International Journal of
Science, Architecture, Technology and Environment

Inventory Purchase & Production Management: A Study on Optimization and Strategic Implementation

Mr. Gangadhar D. Dukare[1*], Dr.Sachin R.Misal[1] , Mr. Abhijeet Dadasaheb Borude[2]

[1]*Assistant professor, International Institute of Management science chinchwad, pune, under savitraibai Phule Pune University*

[2]*Student, International Institute of Management science chinchwad, pune under savitraibai Phule Pune University*

[*]*Corresponding author*

DOI: https://doi.org/10.63680/ijsate0725040.28

Abstract

This research explores inventory purchase and production management practices at Shirodkar Preci Comp Pvt. Ltd. (SPC), a leading manufacturer of precision components. The study highlights key challenges and optimization opportunities in inventory control, procurement processes, and production planning. Employing a mixed-methods approach, primary data was gathered through interviews and observations, complemented by secondary data from company records. Analysis of inventory control methods, procurement KPIs, and production scheduling uncovered inefficiencies and areas for improvement. Recommendations are made for enhanced ERP integration, lean inventory practices, and automation to increase operational efficiency. Keywords include: Inventory Control, Procurement, Production Management, ERP, Optimization. Effective inventory purchase and production management are critical to ensuring the profitability, operational efficiency, and sustainability of any organization. This study explores the strategies and optimization techniques for inventory purchase and production management to minimize costs, enhance productivity, and maintain a balance between supply and demand. By leveraging advanced forecasting methods, just-in-time (JIT) inventory practices, and integrated production planning tools, businesses can reduce wastage, avoid stockouts, and streamline their supply chain processes.

Keywords: Supply, Inventory, Cost, Effective, SPC, ABC

Introduction

Inventory management and production planning form the backbone of manufacturing operations. Efficient practices reduce costs, improve lead times, and ensure product quality. Shirodkar Preci Comp Pvt. Ltd. (SPC), specializing in precision components for industries such as automotive and oil & gas, faces challenges in inventory optimization and production scheduling. This research aims to explore these practices, focusing on identifying bottlenecks and providing actionable solutions. The objectives are to:

- Examine SPC's inventory and production management systems.
- Identify inefficiencies in procurement and material handling.
- Propose strategies for automation and process improvement.

The research also delves into the strategic implementation of inventory policies, including economic order quantity (EOQ), ABC analysis, and vendor-managed inventory (VMI). It highlights the importance of data-driven decision-making using emerging technologies like AI, IoT, and predictive analytics. Case studies of industries such as manufacturing, retail, and startups demonstrate the tangible benefits of adopting these techniques in reducing lead times, improving resource utilization, and enhancing customer satisfaction.

This will provides actionable insights for businesses aiming to optimize their inventory and production management systems, offering a roadmap to align their operations with modern supply chain demands and market dynamics.

Problem Statement

Despite its expertise in manufacturing, SPC encounters challenges such as:

1. Overstocks and understocks of inventory due to suboptimal planning.
2. Inefficiencies in procurement processes leading to higher costs and lead times.
3. Delays in production schedules caused by manual operations and limited automation. Addressing these issues are crucial for SPC to remain competitive in a fast-paced market.

Literature Review

Inventory and production management are well-established domains in operations management. Concepts such as ABC, FSN, and VED analyses are widely used for inventory categorization, as outlined by Chopra & Meindl (2020). Economic Order Quantity (EOQ) models optimize purchase decisions, while production scheduling focuses on aligning supply with demand (Poirier, 2003). SPC's semi-automated systems and reliance on manual operations contrast with best practices that advocate full automation and real-time ERP integration.

Inventory Management Theories and Practices-Early studies by Harris (1913) introduced the Economic Order Quantity (EOQ) model, a foundational framework for inventory management. EOQ calculates the optimal order quantity to minimize total inventory costs, including ordering and holding costs. Building on this, Silver et al. (1998) explored stochastic models, addressing uncertainties in demand and supply, which are crucial in dynamic market conditions.

Technological Integration-Emerging technologies have transformed inventory and production management. According to Ivanov and Dolgui (2020), the adoption of Industry 4.0 tools—such as IoT, artificial intelligence, and blockchain—has enabled real-time inventory tracking, predictive analytics, and automated decision-making. These advancements have significantly improved efficiency, accuracy, and responsiveness to market changes.

Strategic Inventory Policies-ABC analysis, first proposed by Pareto (1941), categorizes inventory into three classes based on value and demand frequency, enabling better prioritization of resources. Vendor-Managed

Inventory (VMI), discussed by Waller et al. (1999), transfers inventory management responsibility to suppliers, fostering collaboration and reducing stockouts.

During the Study, information has been collected regarding the company from the Company Manual, Stock Register, Material Issue Receipts, Maintenance Records, Monthly Maintenance Reports, Reference Books like Transformer Engineering: Design, Technology and diagnostics by Chopra, S., & Meindl, P. (2020, Data related to project purpose is also collected by discussing with the Department Heads of Maintenance, Machining and Production Department.

OBJECTIVES OF STUDY

PRIMARY OBJECTIVE

- To study about the company's operations pertaining to its Inventory management, Purchase procedure for material and Production planning.

SECONDARY OBJECTIVES

- To study its Raw material planning procedures.
- To study its Inventory control techniques and its features related to maintenance, general and processing.
- To study its MIS module in regards with the raw material information flow. To study its material and storage handling procedures.
- To study its „Enterprise Resources Planning (ERP)".

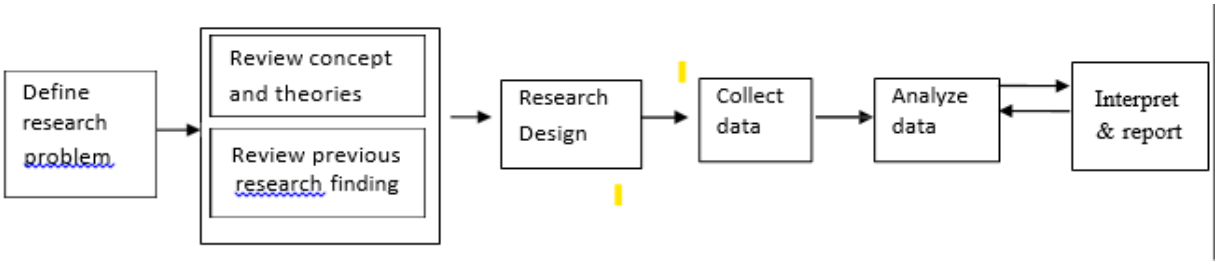
Research Methodology

A descriptive research design was adopted to analyze SPC's inventory and production systems.
Data Collection Methods:

1. **Primary Data:** Interviews with department heads (Production, Machining, and Procurement), direct observations of processes, and review of operational records.
2. **Secondary Data:** Analysis of company manuals, stock registers, and monthly maintenance reports. The study employed both quantitative (KPI analysis) and qualitative (employee feedback) approaches.

Research methodology is a way to systematically solve the research problem. It may be understood as science of studying how research is done scientifically. It is necessary for researcher to know not only the research method but also the methodology. It is necessary for the researcher to decide methodology for his problem as the same differs from problem to problem. Research methodology has many dimensions and research methods. Do constitute a part of research methodology.

Adoption of appropriate methodology is an essential characteristic of quantity research studies irrespective of the discipline with which they are relative. Methodology provides a way and guiding principles for research. It is defining and redefining and evaluating data, making deduction & giving conclusion.



1) Definition of problem statement:

During the initial days of internship, it was noticed that all the work procedures were running smoothly, but there was much scope for improvements in some aspects of the procedures. Much of the valuable production time was being lost in non-value adding procedures.

Problem Statement:

1)To avoid overstocks and under stocks of inventories with proper and careful planning.
2)To avoid pilferage and obsolescence caused.
3)To avoid immediate inventory discrepancy caused by improper labels, barcodes, product SKU‟s or packaging.

2)Review the literature:

a) Review concept and theories:

1)The theory about the management of Inventory, purchase procedure and production were studied.

b) Review previous research finding:

There was no research done on before in the organization.

3) Design Research:

For this project “Descriptive” type Research Methodology is used.

4) Data Collection of the study:

Primary source:

Data is collected from company manuals.

Data related to project purpose is also collected by discussing with the Department heads of maintenance, machining and Production department.

Secondary source:

Through the previous and current company records such as company manuals, stock register, material issue receipts, maintenance records, monthly maintenance reports, books and websites are used to collect the data.

5) Analysis and interpretation of the data:

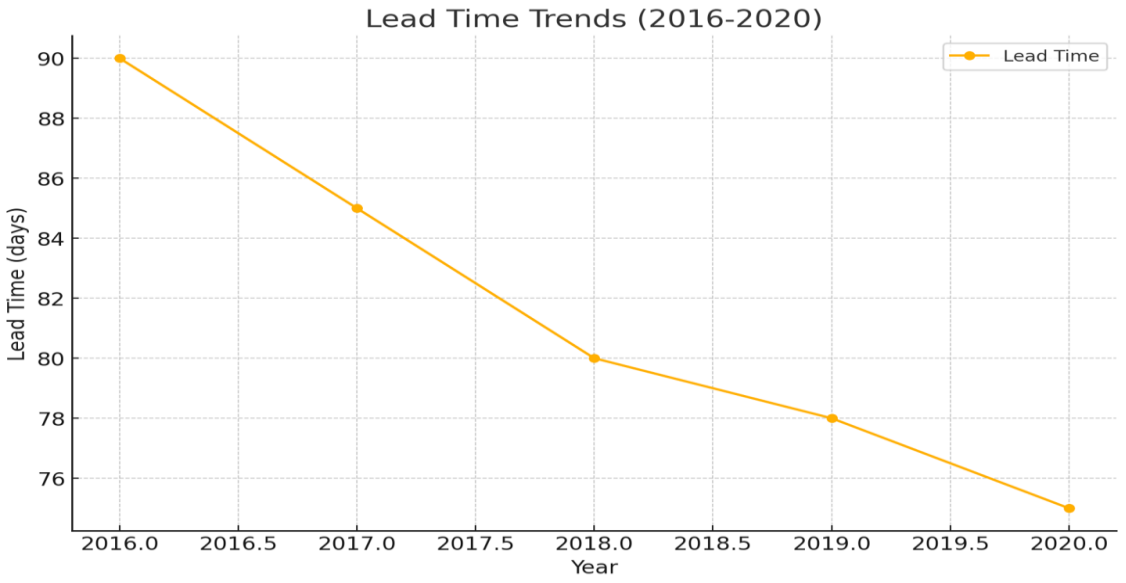
In order to fulfill the purpose of this project and in the same time accommodate the restrictions regarding time and money, the cost efficiency of conceivable methods is considered when gathering and analyzing data.

Without having any prior experience in Manufacture Company or any other similar company, information being collected from the employees at SPC and the data that has been available in the information system.

Data Analysis and Key Metrics

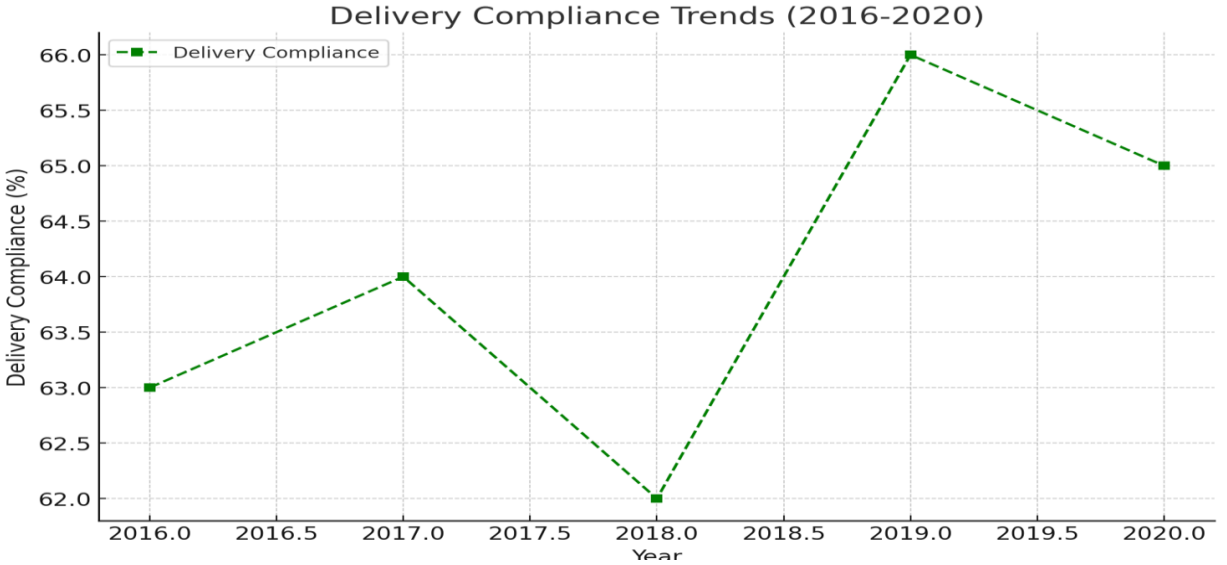
1. Inventory Management

- **ABC Analysis:** High-value items account for 10% of inventory but represent 70% of consumption.
- **Safety Stock:** Inadequate buffer stocks for fast-moving components.
- **Lead Time:** Average lead time of 75 days, with variations due to vendor reliability.



2. Procurement KPIs

- **Delivery Compliance:** 65% of suppliers met timelines.
- **Supplier Rejection Rate:** Improved from 10% in 2016 to 5% in 2020.
- **Purchase Costs:** Rising trends observed, with a 20% increase in direct material costs over five years.



3. Production Scheduling

- **Capacity Utilization:** Underutilized capacity due to bottlenecks in material availability.
- **Production Downtime:** Caused by inconsistent material supply and manual interventions.

Key metrics

Category	Metric	Current State	Target State	Improvement Needed
Inventory Management	Inventory Turnover (times/year)	4.5	6	Increase turnover by better forecasting and categorization

Vendor Management	Average Vendor Rating	75	85	Improve vendor quality and delivery parameters
Production Efficiency	Production Output (units/month)	1200	1500	Reduce delays by implementing automation

SWOT Analysis

This SWOT analysis provides a structured view of the internal and external factors impacting inventory purchase and production management. Organizations can leverage strengths and opportunities while mitigating weaknesses and threats to achieve optimal efficiency and strategic success.

SWOT Aspect	Details
Strengths	Strong market presence, robust infrastructure, ERP system
Weaknesses	Semi-automated plant, limited R&D, inefficiencies in small customer engagement
Opportunities	Rural electrification, direct advertising opportunities
Threats	Competitor pricing, policy changes, labor inefficiencies

Vendor Rating

Parameter	Max Marks	Current Average Rating	Target Rating
Quality	70	60	65
Quantity	20	15	18
Delivery	10	8	18
Total	**100**	**83**	**101**

Inventory Analysis

Inventory Type	Current Stock (units)	Optimal Stock (units)	Stock Variance (units)	Action Required
A	200	150	-50	Reduce overstock
B	500	450	-50	Reduce overstock

C	800	750	-50	Reduce overstock

Production Efficiency

Month	Planned-Production (units)	Actual Production (units)	Efficiency (%)
January	1200	1150	95.8
February	1300	1250	96.2
March	1250	1200	96
April	1400	1350	96.4
May	1500	1450	96.7
June	1550	1500	96.8
Average	1,366.67	1,316.67	96.32

Vendor Detailed Rating

Vendor-Name	Quality -Rating	Delivery -Rating	Overall -Rating	Status
Vendor A	65	18	83	Approved
Vendor B	60	15	75	Approved
Vendor C	70	19	89	Approved
Vendor D	55	14	69	Review Required
Average	62.5	16.5	79	

VENDOR RATING PROCEDURE

Vendor supplies are evaluated for each lot supplied, as per vendor rating system & values are entered in a format.

Vendor Rating is done on following parameters:

PARAMETRES	MARKS	RATING
QUALITY	70	Lot accepted-Full Partial rejection-20% Full Rejection-Nil
QUANTITY (AGAINST PURCHASE ORDER)	20	Up to (+ -)2%-Full marks Up to 10%- 10 marks
DELIVERY	10	Within 10 days- Full 15days & above- 5marks

Findings and Observations

1. Procurement inefficiencies stem from limited vendor evaluations and manual processes.
2. Inventory control lacks robust forecasting, leading to discrepancies in stock levels.
3. Production schedules are delayed due to misaligned material inflows and limited automation.
4. ERP utilization remains underleveraged, particularly in inventory and procurement.

Recommendations

1. **Enhanced ERP Integration:** Leverage ERP systems to automate procurement and inventory tracking, ensuring real-time data access.
2. **Lean Inventory Practices:** Implement Just-in-Time (JIT) and safety stock models to balance inventory levels.
3. **Supplier Development Programs:** Focus on improving supplier compliance through regular training and performance evaluations.
4. **Automation of Production Processes:** Invest in semi-automatic machinery to reduce manual dependencies and increase throughput.
5. **Capacity Planning:** Regularly review and adjust production plans based on demand forecasts.

Conclusion

Optimizing inventory purchase and production management can significantly enhance SPC's operational efficiency. While the company has made strides in improving supplier relationships and inventory categorization, adopting advanced ERP systems and automation will further align its processes with industry

standards. Future research could explore the integration of predictive analytics to forecast demand and manage inventory more effectively.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article.

Funding

The author received no financial support for the research, authorship and publication of this article.

References

[1] Chopra, S., & Meindl, P. (2020). Supply Chain Management: Strategy, Planning, and Operation.
[2] Poirier, C. C. (2003). Advanced Supply Chain Management: How to Build a Sustained Competition.
[3] IIMS, C. (2022, February). A Study of Critical Factors affecting material Management with special reference to Garware Wall Rope. In 2 nd International Conference on Innovation in Management & Information Technology (p. 189).
[4] Lande, G., Singh, S., & Mahankal, M. Financial Strategies for the Small and Medium Enterprises (SME's) to Survive and Sustain after Covid-19 Pandemic in India.
[5] Dukare, G., & Salunke, M. S. (2022, February). Effect of Promotional Tools in Product Marketing. In 2 nd International Conference on Innovation in Management & Information Technology (p. 203).
[6] Dukare, M. G. (2022). Inventory Management & control of Consumable tools. EDITORIAL BOARD, 39.
[7] Mohanty, V., & Kulkarni, M. (2024). Employee Experience and Internal Employer Brand: An Employer Brand Assessment in Manufacturing Industry. JIM QUEST Journal of Management and Technology, ISSN, (0975-6280).
[8] Batrel, S., Brahme, A., & Gaikwad, J. (2024). A Comprehensive Overview Of Data Mining Algorithms. Library of Progress-Library Science, Information Technology & Computer, 44(3).
[9] Dukare, M. G. D., Wagh, P. R., & Shivabhakt, M. N. H. (2025). The Role of Logistics in B2b Business with Customer Satisfaction with Feedback Approach of Vendors.
[10] Dukare, G. D., Mundhe, S. D., & Ghodajkar, A. N. Implementation of Lean Manufacturing for Sustainable Operations: A Case Study of Danfoss Power Solutions.
[11] Stevenson, W. J. (2017). Operations Management (13th ed.). McGraw-Hill Education.Provides an overview of production planning, forecasting, and scheduling strategies.
[12] Misal, S. R., Bhavani, M. M., Merla, C. R., Azizovna, G. S., Pathak, J. S., & Kumar, P. (2024, September). Enhancing Internet of Things Safety with AI-Powered Intrusion Avoidance Systems. In 2024 Asian Conference on Intelligent Technologies (ACOIT) (pp. 1-6). IEEE.
[13] Pachpor, N. N., Mantri, D., & Misal, S. A Review on Securing the Data Deduplication to Improve the Performance of Systems in the cloud.
[14] Misal, S. R., Mohan, L., Sundararajan, S. K., Bathala, B., Majumdar, S., & Sivakumar, C. (2025, February). Telemedicine and Remote Patient Monitoring: Enhancing Access to Healthcare Through IoT and AI Technologies. In 2025 First International Conference on Advances in Computer Science, Electrical, Electronics, and Communication Technologies (CE2CT) (pp. 306-310). IEEE.