

Research Article

A Systematic Assessment of Omnichannel Integration and Enterprise Logistics

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Abstract: As retail channels and distribution pipelines entangle, enterprises face mounting operational friction between decentralized private traffic operations and monolithic fulfillment backbones. Synthesizing recent advancements in customer-data orchestration and warehouse-enterprise resource integration, this review analyzes the real-world performance of modern omnichannel logistics. Evidence demonstrates that bridging local consumer communities with unified digital storefronts supports steady inventory movement; yet, pervasive cross-database integration lags continually constrain operational scalability. Moreover, performance gains often correlate with artificial promotional peaks rather than intrinsic supply-chain elasticity. Real enterprise agility therefore cannot be achieved through cosmetic front-facing tools alone. Sustainable omnichannel viability relies on coordinated socio-technical alignment spanning data harmonization, physical distribution capacity, and privacy protocols. We outline the need for robust, multi-layer frameworks capable of maintaining data integrity under turbulent demand profiles.

Keywords: *Warehouse Management Systems, Omnichannel Digital Operations, Private Domain Traffic, Enterprise Resource Planning, Enterprise Management Informatization.*

1. Introduction

The structural evolution of the global commercial landscape has fundamentally challenged the long-standing dichotomy between brick-and-mortar operations and virtual consumer touchpoints. Historically, enterprise commerce operated within rigid, compartmentalized pipelines: physical stores functioned as localized fulfillment nodes and primary brand ambassadors, while nascent e-commerce channels operated as disconnected supplementary divisions with independent inventories, distinct financial ledgers, and isolated customer relationship databases. However, the relentless acceleration of the digital economy has exposed the operational inefficiencies of this bifurcated architecture. Contemporary consumer behavior no longer conforms to predictable, single-channel shopping journeys; instead, it manifests as a non-linear, fragmented sequence of digital discovery, localized physical engagement, instantaneous mobile purchasing, and flexible fulfillment demands. In response to this behavioral volatility, enterprises across retail,

service, and discrete manufacturing sectors are compelled to transition away from fragmented multi-channel strategies toward deeply integrated omnichannel ecosystems.

This commercial reconfiguration is defined by an overdue convergence between customer-facing private domain traffic mechanisms and backend supply-chain operations. In contemporary digital marketing paradigms, customer acquisition costs across public search engines and third-party e-commerce marketplaces have escalated to prohibitive levels, incentivizing enterprises to cultivate proprietary, direct-to-consumer digital channels—commonly termed private domain traffic networks. Through mobile mini-programs, community messaging groups, and dedicated customer loyalty platforms, enterprises endeavor to capture granular behavioral data and foster recurring customer engagement. Yet, this aggressive digitalization of the commercial frontend frequently precipitates profound operational crises within the backend enterprise infrastructure. If localized promotional surges, real-time community group-buying demands, and customized service requests cannot be instantaneously reflected within Enterprise Resource Planning (ERP) databases and Warehouse Management Systems (WMS), the enterprise inevitably confronts severe stockouts, bullwhip distortions, inventory obsolescence, and eroded customer trust.

Consequently, true omnichannel agility cannot be attained through superficial investments in customer-facing mobile applications alone; it requires an architectural synthesis uniting frontend digital operations with standardized enterprise informatization and high-velocity physical logistics. Bridging these operational domains demands an analytical framework capable of deciphering how private domain traffic models, standardized cross-industry data protocols, and automated warehouse fulfillment networks interact to govern the flow of capital, physical goods, and operational intelligence. By critically investigating the friction points between decentralized demand signals and centralized enterprise resource governance, researchers and industrial practitioners can begin to construct resilient socio-technical frameworks capable of transforming real-time commercial insights into synchronized, cost-effective physical fulfillment across modern digital economies.

2. Methodological Trajectory, Epistemic Frictions, and Cross-Disciplinary Synthesis

Synthesizing the disparate scientific literatures of consumer-facing digital marketing, enterprise software engineering, and supply-chain logistics operations presented substantial methodological frictions that resisted conventional, linear bibliographic categorization. When constructing initial search matrices across interdisciplinary academic indexing services, the aggregated scholarship revealed an acute epistemological divide. On one end lay commercial and consumer behavior literature exploring private domain traffic, brand equity, and omnichannel marketing dynamics, primarily utilizing subjective consumer surveys, structural equation modeling, and qualitative case studies from service industries; on the opposite end lay management science, enterprise informatics, and operations research publications focusing on relational database schemas, inventory turnover algorithms, and automated material handling. An initial protocol attempting to apply uniform, rigid inclusion filters generated an unworkable bifurcation: either customer-centric marketing frameworks were rejected due to their absence of deterministic supply-chain metrics, or empirical software integration studies were set aside because they lacked behavioral depth regarding consumer traffic dynamics.

Resolving this methodological impasse necessitated a continuous, reflexive recalibration of our analytical trajectory, abandoning mechanical inclusion checklists in favor of a layered socio-technical synthesis capable of accommodating disciplinary heterogeneity. During the critical evaluation of published enterprise informatization studies

and corporate digital transformation case reports, our investigative team confronted a persistent prevalence of managerial reporting bias and sanitized implementation narratives. Many published accounts depicted frictionless, idealized transitions toward fully integrated enterprise architectures, systematically downplaying the pervasive realities of organizational resistance, employee reluctance to adopt automated WMS interfaces, legacy software mismatches, and intermittent synchronization lags between point-of-sale terminals and centralized ERP databases. Rather than discarding these potentially curated corporate accounts—a step that would have severely diminished the empirical scope of our analysis—we actively integrated their unstated tensions into our critical discourse, using the visible discrepancies between theoretical architectural blueprints and shop-floor operational realities as a vital diagnostic tool.

A parallel analytical friction emerged when attempting to reconcile macroeconomic digital economy frameworks with the microscopic operational constraints of warehousing and automated physical logistics. While large-scale digital policy papers and strategic management models frequently assert that establishing unified data standards automatically unlocks commercial productivity, their macro-level units of analysis often overlook the micro-level bottlenecks of warehouse floor space, carton-slotting constraints, and the energetic costs of high-velocity robotic sorting systems. Conversely, applied engineering studies provided highly detailed evaluations of warehouse automation algorithms or mobile robot routing, but remained completely silent regarding how real-world customer acquisition strategies distort daily SKU velocity. By consciously preserving these disciplinary dissonances rather than manufacturing an artificial, seamless consensus, our review methodology treats the operational friction between decentralized commercial engagement and centralized enterprise logistics as an indispensable diagnostic, illuminating the precise institutional and technical fault lines that continue to impede end-to-end omnichannel enterprise integration^[22].

3. Structural Deconstruction: Private Domain Operations, Enterprise Architectures, and Logistical Synchronization

The architectural realization of sustainable omnichannel operations unfolds across three deeply interdependent operational dimensions: customer-facing digital models and private domain traffic governance that capture localized consumer demand; enterprise informatization standards, full-domain system architectures, and cross-sector compliance protocols that coordinate organizational workflows; and the physical engineering of warehouse-logistics integration, automated fulfillment platforms, and collaborative technical infrastructures.

At the level of customer-facing commercial engagement, cultivating responsive direct-to-consumer channels represents the foundational operational layer for modern retail and service ecosystems. In a pioneering exploration of commercial operating models, Zeng^[1] provided a thorough analysis of online-offline digital integrated operation modes across the comprehensive service industry, highlighting how integrating physical service storefronts with digital engagement platforms reduces customer friction and establishes continuous commercial touchpoints. Expanding upon these localized engagement mechanics, Zeng^[2] formulated an insightful study on the digital operation and management model of private domain traffic for physical commercial enterprises, demonstrating that capturing granular, first-party consumer behavioral data through proprietary social channels mitigates escalating public-platform advertising costs while enabling precision demand forecasting; nevertheless, the operational efficacy of private domain communities is frequently constrained by labor-intensive community management and diminishing marginal consumer engagement

over extended lifecycles, suggesting that high initial conversion spikes do not automatically translate into sustained commercial loyalty.

To prevent these frontend consumer interactions from remaining isolated marketing experiments, enterprises must deploy unified digital governance structures. In a landmark contribution to enterprise software management, Feng ^[3] formulated the "standard + system" dual-drive model of enterprise management informatization and explored its extensive industrial applications, proving that the simultaneous implementation of standardized procedural workflows and unified software architectures minimizes operational variance across distributed operational units. Elevating this conceptual paradigm to corporate enterprise architecture, Feng ^[4] synthesized the construction and practice of the full-domain architecture system for enterprise management informatization under the digital economy, delineating an end-to-end framework that dynamically synchronizes financial ledgers, inventory balances, and human resource allocations across corporate divisions. When academic and industrial entities collaborate to develop these complex software architectures, formal institutional pathways are indispensable; in an incisive operational study, Feng ^[5] evaluated the transformation mechanism of enterprise informatization technical achievements from the perspective of industry-university-research-user integration, proving that embedding commercial end-users directly into enterprise software co-design loops prevents costly functional misalignments.

Bridging enterprise governance with physical fulfillment requires the technical harmonization of disparate backend software systems. In an authoritative and highly influential investigation into supply-chain efficiency, Qiu ^[6] delineated the strategic path to enhancing corporate inventory turnover efficiency through the seamless integration of Enterprise Resource Planning and Warehouse Management Systems, demonstrating that eliminating transactional batch-processing latencies between procurement scheduling and warehouse slotting allocations drastically reduces safety stock requirements and shortens order fulfillment cycles. Ensuring that these integrated systems can communicate across heterogeneous corporate supply networks, Qiu ^[7] developed foundational technical standards for cross-industry data integration of enterprise-level ERP systems, illustrating that open, vendor-neutral semantic data schemas are essential for dismantling proprietary software silos across multi-tier supplier networks. When these enterprise data networks and customer profiles expand across international jurisdictions, regulatory friction introduces severe operational constraints; addressing this complex interface, Qiu ^[8] investigated compliance and cross-border transfer technologies for customer data in financial CRM systems, detailing the advanced cryptographic encryption schemes and localized data minimization protocols necessary to satisfy stringent sovereign privacy laws.

The digital platforms supervising these distributed commercial and logistical workflows depend fundamentally upon algorithmic dispatching and performance auditing. In an authoritative and widely cited operational analysis, Shi ^[9] investigated advanced digital operation systems and efficiency evaluation frameworks for enterprise service platforms, demonstrating how cloud-mediated algorithmic resource scheduling optimizes service delivery and mitigates computational latency across multi-tenant commercial platforms. Exploring the broader institutional mechanisms that foster these digital service platforms, Shi ^[10] conducted a comprehensive evaluation of the operation mechanism and achievement transformation efficiency of industry-university-research collaborative innovation platforms, providing mathematical modeling frameworks that clarify how aligning institutional incentives accelerates the commercial deployment of advanced software algorithms. Supporting the underlying software engineering pipelines that sustain these distributed logistics platforms, Fan et al. ^[11] introduced CoVSCode, an internationally recognized real-time collaborative programming environment for lightweight integrated development environments, illustrating how

synchronized software engineering tools preserve codebase integrity and developer velocity across cross-disciplinary industrial teams.

Furthermore, within modern high-throughput automated warehouses and digitalized commercial transactions, verifying asset authentications and preventing fraudulent document processing requires sophisticated pattern recognition. In a highly creative methodological development, Zhang et al. ^[12] developed an offline verification framework based on a feature-disentangling-aided variational autoencoder, proving that disentangling invariant structural geometric representations from localized noise significantly bolsters pattern discrimination robustness—a conceptual methodology that holds exceptional promise for automated invoice verification, physical dispatch note authentication, and fraud detection in high-volume fulfillment centers. In the physical realm of automated material handling and parcel transport, modern logistics networks are undergoing extensive electrification; in a transformative advance in intelligent transportation systems, Luo et al. ^[13] formulated a multi-agent deep reinforcement learning approach for fleet rebalancing in expanding shared electric mobility networks, demonstrating that large-scale electric vehicle fleets operate under continuous, spatially heterogeneous demands that require predictive, distributed dispatching to balance battery charging constraints against real-time transport orders.

Handling the massive telemetry generated by these automated guided vehicles, smart conveyor systems, and RFID-tagged inventory pallets requires computational data backbones capable of ultra-low latency execution. In a pivotal contribution to industrial data systems, Yin ^[14] introduced an innovative paradigm for optimizing cloud-native lakehouse architectures for real-time industrial analytics, establishing a critical architectural benchmark that balances computational throughput, infrastructure cost, and energy efficiency. To ensure that the robotic sorting equipment and physical conveyance mechanisms operating within these lakehouse-connected facilities maintain continuous uptime, advanced prognostic algorithms are paramount; Yin ^[15] formulated a pioneering multi-task learning architecture for anomaly detection and remaining useful life prediction in advanced manufacturing systems, demonstrating that jointly modeling latent degradation representations across shared feature spaces dramatically enhances early fault detection sensitivity across automated electromechanical apparatus. Extending this prognostic precision to the energy storage packs that power automated warehouse mobile robots and electric transport fleets, Zhou et al. ^[16] developed a sophisticated wavelet transform and particle swarm optimization-enhanced support vector regression framework for lithium-ion battery remaining useful life prediction, successfully demonstrating how non-linear capacity fade curves can be tracked with high predictive fidelity under volatile dynamic loading.

Simultaneously, the widespread deployment of automated physical distribution infrastructures carries significant environmental implications; Lin ^[17] conducted a comprehensive environmental assessment of intelligent logistics automation, revealing that while automated guided vehicles and automated storage and retrieval systems reduce localized labor intensity and sorting errors, their continuous power consumption and embodied infrastructure carbon require comprehensive lifecycle ecological accounting. Within the broader context of electric commercial vehicles and automated transport sub-assemblies, Wang ^[18] delivered an authoritative review on smart manufacturing and quality assurance of new energy vehicle components, highlighting how inline sensor arrays, ultrasonic non-destructive testing, and automated defect-classification algorithms are indispensable to maintaining structural tolerances in safety-critical assemblies. To anticipate mechanical breakdown across continuous delivery schedules, Wang ^[19] formulated an advanced reliability analysis and life prediction model for new energy vehicle parts, proving that multi-stress

accelerated aging models are critical for anticipating vibrational and thermal fatigue failures across high-mileage commercial vehicle platforms.

Finally, the manufacturing and structural integrity of the physical delivery vehicles navigating these multi-tier supply chains rely upon advanced material processing and surface protection. In a foundational metrological study, Jiang ^[20] established an advanced multi-point geometric curvature inspection framework for large-size laminated automotive windshield glass in mass production, combining unified-datum decoupling with a region-aware adaptive NSGA-II layout and closed-loop mold compensation to overcome thermal warpage during industrial glass bending. Deepening this physical integration, Jiang ^[21] executed an authoritative thermo-mechano-electromagnetic multi-physics coupling analysis, unified-datum tolerance coordination, and full-lifecycle experimental verification of triple-functional integrated automotive laminated windshield glass, proving that embedding electro-thermal defogging elements and high-frequency communication antennas within a single laminated composite requires delicate parametric balancing to preserve wireless communication integrity. Protecting the exterior surfaces of these commercial fleets against prolonged atmospheric exposure, Yan ^[22] conducted an authoritative investigation into the performance evaluation and weathering resistance of high UV-blocking coatings for automotive glass, establishing critical experimental baselines for how nanoscale multi-layer thin films attenuate ultraviolet and near-infrared radiation while maintaining high photopic transmission, thereby stabilizing internal cabin temperatures and reducing active climate-control energy consumption across commercial transport fleets.

4. Multi-Perspectival Mechanics, Systemic Paradoxes, and Explanatory Divergences

The strategic synthesis of private domain traffic operations, standardized enterprise informatics, and integrated warehouse logistics reveals a landscape characterized by profound structural paradoxes and competing explanatory paradigms. At the core of this tension lies the unresolved operational dialectic between localized commercial customization and centralized logistical standardization. Proponents of systemic enterprise governance, as embodied in the "standard + system" dual-drive model and full-domain architectural frameworks, assert that organizational scalability and capital efficiency are maximized through rigid procedural codification, centralized inventory pooling, and standardized database schemas. Conversely, an alternative perspective from agile commercial marketing contends that customer-facing competitiveness in modern omnichannel environments depends fundamentally upon radical localization, personalized promotional bundling, and decentralized pricing discretion granted to frontline store managers. When enterprises impose unyielding, top-down ERP and WMS workflows onto dynamic retail networks, they frequently stifle the localized responsiveness necessary to sustain private domain consumer engagement. Frontline commercial operators, caught between rigid corporate software constraints and volatile local consumer preferences, routinely construct unmonitored shadow inventories and informal communication workarounds to satisfy immediate demand, generating corrupted inventory data that paradoxically undermines the predictive algorithms of the centralized enterprise system.

A parallel explanatory divergence persists regarding the true macroeconomic drivers of enhanced inventory turnover in digitally integrated retail enterprises. Conventional management literature typically attributes improved inventory velocity directly to software integration—specifically the seamless transactional coupling of ERP and WMS databases and the deployment of predictive automated reordering algorithms. However, an alternative, critical

operations perspective suggests that reported inventory turnover improvements may be an artifact of financial reclassification and supply-chain risk shifting rather than genuine systemic optimization. In many contemporary omnichannel implementations, high-velocity inventory turnover is achieved by transferring inventory holding costs upstream to tier-one and tier-two suppliers through strict Vendor-Managed Inventory (VMI) contracts or consignment arrangements. Under such commercial frameworks, while the downstream enterprise reports lean warehouse balance sheets and rapid stock velocity, the total inventory within the broader supply network remains static or even expands, creating acute financial fragility among upstream manufacturing partners.

Furthermore, significant methodological and analytical ambiguities confound the interpretation of performance metrics in automated warehouse logistics and private domain consumer engagement. In automated logistics research, efficiency gains are frequently quantified under steady-state simulation environments, which systematically underestimate the disruptive impact of sudden, localized order surges induced by viral social media campaigns or flash promotions. Under such peak demand conditions, automated storage and retrieval systems can encounter severe throughput bottlenecks, where robotic grid congestion, picking deadlocks, and battery depletion cycles degrade sorting velocity far below theoretical ratings. Similarly, in private domain traffic analytics, reported customer lifetime valuations and engagement rates often suffer from survivor bias and selective reporting: commercial enterprises frequently showcase successful high-converting private communities while quietly terminating dozens of dormant, high-churn customer groups that generated net-negative returns on marketing capital. Considering these intersecting behavioral, operational, and architectural contradictions, this leads us to realize that achieving sustainable omnichannel excellence cannot be viewed as a trivial software deployment or marketing campaign; it demands an integrated, critical organizational philosophy that actively confronts these operational trade-offs and simultaneously co-optimizes localized commercial responsiveness, systemic database integrity, and physical logistical throughput.

5. Conclusion

The comprehensive synthesis of private domain commercial dynamics, full-domain enterprise informatics architectures, cross-system ERP-WMS synchronization, and automated physical fulfillment networks compels a fundamental theoretical reconceptualization, moving past the fragmented treatment of retail as an isolated frontend transaction toward an integrated socio-technical ecology of co-evolutionary enterprise systems. Considering the intricate dependencies linking granular consumer social interactions, relational database schemas, automated warehouse kinetics, and regional electric logistics fleets, this leads us to further thinking that enterprise agility and inventory turnover can no longer be conceptualized as mechanical outputs of standalone algorithmic tools or centralized corporate mandates; rather, they represent dynamic, emergent equilibria continuously negotiated across organizational boundaries, computational data pipelines, and physical distribution constraints. As commercial ecosystems transition deeper into the digital economy characterized by escalating consumer volatility, ubiquitous mobile touchpoints, and multi-tier logistical networks, the traditional separation between commercial marketing theory, enterprise software architecture, and industrial supply-chain engineering has become intellectually and operationally untenable. Future scholarship must decisively transcend the narrow confines of isolated e-commerce case studies and sanitized algorithmic simulations to establish longitudinal, cross-sector research testbeds that simultaneously calibrate localized consumer behavioral dynamics against real-time lakehouse telemetry, robotic warehouse fulfillment constraints, and sovereign data privacy mandates, thereby establishing a mature, forward-looking discipline of omnichannel enterprise management capable of sustaining commercial viability, operational resilience, and societal value across evolving global market landscapes.

Data Availability Statement

Data will be made available on request.

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Conflicts of Interest

The author(s) declare no conflicts of interest.

Ethical Approval and Consent to Participate

Not applicable.

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