Technology-Enabled Quick Commerce, An Operational and Economic Trade-offs in Sub-10-Minute Delivery Models

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Abstract: The rapid rise of quick commerce platforms offering sub-10-minute delivery has transformed urban retail and logistics ecosystems, particularly in emerging markets. These models promise extreme convenience but face significant economic and operational challenges related to cost structures, inventory positioning, workforce orchestration, and technology integration. This paper examines how digital platforms enable ultra-fast delivery while balancing critical trade-offs between speed, cost efficiency, and operational sustainability. Using an exploratory qualitative case study of a 10 -minute delivery model in India, the study integrates insights from operations management, platform economics, and IT-enabled business models. The findings reveal that delivery speed is achieved not solely through geographic proximity but through tight coupling of demand forecasting, micro-fulfilment design, and real-time routing systems. The paper contributes to the IT Business and Management literature by providing an integrated framework for understanding the economic viability of ultra-fast delivery models and offers managerial and policy implications for urban logistics and digital commerce.

Keywords: Quick commerce, last-mile logistics, digital platforms, micro-fulfilment, operational trade-offs, IT-enabled business models, last-mile delivery.

I. INTRODUCTION

The proliferation of digital platforms has fundamentally altered how consumers interact with retail and service ecosystems. In dense urban environments, consumer expectations increasingly prioritize immediacy, reliability, and convenience. Quick commerce (Q-commerce), defined by delivery commitments of 10 minutes or less, represents an extreme manifestation of this shift. Unlike traditional e-commerce models that optimize for scale and cost efficiency, Q-commerce prioritizes time compression as a core value proposition.

Despite rapid adoption across metropolitan regions in Asia and Europe, Q-commerce has sparked debate regarding its economic sustainability. High fixed costs associated with micro-fulfilment infrastructure, elevated variable labour expenses, and thin contribution margins challenge long-term profitability. At the same time, advances in data analytics, routing algorithms, and platform orchestration enable operational efficiencies that partially offset these costs.

Existing academic literature on e-commerce logistics primarily addresses same-day or next-day delivery models, with limited attention to ultra-fast delivery systems. This gap is particularly evident in emerging market contexts, where urban density, labour dynamics, and infrastructure constraints differ significantly from developed economies. Accordingly, this paper addresses two central research questions: (1) What operational and cost trade-offs determine the economic viability of sub-10-minute delivery models? and (2) How do digital platforms orchestrate inventory, routing, and demand forecasting to sustain ultra-fast delivery ecosystems?

By examining these questions through an in-depth qualitative case study from India, this research contributes to the FEMIB domains of IT Business and Management by linking digital platform capabilities with operational and economic outcomes.

II. LITERATURE REVIEW

II.1 Last-Mile Logistics and Cost–Speed Trade-offs

Last-mile logistics has long been recognized as the most expensive and complex segment of the supply chain (Gevaers, Van de Voorde & Vanelslander, 2011). Research consistently highlights the inverse relationship between delivery speed and cost efficiency, wherein faster delivery increases routing complexity, labour intensity, and inventory decentralization (Hübner, Kuhn & Wollenburg, 2016). Time-based competition theory suggests that firms pursuing speed advantages must redesign operational processes rather than incrementally optimize existing systems (Stalk, 1988).

II.2 Platform Economics and Digital Orchestration

Platform-based business models facilitate value creation by coordinating interactions among multiple stakeholders through digital infrastructure (Parker, Van Alstyne & Choudary, 2016). In logistics-intensive platforms, data-driven orchestration enables real-time decision-making across demand forecasting, inventory allocation, and service execution (Tiwana, 2014). Prior studies emphasize that competitive advantage in such platforms increasingly depends on algorithmic capabilities and data integration rather than asset ownership alone.

II.3 Micro-Fulfilment and Urban Logistics

Micro-fulfilment centres (MFCs) are small-scale storage facilities located close to consumption points, designed to reduce delivery distances and time (Boysen, de Koster & Weidinger, 2019). While MFCs support rapid fulfilment, they also introduce challenges related to inventory fragmentation, demand volatility, and higher fixed costs per unit area (Morganti & Gonzalez-Feliu, 2015). The literature suggests that the economic viability of MFC-based models depends on achieving sufficient order density and SKU velocity.

Despite these insights, limited empirical research integrates platform orchestration, operational execution, and economic trade-offs within the context of ultra-fast delivery, particularly in emerging economies. This study seeks to address this gap.

III. RESEARCH METHODOLOGY

This research adopts an exploratory qualitative case study methodology, suitable for investigating complex, contemporary phenomena where contextual factors play a significant role (Yin, 2018). A single-case design was selected to enable in-depth examination of operational processes and decision-making mechanisms within a mature Q-commerce model operating in a major Indian metropolitan region.

Data sources include secondary company materials, industry reports, publicly available interviews, and operational process descriptions. Data were analysed using thematic coding to identify recurring patterns related to technology enablement, operational structure, and cost dynamics. This approach supports analytical generalization rather than statistical inference.

IV.CASE CONTEXT: QUICK COMMERCE OPERATING MODEL

The examined Q-commerce model operates through a distributed network of hyperlocal dark stores positioned within high-density residential clusters. Each dark store maintains a curated assortment of fast-moving consumer goods optimized for high turnover and predictable demand. Inventory decisions are informed by algorithmic demand forecasting models that incorporate historical consumption patterns, time-of-day effects, and local demographic indicators.

Orders placed via the consumer-facing platform are routed to the nearest dark store with available inventory. A centralized technology layer coordinates picking, packing, rider allocation, and routing in real time. Workforce deployment follows a hybrid model combining scheduled staffing with dynamic task allocation to manage peak demand periods.

V. ANALYSIS AND DISCUSSION

The findings indicate that sub-10-minute delivery performance emerges from the interaction of three interdependent dimensions: digital orchestration, operational design, and economic trade-offs.

First, digital orchestration enables tight synchronization between demand forecasting and inventory placement, reducing stock-outs while limiting excess inventory. Second, operational design prioritizes SKU velocity and store proximity over assortment breadth, enabling faster picking and dispatch times. Third, economic viability hinges on achieving high order density per dark store, which offsets elevated labour and infrastructure costs.

However, the model exhibits structural vulnerabilities. High fixed costs associated with dense dark store networks reduce flexibility during demand downturns, while reliance on gig-based labour raises concerns regarding workforce sustainability. These findings align with prior research emphasizing the fragility of time-compressed logistics systems (Hübner et al., 2016)

VI. IMPLICATIONS

VI.1 Managerial Implications

Managers pursuing ultra-fast delivery strategies should prioritize integrated technology investments that align forecasting, inventory, and routing decisions. Expansion strategies must account for urban density thresholds to avoid cost dilution. Selective geographic scaling may be preferable to rapid network expansion.

VI.2 Policy and Economic Implications

From a policy perspective, Q-commerce raises important questions related to urban zoning, labour regulation, and traffic congestion. Policymakers must balance innovation incentives with sustainability objectives and worker protections, particularly in emerging market contexts.

VII. CONCLUSION AND FUTURE RESEARCH

This study contributes to the FEMIB literature by demonstrating how IT-enabled platform orchestration shapes the operational and economic viability of ultra-fast delivery models. While based on a single case, the findings provide transferable insights for platform-based logistics systems. Future research could employ comparative multi-case designs or quantitative modelling to validate and extend these findings.

VIII. EXTENDED DISCUSSION: STRATEGIC, ECONOMIC, AND TECHNOLOGICAL DIMENSIONS OF QUICK COMMERCE

The emergence of quick commerce represents more than an incremental innovation in retail logistics; it reflects a structural reconfiguration of urban consumption, labour organization, and digital coordination mechanisms. This section extends the discussion by situating sub-10-minute delivery models within broader strategic, economic, and technological contexts relevant to the FEMIB domains.

From a strategic perspective, quick commerce platforms compete primarily on time-based differentiation rather than price leadership or assortment breadth. This strategic choice fundamentally reshapes firm behaviour, requiring continuous investment in predictive analytics, operational discipline, and localized execution capabilities. Unlike traditional retail chains that rely on centralized distribution and economies of scale, Q-commerce firms pursue economies of density, where profitability is contingent upon high-frequency demand within narrowly defined geographic zones.

Economically, this density-driven logic creates a non-linear cost structure. Fixed costs associated with dark store leases, technology infrastructure, and supervisory overheads remain relatively stable, while variable costs particularly labour and delivery incentives scale with order volume volatility. The case findings suggest that marginal cost reductions are achievable only beyond a critical demand threshold, implying that quick commerce viability is highly sensitive to urban form, population density, and consumption regularity.

Technologically, platform orchestration acts as the primary coordination mechanism that substitutes for traditional hierarchical control. Algorithms allocate inventory, labour, and routing decisions dynamically, reducing human intervention and enabling rapid response to micro-level demand fluctuations. However, this reliance on algorithmic governance introduces new risks related to system fragility, data bias, and operational opacity.

IX. FINANCIAL AND COST STRUCTURE ANALYSIS

Although detailed financial data are often proprietary, a conceptual cost structure analysis provides insight into the economic dynamics of ultra-fast delivery models. Major cost categories include infrastructure (dark store setup and maintenance), technology (software development, cloud services, data analytics), labour (pickers, riders, supervisors), and customer acquisition.

Infrastructure costs are largely fixed and front-loaded, creating high barriers to entry but also increasing financial exposure during demand downturns. Technology costs, while initially substantial, exhibit scalability advantages as platforms expand across multiple geographies. Labor costs remain the most variable and sensitive component, influenced by delivery time commitments, incentive structures, and regulatory environments.

Revenue streams typically rely on a combination of product margins, delivery fees, and platform-driven monetization strategies such as private labels and advertising. The analysis indicates that profitability depends less on per-order margins and more on cumulative contribution margins achieved through repeat usage and customer retention.

X. WORKFORCE MODELS AND LABOR ECONOMICS

Quick commerce platforms rely heavily on flexible labour arrangements to sustain rapid delivery promises. Riders and in-store personnel are often engaged through hybrid employment models that blend elements of gig work and scheduled shifts. While this flexibility supports peak-demand responsiveness, it raises questions regarding income stability, worker retention, and long-term skill development.

From a labour economics perspective, algorithmic task allocation influences worker behaviour by shaping incentives, workload distribution, and performance evaluation. The findings suggest that excessive reliance on incentive-based compensation may lead to diminishing returns, as rider fatigue and attrition increase operational costs over time.

XI.TECHNOLOGY ARCHITECTURE AND DATA INTEGRATION

The technological backbone of quick commerce platforms consists of modular yet tightly integrated systems encompassing demand forecasting, inventory management, order processing, and routing optimization. Data integration across these modules enables end-to-end visibility and real-time decision-making.

Advanced forecasting models leverage machine learning techniques to predict short-term demand at granular geographic levels. Routing algorithms continuously adapt to traffic conditions, rider availability, and delivery priorities. Together, these systems form a cyber-physical infrastructure that aligns digital intelligence with physical execution.

However, system complexity increases vulnerability to cascading failures. Minor disruptions in data accuracy or system latency can disproportionately affect delivery performance, underscoring the importance of resilience engineering and redundancy planning.

XII.SUSTAINABILITY AND URBAN IMPACT CONSIDERATIONS

The rapid expansion of dark stores and delivery fleets has implications for urban sustainability. Increased traffic congestion, energy consumption, and packaging waste pose environmental challenges. At the same time, localized fulfilment can reduce long-distance transportation emissions if properly managed.

Policy interventions such as zoning regulations, delivery time windows, and incentives for electric vehicles can influence the environmental footprint of quick commerce. The case highlights the need for collaborative governance frameworks involving platforms, municipalities, and community stakeholders.

XIII.COMPARATIVE PERSPECTIVES AND GLOBAL RELEVANCE

While this study focuses on an Indian metropolitan context, the underlying dynamics of quick commerce exhibit global relevance. Comparisons

with European and East Asian markets reveal variations in regulatory regimes, labour costs, and consumer behaviour that shape model viability. Emerging markets benefit from labour availability and urban density but face infrastructure and regulatory constraints.

Cross-country comparative research could further illuminate how institutional contexts mediate the adoption and performance of ultra-fast delivery models.

XIV. THEORETICAL CONTRIBUTIONS

This research contributes to multiple theoretical streams. First, it extends time-based competition theory by demonstrating how digital platforms operationalize speed advantages through algorithmic orchestration. Second, it enriches platform economics literature by highlighting the role of density and locality in value creation. Third, it advances operations management research by integrating micro-fulfilment and real-time coordination within a unified analytical framework.

XV. PRACTICAL ROADMAP FOR PRACTITIONERS

Based on the findings, a practical roadmap for organizations considering quick commerce initiatives includes: (1) assessing urban density thresholds before expansion; (2) investing in integrated technology stacks; (3) designing sustainable labour models; and (4) engaging proactively with regulators and urban planners.

XVI. LIMITATIONS AND RESEARCH ETHICS

As a qualitative case study, this research is subject to limitations related to generalizability and data availability. The reliance on secondary data sources may constrain analytical depth. Ethical considerations include data privacy, labour welfare, and algorithmic transparency, which warrant careful attention in future studies.

XVII. CONCLUSION (EXTENDED)

Quick commerce represents a defining experiment in the intersection of technology, economics, and management. This paper demonstrates that the viability of sub-10-minute delivery models depends on the strategic alignment of digital orchestration, operational design, and economic discipline. While offering compelling consumer value, such models face inherent tensions that require careful management. By situating quick commerce within the FEMIB framework, this research provides a foundation for future scholarly inquiry and informed managerial decision-making.

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