidders. Should the subsequent bidding result in bids received that vary greatly from this estimate, questions should be raised on the validity

of the bids. Underestimates from bidders could lead to poor contract performance and the need for changes and variations as the contract proceeds and overestimates may suggest over pricing, cartel links or other unrealistic bidding.

Decision-making criteria at all stages must be clear, justifiable and objective (with a written record where needed) with no room for discretion at any time, especially in the evaluation and comparison of the bids. Prequalification of bidders for significantly expensive contracts or a series of small contracts¹⁸ is recommended, but avoiding the possibility of establishing cartels.

This prequalification should be based on professional competence (staff and equipment), relevant experience, financial capability and integrity. Any contractor or consultant that has recent, relevant convictions or has been disbarred for irregular, financial activities, or failure to complete contracts, should not be allowed to prequalify.

- Efforts to make any improvement, can give breakthrough results and Cost saving.
- Inter personnel relationship with other departments increased.
- Any complex problem can be solved through team work

5.4 LIMITATION OF THE STUDY:

Minimax inventory management may not be suitable for all businesses or industries. Some industries, such as those with unpredictable demand or frequent product changes, may not benefit from this approach.

The accuracy of demand forecasting is key to the success of minimax inventory management. However, accurately predicting demand can be challenging, particularly during times of uncertainty or disruption, such as a pandemic or natural disaster.

Minimax inventory management requires a significant amount of data analysis and monitoring to determine the optimal inventory levels. This can be resource-intensive and may not be feasible for all businesses, particularly smaller ones with limited resources.

There may be additional costs associated with implementing minimax inventory management, such as investing in technology or hiring additional staff to monitor inventory levels and analyze data.

The minimax approach assumes that the cost of holding inventory is greater than the cost of stockouts or lost sales. However, this may not always be the case for all businesses or industries, particularly those with high carrying costs or limited storage space.

5.3 CONCLUSION

Implementation of this project has resulted in very positive feedback from management and it has made them gain confidence on supply chain team. It has not only resulted in tangible benefits but also on improved the overall morale and confidence. Inventory management has become an inevitable part of significant business entities. Also, many small organizations have adopted the concept to keep track of their stock and raw material. But while practically implementing it, the companies have to deal with the following limitations:

- ★ Lack of Knowledge: The personnel at the receiving and warehousing departments may lack the required expertise and adequate knowledge of segregating the regular and seasonal goods out of the whole stock.
- ★ Expanding Product Portfolios: The customers' demand and requirements for a wide range of products have tremendously increased the inventory size, making it difficult to manage, manually.
- ★ Supply Chain Complexity: The organization, at times, fail to track the stock of goods during the supply chain process. Moreover, it is not necessary that the business partners also maintain an inventory management system, creating hurdles.

Inventory management is a useful method for simplifying all the warehousing activities of the organization. With this technique, the company can now access and determine its stock and inventory with efficiency to smoothen all the business operations. It has also proved to be a valuable tool for maintaining the working capital requirement.

REFERENCE/ BIBLIOGRAPHY

1. JIIRGEN PILZ , MINIMAX Linear Regression Estimation With Symmetric
Parameter Restrictions (1986)

2. DOMINIQUE FOURDRINIERA,*, OTHMANE KORTBIB, WILLIAM E. STRAWDERMAN, Bayes MINIMAX estimators of the mean of a scale mixture of multivariate normal distributions (2006)
3. Yuzo Maruyama , Admissible MINIMAX estimators of a mean vector of scale mixtures of multivariate normal distributions
4. K. Alam, A family of admissible MINIMAX estimators of the mean of a multivariate normal distribution, *Ann. Statist.* 1 (1973) 517–525.
5. J. Berger, MINIMAX estimation of location vectors for a wide class of densities, *Ann. Statist.* 3 (1975) 1318–1328.
6. J. Berger, Admissible MINIMAX estimation of multivariate normal mean with arbitrary quadratic loss, *Ann. Statist.* 4 (1976) 223–226.
7. M.E. Bock, MINIMAX estimators that shift towards a hypersphere for location vectors of spherically symmetric distributions, *J. Multivariate Anal.* 17 (1985) 127–147.
8. A. Brandwein, W.E. Strawderman, MINIMAX estimation of location parameters for spherically symmetric unimodal distributions under quadratic loss, *Ann. Statist.* 6 (1978) 377–416.
9. L.D. Brown, on the admissibility of invariant estimators of one or more location parameters, *Ann. Math. Statist.* 37 (1966) 1087–1136.
10. L.D. Brown, A heuristic method for determining admissibility of estimators—with applications, *Ann. Statist.* 7 (1979) 960–994.
11. D. Fourdrinier, W.E. Strawderman, T. Wells, on the construction of Bayes MINIMAX estimators, *Ann. Statist.* 26 (1998) 660–671.

12. Y. Maruyama, A unified and broadened class of admissible MINIMAX estimators of a multivariate normal mean, J. Multivariate Anal. 64 (1998) 196–205.

WEBSITES

<https://www.lokad.com/min-max-inventory-planning-definition>

<https://smartcorp.com/inventory-control/inventory-control-policies-software/>

<http://blog.logisticsjobs.asia/how-to-set-min-and-max-inventory-levels-for-your-logistics/>

<https://www.reliableplant.com/Read/2542/min-max-ordering>

<https://www.driveyoursuccess.com/2010/11/minmax-inventory-management-determining-minmax-levels.html>

<https://www.investopedia.com/terms/i/inventory-management.asp>

<https://www.tradegecko.com/inventory-management>