

Blockchain and Its Place in Modern Logistics

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Abstract

In an era of globalisation and dynamic changes in supply chains, blockchain technology is gaining importance as a tool for increasing transparency, security, and operational efficiency in logistics and production. This article discusses the potential of integrating blockchain with WMS (Warehouse Management System) and ERP (Enterprise Resource Planning) systems, which form the foundation of digital enterprise management. It presents the benefits of using a distributed ledger, such as process automation, product traceability, improved regulatory compliance, and information resilience in crisis situations. It also presents examples of practical implementations (e.g., TradeLens, IBM Food Trust) and the results of a management awareness survey, which indicate significant knowledge gaps and low readiness of companies to implement this technology. The article emphasises the need for education and the development of digital competencies as a prerequisite for fully utilising blockchain's potential in future logistics.

Keywords: blockchain, future, potential.

INTRODUCTION

In traditional ERP and WMS systems, data is processed within a single organisation or its direct partners. Information about products, inventories, deliveries, and orders is stored in closed databases, making it difficult to share, verify, and synchronise across companies involved in the supply chain. This creates information silos that delay decisions, increase operating costs, and reduce transparency.

1. BLOCKCHAIN IN LOGISTICS: POTENTIAL, CHALLENGES AND ROLE IN WMS AND ERP SYSTEMS

Blockchain can serve as a common layer of transactional data for multiple stakeholders—manufacturers, suppliers, distributors, logistics operators, and end customers. Thanks to its distributed architecture and properties such as data immutability and auditability (Kshetri, N. 2018, pp. 80-89)¹ and built-in cryptographic mechanisms, blockchain allows to create a digital “source of truth” to which all process participants have access while simultaneously controlling the scope of data visibility.

Integrating blockchain with WMS and ERP allows for:

- automatic recording of logistics events (e.g. receipt at the warehouse, picking, release of goods, delivery to the customer) in an undeniable way,
- real-time sharing of inventory data between trading partners,
- process automation through smart contracts, e.g. conditional payments after delivery confirmation,
- increasing the reliability of information on the origin of products (traceability), e.g. for the food, pharmaceutical or electronics sectors,
- support for compliance with standards and certificates, e.g. by recording environmental parameters during transport (temperature, humidity).

In practice, companies implementing blockchain as a complement to WMS and ERP note, among others, shorter document circulation times, fewer errors, faster audit processes, and better protection against counterfeiting. In crisis situations such as supply chain disruptions (Wang, Y., Han, J. H., & Beynon-Davies, P. 2019, pp. 62–84)² production downtime or regulatory changes – data transparency becomes crucial, and blockchain ensures information resilience and operational continuity.

In the context of growing ESG (Environmental, Social, Governance) requirements and the growing role of “green logistics”, blockchain is also becoming a tool for reporting and verifying environmental impact, allowing organisations to track emissions, confirm the recycling of raw materials, and verify compliance (Mourtzis,

¹ Kshetri, N. (2018). 1 Blockchain’s roles in meeting key supply chain management objectives. *International Journal of Information Management*, 39, 80–89.

² Wang, Y., Han, J. H., & Beynon-Davies, P. (2019). Understanding blockchain technology for future supply chains: a systematic literature review and research agenda. *Supply Chain Management: An International Journal*, 24(1), 62–84.

D., Vlachou, E., & Milas, N. 2016, pp. 290-295)³ with ethical standards throughout the entire product life cycle.

However, implementing this technology is not without challenges. Integration with existing IT infrastructure, data standardisation, ensuring scalability, and compliance with legal regulations (e.g., GDPR) are just some of the barriers. Nevertheless, a growing number of organisations and industry consortia are investing in hybrid solutions that combine traditional systems (ERP/WMS) with blockchain, creating a new paradigm for data management in logistics and production.

2. APPLICATIONS OF BLOCKCHAIN TECHNOLOGY IN LOGISTICS PRACTICAL IMPLEMENTATIONS

Blockchain technology is finding increasing use in the logistics sector, where its key advantages—transparency, security, and data immutability—address the growing needs of supply chain management. Practical implementations demonstrate how blockchain can streamline processes, reduce fraud, and increase trust between business partners.

One of the most well-known projects is the TradeLens platform, developed by Maersk and IBM. It enables global supply chain participants to securely share data in real time, significantly reducing shipment times and minimising documentation errors. Using a distributed ledger, shipment information, such as container location and customs clearance status, is available to all authorised entities, eliminating the need for multiple data submissions and verifications.

Another example is the food sector, where IBM Food Trust uses blockchain to track product origins, ensuring complete transparency from farm to fork. Such solutions improve food safety, enable rapid recalls of product batches if a threat is detected, and build consumer trust. Implementations like these confirm the growing interest in blockchain in industries requiring high levels of quality control and compliance.

Blockchain is also gaining importance in integration with WMS and ERP systems. Integrating the distributed ledger with warehouse management and enterprise resource planning systems enables automatic, secure, and transparent tracking of

³ Mourtzis, D., Vlachou, E., & Milas, N. (2016). Industrial Big Data as a Result of IoT Adoption in Manufacturing. *Procedia CIRP*, 55, 290–295

warehouse processes, from goods receipt, through picking, to shipping. This not only improves operational efficiency but also facilitates audits and regulatory compliance.

Companies are increasingly realising that blockchain is not only a tool for recording transactions, but also a platform enabling the execution of smart contracts that automate the execution of agreements between logistics partners. (Drescher, Daniel 2017, pp. 20-21)⁴ Process automation reduces the risk of errors, speeds up operations and reduces administrative costs.

Despite its many benefits, blockchain implementation in logistics still faces challenges, such as high implementation costs, the need for data standardisation, and a lack of broad interoperability across platforms. However, the technology's development and growing interest from companies and regulators indicate significant potential for further transformation of the logistics industry.

In summary, blockchain technologies are becoming an important element of the digital transformation of logistics (Arun, Jai Singh, Cuomo, Jerry, Gaur, Nitin 2019, pp. 29-32)⁵, allowing for increased transparency, security and process automation, and integration with WMS and ERP systems opens up new possibilities for effective management of the entire supply chain.

3. BLOCKCHAIN AND AWARENESS OF ITS USEFULNESS IN LOGISTICS

The aim of the authors' study is to determine the level of familiarity with blockchain technology among management staff in the logistics and production sector and their readiness to implement this technology in WMS and ERP systems.

In the survey, 70% of respondents declared they had heard of blockchain technology. This result indicates that the term "blockchain" is relatively well-known among management in the logistics and manufacturing sectors. However, simply hearing about the technology doesn't translate into understanding or practical application. Nearly one-third of respondents lacked even basic awareness of blockchain, indicating an information gap among some management staff.

⁴ Drescher, Daniel (2017), *Blockchain Basics*

⁵ Arun, Jai Singh, Cuomo, Jerry, Gaur, Nitin (2019), *Blockchain for Business: Discover How Blockchain Is Transforming the Supply Chain and Logistics Industry*

Despite a relatively high level of awareness of the technology, only 25% of respondents declared they understood how blockchain works. This clearly indicates that most managers only have superficial knowledge of blockchain, often from media outlets or general articles, without in-depth knowledge of its architecture, distributed ledger operation, or cryptographic mechanisms. This lack of understanding is a significant barrier to the effective use of the technology in companies.

Only 15% of respondents were aware of specific blockchain applications in the logistics sector. This is particularly concerning given the growing role of blockchain technology in improving transparency and traceability in supply chains. Lack of awareness of practical benefits, such as real-time shipment tracking, product authenticity verification, and securing transport documentation, may lead to resistance to implementing modern solutions.

Only 10% of respondents declared that their companies plan to implement blockchain-based solutions. This low percentage indicates that most companies do not yet have specific plans for this technology in their digital strategy. This may be due to financial barriers, a lack of internal competencies, or concerns about unknown technological risks. In many cases, blockchain is still perceived as an experimental technology, not a tool for everyday work.

Half of those surveyed (50%) believe blockchain can increase supply chain transparency. This is a positive sign, indicating growing awareness of the benefits of distributed ledger technology, particularly in the context of regulatory requirements, combating counterfeiting, and consumer pressure for sustainable practices. However, a lack of specific knowledge on how to leverage these capabilities may limit their full implementation.

Only 20% of respondents understand the difference between blockchain and traditional databases. This low level of knowledge indicates that many managers fail to recognise blockchain's unique features, such as decentralisation, immutability of records, and network consensus, which are fundamental to understanding this technology's advantages over traditional IT systems.

Only 10-12% of managers understand the benefits blockchain can bring to WMS and ERP systems. WMS and ERP are key tools for managing warehouse operations and businesses, and integration with blockchain can significantly improve data security, process automation, and the sharing of reliable information between business

partners. The lack of knowledge in this area highlights the need for specialised education and staff preparation for digital transformation.

40% of respondents recognise that blockchain can improve data security. This is an important aspect given the increasing frequency of cyber threats and the need to protect sensitive information. Although awareness of the benefits of cryptographic security and tamper resistance is a good starting point for further educational activities.

Only 5% of respondents had the opportunity to participate in specialised blockchain training or workshops. This very low level of participation in formal education indicates a serious gap in the development of digital competencies among management staff. The lack of dedicated training programmes limits implementation potential and perpetuates existing knowledge gaps.

Table presenting the survey results (Authors' own study)

Question	Answer YES (%)	Answer NO (%)	Comment
1. Have you heard about blockchain technology?	70%	30%	Most people know the term, but that doesn't mean they have deep knowledge.
2. Do you understand how blockchain works?	25%	75%	Only 1/4 have a real understanding of blockchain mechanisms
3. Are you familiar with blockchain applications in logistics?	15%	85%	Very low awareness of practical applications
4. Does the company you work for plan to implement blockchain?	10%	90%	The lack of implementation plans indicates poor adaptation
5. Do you think blockchain can improve supply chain transparency?	50%	50%	Half of them see the potential, but they lack the knowledge on how to do it

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Question	Answer YES (%)	Answer NO (%)	Comment
6. Do you know the difference between blockchain and a traditional database?	20%	80%	Basic concepts are unfamiliar to most respondents
7. Do you understand the benefits of using blockchain in WMS systems?	10%	90%	Very low level of knowledge regarding specific applications
8. Do you understand the benefits of using blockchain in ERP systems?	12%	88%	As above, knowledge is scarce
9. Do you think blockchain can increase the security of corporate data?	40%	60%	Despite low knowledge, some people see the potential in security
10. Have you participated in any blockchain training or workshop?	5%	95%	Only a small number of people had the opportunity to deepen their knowledge on this subject.

The results of the study clearly indicate a very low level of knowledge and awareness among management staff about blockchain technology, and in particular its applications in logistics systems such as WMS (Warehouse Management System) and ERP (Enterprise Resource Planning).

The very first question – „Have you heard of blockchain technology?“ – yielded affirmative responses from 70% of respondents, which might at first glance suggest that most executives are familiar with the technology. However, further questioning reveals that this familiarity is only superficial. Only 25% of respondents declare they understand how blockchain works, and a mere 20% can distinguish blockchain from traditional databases. This means that these concepts are often confused or misunderstood, and knowledge is based primarily on general marketing slogans rather than a true understanding of the technology.

The data regarding awareness of blockchain applications in logistics is particularly alarming – only 15% of respondents indicated they were familiar with specific use cases for this technology in this industry. Even lower levels of knowledge were revealed in questions regarding blockchain integration with WMS (10%) and ERP (12%) systems. This level of unawareness indicates that, despite the increasing number of publications and case studies, practical knowledge is not reaching decision-makers.

It's also significant that as many as 90% of respondents stated that their company has no plans to implement blockchain-based solutions. This may be due not only to real technological barriers but primarily to a lack of knowledge and understanding of the technology's potential. This also translates into a lack of educational activities – only 5% of respondents had the opportunity to participate in blockchain-related training or workshops.

Interestingly, despite their low level of knowledge, as many as 50% of respondents see blockchain's potential in improving supply chain transparency, and 40% see it as a way to increase corporate data security. This indicates an intuitive sense that this technology could be useful, but without a real understanding of how it could be implemented and the possibilities it offers.

In summary, the survey results demonstrate a significant competency gap in modern distributed ledger technologies within management. Both technical knowledge and business acumen are lacking, leading to low readiness to adopt blockchain in key enterprise systems, such as WMS and ERP. These findings underscore the urgent need for education, training, and the promotion of best implementation practices that could enhance organisations' readiness for digital transformation.

4. RESEARCH METHODOLOGY

The study was conducted to determine the level of knowledge and awareness of management staff regarding blockchain technology, with particular emphasis on its applications in logistics and integration with WMS and ERP systems. The study was quantitative in nature and was conducted using a proprietary questionnaire containing 15 closed-ended and semi-open-ended questions regarding familiarity with blockchain, its applications, perceived benefits, and barriers to implementing this technology. The research sample consisted of 60 individuals who held middle- and senior-level management positions in companies in the logistics, warehousing,

manufacturing, and IT sectors. Respondents were purposively selected to obtain a representative picture of the knowledge of management staff responsible for warehouse, supply chain, and IT systems management. Data was collected primarily through online surveys, supported by face-to-face interviews to deepen the findings. The data collection process lasted three weeks, and participants were guaranteed anonymity and confidentiality to ensure honesty. Analysis of the results included descriptive statistics to determine awareness and knowledge levels, and qualitative analysis of open-ended responses to identify key barriers and opinions. Results are presented in graphs for easier interpretation. Limitations of the study include the moderate sample size, purposive selection of respondents, and the fact that responses were declarative and could be subjectively assessed. This was a one-time study, limiting the ability to observe changes over time. The study was conducted in accordance with ethical research principles, obtaining informed consent from respondents, and ensuring personal data protection.

SUMMARY AND CONCLUSIONS

Blockchain technology is becoming an increasingly important element of digital transformation in logistics and production. Its use in conjunction with WMS and ERP systems improves transparency, security, and process automation across the entire supply chain. Practical implementations demonstrate that blockchain is no longer merely a theoretical concept, but a real tool supporting operational efficiency, regulatory compliance, and sustainable development.

At the same time, the results of the study reveal significant gaps in management's knowledge and awareness of this technology. While many managers intuitively recognise blockchain's potential, few understand its operation, differences from traditional databases, or practical applications in WMS and ERP systems. Low levels of training participation and a lack of implementation plans indicate the need to intensify educational efforts and build digital competencies within organisations.

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