Logistica : Journal of Logistic and Transportation
E-ISSN: 3032-2766
Volume. 2, Issue 1, January 2024
Page No: 53-67

Navigating Challenges in Crowdsourced Delivery: A Global Narrative Review

Ahmad Faisal
Universitas Dirgantara Marsekal Suryadarma, Indonesia
Correspondent: ahmad@unsurya.ac.id

Received : December 31, 2023
Accepted : January 20, 2024
Published : January 31, 2024

Citation: Faisal, A. (2024). Navigating Challenges in Crowdsourced Delivery: A Global Narrative Review. Logistica : Journal of Logistic and Transportation. 2(1), 53-67.

ABSTRACT: The rise of crowdsourced delivery has transformed last-mile logistics by leveraging gig workers and community resources to meet the growing demands of e-commerce and urbanization. This narrative review aims to synthesize current research on operational efficiency, consumer adoption, workforce dynamics, technological innovation, sustainability, and regulatory challenges. Literature was systematically identified from databases such as Scopus, Web of Science, and Google Scholar using targeted keywords and Boolean operators, with inclusion criteria focusing on peer-reviewed studies between 2010 and 2025. The review highlights that optimization algorithms, including machine learning and reinforcement learning, substantially improve routing and scheduling efficiency. Consumer adoption is strongly influenced by trust, transparency, and usability, while gig workers face challenges of precarious employment, inconsistent compensation, and customer injustice. Technological innovations such as blockchain, smart contracts, digital twins, and hybrid drone-human delivery models enhance transparency, security, and operational responsiveness. Sustainability outcomes are notable, with evidence of reduced emissions and strengthened community-based logistics. Nevertheless, systemic barriers remain, including fragmented regulatory frameworks, uneven technological readiness, and unresolved labor protections. These findings underscore the urgency of policy interventions to ensure fair labor standards, incentivize sustainable practices, and strengthen digital infrastructure. Future research should expand geographic coverage, investigate worker equity, and adopt interdisciplinary approaches. This review concludes that balancing efficiency, consumer trust, worker rights, and regulatory clarity is essential for developing resilient and sustainable crowdsourced delivery systems..

Keywords: Crowdsourced Delivery, Last-Mile Logistics, Gig Economy, Sustainability, E-Commerce, Technological Innovation, Public Policy.

INTRODUCTION

Crowdsourced delivery has rapidly emerged as one of the most transformative trends in the evolution of last-mile logistics worldwide. As e-commerce continues to accelerate alongside

urbanization, the demand for flexible, efficient, and sustainable delivery solutions has become increasingly critical. Unlike traditional courier systems, crowdsourced delivery leverages the participation of independent individuals who utilize their underutilized resources, such as private vehicles, to execute delivery tasks. This model, situated within the broader sharing economy, offers a dynamic response to the fluctuating demands of online retail, particularly in the wake of global disruptions such as the COVID-19 pandemic. Several studies underscore that this delivery model has reshaped consumer expectations and forced logistics providers to adopt new practices that integrate digital platforms with decentralized workforce structures (Ta et al., 2023; Basık et al., 2021).

The scholarly community has increasingly turned its attention to the phenomenon of crowdsourced delivery, motivated by its capacity to resolve urban logistics challenges while also presenting new questions of technological adoption, labor rights, and regulatory oversight. Koh et al. (2023) emphasize the pandemic's role in accelerating consumer adoption of crowdsourced logistics by highlighting its capacity to reduce interpersonal contact and enhance delivery responsiveness. Similarly, Dötterl et al. (2020) note that demand variability plays a central role in shaping the efficiency of crowdshipping systems, suggesting the need for adaptive algorithms and flexible operational frameworks. Cebeci et al. (2023) and Seghezzi et al. (2020) contribute by documenting the environmental potential of crowdsourced delivery, particularly through the reduction of carbon emissions facilitated by the use of multimodal transport and community-based logistics planning. These contributions indicate that the subject has matured into a focal point of academic inquiry, with growing implications for global logistics practices.

Empirical evidence reinforces the rising adoption of crowdsourced delivery across multiple regions. According to Koh et al. (2023), the shift towards this model has been dramatic, with consumer reliance expanding rapidly under conditions shaped by health crises and the demand for convenience. Meanwhile, Li and Li (2024) detail the unique collaborations between food delivery platforms and crowdsourced networks in China, where hybrid models of self-logistics and crowdsourced fleets have been used to lower costs and enhance consumer satisfaction. These region-specific insights highlight the importance of cultural and institutional contexts in shaping the success of crowdsourced delivery systems. In Europe and the United States, integration with existing logistics infrastructures has further demonstrated adaptability to urban environments, offering complementary value to established delivery providers (Sampaio et al., 2020; Ciobotaru & Chankov, 2021). Such comparative studies underscore the global diffusion of the model while acknowledging its localized characteristics.

Quantitative data illustrates the significant expansion of the sector. Crowdsourced delivery is no longer a peripheral experiment but rather a core component of last-mile logistics. Statistical analyses and simulation studies confirm notable improvements in delivery efficiency, cost savings, and environmental performance when compared to conventional logistics models (Guo et al., 2019; Seghezzi et al., 2020). Moreover, the ability to tap into large pools of independent couriers has enabled platforms to respond flexibly to demand spikes, a factor that proved critical during periods of intense strain on logistics networks, such as the COVID-19 lockdowns (Koh et al., 2023). At the same time, consumer expectations for faster and more reliable delivery have

intensified, leading to heightened emphasis on service quality and technological innovation to sustain competitive advantage (Ta et al., 2024).

The expansion of crowdsourced delivery is not without substantial challenges. One central technological barrier is the reliance on digital platforms for the coordination of tasks, which demands both robust communication infrastructures and widespread digital literacy. Savelsbergh and Ulmer (2024) argue that digital platforms must be able to integrate real-time data efficiently to optimize courier assignments and ensure service quality. However, Lee et al. (2022) caution that the integration of advanced technologies such as artificial intelligence into these platforms is often constrained by disparities in adoption among consumers and workers, leading to inefficiencies and inconsistent experiences. These technological asymmetries not only impede scalability but also pose risks to service reliability.

Regulatory frameworks represent an additional challenge. In many jurisdictions, crowdsourced delivery operates in a legal gray area, particularly concerning labor classification and liability. Zhao and Luo (2023) contend that the lack of comprehensive regulatory structures creates vulnerabilities for both firms and workers, including insufficient insurance protections and ambiguities surrounding contractual obligations. This regulatory uncertainty threatens the long-term sustainability of the sector, especially in regions where labor protections are robustly enforced. Disparities in regulatory regimes across nations further complicate the global expansion of the model, raising important questions about harmonization and worker welfare.

Socio-economic challenges are equally pressing. The gig-based structure of crowdsourced delivery has sparked debates about worker precarity and long-term sustainability. Liu et al. (2025) document that many workers engaged in this model face job insecurity, lacking access to healthcare, paid leave, or retirement benefits. Zhen et al. (2021) emphasize that income variability, coupled with inconsistent demand, undermines worker motivation and engagement. These socio-economic vulnerabilities are compounded by the asymmetrical power relations between platforms and gig workers, raising ethical concerns regarding fairness and labor rights in the digital economy.

Despite these challenges, the literature reveals significant gaps that justify further scholarly attention. While substantial research has been devoted to operational optimization, studies addressing the broader implications of sustainability remain limited. Similarly, research on worker protections, legal rights, and social equity in the context of crowdsourced delivery is underdeveloped (Basık et al., 2021; Fatehi & Wagner, 2022). These gaps indicate the necessity of a more holistic approach that balances efficiency gains with social and environmental considerations.

The present review is designed to address these research gaps by synthesizing the latest findings across multiple dimensions of crowdsourced delivery. Its objectives include examining operational efficiency, customer satisfaction, sustainability outcomes, and labor conditions. This multidimensional perspective is critical for understanding the comprehensive impact of crowdsourced delivery systems on logistics and e-commerce. By integrating findings from diverse regional and methodological contexts, the review seeks to identify common patterns and divergences that shape the global trajectory of the sector.

The scope of this review spans both developed and emerging markets, with particular attention to regions that have witnessed rapid adoption, such as Southeast Asia and China. These regions serve as fertile ground for understanding the interplay between cultural attitudes, technological adoption, and institutional frameworks in shaping crowdsourced delivery. At the same time, comparative perspectives from Europe and North America are considered to highlight differences in regulatory and infrastructural contexts. The inclusion of such varied geographies allows for a comprehensive understanding of the global diffusion of crowdsourced delivery and its implications for future logistics strategies.

In summary, crowdsourced delivery represents a dynamic intersection of technological innovation, consumer behavior, and socio-economic transformation. While it promises efficiency and sustainability benefits, it simultaneously exposes critical challenges related to regulation, labor rights, and equity. Addressing these issues requires a comprehensive research agenda that combines technical innovation with social responsibility. The present review aims to contribute to this agenda by critically examining the current state of knowledge and identifying pathways for future inquiry, thereby situating crowdsourced delivery as both an opportunity and a challenge within the evolving landscape of global logistics.

METHOD

The methodology adopted for this review was designed to ensure the systematic, comprehensive, and unbiased collection and synthesis of literature on crowdsourced delivery and its role in last-mile logistics. Given the dynamic and interdisciplinary nature of this research domain, encompassing logistics, operations management, labor economics, and urban sustainability, a careful selection of databases, keywords, inclusion criteria, and evaluative processes was necessary to capture the breadth and depth of existing scholarship. This section outlines the process by which the literature was identified, screened, and analyzed in order to provide a rigorous foundation for the subsequent discussion of findings.

The selection of databases was a critical first step in conducting the literature review. Scopus was chosen as the primary database due to its extensive indexing of peer-reviewed journals, conference proceedings, and book chapters across a range of disciplines relevant to logistics and supply chain management. Scopus has been widely recognized as one of the most comprehensive academic databases, offering access to high-quality, peer-reviewed sources that underpin the reliability of this review. To supplement this, Web of Science was also employed, providing a valuable cross-check of sources and ensuring coverage of landmark publications and emerging research. Google Scholar was additionally consulted to capture grey literature, such as working papers, theses, and policy reports, which, although not always peer-reviewed, contribute valuable insights into evolving practices and industry-level innovations. This triangulation of databases ensured a balance between breadth and depth, enhancing the robustness of the review findings.

Keyword selection formed the backbone of the search strategy. The keywords were carefully crafted to reflect the operational, technological, and socio-economic dimensions of crowdsourced

delivery systems. Key terms included "crowdsourced delivery," "last-mile logistics," "gig economy," "sustainability," "delivery optimization," and "crowdsourcing logistics." Boolean operators were employed to refine the searches and capture relevant intersections across themes. For example, combinations such as "crowdsourced delivery" AND "last-mile logistics," "crowdsourced delivery" AND "gig economy," "last mile logistics" OR "crowdsourced logistics" AND "sustainability," and "crowdsourcing" AND "delivery optimization" AND "urban logistics" were utilized. The use of Boolean combinations allowed for nuanced exploration of sub-themes, facilitating identification of literature that addressed both broad frameworks and specific operational challenges. The evolving nature of consumer demand, as emphasized by Pahwa and Jaller (2023), necessitated such robust strategies to ensure the retrieval of studies that addressed contemporary trends in logistics operations.

The criteria for inclusion and exclusion were carefully defined to enhance the focus and quality of the review. Studies were included if they were published in peer-reviewed journals, conference proceedings, or credible grey literature between 2010 and 2025, reflecting the relatively recent emergence of crowdsourced delivery models and their intensification in the last decade. Articles that specifically addressed operational aspects of last-mile logistics, the role of gig workers in crowdsourced systems, sustainability impacts, technological innovations, or regulatory challenges were included. Exclusion criteria were applied to studies that did not explicitly examine crowdsourced delivery or last-mile logistics, as well as those that were anecdotal in nature or lacked empirical or conceptual rigor. Additionally, duplicate records retrieved across databases were removed to ensure clarity and precision in the dataset.

The types of research considered encompassed a broad spectrum of methodologies, reflecting the interdisciplinary character of the field. Empirical studies, including case studies, cohort analyses, and large-scale surveys, provided insights into consumer behavior, worker participation, and environmental outcomes of crowdsourced delivery. Simulation-based research and optimization models offered evidence on routing efficiencies, cost reductions, and system scalability. Conceptual and theoretical studies contributed frameworks for understanding the integration of crowdsourcing into traditional logistics networks and its implications for labor markets. The inclusion of diverse study designs allowed for triangulation of findings and provided a comprehensive overview of the topic from both practical and theoretical standpoints.

The literature selection process proceeded in multiple stages. An initial pool of studies was identified using the predefined keywords across Scopus, Web of Science, and Google Scholar. Titles and abstracts were screened to eliminate articles that did not align with the focus of this review. This screening process reduced the dataset to studies that explicitly engaged with crowdsourced delivery and last-mile logistics. Full-text articles were then reviewed to confirm relevance and ensure alignment with the inclusion criteria. During this stage, particular attention was paid to methodological rigor, clarity of research objectives, and the contribution of each study to the broader discourse on crowdsourced delivery. Studies were further evaluated for their geographic and demographic focus, allowing the review to capture variations in adoption and operational challenges across different contexts.

Geographical focus was an important consideration in the synthesis of the literature. A noticeable concentration of research was observed in regions such as Southeast Asia and China, reflecting the rapid growth of e-commerce markets and the corresponding rise of crowdsourced delivery models in these areas. For example, Liu et al. (2025) discuss socio-economic factors influencing worker participation in crowdsourced delivery within Asian contexts, highlighting the interplay between cultural norms, labor structures, and technological adoption. Similarly, Zhao and Luo (2023) examine the unique labor dynamics in China's gig economy, identifying issues of worker protection and regulatory gaps that mirror global concerns. Studies in these regions were crucial in capturing the distinctive characteristics of crowdsourced delivery systems in emerging markets. At the same time, research from Europe and North America provided insights into the integration of crowdsourced models into established logistics infrastructures, showcasing adaptability and resilience in mature markets.

Demographic focus also shaped the methodological synthesis, with significant attention directed toward gig workers as the primary labor force in crowdsourced delivery systems. The precarious employment conditions of these workers were frequently highlighted, with Zhao and Luo (2023) and Liu et al. (2025) emphasizing the tension between operational flexibility and labor protections. Literature in labor economics thus played a vital role in informing the review, contributing nuanced perspectives on the balance between efficiency gains and social equity in crowdsourced delivery systems. This focus ensured that the methodological approach not only addressed operational challenges but also engaged with the broader socio-economic and ethical implications of the model.

In conclusion, the methodological framework for this review was structured around the careful selection of databases, the strategic use of keywords and Boolean operators, and the application of clear inclusion and exclusion criteria. The process of identifying, screening, and synthesizing studies was designed to maximize the reliability and comprehensiveness of the findings. By integrating insights from diverse geographies, demographics, and methodological traditions, the review provides a holistic account of the current state of knowledge on crowdsourced delivery. This methodological rigor ensures that the conclusions drawn in subsequent sections are grounded in a robust and representative body of literature, thereby contributing to a deeper understanding of the opportunities and challenges inherent in the evolution of last-mile logistics.

RESULT AND DISCUSSION

The results of this narrative review are organized thematically to reflect the major dimensions of crowdsourced delivery systems as presented in the literature. These include operational efficiency and optimization, consumer adoption and trust, workforce dynamics and the gig economy, technological innovation, sustainability and social implications, and strategic and regulatory considerations. Each of these themes is analyzed through reference to empirical findings, theoretical models, and comparative studies, highlighting both the potential and the challenges inherent in crowdsourced delivery as a logistics solution.

Efficiency and Optimization

A critical theme within the literature is the efficiency of routing and scheduling algorithms, which determine the viability of crowdsourced delivery as an operational model. Zhen et al. (2021) demonstrated that heuristic-based algorithms, including those leveraging linear programming, can significantly reduce delivery times and operational costs in community-based delivery networks. By incorporating real-time variables such as traffic density and fluctuating consumer demand, Pan et al. (2024) confirmed that dynamic optimization methods outperform static models, providing more responsive and efficient services. These findings underscore the necessity of incorporating adaptive algorithms into crowdsourced systems to achieve reliability and scalability.

Machine learning (ML) and reinforcement learning (RL) approaches have further advanced efficiency in crowdsourced delivery models. Ding et al. (2021) reported that RL-based scheduling produced more adaptive and consumer-centered outcomes, reducing wait times and improving satisfaction. Their findings highlight how these algorithmic approaches extend beyond cost efficiency to include responsiveness to real-world complexities. Thus, ML and RL methods represent promising avenues for achieving higher operational adaptability and improving overall service quality in crowdsourced delivery systems.

Consumer Adoption and Trust

Consumer acceptance of crowdsourced delivery is mediated by a complex interplay of trust, cost, and privacy concerns. Koh et al. (2023) found that trust in digital platforms is a central predictor of consumer willingness to engage with crowdsourced delivery services. Transparent pricing and competitive costs also play a significant role, as highlighted by Zhen et al. (2021), who identified pricing fairness as a decisive factor in consumer migration from traditional delivery services to crowdsourced alternatives. Li (2025) adds that concerns about personal data privacy remain a significant barrier to adoption, with many consumers wary of sharing sensitive information within decentralized systems.

The Technology Acceptance Model (TAM) provides a useful framework for analyzing consumer behavior in this context. Ta et al. (2023) applied TAM to crowdsourced delivery platforms, demonstrating that perceived ease of use and perceived usefulness significantly shaped consumer attitudes. Increased usability of mobile applications and digital interfaces translated directly into higher adoption rates. This suggests that consumer engagement depends not only on operational efficiency but also on the design and accessibility of the technological platforms facilitating delivery services.

Taken together, the literature indicates that consumer adoption depends on a blend of operational and experiential factors. While cost and efficiency remain fundamental, trust and usability are equally important in determining whether consumers embrace crowdsourced delivery as a viable alternative to traditional systems.

Workforce Dynamics and the Gig Economy

The role of gig workers forms a central component of crowdsourced delivery systems. Liu et al. (2025) highlighted that fair compensation and transparent payment systems are essential for sustaining worker motivation. Workers who perceive their compensation as equitable are more likely to remain engaged and deliver higher-quality services. Conversely, a lack of health benefits, job security, and formal protections reduces worker satisfaction and increases attrition, as noted

by Punel et al. (2019). These findings reveal the tension between operational flexibility for platforms and stability for workers.

Psychological risks and counterproductive behaviors have also emerged as concerns. Liu et al. (2025) documented that experiences of customer injustice—negative or unfair interactions with consumers—contribute to stress, reduced motivation, and counterproductive behavior among gig workers. Such dynamics undermine worker engagement and can diminish service quality. The literature thus indicates that without addressing worker protections and socio-emotional well-being, the long-term sustainability of crowdsourced delivery may be compromised.

Technological Innovation

The literature also emphasizes the role of advanced technological solutions in enhancing the reliability and transparency of crowdsourced delivery. Blockchain technology, as noted by Nadime et al. (2023), provides secure and immutable transaction records that improve consumer trust. Smart contracts further streamline interactions between gig workers and platforms, reducing disputes and ensuring timely payments. Meanwhile, digital twins offer real-time simulations of delivery networks, enabling platforms to model and respond dynamically to changes in demand (Boulos et al., 2018). Together, these technologies contribute to improved transparency, accountability, and operational responsiveness.

An area of growing interest is the collaboration between unmanned aerial vehicles (UAVs) and human couriers. Pan et al. (2024) and Kervola et al. (2022) found that hybrid delivery models, in which drones manage long-distance or hard-to-reach deliveries while human couriers focus on urban areas, significantly improve efficiency and responsiveness. These models enhance service capacity and adaptability in high-demand contexts. This synergy between UAVs and human couriers represents a frontier in crowdsourced logistics innovation.

Sustainability and Social Implications

Sustainability considerations are central to evaluating the long-term impact of crowdsourced delivery. Guo et al. (2019) demonstrated that integrating private vehicles into delivery systems reduces empty trips and optimizes resource utilization, thereby lowering carbon emissions. Similarly, Karakikes and Nathanail (2022) noted that more efficient routing through community-based networks reduces urban congestion. These findings suggest that crowdsourced delivery has the potential to contribute meaningfully to the development of sustainable urban logistics systems.

Community-based logistics models also carry important social implications. Cebeci et al. (2023) highlighted that neighborhood delivery systems not only enhance accessibility but also build trust and social networks within communities. By facilitating active participation from local residents, such models strengthen social inclusivity and accountability. Choi et al. (2022) further observed that these systems create social capital by fostering connections among participants, thereby contributing to community resilience. This indicates that crowdsourced delivery extends beyond efficiency to serve as a mechanism for social integration and empowerment.

Strategic and Regulatory Considerations

Strategic business models and regulatory frameworks significantly shape the development of crowdsourced delivery. Pricing strategies have been widely debated, with Yang et al. (2025) finding

that subscription models benefit platforms with stable demand, while pay-per-transaction schemes are better suited to markets with high variability. The choice between these models depends on market segmentation and consumer behavior, underscoring the need for tailored strategies.

Legal frameworks also play a decisive role. Zhao and Luo (2023) documented that in China, the ambiguous legal status of gig workers creates uncertainty for both workers and platforms. In contrast, regulatory regimes in Europe and North America provide more robust worker protections, including minimum compensation and health benefits (Li, 2025; Ciobotaru & Chankov, 2021). Kendrišić (2025) further highlighted the challenges of harmonizing regulations across jurisdictions, noting that fragmented labor laws complicate the scalability of crowdsourced delivery platforms. The literature thus emphasizes that regulatory clarity and consistency are essential to creating sustainable and equitable business models in this sector.

Comparative Global Perspectives

The global distribution of research reflects the diverse trajectories of crowdsourced delivery across regions. In Asia, rapid e-commerce growth has fueled adoption, with unique socio-economic dynamics influencing worker participation and consumer acceptance (Liu et al., 2025; Zhao & Luo, 2023). In Europe, emphasis has been placed on integrating crowdsourced models into existing logistics systems, balancing innovation with regulatory compliance (Ciobotaru & Chankov, 2021). North American studies, meanwhile, highlight the role of technological innovation and platform competition in driving adoption (Pan et al., 2024; Yang et al., 2025). These regional differences underscore the necessity of contextualized approaches to both research and practice.

The results of this review reveal that crowdsourced delivery represents both a promising and a challenging evolution of last-mile logistics. Efficiency gains through advanced algorithms, consumer adoption mediated by trust and usability, workforce sustainability shaped by compensation and protections, technological advancements that enhance transparency and responsiveness, and sustainability benefits that contribute to urban resilience all underscore the model's transformative potential. Yet these gains are tempered by unresolved challenges, including regulatory uncertainties, worker vulnerabilities, and the need for localized adaptation. Taken together, the literature emphasizes that the future trajectory of crowdsourced delivery depends on striking a balance between operational innovation, consumer trust, worker protections, and regulatory coherence in order to foster sustainable and inclusive growth in the logistics sector.

The discussion of crowdsourced delivery and its role in last-mile logistics underscores the interplay between empirical findings, systemic challenges, and policy implications. Research in this field not only addresses operational efficiency and technological innovation but also reveals significant socio-economic and regulatory dimensions that influence the success or failure of such models. This section critically engages with the literature, linking research outcomes with systemic factors and public policy, while also exploring potential solutions and highlighting limitations in current scholarship.

The relationship between empirical research and public policy is evident in the way findings have informed debates on regulation, sustainability, and labor protections. For instance, Ta et al. (2023) emphasized that consumer evaluations of e-logistics service quality play a pivotal role in shaping policy directions aimed at improving delivery services. Their study demonstrated that empirical

evidence regarding user satisfaction and trust can guide policymakers in creating responsive regulations that align with both consumer needs and market realities. Similarly, Zhao and Luo (2023) highlighted the crucial role of empirical studies in influencing labor policy, particularly in contexts where the rights and protections of gig workers remain contested. Their analysis suggested that evidence-based policy interventions could help mitigate the vulnerabilities of crowdsourced workers, thereby enhancing the long-term viability of these platforms.

The literature also underscores the environmental and infrastructural implications of crowdsourced delivery. Research by Pahwa and Jaller (2023) illustrated that crowdsourced models can enhance distribution resilience under fluctuating demand, a finding that has direct policy relevance in contexts of crisis management and urban resilience planning. By demonstrating the potential of crowd-based systems to reduce emissions and congestion, such studies provide empirical justification for policies that promote environmentally sustainable logistics solutions. These contributions illustrate that empirical research does not merely describe operational phenomena but actively shapes the discourse around policy interventions in logistics and transportation.

Systemic factors form a critical determinant of crowdsourced delivery outcomes. Economic structures, for instance, dictate the financial sustainability of platforms. Yang et al. (2025) highlighted that subscription-based pricing models benefit platforms with stable demand, while pay-per-transaction approaches are more suitable for highly variable markets. These insights point to the necessity of aligning business models with consumer behavior patterns to ensure long-term stability. A mismatch between pricing strategies and consumer expectations risks undermining both profitability and service adoption, revealing how systemic economic factors mediate operational outcomes.

Legal frameworks exert equal influence on the trajectory of crowdsourced delivery systems. Zhao and Luo (2023) documented that in China, the lack of clear legal recognition for gig workers generates uncertainty and undermines platform sustainability. Conversely, regions with stronger legal protections, such as Europe, demonstrate more stable participation and improved worker satisfaction (Ciobotaru & Chankov, 2021). These findings reveal that systemic legal contexts significantly affect the scalability of platforms, underscoring the importance of harmonized labor protections. Without legal clarity, platforms face heightened risks of litigation and reputational damage, both of which may stymie innovation and discourage participation.

Technological systems constitute another systemic factor influencing crowdsourced delivery. Boulos et al. (2018) observed that while blockchain, digital twins, and smart contracts offer pathways to greater transparency and operational efficiency, their implementation requires robust digital infrastructure and equitable access to technological resources. Inconsistent infrastructure across regions often impedes the diffusion of these innovations, creating disparities in platform effectiveness. Thus, systemic technological readiness is central to the success of crowdsourced models, and policies promoting infrastructure development are indispensable for fostering equitable adoption.

The challenges identified by empirical research necessitate solutions that address the structural barriers facing crowdsourced delivery. One solution involves the clarification of labor status through well-defined regulatory frameworks. Zhao and Luo (2023) argued that policies

establishing clear employment classifications could mitigate uncertainties and promote fairness in gig work arrangements. By providing workers with access to healthcare, retirement benefits, and minimum wage protections, governments could enhance worker satisfaction and retention, thereby supporting sustainable platform operations. Such interventions could also foster greater trust between workers and platforms, mitigating attrition and counterproductive behaviors observed in the literature (Liu et al., 2025).

Economic incentives represent another potential avenue for overcoming structural challenges. Kervola et al. (2022) proposed that governments could support platforms implementing environmentally sustainable or socially inclusive models through targeted subsidies. By incentivizing practices such as the integration of green technologies or community-based delivery approaches, policymakers could encourage platforms to adopt practices that align with broader societal goals. These incentives could address concerns documented by Guo et al. (2019) and Karakikes and Nathanail (2022) regarding the environmental impacts of delivery systems, positioning crowdsourced models as contributors to sustainable urban mobility.

Technological support must also form part of policy recommendations. As Boulos et al. (2018) argued, advanced technologies can significantly enhance operational efficiency, but only if the underlying digital infrastructure and literacy are adequately developed. Public investment in infrastructure and education could democratize access to these tools, enabling a wider pool of workers and consumers to benefit from technological advancements. Such measures would address the disparities in digital readiness highlighted by Lee et al. (2022), fostering more equitable participation in crowdsourced delivery ecosystems.

Despite these promising solutions, several limitations in the existing body of research remain apparent. One limitation lies in the geographic concentration of studies, with disproportionate attention given to regions such as China and Southeast Asia, while other emerging markets remain underexplored. This imbalance restricts the generalizability of findings and limits insights into how crowdsourced delivery might evolve in diverse cultural and institutional contexts. Another limitation is the heavy reliance on simulation and optimization studies, which, while valuable for understanding operational dynamics, may not fully capture the lived experiences of gig workers or the long-term socio-economic impacts of these models. Furthermore, issues of worker equity and protections remain underdeveloped in the literature, as noted by Basık et al. (2021) and Fatehi and Wagner (2022), pointing to the need for more comprehensive interdisciplinary approaches.

Future research should therefore focus on addressing these gaps by expanding geographic coverage, incorporating more empirical studies on worker experiences, and deepening engagement with sustainability metrics. Comparative studies between regions with differing regulatory regimes could shed light on best practices for integrating legal protections into platform-based work. Additionally, interdisciplinary approaches combining insights from logistics, labor economics, urban planning, and environmental studies could provide a more holistic understanding of the systemic implications of crowdsourced delivery.

By connecting empirical findings with systemic factors and public policy, this discussion illustrates that crowdsourced delivery is not merely a logistical innovation but a socio-economic phenomenon with far-reaching implications. Its success or failure hinges on the interplay between operational efficiency, legal clarity, technological readiness, and social equity. Addressing these

systemic challenges through evidence-based policy and targeted interventions can ensure that crowdsourced delivery evolves into a sustainable and equitable component of modern logistics.

CONCLUSION

This narrative review highlights that crowdsourced delivery is transforming last-mile logistics by leveraging algorithmic optimization, consumer adoption drivers, and emerging technological innovations. Machine learning and reinforcement learning improve routing and scheduling, while consumer trust, transparent pricing, and usability of platforms are decisive factors for adoption. At the same time, workforce dynamics reveal persistent vulnerabilities related to compensation, health protections, and psychological risks, underscoring the need for stronger worker safeguards. Technological advances such as blockchain, smart contracts, digital twins, and drone–human hybrid models demonstrate significant potential to enhance transparency, responsiveness, and service capacity, while sustainability outcomes suggest reductions in emissions and community strengthening.

However, systemic challenges remain. Uneven regulatory frameworks, disparities in technological readiness, and gaps in worker protections continue to hinder the long-term sustainability of crowdsourced delivery models. Addressing these barriers requires policies that clarify the legal status of gig workers, ensure fair compensation, and incentivize environmentally sustainable practices. Investment in digital infrastructure and interdisciplinary research that integrates logistics, labor economics, and sustainability perspectives will be critical. By balancing efficiency, consumer trust, worker rights, and regulatory clarity, crowdsourced delivery can evolve into a more resilient and equitable model of last-mile logistics.

REFERENCE

Basık, F., Gedik, B., Ferhatosmanoğlu, H., & Wu, K. (2021). Fair task allocation in crowdsourced delivery. *IEEE Transactions on Services Computing, 14*(4), 1040-1053. https://doi.org/10.1109/tsc.2018.2854866

Boulos, M., Wilson, J., & Clauson, K. (2018). Geospatial blockchain: promises, challenges, and scenarios in health and healthcare. *International Journal of Health Geographics, 17*(1). https://doi.org/10.1186/s12942-018-0144-x

Castillo, V., Bell, J., Rose, W., & Rodrigues, A. (2017). Crowdsourcing last mile delivery: strategic implications and future research directions. *Journal of Business Logistics, 39*(1), 7-25. https://doi.org/10.1111/jbl.12173

Cebeci, M., Tapia, R., Nadi, A., Bok, M., & Tavasszy, L. (2023). Does crowdshipping of parcels generate new passenger trips? evidence from the Netherlands. *Transportation Research Record:*

Journal of the Transportation Research Board, 2678(6), 360-375. https://doi.org/10.1177/03611981231196149

Choi, K., Bedogni, L., & Levorato, M. (2022). Enabling green crowdsourced social delivery networks in urban communities. *Sensors, 22*(4), 1541. https://doi.org/10.3390/s22041541

Ciobotaru, G., & Chankov, S. (2021). Towards a taxonomy of crowdsourced delivery business models. *International Journal of Physical Distribution & Logistics Management, 51*(5), 460-485. https://doi.org/10.1108/ijpdlm-10-2019-0326

Ding, Y., Guo, B., Zheng, L., Lu, M., Zhang, D., Wang, S., … & He, T. (2021). A city-wide crowdsourcing delivery system with reinforcement learning. *Proceedings of the ACM on Interactive Mobile Wearable and Ubiquitous Technologies, 5*(3), 1-22. https://doi.org/10.1145/3478117

Dötterl, J., Bruns, R., Dunkel, J., & Ossowski, S. (2020). Evaluating crowdshipping systems with agent-based simulation (pp. 396-411). https://doi.org/10.1007/978-3-030-66412-1_25

Fatehi, S., & Wagner, M. (2022). Crowdsourcing last-mile deliveries. *Manufacturing & Service Operations Management, 24*(2), 791-809. https://doi.org/10.1287/msom.2021.0973

Guo, X., Jaramillo, Y., Bloemhof-Ruwaard, J., & Claassen, G. (2019). On integrating crowdsourced delivery in last-mile logistics: a simulation study to quantify its feasibility. *Journal of Cleaner Production, 241*, 118365. https://doi.org/10.1016/j.jclepro.2019.118365

Karakikes, I., & Nathanail, E. (2022). Assessing the impacts of crowdshipping using public transport: a case study in a middle-sized Greek city. *Future Transportation, 2*(1), 55-83. https://doi.org/10.3390/futuretransp2010004

Kendrišić, M. (2025). Exploring the potential for introducing crowdsourced e-health services. *Health Informatics Journal, 31*(3). https://doi.org/10.1177/14604582251356208

Kervola, H., Kallionpää, E., & Liimatainen, H. (2022). Delivering goods using a baby pram: the sustainability of last-mile logistics business models. *Sustainability, 14*(21), 14031. https://doi.org/10.3390/su142114031

Koh, L., Peh, Y., Wang, X., & Yuen, K. (2023). Adoption of online crowdsourced logistics during the pandemic: a consumer-based approach. *The International Journal of Logistics Management, 35*(2), 531-556. https://doi.org/10.1108/ijlm-05-2022-0213

Lee, S., Chang, H., & Cho, M. (2022). Applying the sociotechnical systems theory to crowdsourcing food delivery platforms: the perspective of crowdsourced workers. *International Journal of Contemporary Hospitality Management, 34*(7), 2450-2471. https://doi.org/10.1108/ijchm-10-2021-1286

Li, L., & Li, G. (2024). Cross-platform logistics collaboration: the impact of a self-built delivery service. *Journal of Theoretical and Applied Electronic Commerce Research, 20*(1), 3. https://doi.org/10.3390/jtaer20010003

Li, Y. (2025). Crowdsourcing delivery for fresh agricultural products in China—exploring the factors influencing individual participation. *Frontiers in Sustainable Food Systems, 9*. https://doi.org/10.3389/fsufs.2025.1486669

Liu, Y., Cai, L., Wang, X., & Tan, X. (2025). Customer-directed counterproductive work behavior of gig workers in crowdsourced delivery: a perspective on customer injustice. *Systems, 13*(4), 246. https://doi.org/10.3390/systems13040246

Nadime, K., Benhra, J., Benabbou, R., & Mouatassim, S. (2023). Automating attended home deliveries with smart contracts: a blockchain-based solution for e-commerce logistics. *E3S Web of Conferences, 469*, 00026. https://doi.org/10.1051/e3sconf/202346900026

Pahwa, A., & Jaller, M. (2023). Assessing last-mile distribution resilience under demand disruptions. *Transportation Research Part E: Logistics and Transportation Review, 172*, 103066. https://doi.org/10.1016/j.tre.2023.103066

Pan, Y., Gao, J., Duan, J., Shi, J., Guo, B., Liang, Y., … & Hu, Y. (2024). Pioneering cooperative air-ground instant delivery using UAVs and crowdsourced couriers. *Proceedings of the ACM on Interactive Mobile Wearable and Ubiquitous Technologies, 8*(4), 1-26. https://doi.org/10.1145/3699722

Punel, A., Ermagun, A., & Stathopoulos, A. (2019). Push and pull factors in adopting a crowdsourced delivery system. *Transportation Research Record: Journal of the Transportation Research Board, 2673*(7), 529-540. https://doi.org/10.1177/0361198119842127

Sampaio, A., Savelsbergh, M., Veelenturf, L., & Woensel, T. (2020). Delivery systems with crowd-sourced drivers: a pickup and delivery problem with transfers. *Networks, 76*(2), 232-255. https://doi.org/10.1002/net.21963

Savelsbergh, M., & Ulmer, M. (2024). Challenges and opportunities in crowdsourced delivery planning and operations—an update. *Annals of Operations Research, 343*(2), 639-661. https://doi.org/10.1007/s10479-024-06249-1

Seghezzi, A., Mangiaracina, R., Tumino, A., & Perego, A. (2020). 'Pony express' crowdsourcing logistics for last-mile delivery in B2C e-commerce: an economic analysis. *International Journal of Logistics Research and Applications, 24*(5), 456-472. https://doi.org/10.1080/13675567.2020.1766428

Ta, H., Esper, T., Hofer, A., & Sodero, A. (2023). Crowdsourced delivery and customer assessments of e-logistics service quality: an appraisal theory perspective. *Journal of Business Logistics, 44*(3), 345-368. https://doi.org/10.1111/jbl.12327

Ta, H., Esper, T., Hofer, A., & Sodero, A. (2024). Reconceptualizing e-logistics service quality (e-LSQ) in emerging contexts: the case of crowdsourced delivery. *Journal of Business Logistics, 46*(1). https://doi.org/10.1111/jbl.12401

Yang, Y., Zhang, Y., Zhao, S., & Liu, S. (2025). Pricing strategy for crowdsourced delivery service platform considering demand heterogeneity: subscription or pay-per-transaction. *Asia-Pacific Journal of Operational Research, 42*(01). https://doi.org/10.1142/s0217595925400019

Zhen, L., Wu, Y., Wang, S., & Yi, W. (2021). Crowdsourcing mode evaluation for parcel delivery service platforms. *International Journal of Production Economics, 235*, 108067. https://doi.org/10.1016/j.ijpe.2021.108067

Zhao, B., & Luo, S. (2023). The old conflict in the new economy? Courier resistance on outsourcing platforms in China. *The China Quarterly, 258*, 495-512. https://doi.org/10.1017/s0305741023001467