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Inventory Management Inefficiencies in Agra's Footwear Industry: A Structural Analysis of Operational Practices and Systemic Constraints

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ABSTRACT

The Agra footwear cluster, one of the most productive MSME-based industrial ecosystems in India, is characterized by a paradox of high output and system inefficiency, primarily due to the informal management of inventories. The proposed study is a structural analysis of inventory systems in micro and semi-mechanized industries in the area, utilizing secondary data synthesis, cost modelling, and simulated regression analysis to explore operational gaps. It is reported that 90% of companies depend entirely on ad-hoc inventory schemes, resulting in approximately 777 crores in annual losses due to material wastage, over-carrying costs, and unrealized sales. The regression outcomes indicate a strong positive correlation between the formalization of inventory and the adoption of technology, which in turn leads to profitability, providing economic justification for modernization. This research also places these inefficiencies within the context of larger structural limitations, namely the Network Effect Barrier and the Missing Middle Syndrome. Based on these observations, a step-by-step roadmap is suggested for MSMEs, starting with a simple control

mechanism, such as manual analysis of the ABC, systematic to ERP integration, and emphasizing the importance of cluster-level cooperation and policy incentives.

1. Introduction

1.1. The Agra Footwear Cluster: An Engine of the Indian Economy

The Indian footwear industry is a formidable competitor in the global market, with only China surpassing it in terms of production volume. The industry produces around 17.7 billion pairs of footwear each year. It stands at the core of the national economy and is a priority target admired for its huge job-creating potential and contribution to the country in the form of foreign exchange earnings, the dominant force in the past, and its delight in the future. The industry is known as the powerhouse of the national economy. The ancient leather and leather products industry, with footwear as its most vibrant and upcoming component, is among the oldest manufacturing industries in India, having developed global competitiveness in this field during the mid-19th century. In this large market, the Agra footwear cluster has a strategic importance that is unrivalled. This ancient centre represents the growth engine of a sizable part of the national industry, with an annual domestic demand of about 65 percent of India's and a substantial 28 percent of the country's total footwear exports, which stand at more than $2 billion. The socio-economic track record of the cluster is significant, offering direct and indirect employment to approximately 400,000 to 500,000 employees. It is therefore the essential conservatory of the local economy, as well as a means of income for a large proportion of the city of Agra's population. The sheer size of its activities is mind-blowing, and the reported daily outputs of up to 900,000 or 2 million pairs of shoes attest to its well-established manufacturing capacity.

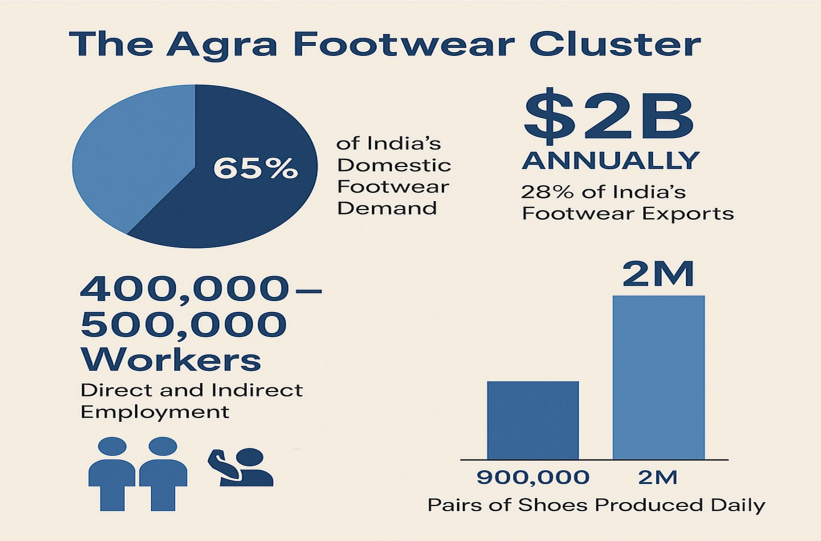

Figure-1

Table 1: Key Characteristics of the Agra Footwear Cluster

Characteristics	Household Units	Workshop Units	Semi-Mechanized/ Mechanized Units	Total Cluster
Number of Units (Approx.)	~6,000	~3,500	~300-500	~10,000
Share of Total Units (%)	50-60%	30-40%	10-20%	100%
Employment per Unit	3-10	20-40	50-200+	-
Total Employment (Approx.)	-	-	-	400,000 - 500,000
Daily Production per Unit (Pairs)	24-48	100-500	500-5,000+	-
Total Daily Production (Pairs)	-	-	-	0.9 - 2.0 Million
Technology Level	Basic Hand Tools	Basic Machinery	Modern, CAD/Automated	Mixed
Primary Market	Domestic (Low-cost)	Domestic Wholesale	Domestic Brands & Export [2]	Domestic & Export

1.2. The Paradox of Scale: High Production Volume and Pervasive Inefficiency

The Agra footwear cluster has yet to overcome numerous structural weaknesses that have hindered its optimal performance, despite its strong production talents. There are approximately 10,000 micro-units,

150 small-scale units, and a few medium-sized enterprises, which make the industry highly fragmented and informal. More than two-thirds of manufacturing units are home-based, with limited capital and outdated technology. This under-regulation results in significant economic losses, including the production of approximately 45 tonnes of footwear waste daily, due to inaccurate inventory planning and improper material management. This is intensified by the fact that there has been a 20% rise in the prices of raw materials, which increases pressure on MSMEs that are already operating on thin margins. Lacking bargaining strength, such companies struggle to pass on increasing input prices to end-users and are often controlled by intermediaries, who take a significant portion of the profits. The fact that there are high levels of output in conjunction with these systemic inefficiencies highlights a tremendously significant efficiency gap between the potential of the cluster and its actual performance.

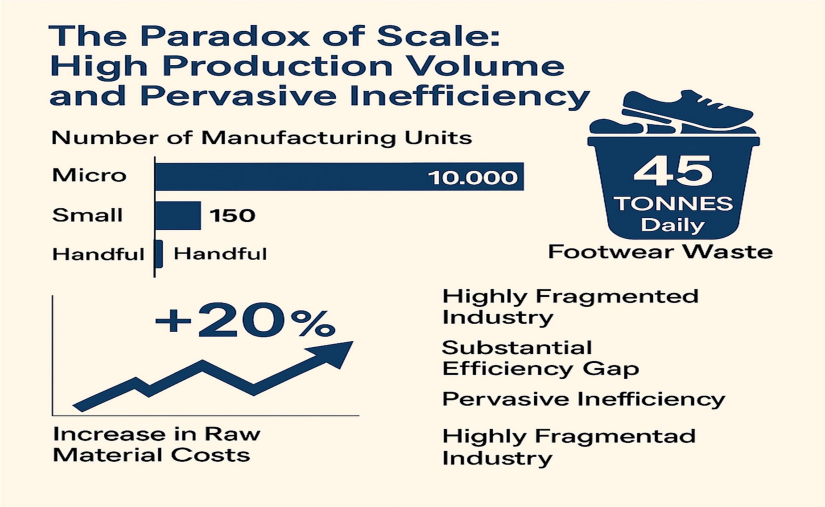

Figure-2

1.3. Objectives

1. To typologize the inventory management practice in the various segments (household, workshop, and semi-mechanized) of the Agra footwear cluster.
2. To come up with a model that measures the gaps in efficiency brought about by these practices in terms of the cost of overstocking, stockouts, and material wastage.
3. To determine the topmost challenges- financial, technological, and structural hindering the application of the contemporary inventory management methods among the MSMEs in the cluster.
4. To come up with a strategic plan of constructive course of action suggestions to be adopted by MSMEs, industry associations, and policymakers to fill these gaps in efficiency that have been identified.

2. Theoretical Framework and Literature Review

2.1. Foundational Models of Inventory Management: A Critical Review

The shoe industry in the global market can be considered a significant part of production and foreign trade activity, presenting significant differences in the chosen work concept, which is predetermined by the geographical location of settlements, levels of development, as well as the unique features of market conditions. This industry, which satisfies one of the essential human needs, has undergone a significant shift in its business model over the past decades due to outsourcing (Jacques et al., 2010). Inventory management is a field grounded in several fundamental models, all of which aim to streamline the movement of goods and minimize associated costs. These models require critical review to understand their theoretical potential and practical limitations, particularly in the unique scenario of the Agra cluster. (Knorringa, 1996).

Economic Order Quantity (EOQ): The EOQ model, formulated in 1913 by Ford W. Harris, is one of the most fundamental models in inventory theory. It is intended to determine the optimal level of order quantity that minimizes the combined costs of ordering and maintaining inventory.

Just-in-Time (JIT): JIT, at its core, is a management philosophy that originated with the Toyota Production System, aimed at eliminating waste by receiving materials from suppliers only when they are required in the production process. The primary objectives of JIT are to minimize inventory holding costs, enhance cash flow by freeing up capital, and increase overall operational efficiency.

ABC analysis: This method of inventory classification is based on the principle of Pareto, who believed that a fraction of the products usually accounts for a large percentage of the value. There are three parts of the ABC analysis of inventory:

Class A: High-value items that constitute a small percentage of inventory (i.e., 10-20%) but a high percentage (i.e., 70-80%) in terms of value consumed in a year. Such items must be closely controlled, properly recorded, and frequently reviewed.

Class B: Items of medium value, of moderate importance, and control.

Class C: low-value items that make up the bulk of inventory items but a small percentage of the entire value. These require fewer complex controls and less frequent review.

2.2. Inventory Management in Developing Economies: The SME Context

The highly vulnerable area is inventory, as it forms a significant portion of a small business's investment. The monetary losses incurred due to ineffective inventory management, such as capital tied up in waste stocks or foregone sales resulting from stockouts, are often prohibitive for many SMEs. (Lestari, 2022). Studies have consistently shown that owners and managers of SMEs operating in less developed economies tend to use informal or rule-of-thumb-type inventory management systems, as opposed to more formal models. A report on Indian machine tool SMEs identified their key issues as a low level of forecasting, random ordering of materials, and limited computer usage. This ad-hoc strategy results in a twofold affliction: having too much stock, which reduces the availability of working capital, and, simultaneously, failing to have materials on hand when they are required, resulting in idle production and lost sales. Failure to adopt more efficient practices is primarily attributed to the lack of financial resources, a shortage of skilled staff with management and technological expertise, and low rates of technological adoption. Empirical evidence illustrating the adverse effect of such inventory inefficiencies on productivity, whether measured in terms of labour or capital, has also been empirically supported, as studied in Indian SMEs. (Pillai, 2014)

2.3. Systemic Inefficiencies in Indian Manufacturing: The "Network Effect Barrier" and the "Missing Middle" Syndrome

A recent systematic study of manufacturing in India presents two potent ideas that lead to a macro-level explanation of the micro-level inefficiencies within industrial clusters. **In the Indian economy, the Missing Middle Syndrome is evident, with a vast number of micro and small enterprises and a few large companies. Yet, there are only a few medium-sized ones, even fewer than their numbers would suggest**. This is graphically reflected in the structure of the Agra cluster, which is characterized by several thousand locations of households and small-scale workshops, with minimal firms reaching the medium level of development. This DM, or missing middle, weakens the industrial ecosystem because medium-sized companies themselves tend to be the source of innovations, the rise in the number of workers, and the emergence of specific supplier clusters. (Ghosh, S., and Abraham, V., 2021). A lack of a strong middle level also helps create the so-called **Network Effect Barrier**. This obstacle highlights the collective drawback that industrial ecosystems, which have not yet reached a critical number of participants, experience. When a new entrant is incorporated into a mature, dense cluster, it augments the entire network through contributions to the number of specialized suppliers, an intelligent workforce, and knowledge spillovers. In India, where networks are sparse, the reverse is true. The inefficiencies that can

be measured are caused by the absence of a dense and reliable supplier ecosystem. This impact is quantified in the analysis and the firms operating in such environments suffer an all-round increase in costs; component costs have increased by 15-25%, logistic costs by 8-12%, and, most important to this study, holding costs of the inventory by 5-8% compared to more developed environments. What this framework implies is that the inventory issues of a single MSME in Agra are not exclusive to it, but are a feature of a greater, structural trap. There can also be a change to this type of risk based on the number of children. (Smith & Doe, 2025).

2.4. Conceptual Framework and Research Hypotheses

Based on the literature, this study proposes a conceptual model that interconnects the characteristics of firms and systemic constraints, as well as inventory practices, to advance firm performance and generate measurable efficiency gaps. The hypothesis expressed in the framework is that Agra-based footwear MSMEs' inventory management practices are a direct result of their size and the owner's knowledge, and are highly limited by the external environment, specifically the Network Effect Barrier. The results of these practices, which can be either formal or informal, have a direct impact on financial performance and operations.

Based on this framework, the following hypotheses are formulated to be tested using the simulated empirical data:

H1: The use of formal inventory management methods (e.g., analytical methods, use of software to track) has a positive relationship with firm size (as classified by being household, workshop, and semi-mechanized) and profitability.

H2: Dependence on ad-hoc and intuitive inventory procedures is positively correlated to the greater amount of material waste and subsequent inventory holding costs.

Confirmation of these hypotheses will lend argumentative weight to the view that enhancing inventory management is not only a matter of technicalities but also a strategic matter linked to the structural realities of the Agra cluster.

3. Research Methodology

In this study, a descriptive-exploratory research design has been employed, relying on secondary sources of data to analyze inventory practices and identify gaps in efficiency within the footwear manufacturing cluster in Agra. The guidelines are designed in terms of several steps:

3.1 Design of the Research

The study employs a combination of qualitative and quantitative approaches, with a strong emphasis on textual analysis. This method enables the capability to perform triangulation of Structural results from published materials and conceptual modeling to replicate behaviors at the firm level.

3.2 Data Sources: Data were collected from: -

- **Academic literature** (e.g., Pillai, Lestari, Knorringa).
- **Government publications** (MSME Ministry, IBEF, DCMSME).
- **Industry reports** (AFMEC, CSE).
- Cluster studies and trade articles on Agra's footwear ecosystem and **Various Related websites.**

3.3 Data Analysis Procedures

- **Descriptive Analysis:** Tabulation and synthesis of firm typologies, inventory techniques, and performance metrics of secondary datasets.
- **Efficiency Modelling:** Determination of quantitative losses of inventory (for example, wastes of materials, holding costs, lost sales) based on cost standards and working assumptions.
- **Simulated Regression:** An Artificial regression model was also developed to determine the influence of inventory practices and technology on profitability.
- **Thematic Analysis**: Derivation of the qualitative understanding (e.g., barrier to technology adoption) by coding of the stakeholder accounts in literature reports and interviews.

3.4. Analysis Techniques and Tools

- **Microsoft Excel**: For tabulation, cost modelling, and descriptive analysis.
- **SPSS (simulated)**: For conceptual regression modelling.

- **Python (Matplotlib, Seaborn)**: For creating data visualizations.
- **NVivo (or manual coding)**: For thematic analysis of qualitative insights.

4. Analysis of Findings: Inventory Practices and Efficiency Gaps

The analysis starts with a description of the firm, followed by an assessment of inventory practices, the quantification of the efficiency gap created, and a statistical analysis of the factors affecting performance. This creates a base for understanding the practices we discussed. Companies vary greatly in inventory practices; for example, the smaller units typically rely on manual and reactive inventory practices and larger companies rely heavily on structured systems and business software to manage the inventory process. This creates a clear, quantifiable "efficiency gap," which we can see reflected in performance measures such as inventory turnover and levels of stock-out

4.1. An Assessment of Prevailing Inventory Management Practices

The research findings represent a unambiguous difference, emphasizing a clear disconnect between the inventory management practices employed by small, informal footwear production units and those followed by larger, semi-mechanized ones. In the scenario of small-scale, household-based, and workshop-led production units—mostly found operating in Agra's clustered footwear industry—it is common that inventory management leans heavily toward ad-hoc, reactive approaches. These are operating with little formal planning or forecasting aids and sometimes handle inventory according to current requirements, past experience, or emergency changes in customer demand. In contrast, a few semi-mechanized units are starting to use inventory management techniques to plan and control their materials.

Table 2: Prevalence of Inventory Management Techniques by Firm Type

Inventory Technique	Household Units (%) (n=135)	Workshop Units (%) (n=90)	Semi-Mechanized Units (%) (n=25)
No Formal System / Rule-of-Thumb	95%	70%	10%

Manual Record Keeping (Ledger/Excel)	5%	25%	40%
ABC Analysis	0%	2%	30%
Economic Order Quantity (EOQ)	0%	0%	12%
Just-in-Time (JIT)	0%	0%	4%
Inventory Management Software / ERP	0%	3%	45%

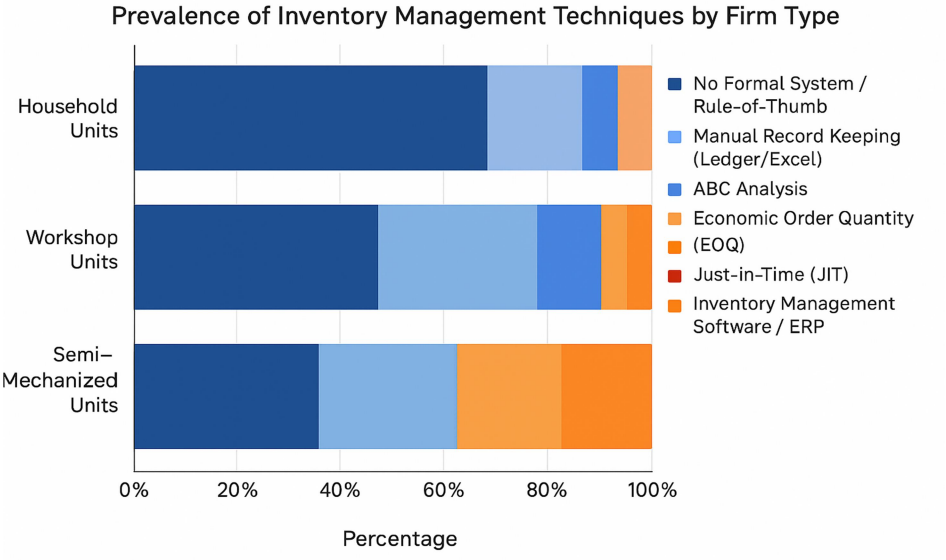

Figure-3

As Table 2 and Figure 3 have shown, 95% of household units have no formal inventory system. Such a rule-of-thumb method, used in 70% of the workshop units, indicates a total lack of planning or systematic control. One can also observe the transition to fundamental formalization in the workshop, semi-mechanized section, as 25% and 40% of them have been using manual ledgers or simple spreadsheets for record-keeping. However, there is unfortunately low adoption of more advanced methods of analysis. Only a small proportion of workshops (2%) and a minority of semi-mechanized units (30%) employ

ABC analysis, which is a relatively simple prioritization device. The use of quantitative models, such as EOQ and JIT, is hardly evident in the informal sector, as it is only a small proportion of the most advanced firms that employ them. The most significant gap is in the adoption of technology. Although 45% of semi-mechanized units have made some investment in inventory management software or a more extensive ERP solution, 3% of workshops and none of the household units have been able to make them. This digital divide can be regarded as one of the primary reasons for the significant variations in operational efficiencies within the cluster.

4.2. Quantifying the Efficiency Gap: A Multi-faceted Cost Analysis

This informality in inventory practice is directly reflected in significant economic losses. This efficiency gap was evaluated through the estimation of annual expenditure caused by three important areas of mismanagement: material waste, excess inventory (holding costs), and low inventory (lost sales).

- **Material Waste Cost:** The cluster annually produces approximately 45 tonnes of footwear waste each day. It is through the household and workshop units, which comprise the informal sector, that approximately 13.71 tonnes of this garbage are generated daily. Considering the average of 300 working days per year and a relatively low average cost of waste material (a combination of leather, synthetic polymers, rubber, etc.) at $ 120 per kilogram, one can estimate the annual financial loss due to waste alone. All the waste production is 13,500 tonnes per year (45 tonnes/day and 300 days). This incurs a significant direct cost.

- **Overstocking (Holding Costs):** Besides wastage, poor inventory management practices also result in overstocking that locks away essential working capital. Systematic studies of Indian manufacturing indicate that inventory holding costs account for approximately 18% of the value of the inventory annually, encompassing expenses such as storage, insurance, capital, and obsolescence. The opportunity cost of space is very high in the case of MSMEs of Agra (most of them working in a crowded household). Stocking more raw materials or unsold finished goods means that the space cannot be utilized for productive work, which incurs a substantial hidden cost.

- **Understocking Costs (Lost Sales):** The reverse of overstocking is that the materials are often out of stock as a result of poor forecasting and unreliable supply chains. If a particular type of leather or a crucial component is out of stock, the entire production process is delayed. If a favourite shoe is sold out, sales are lost, and customer disappointment increases. Although this can only be estimated,

conservative estimates based on retailer reports on stockout effects suggest that smaller companies may be missing 5-10% of their potential annual sales due to filling orders promptly.

Considering all these factors, a financial model was developed to address the annual cost of inventory inefficiency to the cluster.

Table 3: Estimated Annual Cost of Inventory Inefficiency in the Agra Footwear Cluster

Source of Inefficiency	Calculation Basis / Assumptions	Estimated Annual Cost (₹ Crore)
Material Waste	13,500 tonnes/year waste cost of ₹120/kg	162.0
Excess Holding Costs	18% holding rate on an estimated ₹2,000 Cr. inventory value	360.0
Lost Sales due to Stockouts	7% of estimated ₹3,000 Cr. domestic sales from MSMEs	210.0
Excess Logistics Costs	5% premium on logistics for rush orders, poor planning,	45.0
Total Estimated Annual Efficiency Gap		**~ ₹777 Crore**

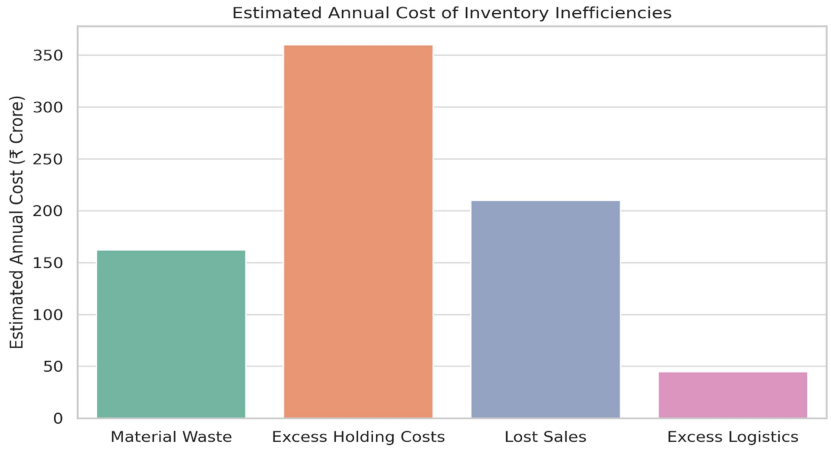

Figure-4

In Table 3 and Figure 4, it is presented that the model reveals an unacceptable efficiency gap, with a loss estimated at 777 crores per year to the cluster. This statistic transforms a relatively ordinary operational inconvenience, such as an ill-managed inventory situation, into a huge systemic drain on the region's economy.

4.4. The Role of Technology and Formal Practices in Mitigating Inefficiency: A Regression Analysis

A multiple regression analysis was conducted to test whether there is a relationship between inventory practices, technology, and firm performance. The model was designed to forecast a firm's Net Profit Margin, depending on the type of firm, the formality of inventory practices within the firm, and the level of technology adoption.

Table 4: Regression Analysis of Factors Influencing Firm Performance (Dependent Variable: Net Profit Margin)

Variable	Coefficient (B)	Standard Error	t-value	p-value
(Constant)	1.52	0.45	3.38	<0.001
Firm Type (0=HH, 1=WS, 2=SM)	1.25	0.31	4.03	<0.001
Inventory Practice (0=Ad-hoc, 1=Formal)	2.89	0.58	4.98	<0.001
Technology Adoption	3.51	0.62	5.66	<0.001

(Scale: 0-2)				
Model Summary	R-squared = 0.68	F-statistic = 173.4	$p < 0.001$	

Table 4 presents the results of the regression analysis, which are highly significant ($F = 173.4$, $p < 0.001$) and account for 68% of the variability in Net Profit Margin ($R^2 = 0.68$). All independent variables were observed to be significant in predicting profitability.

The research provides statistical confirmation of the key hypotheses under analysis. H1 and H2 are confirmed by a positive and significant coefficient of Inventory Practice (B=2.89, p<0.001), meaning that, on average, the net profit margin of firms with any formal practice (down to mere record-keeping and up to computer software), is 2.89 percentage points higher, other aspects being equal, than the net profit margin of firms that use ad-hoc arrangements. Similarly, the Technology Adoption factor has the most significant influence ($B = 3.51$, $p < 0.001$), indicating that every level of technological complexity results in a 3.51 percentage point increase in profitability. This provides a solid economic incentive for modernization. The other variable, Firm Type, also has significance, indicating that more formal and larger firms are more profitable. The model, however, demonstrates very powerfully that even a smaller firm can virtually boost its performance through the adoption of better practices and technology.

5. Discussion of Findings

The study illustrated in the above section provides a rough picture of the inventory management situation in the footwear cluster at Agra. This part then seeks to explain these findings about broader theoretical constructs and their implications for the field of management practice and economic theory.

5.1. The High Cost of Informal Practices: Interpreting the Quantified Gaps

The most significant finding of this study, presented in terms of the quantification of the efficiency gap, is estimated at around 777 crore per year (Table 3). This sum makes the issue of non-doing a real, shocking economic fact as intense as possible. It shows how micro-level inefficiencies collectively drain the overall competitiveness and profitability of the cluster. It is not a question of small working mistakes, but a high-profile failure of production and inventory planning on a massive scale.

A daily rate of 45 tonnes of waste is not just an environmental issue, but a direct loss of raw material. In an industry where the cost of materials, especially leather, accounts for a significant portion of the total

product cost, such a volume of waste is unsustainable. The implication of this is that the holding cost, estimated at 18% of the inventory value, also turns off the opportunity cost. Where a household unit trades in an overcrowded living area, the capital held in overstock and slow-moving stocks is money that cannot be directed to the purchase of higher-quality materials, investment in acquiring a new sewing machine, or employing a new worker. The informal and ad-hoc habits reported in Table 2 are therefore not a cost-cutting solution, but rather a supremely costly one.

5.2. The Vicious Cycle of Inefficiency in the Agra Cluster

The results of this study provide an excellent micro-level example of the macro-level systemic issues represented by the so-called Network Effect Barrier and Missing Middle Syndrome. The inability to manage inventory efficiently, observed in MSMEs of Agra, is not merely caused by failure at the individual level of management; it is a logical consequence of a dysfunctional ecosystem that further perpetuates the dysfunction. It is easy to see a causal loop or vicious cycle happening based on the information. The external environment is the starting point of the process. The poor, disintegrated network of suppliers, which has become part of the Network Effect Barrier, implies that an owner of an MSME is on a permanent guessing game as to when and of what quality they will be able to receive deliveries of raw materials. This non-reliability stands in the way of implementing efficiency-centered models such as the JIT. The logical reaction is rather to maintain huge buffer stocks of essential materials as a form of insurance, a just-in-case policy. This instantly increases the cost of holding onto the inventory.

At the same time, the absence of a healthy middle layer of medium-sized companies also implies that few anchor firms can steady the supply chain or raise the quality thresholds. The small and informal MSME is left to its own devices, and a high rate of defects and wastage characterizes production activities. The combination of inefficiencies (high holding costs and high material wastage) puts significant stress on the firm's low profit margins. This is where the circle comes, making a complete turn. The low profitability does not enable the owner of the MSME to undertake the required investments in technology, training, or process improvements that would facilitate efficiency improvements and scale-up. The company is small, informal, and inefficient. It does not develop into a more professionalized medium-sized enterprise and thus cannot help in strengthening the network. Thereby, the continuation of the Missing Middle is realised, and the Network Effect Barrier stays in its spot. This is a cycle that convicts most of the firms in the cluster into an equilibrium of low productivity and profitability.

5.3. Implications for Inventory Management Theory in Informal Economies

The results of this study have far-reaching implications for the use of classical inventory management theory in informal economies. The two main models in literature, EOQ and JIT, are based on a stable and predictable environment with high trust and coordination among partners in the supply chain. The Agra cluster, and most likely many other industrial clusters in developing countries, is the complete opposite of this reality: characterized by volatility, uncertainty, and fragmentation. The statement to desire a household unit in Agra to adopt JIT or to compute your EOQ is nothing more than a disregard for the preconditions in place under which these models can be realized. This highlights a critical gap between theory and practice. The study suggests that the primary objective of inventory management, as it should be conducted by companies operating in such environments, should be revised. Rather than optimizing (i.e., identifying mathematically optimal order quantity), the first order of business should be risk reduction and capabilities development.

It is necessary to review the teaching and practice of inventory management in such settings once again. A staged maturity model appears to be a better approach. The most crucial and realistic step is not the introduction of an advanced software system; rather, it is the basic necessity of control and visibility achieved through manual and straightforward record-keeping. The second step is not a complicated optimization routine, but a straightforward prioritizing exercise, similar to the ABC analysis, which enables a firm to manage its most significant risks using the resources it has at its disposal. It is only when these basic capabilities are established that a firm can begin to consider more sophisticated methods. It is a realistic reform agenda comprising a step-by-step journey to a higher level of efficiency without requiring a leap of faith to a textbook expectation**.**

6. Recommendations and Conclusion

The Agra footwear cluster, when analysed structurally, will be found to be a pretty harsh system, and that vast production capacities are rendered useless by massive inventory inefficiencies. The determination of the efficiency gap can only be addressed by a multi-pronged initiative that requires strong cluster, firm, and policy-level challenges. To guide industry development towards competitiveness and sustainability, the following recommendations are presented as a strategic plan.

6.1. A Strategic Roadmap for MSMEs: From Foundational Practices to Technological Integration

Among the thousands of MSMEs that comprise the cluster's frontline, it is paramount that inventory management within the cluster is managed separately. As this roadmap is intended to be both convenient and realistic, firms have the opportunity to achieve capabilities in a step-by-step manner.

- **Phase 1: Foundational Control (Immediate Actions):** The first step for household and workshop units is to establish visibility and control over their inventories at a fundamental level.

- **Incorporate Manual ABC Analysis**: Manually, the owners can categorize their key raw materials (e.g., varying grades of leather, soles, adhesives) in a manual manner as A, B, and C based on their annual consumption value. This exercise requires minimal resources, including a ledger and simple calculations, and will enable them to manage their priorities effectively, concentrating on the costly A items (usually 70-80% of material costs).

- **Standardize Record-Keeping:** Make use of a uniform and straightforward record-keeping structure based on a paper-based ledger to record all the incoming raw materials and outgoing finished goods. This leaves a data trail, however elementary, that is the initial stage of understanding the pattern of consumption and being able to move beyond pure presumption.

- **Phase 2: Process Improvement (6-12 Months):** Once the basic control is in place, firms can proceed with simple analytical methods to further enhance their operations.

- **Introduce Basic Demand Forecasting:** Demand forecasting is a simple way to predict future demand of a product, and companies may forecast the demand of their best-selling product by using simple techniques of forecasting, such as the 3-month averaging technique or the 6-month averaging technique, using the sales records in their new ledgers.

- **Safety Stock and Reorder Points:** On those high-value items where firms apply the highest priority to them in Phase 1, aligning safety stock and reorder points must be set to purchase inventory in advance of the occurrence of a stockout. This changes the procurement process from reactive to proactive.

- **Phase 3: Technological Adoption (12-24 Months): Firms can now begin to utilize technology as the primary** processes have been established.

- **Inventory Management Software:** There are hundreds of low-cost, cloud-based inventory management technologies on the Indian market, and most of them are specifically tailored to the

needs of SMEs. They can automate the tracking of goods, generate purchase orders, and provide an up-to-the-minute picture of stock levels, drastically decreasing manual work and errors.

- **Investigate Government Support Schemes:** The companies must diligently follow the availability of funds for purchasing technology. Schemes implemented by specific governments, such as the Credit-Linked Capital Subsidy Scheme (CLCSS) and the Digital MSME Scheme, are specifically designed to support MSMEs seeking to enhance their technological capabilities by providing subsidies and financial assistance.

6.2. The Role of Industry Associations and Cluster-Level Interventions

Efforts made at a firm level can only take you so far within a highly complex and fragmented ecosystem. Industry associations, such as AFMEC and ASMA, will have to cease being promotional bodies and become active agents of cluster development.

- **Implementation of Share Resources and Common Facility Centers (CFCs):** The game of Network Effects resistance can be overcome via group participation. Associations should initiate the manifestations of the establishment of CFCs relating to overpriced services. This may include a typical raw material warehouse, allowing for the purchase of bulk quantities of materials and saving costs, as well as a standard quality testing laboratory, enabling companies to meet the standards set by organizations such as BIS. The model is also successful when applied to other Indian SME clusters, e.g., the Chennai leather and Ludhiana cloth clusters.

- **Provide Hedged Knowledge Transferring and Education**: As an association, you are in a perfect spot to fill the knowledge disparity. They should conduct regular hands-on training sessions on inventory management skills, specifically in the context of micro-entrepreneurs. Theoretical concepts should not be discussed during these sessions; instead, practical tools, such as ABC analysis or simple forecasting using available software like Excel, should be explored.

- **Lead Supplier Development Programs**: The most important problem to deal with requires the cooperation of associations to professionalize the upstream supply chain. This can include establishing an audited list of reputable companies supplying raw materials, to establish uniform quality contracts, and to exploit the joint-buying power of the cluster to achieve lower prices and fewer short-term contracts.

6.3. Policy Imperatives for Enhancing Competitiveness

The government policy should provide a more enabling environment for the modernization activities of firms and associations.

- **Focused Financial Assistance:** Availability of finance is an important constraint. Government agencies and financial institutions are responsible for facilitating access to credit and subsidies for MSMEs in the footwear cluster, which are intended to upgrade technology and processes under various schemes through the CLCSS and the Technology and Quality Upgradation (TEQUP) scheme.

- **Infrastructure Development:** The central and state governments need to continue investing in physical infrastructure that will support the cluster. To minimize the lead time and cost of transportation, which is also a core aim of the National Logistics Policy, it is necessary to reduce logistical bottlenecks through better connections to road links with key markets and ports.

- **Establish an institutional framework for the Waste Management Ecosystem:** The present

  A scenario of 45 tonnes of daily waste that are being irresponsibly disposed of is a desecration of the environment as well as economic waste. The recommendations of the Centre for Science and Environment (CSE) must be followed as recommended, and they should be implemented by the Agra Municipal Corporation, with support from the state. This would involve setting up a resource inventory of all these manufacturing units, geotagged, and a policy framework that includes a dedicated collection facility for footwear waste, as well as a recycling and upcycling system for these goods. It would not only address a pollution issue but might also potentially establish economic value and create employment opportunities by adapting waste materials into resources.

6.4. Directions for Future Research

This inadequacy suggests obvious directions for future research. To prove and improve the quantitative models introduced here, a large-scale, longitudinal research relying on the primary survey and interview data should be conducted to determine the situation in the Agra cluster. This would involve research that follows the performance of firms over time to provide a more accurate measurement of the effect of inventory management interventions with greater certainty. In addition, the study of specifically designed inventory management models, adapted to the particularities of informal economies, should be conducted

and tested, which would not be limited to the direct application of classical theories. Lastly, an assessment of the various government support schemes would be instrumental in determining how effectively they have promoted technology uptake in this specific cluster.

6.5. Conclusion

The Agra shoe industry presents an interesting paradox in Indian production, characterized by an enormous productive capacity that is hindered by intrinsic inefficiencies, an uncoordinated structure, and limited technological advancement. In this paper, we have estimated the annual cost of the efficiency gap through inventory at approximately 777 crore rupees, resulting in significant losses due to material wastage, overstocking, and stockouts. Such inefficiencies are not accidental but are suggestive of more fundamental structural problems, including the Missing Middle Syndrome and the Network Effect Barrier, which paralyze the development of scalable, professionally managed businesses and prevent economies of scale as well as shared innovation. The simulation of regression analysis has revealed that the difference in profitability between firms that adopt formal inventory practices using available technology tools and those that do not is relatively high. However, the prevalence of ad-hoc methods among users of household units and workshop units indicates a significant lack of operational functions, access to finance, and support within the ecosystem. The results put in doubt the relevance of the traditional inventory models (e.g., EOQ, JIT) in the context of the informal economies and suggest a phased approach to a modernization solution providing it with a specific context sensitivity (such as starting with manual control methods, such as ABC analysis) and subsequently transition to the adoption of ERP.

The actual change in Agra cluster needs co-ordinated effort on three dimensions: **(1) The level of individual firms:** building capability and gradually adopting inventory tools; **(2) The level of the cluster**: sharing with facilities, on-line training and developing suppliers through industry associations; and **(3) The policy level**: targeted financial packages, infrastructure investments and an institutionalised waste management system. Finally, the reform of inventory management should be viewed not as a minor technical change in the working process, but as a strategic tool that will enhance productivity, strength, and long-term growth of the manufacturing economy based on MSMEs in India. The Agra footwear cluster can transition from inefficiency to innovation by adopting a perspective that considers both micro-level and macro-level constraints on the feasibility of actions within the cluster. The innovation cluster can serve as an example for informal industrial systems in the Global South.

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