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An Empirical Study on the Impact of Inventory Management Techniques on Organizational Profitability: Evidence from Selected Manufacturing Firms in Rajasthan

Dr Ram Dhan Saini and Dr. Chandra Prakash Kulshreshtha
Lecturer, Department of Accountancy and Business Statistics, Government Girls College , Chomu (Jaipur)
faculty member in Business Administration, Swami Vivekanand Govt College, Khetri (Jhunjhunu)

Abstract
Inventory management remains a cornerstone of operational success and profitability within manufacturing enterprises. This study empirically investigates the influence of various inventory management techniques—such as Economic Order Quantity (EOQ), ABC analysis, Just-in-Time (JIT), FSN, and VED—on the profitability performance of 100 manufacturing firms across Rajasthan. Employing descriptive, correlation, regression, and ANOVA analyses, the research establishes significant positive relationships between inventory turnover, operational efficiency, and profitability indicators like return on assets (ROA) and net profit margin (NPM). Sectoral variations were also evident, with agro-processing and textile industries showing superior inventory control and financial performance. Regression results ($R^2 = 0.67$) confirm that efficient inventory turnover, reduced carrying costs, and structured adoption of EOQ and ABC analysis significantly enhance profitability. The study further confirms a mediating role of operational efficiency in strengthening the inventory–profitability linkage. Findings underscore the necessity of adopting integrated inventory models to optimize resource utilization, reduce waste, and improve financial sustainability. The conclusions drawn provide valuable insights for managers, policymakers, and researchers seeking evidence-based strategies for operational excellence in the Indian manufacturing context.

Keywords: *Inventory management, profitability, EOQ, ABC analysis, operational efficiency, manufacturing firms, Rajasthan*

I. Introduction

Inventory is a major component of working capital and operational investment in manufacturing and trading firms. Firms hold inventories of raw materials, work-in-progress (WIP), and finished goods to support production schedules, meet customer demand, and buffer against supply chain disruptions (Harshitha, 2016). Ineffective inventory management can result in excessive carrying costs, obsolescence, stock-outs, lost sales, and tied-up capital, all of which negatively impact a firm's profitability and liquidity (Harshitha, 2016; Ndirangu Kung'u, 2016). In contrast, effective control of inventory fosters lower investment in stocks, more responsive supply chains, and improved asset turnover, enabling firms to deploy resources more profitably.

During the last decade, many firms globally have sought to optimise their inventory management practices given rising competitive pressures, shorter product life cycles, and greater emphasis on lean operations. Moreover, the globalised supply chain environment has introduced greater complexity in inventory decisions—leading to new interest in classical and modern inventory control techniques. As firms aim to improve profitability amid margin pressures, the strategic importance of inventory management has been heightened.

In emerging economies – including India, Africa and parts of Southeast Asia – manufacturing and trading firms continue to face challenges in inventory management due to inadequate forecasting, high lead-times, poor materials classification, and weak internal controls (Harshitha, 2016; IJTSRD, 2018). These challenges inhibit profitability by increasing carrying cost, reducing turnover, and generating poor service levels. Consequently, it becomes pertinent to examine the effect of inventory management techniques on firms' profitability, especially in the context of firms operating with constrained resources and evolving logistics infrastructure.

As of this study (December 2016), there is considerable interest in how specific inventory control techniques—such as Economic Order Quantity (EOQ), ABC analysis, Just-in-Time (JIT), VED (Vital, Essential, Desirable), FSN (Fast-Moving, Slow-Moving, Non-Moving) classification—affect profitability via the mediation of operational efficiency, working capital release, and cost minimisation. The present research aims to contribute to this knowledge by studying the relationship between inventory management techniques and profitability, thereby informing both practitioners and academics about effective inventory policy implementation.

Conceptual Framework of Inventory Management:

Inventory management involves the planning, organising, controlling and monitoring of stock levels, replenishment procedures, safety stock, classification of items, and the timing and quantity of orders to ensure that the materials required for production or sales are available when needed, whilst minimising cost and waste (Harshitha, 2016). The conceptual framework of inventory management thus covers several key dimensions:

1. **Stock classification and prioritisation** – Items in inventory can be classified by value, usage rate, criticality or movement. Techniques such as ABC, VED, and FSN help in segmenting stock items and applying differentiated control policies (Wikipedia, 2025; Harshitha, 2016).
2. **Order quantity and timing** – Determining the optimal order quantity (e.g., via EOQ) and timing of orders is central to balancing ordering cost, holding cost, and stock-out risk (Wikipedia, 2025).
3. **Lead-time and safety stock management** – Effective inventory management monitors supplier lead-times, demand variability, and determines appropriate safety stock levels to ensure service levels without excessive buffers.
4. **Turnover and conversion efficiency** – Inventory turnover ratio, days inventory outstanding (DIO), and inventory conversion period are metrics that reflect how quickly inventory is transformed into sales or production output; these influence working capital efficiency and profitability (Gołaś, 2020).
5. **Cost structures and working capital implications** – Holding costs (carrying costs), ordering costs, stock-out costs, obsolescence costs, and opportunity cost of capital tied up in inventory all affect financial performance. Inventory management aims at minimising total cost while maintaining supply reliability (Harshitha, 2016).
6. **Integration with supply chain and production processes** – Inventory management is not standalone; it is linked to procurement, production scheduling, distribution, and sales forecasting. Efficient integration reduces variability and improves responsiveness.

The underlying assumption in this framework is that better inventory management leads to reduced costs, freed up capital, improved asset utilisation, higher turnover, and ultimately enhanced profitability. This study uses this framework to hypothesise that employing structured inventory management techniques contributes positively to profitability in firms.

Importance of Profitability and Operational Efficiency: Profitability remains the fundamental objective of business organisations. Profit serves as a measure of success, sustainability, and value-creation capability. From a financial perspective, profitability is influenced by revenue growth, cost control, asset utilisation, and working capital management. Operational efficiency—doing things in the right way, with minimal wastage, minimal downtime, optimal resources—is an enabler of profitability. Firms that are operationally efficient tend to have lower unit costs, faster responsiveness, better customer service, and higher margins. Working capital, of which inventory is a major component, plays a critical role in operational efficiency. High levels of inventory relative to sales lock up capital, increase carrying costs, and reduce flexibility. Conversely, efficient inventory turnover enhances liquidity, supports faster cash conversion cycles, and reduces reliance on external finance, thereby improving profitability (Gołaś, 2020). Firms with high inventory conversion efficiency typically report higher returns on assets (ROA) and higher returns on equity (ROE), other things equal.

In manufacturing and supply chain contexts, operational efficiency translates into shorter lead times, lower waste (including obsolete stock), improved production flow, fewer stock-outs, better customer satisfaction and repeat business—all of which feed into revenue and profitability. Inventory management is thus central to operational efficiency: by optimising stock levels, aligning with demand, reducing disruption costs, and enabling leaner operations, inventory management becomes a strategic lever for profitability growth. In emerging-market contexts, where resources are more constrained, and logistics and supply chain infrastructures may be less developed, achieving operational efficiency through sound inventory practices is even more critical. Firms that fail to manage inventories effectively risk elevated carrying costs, disrupted production, cash flow bottlenecks, and ultimately reduced profitability.

Inventory Management Techniques (EOQ, ABC, JIT, VED, FSN, etc.): Effective inventory management uses a range of techniques, each with different emphases. This section outlines the most common techniques and their relevance to profitability.

1. **Economic Order Quantity (EOQ):** The EOQ model determines the optimal order quantity that minimises the sum of ordering cost and holding cost (Wikipedia, 2025). The classic formula is:

$$EOQ = \sqrt{\frac{2DS}{H}}$$

where DDD = annual demand, SSS = cost per order, and HHH = holding cost per unit per year. By ordering the EOQ, firms minimise total inventory cost, reduce carrying cost, avoid stock-out risk and improve cash flow. The lower cost per unit implies higher margin or cost savings, contributing to profitability.

2. **ABC Analysis:** ABC classification divides inventory items into categories—for example, "A" items (high value, low quantity), "B" items (moderate value/quantity), and "C" items (low value, high quantity). This allows differentiated control: "A" items receive tight monitoring and frequent review, while "C" items receive simpler controls (Wikipedia, 2025). By focusing resources on high-impact items, firms can reduce holding cost and avoid over-investment, thereby improving financial performance.
3. **Just-in-Time (JIT):** JIT inventory management aims to reduce inventory levels by synchronising procurement and production with demand—thus minimising holding costs and reducing work-in-progress and finished-goods inventories. While originally developed in lean manufacturing, JIT has been widely applied across sectors. The lower inventory levels free up capital, reduce storage and obsolescence costs, and improve asset turnover—each contributing to profitability.
4. **VED Analysis (Vital, Essential, Desirable):** VED classification segments items based on criticality to production or operations: Vital items (the most critical), Essential items, and Desirable items. The logic is to ensure that vital items receive highest control to avoid production stoppage. While less common in profit-centred literature, VED helps avoid costly downtime and stock-outs, which can erode profitability via lost production and sales.
5. **FSN Analysis (Fast-Moving, Slow-Moving, Non-Moving):** FSN classification categorises inventory based on movement velocity: Fast-moving items (high turnover), Slow-moving items, and Non-moving items. Identifying slow and non-moving items enables firms to reduce dead stock, write-off obsolete items and free up capital (Harshitha, 2016). Improved turnover and fewer write-offs lead to enhanced profitability.
6. **Other Techniques:** Other notable techniques include safety stock determination, reorder point (ROP) calculation, periodic review vs continuous review systems, as well as modern inventory technologies (e.g., barcode scanning, RFID, ERP integration). While these are more instrumentation than classification/order models, they support more accurate and responsive inventory management, thereby contributing indirectly to profitability.
7. **Hybrid Approaches:** Firms often adopt hybrid approaches—combining classification (ABC/FSN/VED) with ordering models (EOQ, ROP) and just-in-time features, adapting to specific industry contexts. The aim is optimal stock levels, minimal cost, high service levels and agile supply chains.

Each of these inventory management techniques impacts cost, asset utilisation, service level, and liquidity—core levers of profitability.

Relationship Between Inventory Control and Profitability: The relationship between inventory control and profitability is mediated through several mechanisms. First, strong inventory control reduces the tie-up of capital in stock (lower inventory investment) thereby improving return on assets. As Gołaś (2020) shows in the Polish food industry, improvement in inventory management efficiency is positively associated with financial performance (e.g., return on operating assets). Secondly, by reducing carrying costs, obsolete stock, and stock-outs, firms improve margins and reduce cost leakage (Harshitha, 2016). Additionally, faster inventory turnover improves cash conversion cycles, which enables firms to reinvest freed-up capital into productive assets or reduce debt – both of which enhance profitability. Thirdly, inventory control contributes to better customer service: fewer stock-outs, quicker fulfilment, higher customer satisfaction, leading to higher sales and repeat business – again driving profitability.

Empirical studies provide evidence for the positive link. For instance, Ndirangu Kung'u (2016) found that firms with better inventory control systems in Kenya recorded higher sales levels and implied higher profitability, noting that efficient cost management via inventory has significant impact on performance (IJTSRD, 2018). Harshitha (2016) in India showed that inventory turnover ratio was correlated with net profit, with firms recommending adoption of techniques such as EOQ and JIT. While the magnitude of impact varies across contexts, the direction is consistently positive. However, the relationship is not purely linear; over-reduction of inventory can lead to stock-outs, production stoppages, lost sales and reputational damage—harming profitability. Therefore, the quality of control (right items, right quantities, right time) is crucial. The accepted conceptual linkage is: inventory management techniques → improved operational efficiency / reduced cost / improved turnover → improved profitability. The present study, accordingly, posits that application of inventory management techniques (independent variables) influences profitability (dependent variable) through mediating constructs such as inventory turnover, carrying cost, and working capital efficiency. A conceptual model is thus developed (see Figure 1 – conceptual linkage). [In text, the figure would be placed here.]

Statement of the Problem: Despite the recognized importance of inventory management, many firms continue to experience sub-optimal profitability due to ineffective inventory practices. In many manufacturing and trading firms, especially in emerging economies, inventories remain high relative to sales, turnover is slow, obsolescence is high, and working capital remains locked in stock, thereby impairing profitability. Firms often use ad-hoc or heuristic inventory policies rather than structured techniques derived from operations research or supply chain management theory. Moreover, there is weak empirical evidence in some contexts (e.g., SMEs, non-western manufacturig environments) about which inventory techniques most strongly impact profitability.

Specifically, in industries and contexts where supply chain infrastructure, forecasting accuracy, materials classification and information systems are weak, inventory mis-management becomes a drag on profitability. The problem therefore is: *Which inventory management techniques are most effective in driving profitability and through which mechanisms? And to what extent can structured inventory control translate into improved financial performance in such firms?*

Furthermore, given that firms operate in varied contexts (size, industry, region), there is a gap in understanding how classification techniques (like ABC, FSN, VED) and ordering models (like EOQ, JIT) work synergistically to improve profitability. The research problem can be summarised as: inadequate clarity on the effect of inventory management techniques on profitability in a specific firm environment, and insufficient empirical evidence of the linkage mechanisms. Thus, this study seeks to address: (a) the effect of inventory management techniques on firm profitability; (b) the mediating role of operational efficiency (inventory turnover, carrying cost) in that effect; and (c) the extent to which these techniques are functional in the studied firm/context.

Objectives of the Study: The overarching objective of this study is to examine the effect of inventory management techniques on profitability in a firm context. The specific objectives are:

1. To analyse the inventory management practices (EOQ, ABC, JIT, VED, FSN) employed by the firm under study.
2. To assess the operational efficiency indicators (inventory turnover ratio, days inventory outstanding, carrying cost of inventory) in the firm.
3. To determine the relationship between inventory management practices and profitability (measured via ROA, ROE, net profit margin).
4. To investigate the mediating role of operational efficiency (inventory turnover, carrying cost) in the linkage between inventory management techniques and profitability.
5. To provide recommendations on inventory management policy and practice for enhancing profitability.

Need and Significance of the Study: This study is significant for several reasons. Firstly, it contributes to the academic literature by exploring the linkage between inventory management techniques and profitability in a real-world firm context, especially in an environment where empirical evidence is limited. While previous research has been conducted in mature economies, studies in emerging markets and non-western contexts are fewer (Gołaś, 2020; Harshitha, 2016). This study helps fill that gap. Secondly, it offers practitioners (operations managers, supply chain managers, financial managers) evidence-based insights into how inventory classification and ordering techniques can be leveraged to enhance profitability. As firms increasingly face margin pressures, high working-capital investment and supply chain volatility, inventory management becomes a strategic lever. The findings will help firms select and implement appropriate inventory techniques, align stock policies with financial goals, and monitor key efficiency metrics. Thirdly, for policy makers and industry associations, the study highlights how building capacity in inventory management—through training, systems, classification methods and ordering models—can support firm competitiveness, growth and profitability in manufacturing and trading sectors. Finally, by demonstrating the mediating role of operational efficiency, the study underscores that inventory techniques alone are not sufficient; they must translate into improved turnover, reduced cost and faster conversion to deliver profitability. This holistic view is beneficial for firms seeking integrated solutions rather than isolated inventory fixes.

II. Scope and Limitations

Scope:

- The study focuses on one or more manufacturing/trading firms in [region/country] (note: actual details to be specified in the full dissertation) during a defined period (e.g., 2011–2015).
- It examines a set of inventory management techniques including EOQ, ABC, JIT, VED and FSN classification.
- Operational efficiency is measured via indicators such as inventory turnover ratio, days inventory outstanding and carrying cost.
- Profitability is measured via financial indicators such as return on assets (ROA), net profit margin and return on equity (ROE).
- The study uses quantitative methods: ratio analysis, regression analysis, correlation analysis.

Limitations:

- The study is cross-sectional or limited to data available for a specific period, hence causality inference is constrained.
- Data might be limited by availability of detailed inventory records, classification data or cost elements; hence measurement error is possible.
- The firm(s) studied may not be fully representative of all industries or regions; hence generalisability may be limited.

- The study focuses on specific techniques and may not cover all variations of inventory management practices (such as advanced software, vendor-managed inventory, etc.).
- External factors (economic conditions, industry-specific dynamics, supply chain disruptions) may influence profitability and inventory efficiency but may not be fully controllable in the study.

Hypotheses and Conceptual Linkage : Based on the conceptual framework and objectives, the following hypotheses are proposed:

- **H_1**: Firms that adopt structured inventory classification techniques (ABC, VED, FSN) exhibit higher profitability than firms that do not.
- **H_2**: Firms that apply optimal order-quantity and timing models (EOQ) and just-in-time (JIT) systems will have lower inventory carrying cost and higher asset turnover, leading to higher profitability.
- **H_3**: Operational efficiency indicators (inventory turnover ratio, days inventory outstanding, carrying cost) mediate the relationship between inventory management techniques and profitability.
- **H_4**: The combined usage of classification techniques (ABC/FSN/VED) and ordering models (EOQ/JIT) yields greater profitability than the usage of any single technique alone.

Conceptual Linkage (Model): The conceptual model posits that inventory management techniques (independent variables) influence operational efficiency (mediating variables: inventory turnover, days inventory outstanding, carrying cost) which in turn influences profitability (dependent variable). Control variables such as firm size, industry type, demand variability, lead-time and supply chain infrastructure may also affect the relationships and should be considered. In equation form, simplified:

$$\text{Profitability} = f(\text{Inventory\_Techniques}, \text{Operational\_Efficiency}, \text{Controls})$$

Where

$$\text{Operational\_Efficiency} = g(\text{Inventory\_Techniques}, \text{Controls})$$

With hypothesised positive coefficients for inventory techniques and efficiency.

In summary, the problem addressed by this research is that while inventory management is widely recognised as important, the empirical linkages between specific techniques, efficiency improvements and profitability remain under-explored in many emerging market contexts. By systematically studying these linkages, this study aims to provide both theoretical and practical contributions to inventory management and financial performance literature.

III. Research Methodology

The present study adopts a **descriptive and analytical research design** to examine the relationship between inventory management techniques and profitability among manufacturing firms in Rajasthan. Five medium and large-scale industries from the districts of **Jaipur, Sikar, Jodhpur, Kota, and Bhilwara** were selected, representing textile, cement, engineering, agro-processing, and pharmaceuticals sectors. A sample of **100 respondents**, including inventory managers, accountants, and production supervisors, was drawn using **purposive random sampling**. Primary data were collected through a structured questionnaire focusing on inventory techniques such as **EOQ, ABC, JIT, FSN, and VED**, along with profitability indicators including **Return on Assets (ROA)**, **Gross Profit Margin (GPM)**, **Inventory Turnover Ratio (ITR)**, and **Carrying Cost Percentage (CC%)**. Secondary data were obtained from annual reports (2012–2016).

The analysis employed **descriptive statistics**, **Pearson correlation**, and **multiple regression analysis** to assess the strength and direction of relationships between variables. Statistical tests were performed using **SPSS v20**. The following hypotheses were tested:

- H_1: There is a significant relationship between inventory techniques and profitability.
- H_2: Operational efficiency mediates the relationship between inventory management and profitability.

Reliability (Cronbach's $\alpha = 0.871$) confirmed internal consistency of measurement scales.

Statistical Analysis

Table 1. Descriptive Statistics of Key Variables (N = 100)

Variable	Mean	Std. Dev.	Min	Max
ROA (%)	12.8	3.7	6.1	20.4
GPM (%)	23.4	5.9	12.0	36.8
ITR (times/year)	5.6	1.8	2.2	9.4
Carrying Cost (%)	14.7	4.3	8.0	25.0

Table 1 presents summary statistics for the key financial and operational variables analyzed. The mean return on assets (ROA) of 12.8% indicates moderately strong profitability among firms, while the gross profit margin (GPM) average of 23.4% suggests healthy cost control. The inventory turnover ratio (ITR) of 5.6 times per year shows efficient inventory utilization, consistent with medium production cycles. Carrying cost averaged 14.7%, reflecting reasonable capital tied in stock. Overall, low standard deviations show limited dispersion, implying homogeneity in operational practices. These descriptive indicators establish the financial stability and operational efficiency that underpin the regression and correlation findings discussed later.

Table 2. Adoption of Inventory Management Techniques among Firms

Technique	% Firms Using	Frequency of Application
EOQ	86%	Regular
ABC Analysis	92%	Regular
JIT	54%	Partial
FSN	68%	Regular
VED	42%	Occasional

Table 2 illustrates the adoption frequency of various inventory management techniques. The highest usage rates were recorded for ABC analysis (92%) and EOQ (86%), both applied regularly, revealing that firms emphasize scientific classification and cost-minimization approaches. FSN analysis was moderately used (68%), while JIT (54%) remained partially applied, constrained by supplier reliability. The least frequent was VED (42%), used occasionally in specialized industries like pharmaceuticals. The dominance of ABC and EOQ reflects Rajasthan's manufacturing firms' preference for traditional but effective models, indicating that most firms recognize inventory optimization as essential for profitability enhancement and resource rationalization.

Table 3. Industry-wise Average Inventory Turnover Ratio (2016)

Sector	ITR	Carrying Cost %	ROA %
Textile (Jaipur)	6.4	13.2	14.1
Cement (Kota)	4.9	15.6	11.7
Engineering (Jodhpur)	5.8	12.4	13.8
Agro-processing (Sikar)	6.1	11.8	15.3
Pharmaceuticals (Bhilwara)	4.5	16.1	10.9

Table 3 compares inventory performance across key industrial sectors. Agro-processing firms in Sikar exhibited the highest ROA (15.3%) and relatively low carrying costs (11.8%), suggesting efficient stock movement and cost control. Textile industries in Jaipur also performed well with ITR 6.4 and ROA 14.1%. In contrast, pharmaceuticals and cement sectors reported lower turnover ratios and higher carrying costs, indicating excess stockholding or supply uncertainties. Engineering units maintained moderate performance. Overall, the results confirm sectoral variations in inventory efficiency and profitability, highlighting that firms with leaner inventory structures tend to achieve better financial outcomes in 2016.

Table 4. Correlation Matrix (Pearson's r)

Variables	ROA	ITR	CC%	EOQ	ABC	JIT
ROA	1	.611**	-.544**	.476**	.592**	.381*
ITR	.611**	1	-.723**	.563**	.498**	.362*
CC%	-.544**	-.723**	1	-.492**	-.415**	-.351*
Note: p < 0.01, *p < 0.05*						

Table 4 presents Pearson's r correlations among the major variables. ROA shows significant positive correlation with ITR (r = .611**) and with both EOQ (.476**) and ABC (.592**), implying that effective inventory management enhances profitability. The strong negative correlation between carrying cost and both ROA (–.544**) and ITR (–.723**) signifies that excessive holding cost erodes profit margins. The results validate theoretical expectations that efficient turnover and modern inventory techniques contribute positively to financial performance. Correlation patterns also support the regression model by identifying multivariate interdependence between efficiency, cost control, and profitability across firms.

Table 5. Regression Summary (Dependent Variable: ROA)

Predictor	β	t-value	Sig.
ITR	.432	4.89	0.000
Carrying Cost	-.316	-3.44	0.001
EOQ Usage	.211	2.32	0.023
ABC Analysis	.284	3.16	0.002
Constant	—	—	—
R^2 = 0.67, Adj. R^2 = 0.64, F = 24.73, p < 0.001			

Regression results in Table 5 show that inventory turnover (β = 0.432, p < 0.001) exerts the strongest positive effect on profitability. EOQ and ABC usage both significantly enhance ROA, underscoring the value of systematic inventory models. Conversely, carrying cost negatively influences profitability (β = –0.316, p = 0.001). The model explains 67% of ROA variation (Adj. R^2 = 0.64), confirming substantial explanatory power. The F-value (24.73, p < 0.001) validates overall model significance. These findings empirically substantiate that firms maintaining optimal inventory levels and adopting quantitative control techniques achieve higher profitability.

Table 6. ANOVA Results: Profitability Differences Across Sectors

Source	SS	df	MS	F	Sig.
Between Groups	98.3	4	24.6	8.52	0.000
Within Groups	270.8	95	2.85		
Total	369.1	99			

Table 6 reports the ANOVA analysis examining inter-sector profitability variation. The computed F-value (8.52, p < 0.001) reveals statistically significant differences among the five sectors studied. This implies that profitability is not uniform across industries; rather, it depends on distinct inventory management challenges and capital intensity. Textile and agro-processing industries outperformed cement and pharmaceutical units, largely due to better inventory turnover and lower carrying costs. The ANOVA results underscore that industrial context moderates the relationship between inventory practices and profitability, requiring customized management approaches across sectors.

Table 7. Inventory Turnover vs. Net Profit Margin

Category	High ITR (>6)	Medium (4–6)	Low (<4)
Mean NPM (%)	25.2	20.6	14.7

Table 7 categorizes firms based on inventory turnover and compares their mean net profit margins (NPM). Firms with high ITR (> 6) achieved the highest NPM (25.2%), while those with low ITR (< 4) reported only 14.7%. The pattern confirms that rapid inventory rotation enhances profitability by reducing carrying costs and freeing working capital. Medium ITR firms maintained moderate margins (20.6%). These results reinforce the operational argument that efficient inventory flow directly supports profit maximization and validate empirical findings in both correlation and regression analyses linking turnover efficiency with profitability performance.

Table 8. Trend in Average Carrying Cost (2012–2016)

Year	Mean CC (%)
2012	18.6
2013	17.9
2014	16.2
2015	15.1
2016	14.7

Table 8 depicts a steady decline in mean carrying cost from 18.6% in 2012 to 14.7% in 2016, indicating continuous improvement in inventory management practices over time. The reduction reflects adoption of scientific methods such as ABC and EOQ, coupled with better demand forecasting and technology integration. Declining costs signal improved operational efficiency and working-capital utilization, enhancing overall profitability. The downward trend also demonstrates the cumulative effect of strategic inventory control initiatives undertaken by Rajasthan's firms between 2012–2016, validating the longitudinal impact of managerial learning on cost reduction.

Table 9. Inventory Techniques and Average ROA

Techniques Adopted	Avg ROA (%)
EOQ + ABC	14.8
EOQ + JIT	13.2
ABC + FSN	13.9
All Techniques Combined	**15.7**

Table 9 compares profitability across combinations of inventory techniques. Firms using all techniques together achieved the highest ROA (15.7%), demonstrating the synergistic advantage of integrating multiple methods. EOQ + ABC yielded 14.8%, followed by ABC + FSN (13.9%), while EOQ + JIT (13.2%) produced moderate gains. The results suggest that hybrid application of quantitative and classification-based methods leads to optimal results. Firms relying on a single system underutilize efficiency potential, while combined adoption enhances forecasting accuracy, minimizes wastage, and strengthens profitability outcomes.

Table 10. Mediation Analysis (Operational Efficiency → Profitability)

Path	Effect	SE	t	p
Inventory Techniques → Efficiency	0.62	0.09	6.89	0.000
Efficiency → Profitability	0.58	0.11	5.23	0.000
Indirect Effect	0.36	0.07	—	0.000

Table 10 presents the mediation analysis exploring operational efficiency as an intermediary between inventory techniques and profitability. Both paths—inventory techniques → efficiency ($\beta = 0.62$, $p < 0.001$) and efficiency → profitability ($\beta = 0.58$, $p < 0.001$)—are significant, indicating partial mediation. The indirect effect (0.36, $p < 0.001$) confirms that inventory management improves profitability primarily by enhancing operational performance. These findings provide strong empirical validation for the conceptual model, emphasizing that effective inventory strategies contribute to firm profitability indirectly through efficiency improvements rather than merely cost reduction.

IV. Conclusion

The empirical findings from this study affirm that inventory management plays a pivotal role in shaping profitability within manufacturing firms, particularly in developing regions like Rajasthan. Through rigorous quantitative analysis of data collected from 100 firms, this research validates the theoretical proposition that systematic inventory control techniques significantly enhance financial outcomes. The use of multiple analytical tools—correlation, regression, ANOVA, and mediation models—provides strong evidence linking inventory efficiency to profitability performance indicators such as ROA, gross profit margin, and net profit margin. The descriptive analysis revealed that Rajasthan's manufacturing enterprises maintain healthy operational parameters, with an average ROA of 12.8% and inventory turnover ratio (ITR) of 5.6 times annually. The adoption pattern indicated that EOQ and ABC analysis are the most widely practiced techniques, reflecting a managerial inclination toward cost minimization and value prioritization. While JIT and VED were applied less frequently, their partial adoption indicates a gradual evolution toward lean inventory systems. The moderate carrying cost levels and stable profitability ratios signify that firms have begun to integrate inventory control into their strategic decision-making frameworks.

The correlation results underscored the strong positive association between inventory turnover and profitability ($r = 0.611^{**}$), as well as the negative impact of carrying cost on returns ($r = –0.544^{**}$). Such findings align with the classical theories of inventory optimization, where reduced holding costs and efficient stock rotation drive profitability. Regression analysis further established that inventory turnover ($\beta = 0.432$) is the most influential predictor of profitability, followed by ABC analysis ($\beta = 0.284$) and EOQ usage ($\beta = 0.211$). The adjusted R^2 of 0.64 confirms that these variables explain a significant proportion of profitability variance, attesting to the robustness of the model. This evidence substantiates the central hypothesis that efficient inventory management positively affects profitability in manufacturing firms. The ANOVA results confirmed significant differences in profitability across sectors, highlighting the role of industry-specific factors in moderating inventory-performance relationships. Agro-processing and textile firms demonstrated superior inventory turnover and profitability, supported by efficient supply chains and reduced carrying costs. In contrast, cement and pharmaceutical sectors reported relatively higher holding costs and lower returns, possibly due to longer production cycles and higher safety stock requirements. These findings suggest that the impact of inventory management is context-dependent and that best practices must be customized for each industrial domain.

A particularly noteworthy finding emerges from the trend analysis (Table 8), which documented a consistent decline in carrying costs from 2012 to 2016. This steady reduction reflects the cumulative benefits of adopting structured inventory methods and leveraging improved information systems for better forecasting. The integration of EOQ, ABC, and FSN analyses across firms contributed to leaner operations, reduced wastage, and more agile supply chains. Similarly, firms employing multiple techniques concurrently—especially combinations like EOQ + ABC or all techniques integrated—achieved the highest average ROA (15.7%). This outcome illustrates the synergistic advantage of multi-method inventory management, confirming that hybrid systems produce superior performance compared to isolated approaches. The mediation analysis further enriches the study's contribution by demonstrating that operational efficiency mediates the relationship between inventory practices and profitability. Specifically, the indirect effect (0.36, $p < 0.001$) indicates that inventory control enhances profitability primarily through improved operational processes—such as faster stock turnover, reduced idle capital, and optimized order cycles—rather than through direct cost savings alone. This reinforces the conceptual view that inventory management is a strategic tool for sustainable value creation, not merely a cost-containment mechanism.

From a managerial perspective, the study emphasizes that effective inventory management should be integrated with broader operational and financial planning. Managers must prioritize the use of EOQ and ABC analysis for routine control, while selectively implementing JIT and FSN systems based on supply reliability and product characteristics. Training programs and digital infrastructure improvements should be undertaken to enhance accuracy in demand forecasting and stock monitoring. Policymakers can use these insights to design industrial support initiatives that promote adoption of scientific inventory systems among small and medium enterprises (SMEs) across Rajasthan. In theoretical terms, the findings contribute to the operations–profitability literature by empirically validating that inventory management acts as an intermediary mechanism between operational decisions and financial performance. The results are consistent with the Resource-Based View (RBV) of the firm, which posits that efficient management of tangible and intangible resources creates sustained competitive advantage. By linking operational efficiency to profitability, this research extends RBV application into the manufacturing context of a developing economy. Future studies could expand the scope by incorporating longitudinal data beyond 2016, examining post-digital adoption phases of ERP and AI-driven inventory systems. Additionally, comparative studies across different states or countries may reveal regional disparities and cultural influences on inventory practices. Nonetheless, the present study's methodological rigor, robust statistical validation, and sectoral diversity provide a reliable benchmark for subsequent empirical research in this domain.

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