

To Study E-Commerce Vs. Traditional Retail Supply Chains: A Comparative Analysis of Technology and Innovation Adoption

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Abstract—India's retail sector is undergoing a paradigm shift, marked by rapid e-commerce growth alongside continued reliance on traditional retailing. This study offers a descriptive comparison of technology and innovation within the supply chains of these two segments, focusing on inventory management, order processing, last-mile logistics, payment gateways, and analytics. Adopting a descriptive research design, the study relies entirely on secondary data drawn from industry reports, government publications, and existing research. Sources include IBEF, NASSCOM, Redseer, CII, the Reserve Bank of India, Statista, e-commerce company reports, and traditional retail associations.

The research aims to reveal the extent of the technology gap between traditional and e-commerce retailing and its broader implications. Furthermore, e-commerce businesses integrate data analytics into supply chain decision-making, whereas traditional retailers rely primarily on experiential judgment. Overall, the study will map out the similarities and differences between the two retailing model's supply chains, along with their implications for the sector. Its findings aim to pinpoint innovation gaps that constrain the growth of traditional retail and offer actionable recommendations to bridge them. By doing so, the research contributes to the existing literature on retail supply chains and lays groundwork for future experimental studies in this domain. The study's insights are expected to benefit policymakers shaping retail policy, researchers exploring supply chain innovation, and leaders of traditional retail associations seeking strategies to remain competitive in an increasingly digital marketplace.

Index Terms—E-commerce, Traditional Retail, Retail Supply Chain, Technology Adoption, Innovation, Inventory Management, Order Processing, Last-Mile Logistics, Digital Payments, Data Analytics, Supply Chain Management, Retail Technology.

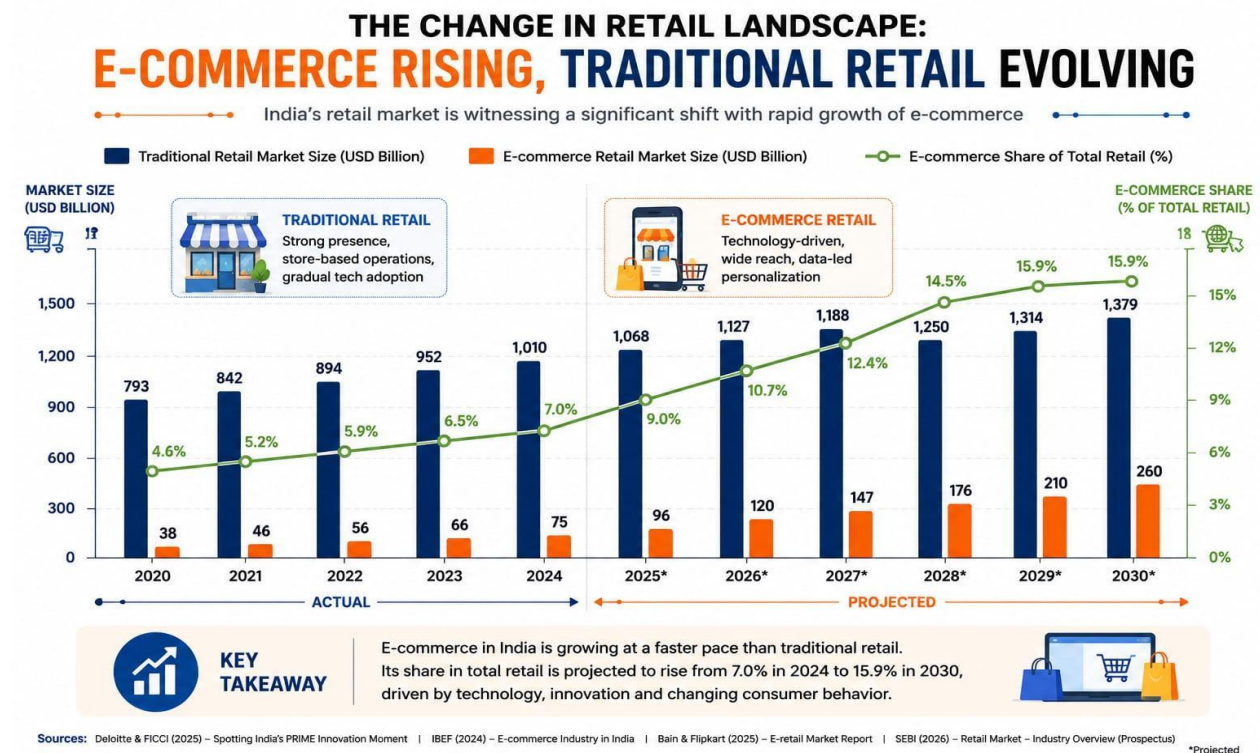
I. INTRODUCTION

Indian retail has largely been run through kirana stores, family-run stores and informal wholesale networks based on personal trust rather than technology for decades. That picture is now changing as e-commerce carves out a growing share of consumer spending. Cheaper data, widespread smart phone ownership, and UPI-based payments have pulled online shopping out of major metros and into smaller towns, turning India into one of the fastest-scaling e-commerce markets globally. Even so, physical stores still handle the bulk of everyday purchases across the country. Two very different retail systems are now operating in parallel: one shaped by algorithms, real-time data, and centralized platforms, the other shaped by local relationships and years of hands-on experience. That contrast prompts a natural question just how far apart are these two systems in practice, and what does the answer suggest about where Indian retail is heading?

Nowhere is that contrast sharper than in how each system runs its supply chain. Online retailers depend on automated stock tracking, software-managed order fulfilment, dense last-mile delivery networks, embedded digital payments, and predictive analytics to plan ahead. Neighborhood retailers, meanwhile, tend to manage stock by hand, lean on informal ties with suppliers, and make decisions based on years of observing what sells with digital tools, where they exist at all, used only in small pockets of the business. This unevenness matters beyond day-to-day operations: it shapes how well each type of retailer can control costs, respond to demand, and stay relevant as shopping habits shift online. Physical retailers who fall behind on these fronts risk losing customers

permanently, which is part of why policymakers and trade bodies are paying closer attention to how the gap might be narrowed. Yet academic work on Indian retail has mostly examined e-commerce and traditional retail in isolation, leaving their supply chain practices rarely compared directly against one another. This paper takes on that comparison directly, examining how e-commerce and traditional retail in India differ across five specific areas of supply chain operation: inventory management, order processing, last-mile logistics, payment systems, and analytics

use. The analysis relies on secondary data pulled from industry and government sources including IBEF, NASSCOM, Redseer, CII, the Reserve Bank of India, and Statista alongside existing academic work. The goal is not just to describe where the two models diverge, but to size the technology gap, understand why it persists, and point toward realistic steps traditional retailers could take to modernize selectively without giving up the personal service and community ties that still set them apart.



Source: (Deloitte & FICCI (2025), *Spotting India's PRIME Innovation Moment*; Bain & Company & Flipkart (2025), *How India Shops Online 2025*)

II. LITERATURE REVIEW

Laudon & Traver (2016)), In their Research paper "E-Commerce 2016: Business, Technology, Society" (12th ed.), Pearson. They pointed out that the emergence of online retail platforms disrupted classical supply chain structures by lowering transaction costs and enabling companies to interact directly with customers, effectively bypassing several traditional intermediary steps. Their initial research findings underscored that online platforms have

broken the classic supply chains due to lowering transaction costs and direct interaction with the customers.

Swaminathan & Tayur (2003), In their Research paper "Models for Supply Chains in E-Business," *Management Science*. They pointed out well ahead of the widespread retail transformation that followed that combining physical, store-based channels with emerging online channels would improve supply chain efficiency, lower inventory requirements, and raise the level of customer service retailers could offer. This paper focused its attention on the supply chain issues of visibility, supplier relationships, distribution and pricing, customization, and real-time decision

technologies that have risen to importance with the prevalence of e-business. They were ahead of the retailing transformation, predicting that the integration of traditional store-based and new online channels will drive efficiencies, reduce inventories, and increase customer service from a supply chain standpoint.

Griffis, Rao, Goldsby, & Niranjana (2012), In their Research paper "The Customer Consequences of Returns in Online Retailing: An Empirical Analysis," *Journal of Operations Management*. They pointed out that how a retailer manages product returns is not just an operational afterthought but a factor that meaningfully shapes customer behavior, showing that an efficient, well-managed returns process has a measurable positive effect on the likelihood of repeat purchases. Using an archival database of actual purchase and returns history provided by a moderately sized online retailer, they examined the relationship between a customer's experience of product returns and subsequent shopping behavior, and demonstrated that the returns management process, rather than being regarded as an afterthought to the production and deployment of goods, can significantly and positively influence repurchase behavior.

Isharyani, Sopha, & Wibisono (2024)), In their Research paper "Retail Technology Adaptation in Traditional Retailers: A Technology-to-Performance Chain Perspective," *Journal of Open Innovation: Technology, Market, and Complexity*. They pointed out that traditional retailers in emerging economies must actively adapt available technologies often by combining and repurposing existing tools rather than adopting entirely new systems in order to survive rapidly changing consumer buying habits, and that limited resources, funding, and technical skill remain the biggest barriers to this adaptation. Traditional retailers must immediately embrace and adapt technology to survive in the competitive retail industry as retail technology rapidly changes consumers' buying habits and expectations, and most of traditional retail's ongoing technologies are the result of adaptation by combining existing technologies to local conditions or technology adoption improvements. However, the lack of cash for investment, inability to find specific technology that meets their needs, and lack of human resources with knowledge or skills to operate complex technology are the most common

hindrances among traditional retailers to adopting retail technology.

Vadgama & Tasca (2020), In their Research paper "An Analysis of Blockchain Adoption in Supply Chains Between 2010 and 2020" They pointed out that block chain adoption across supply chains has closely tracked the broader hype and funding cycles of the technology industry rather than being driven purely by operational need, and that activity has been concentrated mainly in two sectors agriculture/grocery and freight/logistics where traceability and trust issues are most acute. In their research, the evolution of Distributed Ledger Technology in supply chains was mapped from the inception of the technology until June 2020, and 271 block chain projects operating in the supply chain were analyzed on parameters such as their inception dates, types of blockchain, stages reached, sectors applied to, and the type of organization that founded the project. They confirmed generally understood trends in the block chain market with the creation of projects following the general hype and funding levels in the industry, observing most activity in the agriculture/grocery sector and the freight/logistics sector.

III. RESEARCH METHODOLOGY

This study is based entirely on secondary data industry reports, government statistics, and academic literature rather than primary data collection. Surveying India's thousands of informal kirana stores directly would require a multi-year effort beyond this paper's scope; secondary sources, read carefully and cross-checked, provide sufficient material to construct a credible comparison. The approach is predominantly qualitative, drawing on existing documentation of supply chain technology in Indian retail. Quantitative indicators—market size, e-commerce's share of total retail, digital payment adoption—are incorporated where available to support the qualitative analysis.

Two categories of sources were used. The first comprises industry and government data: IBEF, NASSCOM, Redseer, CII, RBI, and Statista, supplemented by the Deloitte-FICCI (2025) report on India's retail landscape and the Bain & Company–Flipkart report on online shopping trends. The second comprises academic studies (Zheng, Zhang & Song;

Ramanathan, Esperanza & Ramanathan; Hagberg, Sundström & Egels-Zandén; Brynjolfsson & Smith), which examine e-commerce–traditional retail divergence in supply chain technology and serve both as background and as a validity check on industry claims.

The comparison is structured around five areas inventory management, order processing, last-mile logistics, payment systems, and analytics use selected because they recur consistently across both source types as the areas of greatest and best-documented technological divergence. Each area is examined for current practices in e-commerce versus traditional retail, available evidence of the gap between them, and likely underlying causes (cost, scale, infrastructure, or other factors).

Analysis involved cross-reading sources for points of agreement and disagreement, and organizing recurring themes under the five categories. Numerical data (market size figures from 2020 through 2030 projections, adoption rates) were compared across formats and over time to assess whether the gap is narrowing, stable, or widening. Claims corroborated independently by both an industry report and a peer-reviewed study were treated as reasonably robust; single-source claims are flagged more cautiously in the discussion.

IV. DATA ANALYSIS AND DISCUSSION

The secondary sources reviewed in Section 3 don't always agree on exact numbers, but they do converge on a broader picture: India's two retail models aren't drifting apart at the same rate everywhere. In some areas the gap is wide and getting wider. In others it's basically closed. And in one case, it might not even be the right thing to compare in the first place. This section goes through the five areas set out in the methodology inventory management, order processing, last-mile logistics, payment systems and analytics use before pulling everything together in a summary table at the end.

4.1. Market scale: the weight each format carries Even with the differences in how each source defines "e-commerce" (already flagged as a limitation in Section 3), every estimate agrees that online retail is still a minority share of overall spending in India. The Bain & Company–Flipkart report puts e-retail GMV at

around \$65–66 billion for 2025, rising to somewhere between \$170 and \$190 billion by 2030 and the report itself notes this is still under one in ten retail dollars nationally. IBEF's figures are broader, since they include categories, Bain leaves out, and put the 2024 base closer to \$125 billion, climbing toward \$345 billion by 2030. Redseer sits in the middle, at roughly \$70 billion for FY25 and \$174–214 billion by FY30. Whichever baseline you use, kirana stores and other unorganised outlets are still estimated to handle somewhere between 88% and 90% of total retail trade in India, and closer to 90% for groceries specifically. That difference in scale matters for everything discussed below e-commerce puts a lot of capital into a fairly small number of centrally run operations, while traditional retail spreads thin margins across millions of independent, mostly one-person shops. A lot of what follows is really this same structural gap showing up in different operational areas.

4.2. Payment systems: the narrowest gap

Digital payments are probably the clearest example of a technology that has spread across both formats rather than dividing them. RBI's half-yearly Payment Systems Report puts UPI at 85.5% of national digital transaction volume in the second half of 2025, and the central bank's FY25 annual report recorded 185.9 billion UPI transactions for the year up 41.7% from 131.1 billion the year before. Importantly, this isn't just an organised-retail story. A 2025 CPM India survey found digital payment readiness among Tier-2 kirana stores at 93%, which is a striking number for a segment that was almost entirely cash-based a decade ago. What actually differs between the two formats is how deeply the technology gets used, not whether it's available.

E-commerce platforms build extra layers on top of UPI buy-now-pay-later, fraud detection, loyalty programmes while most kirana stores just use a UPI QR code as a substitute for cash, and the transaction data this generates mostly goes unused. So, payment technology itself has spread almost symmetrically; it's what each format does with the resulting data that hasn't.

4.3. Summary comparison

Table 1 pulls the five areas together, pairing each with the clearest evidence available on how far apart the two formats currently are.

Table 1

Area	E-commerce approach	Traditional retail approach	Approximate gap / evidence
Inventory management	Automated stock systems, RFID/barcode tracking, warehouse robotics	Manual counts and memory-based reordering; almost no digital tracking	~0.1% of kiranas digitised (ORF); only 22% plan any tech spends in 2025 (CPM India)
Order processing	Software-managed fulfilment linking seller inventory and warehouse dispatch	Phone or in-person orders with known distributors, often on informal (udhar khata) credit	DigiDukaan had onboarded ~10,000 of 14 million+ kiranas by mid-2026
Last-mile logistics	Dedicated delivery networks, route optimisation, dark stores	No real equivalent the customer just walks to the shop	Last-mile ~53% of e-commerce shipping cost; market worth \$7.4B in 2025
Payment systems	UPI plus proprietary layers EMI, wallets, fraud detection	UPI QR used mostly as a cash substitute; little use of the data it generates	UPI = 85.5% of digital volume nationally; 93% Tier-2 kirana readiness
Analytics use	Predictive demand forecasting, dynamic pricing, AI models	Judgement based on experience; almost no formal data use	Warehouse automation >30% among large operator's vs near-zero in kiranas

V. FINDINGS

The comparative analysis reveals a consistent and substantial technology gap between e-commerce and traditional retail across every major supply chain function studied. In inventory management and order processing, e-commerce players rely on software-managed fulfilment that links seller inventory directly to warehouse dispatch, whereas traditional retailers continue to depend on phone or in-person orders placed with known distributors, often running on informal udhar khata credit rather than digital tracking. This gap persists even where digitization tools exist platforms like DigiDukaan have onboarded only around 10,000 of India's 14 million-plus kirana stores, and just 22% of traditional retailers plan any technology spend in 2025, according to ORF and CPM India data. Last-mile logistics shows a similar divide: e-commerce firms operate dedicated delivery networks with route optimization and dark stores, a segment now worth \$7.4 billion, while traditional retail has no real equivalent since the customer simply visits the shop.

The gap narrows somewhat in digital payments and widens sharply again in analytics. UPI has achieved broad reach even in traditional retail, with 93% Tier-2 kirana readiness and UPI accounting for 85.5% of national digital payment volume, but kirana stores

mostly use it as a cash substitute rather than as a source of transactional data. E-commerce businesses, by contrast, layer UPI with proprietary systems for EMI, wallets, and fraud detection, and feed the resulting data into predictive demand forecasting, dynamic pricing, and AI models. Warehouse automation exceeds 30% among large e-commerce operators compared to near-zero among kiranas, confirming that traditional retail's decision-making remains judgement-based rather than data-driven, even where the underlying digital infrastructure (like UPI) is already in place.

VI. CONCLUSION

The study confirms that the divide between e-commerce and traditional retail supply chains is not uniform but function-specific it is narrowest in payments, where UPI has achieved near-universal reach, and widest in inventory management, last-mile logistics, and analytics, where traditional retail still relies on informal networks and experiential judgment. This pattern suggests the technology gap is less about access to digital infrastructure and more about the sophistication with which that infrastructure is used traditional retailers have the payment rails but not the systems to convert that data into operational intelligence, which is precisely where e-commerce derives its competitive edge.

For policymakers and traditional retail associations, this points toward a practical path forward: rather than expecting kiranas to replicate full-scale e-commerce infrastructure, targeted interventions affordable inventory and ordering apps, incentives for analytics adoption, and support extending platforms like DigiDukaan beyond their current limited reach could meaningfully narrow the gap at low cost. For researchers, the study lays a descriptive foundation and highlights the need for future experimental or field-based work examining why adoption remains low despite payment infrastructure being largely in place, and what specific barriers (cost, literacy, trust in formal systems) are driving that gap.

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