Economics

UDC 658.7:004.738.5

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DIGITAL TRANSPARENCY IN TRACKING THE STATUS OF GOODS DELIVERY

Summary. *This article substantiates the significance of digital transparency in tracking the status of goods delivery as a critical factor for enhancing the efficiency of logistics chains and end-consumer satisfaction. The relevance of the study is driven by the rapid growth of e-commerce and intensifying competition in the logistics services sector, where client demands for speed, accuracy, and clarity of information on cargo movement have reached a fundamentally new level. The paper aims to analyze the contribution of digital transparency in logistics and its effect on service quality and customer experience. To this end, an overview of market-industry reports by Grand View Research, IoT Analytics, and Precedence Research is undertaken quantitatively to articulate key components for transparency, as well as their growth rates; while in-depth case studies are conducted qualitatively in a pursuit of best practices and technological impediments. The innovation of the paper rests in merging a multilayered approach to the assessment of transparency. The paper puts forward an integrated system of indicators that can cover at once the technical, user-centric, and economic dimensions of digital delivery monitoring. The key results show that a three-layer transparency design guarantees an almost seamless "flow of life" for every order, resulting in cuts in average final-mile delivery times, drops in contact-center questions, and boosts in repeat buys due to improved customer trust. At the same time, the implementation of such systems*

is constrained by cyber-risks, complexities in integrating heterogeneous IT solutions, and the high capital intensity of modernization. Prospects lie in the application of artificial intelligence for predictive ETAs, digital twins for what-if simulations, and blockchain for reliable movement recording and smart contracts. This article will be useful for logistics managers, supply-chain researchers, and developers of digital platforms seeking to optimize delivery processes.

Key words: *digital transparency, delivery tracking, GPS trackers, IoT sensors, cloud technologies, last mile, logistics, predictive analytics, digital twins, blockchain.*

Introduction. Digital visibility of goods' whereabouts is the ability to share precise and up-to-date details about an item's place during its delivery journey by using advanced digital tools. For logistics, this involves GPS, IoT devices, mobile apps, and cloud software to keep track of and show the condition, place, and progress of a package in the supply chain. Digital visibility does not just make things work better, it also improves communication between everyone involved in delivering the products from makers to the consumers.

This study has relevance in view of the rapidly increasing demands by users for speedier and more accurate delivery of goods. As e-commerce grows and more purchases are made online, customers want more visibility and control over how their goods are delivered. They want to be able to track their orders in real time. This would help to elevate their satisfaction and loyalty to the service provider. In such a highly competitive logistics services market, firms that implement digital tracking solutions stand a better chance of enhancing their competitiveness as well as improving performance while reducing costs.

This article aims to explore the role of digital transparency in logistics and how it affects service quality and customer experience. It reviews the major

technologies that can afford delivery transparency, their benefits to businesses and consumers, and the challenges firms face in implementing them. It also analyzes prospects and further developments of digital solutions aimed at enhancing tracking and delivery processes, as well as improving their reliability and security.

Materials and Methodology. The study is based on a comprehensive analysis of industry market reports and practical case studies reflecting the state of digital delivery control technologies. For the quantitative assessment of the scale and growth rates of key transparency components, results from Grand View Research on the GPS tracker market [1], data from IoT Analytics on the number of connected IoT devices [2], and the Precedence Research report on the cloud logistics solutions market [3] were utilized. These sources enabled the determination of investment volumes and growth forecasts necessary for evaluating the economic feasibility of implementing end-to-end monitoring systems.

For the qualitative analysis, a content-analysis method and a comparative examination of practical digital transparency implementations were applied. The case studies examined include Project 44's initiative to reduce last-mile delivery time [4], the MoldStud example of telemetry exchange between retail partners [5], WISMO Labs' proactive notification mechanism [6], and the FedEx SenseAware platform for immediate response to cargo parameter deviations [7]. The analysis covered three technological layers: sensor layer (GPS trackers and IoT sensors), interface layer (mobile and web applications with route visualization and notifications), and cloud layer (storage, data aggregation, and API integrations). As a result, a methodology for evaluating transparency effectiveness was developed based on key metrics: status update accuracy and frequency, changes in delivery duration, reduction in call-center load, and the frequency of unexpected returns.

Results and Discussion. The key technical layer of digital transparency is the combination of satellite positioning and the Internet of Things: miniature GPS trackers, embedded in transport units or cargo batches, continuously transmit coordinates, while IoT sensors add temperature, vibration, and other parameters, forming a telemetry stream that can be analyzed frame by frame. The scale of the technology is already reflected in its economics: in 2024 the global GPS tracker market was valued at 4.04 billion USD and exhibits a CAGR of 17.4% through 2030 [1], as shown in Fig. 1, whereas the total number of connected IoT devices will reach 18.8 billion units by the end of 2024, 13% more than a year earlier [2]. Such sensor density allows for an almost continuous "lifeline" of each shipment and the instantaneous detection of route deviations or threats to cargo integrity.

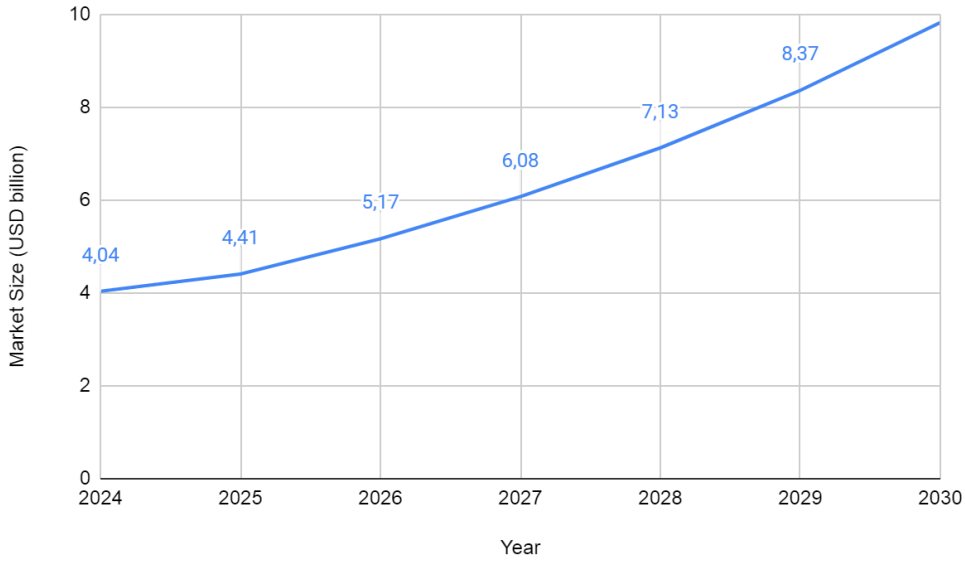

Fig. 1. GPS Tracker Market Size [1]

User interfaces form the second layer of transparency. Mobile apps and web portals unify the telemetry mass into a comprehensible narrative: the end user sees not raw coordinates and timestamps but a live map, a stage progress bar, and an arrival date recalculated to include traffic, weather, and warehouse throughput. Interactive notifications close the information gap between sender and recipient; once the system registers a status change, it pushes an alert to the

addressee, which reduces contact-center load while improving end-user satisfaction. At the same time, interfaces for couriers receive updated instructions that minimize empty trips and unplanned returns.

The third layer is the cloud infrastructure that links sensors, gateways, and client applications into a single computing fabric. Data from field devices flows into distributed storages, where it undergo cleansing, aggregation, and machine analytics, after which they are made available via APIs to partners and internal planning systems. The concentration of logistics processes in the cloud scales faster than local servers and provides elastic fault tolerance: in 2024 alone the cloud logistics solutions market reached 33.82 billion USD and is projected to triple by 2034 at an average annual rate of 13% [3], as shown in Fig. 2. This trend reflects the strategic role of the cloud as an operational backbone—without it neither the sensor stream nor real-time interfaces could deliver the declared level of transparency.

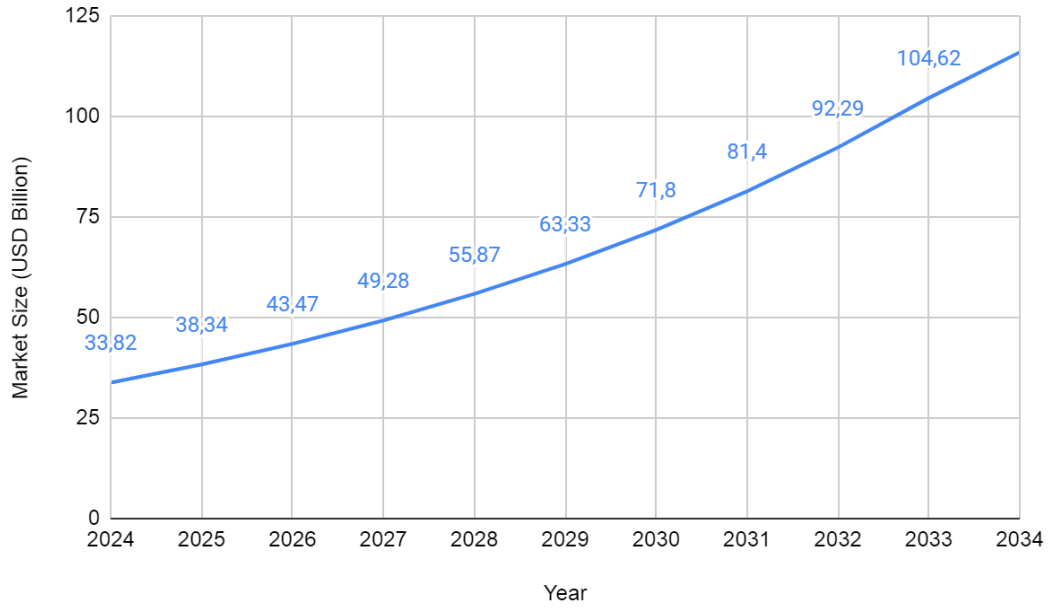

Fig. 2. Cloud Logistics Market Size [3]

Transparency built on the technologies described above primarily enhances trust. The ability to independently monitor a parcel's route reduces anxiety and

transforms logistics from a black box into a predictable service, thereby raising the likelihood of repeat purchases and positive feedback.

The level of data granularity received in real time accelerates the processes themselves: the average last-mile time in the USA decreased from 5.8 to 4 days in just two years, a 31% reduction directly attributed to the deployment of end-to-end visibility systems [4]. Concurrently, retailer surveys indicate that telemetry exchange among partners can further cut approximately 20% of calendar buffer in inter-warehouse stages by eliminating idle time [5].

The economic outcome is expressed not only in time but also in money. Customer support costs are reduced: for example, thanks to the Wismo platform—whose algorithm is presented in Fig. 3 — proactive status transmission reduces "Where is my order?" calls by 75–95%, offloading contact centers and freeing agents for complex inquiries [6].

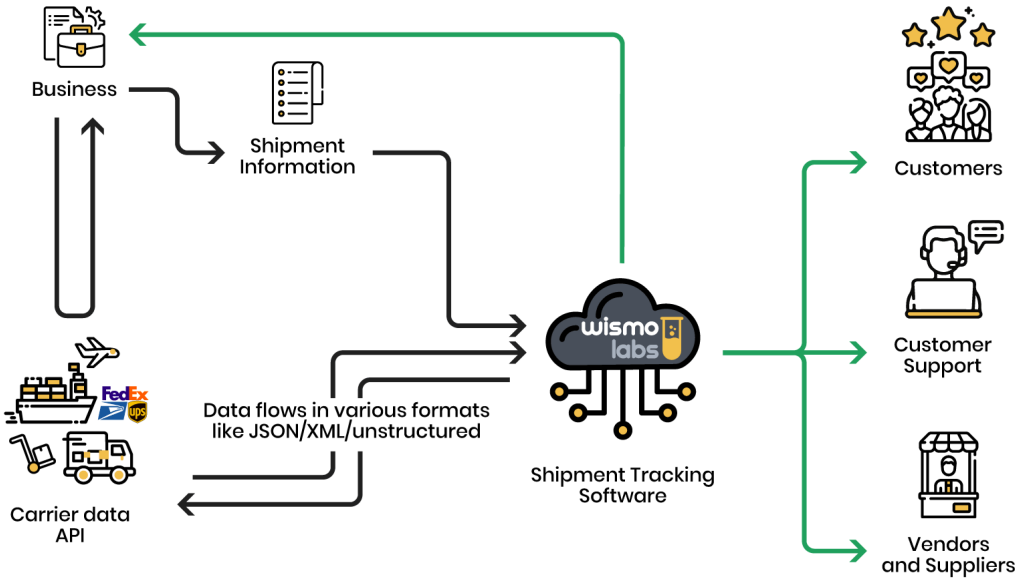

Fig. 3. Wismo platform working algorithm [6]

For the end consumer, transparency converts into a sense of control and security: temperature, shock, and tamper sensors integrated into the FedEx SenseAware service enable a deviation signal within seconds and immediate initiation of corrective actions, whether a change of transport or cargo insurance

[7]. In aggregate, these examples confirm that transparency has ceased to be a competitive advantage of a few and has become the hygiene minimum for all who intend to remain in the e-commerce chain.

Despite proven benefits, deployment of transparent logistics encounters three systemic barriers. The first is cyber risks: the denser the telemetry stream, the broader the attack surface. The second barrier is the integration of heterogeneous technologies. Data are fragmented across TMS, WMS, and external platforms, forcing companies to invest in intermediate buses and universal connectors, which extend payback periods. The third barrier is capital intensity. Although the global market for supply-chain management systems is growing at 11.2% per year, the absolute costs of infrastructure modernization often exceed IT department budgets, especially for mid-sized carriers that must update equipment and train personnel simultaneously [8]. Consequently, many organizations implement transparency in stages: first last-mile, then inter-warehouse transport, and finally reverse logistics.

The future of digital visibility is shaped by three technological trajectories. First, artificial intelligence: the AI solutions market for supply chains will enable a transition from retrospective monitoring to predictive ETAs and autonomous resource reallocation. Second, digital twins: the global segment of digital-twin platforms is expanding, opening the way to what-if simulations for routes and warehouses even before actual dispatch of cargo. Third, blockchain: it ensures immutability of movement records and automatic enforcement of guarantees through smart contracts. In the coming years, these models will scale beyond classic retail into pharmaceutical cold chains, agri-food exports, and project logistics for renewable energy, where precision and transparency become regulatory requirements rather than competitive options.

Thus, under conditions of rapid e-commerce growth and intense competition, digital transparency in delivery tracking becomes not merely a

desirable advantage but a necessary service standard: integration of GPS and IoT monitoring, intuitive user interfaces, and cloud platforms provides real-time data exchange, strengthens customer trust, and optimizes logistics chains. Companies seeking not only to meet current market expectations but also to set new standards of customer experience will inevitably adopt full-scale digital tracking as the foundation of sustainable logistics development.

Conclusion. In conclusion of the conducted study, it can be stated that digital transparency in tracking delivery statuses constitutes a key factor in enhancing the efficiency and reliability of logistics chains. Integration of satellite positioning and IoT sensors provides an almost continuous lifeline for shipments, allowing instantaneous response to deviations and threats to cargo integrity. User interfaces that consolidate telemetry into an intelligible chronology and are equipped with interactive notifications not only increase end-consumer satisfaction but also optimize contact-center and courier operations. Cloud infrastructure, acting as an operational backbone for sensors, gateways, and applications, ensures scalability, fault tolerance, and high data-processing speed.

Economic and operational benefits of digital transparency are confirmed by concrete metrics: reduction of average last-mile time in the USA from 5.8 to 4 days (–31%) thanks to end-to-end visibility, decrease of buffer inventory on interwarehouse stages by 20% due to telemetry exchange, as well as reduction of contact-center inquiries by 75–95% owing to proactive notifications. For the end consumer, temperature, shock, and tamper sensors convert logistics into a predictable and controllable service, which strengthens trust and increases the likelihood of repeat purchases.

At the same time, deployment of digital transparency faces three systemic barriers: the growth of cyber-risks with increased telemetry flow, challenges of integrating heterogeneous systems, and the capital intensity of infrastructure modernization. Addressing these issues requires a phased approach: prioritizing

implementation in critical segments such as the last-mile, parallel development of connectors, and staff training.

Prospects for further development of transparency in logistics lie in artificial intelligence, digital twins, and blockchain. The transition from retrospective monitoring to predictive ETAs, what-if modelling via digital twins, and application of smart contracts for immutable movement recording will create new service standards. In the coming years, these technologies will be applied not only in retail but also in pharmaceutical cold chains, agri-food exports, and project logistics for renewable energy. Integration of GPS and IoT monitoring, intuitive interfaces, and cloud platforms will become the hygiene minimum for all participants in e-commerce, laying the foundation for sustainable logistics development.

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