UDC 339.1:004.056:658.5
JEL classification: L81, O33, M15, D23
https://doi.org/10.31891/dsim-2025-12(33)

DIGITALIZATION OF TRADE ENTERPRISES BUSINESS PROCESSES: TECHNOLOGICAL DETERMINANTS, ROI AND CYBER RISK MANAGEMENT

BIELIAIEVA Nataliia
PhD, Associate Professor, Associate Professor of the Department of Management
State University of Trade and Economics
https://orcid.org/0000-0001-8833-1493
e-mail: n.bieliaieva@knute.edu.ua
MYKOLAICHUK Iryna
PhD, Associate Professor, Associate Professor of the Department of Management
State University of Trade and Economics
https://orcid.org/0000-0001-7380-5000
e-mail: i.mykolaichuk@knute.edu.ua
RAHIMOV Samad
Researcher of the Faculty of Economics, Management and Psychology
specialty "Management", educational program "Business Management"
State University of Trade and Economics
https://orcid.org/0009-0007-4551-0804
e-mail: s.rahimov_femp_14am_24_m_d@knute.edu.ua

Digital transformation is an imperative for the retail sector, fundamentally changing the way the value is created and captured through technologies such as artificial intelligence (AI), the Internet of Things (IoT), and cloud architectures. While these tools provide significant operational efficiency gains – including up to 40% improvement in demand forecasting accuracy – realization of this potential is uneven. Measuring the net return on investment (Net ROI) is a pressing scientific and practical challenge, as growing digital risks, especially cyberthreats, can offset all operational benefits, requiring an integrated approach to evaluating investments. The net return on investment (Net ROI) from digitalizing retail business processes is a function not only of technology adoption (Gross ROI), but also of two key endogenous moderators: the organization's level of digital maturity (DMM) and the effectiveness of its cyber risk management system (Cyber Risk Discount). The study is based on a systematic analysis of the current economic literature, covering quantitative data on the impact of technologies on the operational efficiency of trade and empirical models of digital risk management. Current quantitative data on the impact of dominant technologies (AI, IoT) on key operational indicators of trade is clustered, providing an empirical basis for calculating Gross ROI. The results demonstrate that unintegrated digital solutions (low DMM) reduce potential ROI by 2-3 times, while an immature security posture leads to significant losses of customer trust (82% of customers may abandon the brand) and direct financial losses. The DMM-Risk-ROI model is substantiated, providing a holistic toolkit for assessing the sustainability of digital investments. The DMM-Risk-ROI model allows management to shift cybersecurity investments from a passive expense (compliance) to an active strategic investment necessary to preserve and maximize the net profit gained from digitalization. To increase Net ROI, retail companies must simultaneously invest in technology (AI/IoT), data integration (DMM), and institutional protection (Cyber Risk Management).

Keywords: Digitalization, Business Process, Artificial Intelligence, Digital Maturity, Cyber Risks, Cybersecurity, Supply Chain, ROI.

ЦИФРОВІЗАЦІЯ БІЗНЕС-ПРОЦЕСІВ ТОРГОВЕЛЬНИХ ПІДПРИЄМСТВ: ТЕХНОЛОГІЧНІ ДЕТЕРМІНАНТИ, ROI ТА УПРАВЛІННЯ КІБЕРРИЗИКАМИ

БІЛЯЄВА Наталія, МИКОЛАЙЧУК Ірина, РАГІМОВ Самад
Державний торговельно-економічний університет

Цифрова трансформація є імперативом для роздрібної торгівлі, докорінно змінюючи способи створення та отримання цінності завдяки таким технологіям, як штучний інтелект (AI), Інтернет речей (IoT) та хмарні архітектури. Хоча ці інструменти забезпечують значне підвищення операційної ефективності — зокрема до 40% покращення точності прогнозування попиту — реалізація цього потенціалу є нерівномірною. Вимірювання чистої рентабельності інвестицій (Net ROI) є актуальною науковою та практичною проблемою, оскільки зростаючі цифрові ризики, особливо кіберзагрози, можуть нівелювати всі операційні вигоди, вимагаючи інтегрованого підходу до оцінювання інвестицій.

Чиста рентабельність інвестицій (Net ROI) від цифровізації бізнес-процесів у роздрібній торгівлі є функцією не лише рівня впровадження технологій (Gross ROI), але й двох ключових ендогенних модераторів: рівня цифрової зрілості організації (DMM) та ефективності її системи управління кіберризиками (Cyber Risk Discount). Дослідження ґрунтується на систематичному аналізі сучасної економічної літератури, що охоплює кількісні дані щодо впливу технологій на операційну ефективність торгівлі та емпіричні моделі управління цифровими ризиками.

Актуальні кількісні дані щодо впливу домінантних технологій (AI, IoT) на ключові операційні показники торгівлі кластеризовано, що забезпечує емпіричну основу для розрахунку Gross ROI. Результати демонструють, що неінтегровані цифрові рішення (низький DMM) знижують потенційний ROI у 2–3 рази, а незріла система безпеки призводить до суттєвих втрат довіри клієнтів (82% споживачів можуть відмовитися від бренду) та прямих фінансових збитків. Обґрунтовано модель DMM-Risk-ROI, яка забезпечує цілісний інструментарій для оцінки стійкості цифрових інвестицій.

Модель DMM-Risk-ROI дозволяє менеджменту перетворити інвестиції в кібербезпеку з пасивних витрат (комплаєнс) на активну стратегічну інвестицію, необхідну для збереження та максимізації чистого прибутку від *цифровізації. Для підвищення Net ROI компаніям роздрібної торгівлі необхідно одночасно інвестувати в технології (AI/IoT), інтеграцію даних (DMM) та інституційний захист (управління кіберризиками).*

Ключові слова: цифровізація, бізнес-процес, штучний інтелект, цифрова зрілість, кіберризики, кібербезпека, ланцюг постачання, ROI.

Стаття надійшла до редакції / Received 27.10.2025
Прийнята до друку / Accepted 18.11.2025

PROBLEM STATEMENT AND ITS RELATIONSHIP WITH IMPORTANT SCIENTIFIC AND PRACTICAL TASKS

The modern economy is experiencing a phase of intense digital transformation that goes beyond simple automation. In that way digitalization exists as the process of using interconnected technologies, including cloud computing, IoT architectures, AI analytics, blockchain, to generate fundamental changes in the way value is created and captured at the organizational and societal levels. Especially for retail enterprises, this process is a critical imperative for survival and competitiveness. The weakening of social interactions caused by global events has accelerated the development of e-commerce, mobile applications and contactless services, which have now become commonplace for consumers.

The practical tasks of retail enterprises are focused on optimizing key processes: inventory management, logistics, pricing and personalized customer interaction. The scientific task is to develop valid methods for assessing the economic return on these large-scale investments. Traditional models for measuring return on investment (ROI) often fail to take into account the complex interplay between technological potential, the internal capacity of the organization to realize this potential (digital maturity), and the increasing costs associated with digital risks, such as cybercrime. The problem of measuring the net economic effect (Net ROI) in the context of digitalization remains central to both academic theory and business management. Thus, taking into account technological determinants and cyber risks becomes particularly important for retail businesses in the context of constant digitalization.

ANALYSIS OF RESEARCH AND PUBLICATIONS

Research analysis confirms that the current digitalization of trade is based on three dominant technology clusters: e-commerce platforms and cloud services, IoT solutions for the supply chain, and AI analytics. AI analytics is the most dynamic research area, especially in Northern Europe and East Asia, at the same time, it is predicted that more and more companies will take it into consideration.

The economic impact of these technologies is significant from year to year. In particular, research shows that the implementation of e-commerce and cloud services consistently increases the export intensity of enterprises, sometimes doubling it for firms that have achieved high digital maturity [11]. In terms of operational efficiency (OE), AI solutions for supply chain management (SCM) have proven their transformative power, providing, for example, a 30–40% improvement in demand forecasting accuracy and a 25% reduction in excess inventory [2]. Oriekhoe et al. argue that blockchain technology has become a transformative force in addressing these challenges by offering a decentralized and secure framework for supply chain management [14]. Such a quantitative impact demonstrates a direct link between advanced digital technologies and productivity gains. In addition to theoretical generalizations, researchers offer practical methodological recommendations aimed at implementing restructuring processes in enterprises under martial law in Ukraine, thereby enhancing business adaptability and resilience to external threats [22].

However, the scientific literature clearly indicates that the benefits of digitalization are unevenly distributed and depend on external and internal factors. Researchers argue that the trade-enhancing effects of digitalization are contingent on reliable national infrastructure (broadband), the availability of cloud services, and harmonized data governance regimes [4; 5; 12]. According to Benjamin et al., the most significant constraints are cybersecurity and regulatory fragmentation [2]. Threats from hacker attacks, data leaks, and unauthorized access complicate the implementation of enterprise development strategies and lead to a decline in customer trust [1; 13]. This indicates that achieving high operational efficiency is a necessary but not sufficient condition for obtaining net economic profit.

UNRESEARCHED PARTS OF THE PROBLEM STATEMENT

Despite the significant amount of research on both the potential of technologies (AI, IoT) and the risks (cybersecurity), there remains a gap in the academic literature on integrated quantitative modeling. Existing approaches often consider digital maturity (DMM) as a qualitative indicator and cyber risks as an external factor, resulting in a lack of tools that would holistically assess the investment process.

A previously unsolved problem is the lack of a conceptual model that would provide a quantitative link between:

1. Operational efficiency potential: Gross ROI generated by technologies (Table 1).

2. Execution capability: The DMM adjustment factor that determines how effectively an enterprise transforms potential into real results (e.g., overcoming data silos) [21].

3. Risk Discounting: Quantifying the impact of cybersecurity maturity as a factor that reduces Net ROI through direct incident costs and indirect loss of customer trust [9]. This is compounded by an “optimistic bias” in management’s perception of risk [16], leading to under-allocation of resources to critical protective measures [6].

OBJECTIVE FORMULATION

The main goal of the article is to propose and substantiate a conceptual way for integrating the assessment of digital maturity of trade business processes with cyber risk management mechanisms, which will allow maximizing and quantifying the net economic effect (Net ROI) from digital transformation.

RESEARCH MATERIAL PRESENTATION

In order to reveal the topic of the article, it is necessary to analyze three main factors that together have a synergistic relationship: technological determinants of operational efficiency, digital maturity, cyber risk management.

1. Technological Determinants of Operational Efficiency: AI, IoT and Blockchain in Retail. Digitalization in retail is focused on optimizing key business processes that directly impact financial performance and competitiveness. Among the dominant technologies that shape Gross ROI, AI, IoT and Blockchain stand out, operating in synergy.

1.1. AI and predictive capabilities. Artificial intelligence plays a crucial role in transforming inventory management and logistics. Using advanced machine learning algorithms, retailers can analyze large volumes of historical sales data and identify new consumer trends, which significantly increases the accuracy of demand forecasts [15]. Thanks to this ability, AI systems can provide a 30–40% improvement in forecasting accuracy [2]. Such high accuracy directly affects operational efficiency, as it allows you to optimize stock replenishment, reducing excess inventory by up to 25% [19]. Reducing excess inventory reduces holding costs and minimizes write-off risks, especially for perishable goods [5]. In addition, AI analytics enables data-driven decisions to optimize pricing and marketing campaigns, which can lead to a 10–15% increase in margin capture [2].

1.2. IoT, Logistics and Technology Synergy. The Internet of Things (IoT) provides real-time visibility into the supply chain, monitoring inventory and identifying potential bottlenecks. When data collected by IoT is integrated with AI algorithms, significant synergies are achieved, for example in the areas of route optimization and automatic replenishment. This leads to a 20–30% improvement in on-time delivery (OTD) [2]. Research from 2025 shows that AI solutions for logistics and transportation can also reduce transportation costs by 5–10% [21].

1.3. Blockchain for Traceability and Trust. Blockchain technology provides transparency and immutability of transaction records in the supply chain [14]. This is critical for retailers as it allows them to prove product authenticity, ensure reliable traceability, and monitor compliance with environmental, social, and governance (ESG) standards [20]. By increasing transparency and trust, blockchain helps streamline payment processes and prevent counterfeiting.

The following table summarizes the quantitative results that form the basis for calculating Gross ROI (Table 1).

2. Digital Maturity (DMM) as a Moderator of Potential Realization. Getting a high Gross ROI from the technologies described above is not automatic. Research shows that a key factor determining an enterprise’s ability to transform technological potential into real financial results is its level of digital maturity (Digital Maturity Model, DMM) [7; 8].

Table 1

Quantitative Impact of Dominant Technologies on Retailers’ Operational Efficiency

Business Process	Dominant Technologies	Key Performance Indicator (KPI)	Average Improvement
Inventory Management	AI Forecasting Models	Demand Forecast Accuracy	30,0–40,0
Inventory Management	AI Forecasting Models	Reduction of inventory excesses	25,0
Logistics and Fulfillment	AI Route Optimization, IoT	On-Time Delivery (OTD) Improvement	20,0–30,0
Logistics	Integrated AI platforms	Reducing transportation costs	5,0–10,0
Reverse Logistics	Automated Routing (AI)	Reduction in Returns Processing Time	20,0

Source: compiled based on [2; 19; 21]

2.1. The essence and role of DMM. Digital maturity is a structured framework that assesses not only the fact of the presence of technologies, but also the ability of an organization to integrate them into its operations, decision-making processes and long-term strategy [7]. DMM is critically important because it acts as a moderator between investment and return. If a company has low maturity (for example, data is stored in isolated systems - data silos), its investment in AI will not bring significant results, as the algorithms will lack high-quality integrated data for optimal performance.

Research confirms that organizations that implement unified AI platforms and have an integrated data foundation (high DMM) achieve 2–3 times higher ROI compared to those that use disparate, isolated “point” solutions [8; 21]. This explains why strategic planning for digitalization through DMM is indispensable: the maturity model allows you to translate abstract goals, such as "increasing operational efficiency," into concrete criteria for improvement.

2.2. Identifying Maturity Gaps. Low digital maturity in retail enterprises, especially in the early stages of transformation, is often associated with specific capability gaps:

1. Infrastructure inadequacy: Lack of a robust technology foundation capable of supporting resource-intensive AI systems.

2. Data issues: Insufficient quality, volume, or lack of integration of data that hinders the successful operation of AI systems.

3. Talent shortage: Lack of qualified specialists in the field of AI technologies and analytics.

The DMM acts as a roadmap for continuous transformation, indicating that, for example, data weakness requires investment not only in software, but also in improving infrastructure and staff skills [10; 17; 19].

3. Cyber Risk Management: A Discounting Factor for Net ROI. The rapid integration of digital technologies has dramatically increased the attack surface of retail businesses. The retail sector, which handles a large amount of sensitive data (PII, payment data), is one of the main targets. Cybersecurity has evolved from a technical control issue to a fundamental pillar of business continuity and the preservation of net economic impact [1].

3.1. Quantifying the Impact of Cyber Risks on ROI. Cyber risks act as a powerful discounting factor that directly reduces Net ROI. This impact manifests itself through two main categories of losses:

1. Direct Financial Costs: Cyber incidents require immediate increased investment in security measures, software, training of personnel and incident response teams, which leads to overspending of financial assets [3].

2. Indirect Losses (Loss of Trust and Customer Departure): Loss of trust is the most serious indirect financial risk. With 82% of consumers willing to abandon a brand due to concerns about privacy and data security, a security breach can quickly offset any operational efficiency gains [18]. Customer churn following incidents is directly related to their severity and significantly reduces long-term revenue [13].

3.2. The Business Case for Cybersecurity Maturity. Investing in cybersecurity maturity is not just a compliance cost, but a strategic investment that improves financial resilience. A mature security posture delivers significant cost savings:

- organizations with a mature system can achieve 25.9% savings in incident-related costs due to faster threat detection and response [9];
- furthermore, 78% of enterprises that have not been audited for compliance with standards (e.g. PCI DSS for payment systems) have also experienced a data breach, compared to only 21% of those that have been audited. This demonstrates the direct relationship between security maturity and the prevention of costly incidents (Table 2).

Table 2

Impact of cyber risks and cybersecurity maturity on economic performance (ROI)

Type of Impact	*Risk Factor*	*Business Outcome*	*Quantitative Effect / Change*
Direct Financial Losses	Response and recovery costs	Decreased net profit	Increased security investment required
Indirect Revenue Losses	Reputation Loss / Privacy Breach	Customer Churn	82,0% of customers may abandon a brand
Operational Savings	Security Posture Maturity	Incident Response Savings	25,9% Savings
Regulatory Risk	Low maturity/non-compliance	Fines and reputational damage	78,0% of companies that failed an audit experienced a leak

Source: compiled based on [9; 11; 13]

3.3. Adapting Frameworks for Retailers. For retailers, who often face high fixed digital costs and limited resources, implementing comprehensive top-down cybersecurity standards is problematic [4]. This requires the development of adaptive, bottom-up frameworks that focus on three pillars: Governance, Culture, and Standards [11]. This approach, built on the Plan-Do-Check model, allows retailers to more effectively manage the risks generated by the implementation of new technologies such as IoT and AI, taking into account their specific needs and resource constraints.

4. DMM-Risk-ROI Conceptual Model for Retailers. To address the unresolved issue of integrated investment assessment, a conceptual model is proposed that formalizes the relationship between technology, maturity, and risk. This model allows us to move from a simple assessment of technological potential to calculating the net economic effect.

The DMM-Risk-ROI conceptual model defines Net ROI as a function where:

$$Net\ ROI = \frac{\text{Gross ROI}}{\text{DMM Factor}} - \text{Cyber Risk Discount} \quad (1)$$

1. Gross ROI (Operational Efficiency Potential): calculated based on quantitative improvements in key operational indicators (KPIs) achieved through AI, IoT, and other technologies (Table 1). For example, savings on transportation costs and inventory.

2. DMM Factor (Correcting Moderator): This is a coefficient (from 0 to 1) that reflects the degree of integration of digital solutions and the organization's ability to overcome data silos and personnel gaps. The higher

the maturity (higher DMM Factor), the closer the realized ROI is to the potential Gross ROI. Organizations with low maturity have a DMM Factor that reduces the potential return by 2–3 times [21].

3. Cyber Risk Discount: This is a quantitative assessment of the expected or actual costs associated with digital risks, including the costs of prevention (investment in security maturity) and the estimate of the loss of LTV (Lifetime Value) of customers due to a breach of trust (Table 2).

This model provides strategic managers with a tool to assess that insufficient attention to DMM (as an internal capability) or cybersecurity (as a defense mechanism) automatically reduces the profitability of digital investments, regardless of the strength of the implemented technologies. Thus, investments in cybersecurity and the development of digital maturity (e.g., staff training and system integration) become not additional costs, but a necessary condition for ensuring a positive Net ROI.

The widespread application of this model also has important implications for national policy. If governments do not ensure harmonized data regulation and do not invest in national digital infrastructure, this creates structural obstacles (increasing Cyber Risk Discount and decreasing DMM Factor at the country level), which can limit the growth potential for all trading entities.

CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

In conclusion, it is appropriate to note that the study confirms the hypothesis that the net economic effect (Net ROI) from the digitalization of business processes in retail enterprises is an integrated function of technological potential, digital maturity, and cyber risk management. Achieving high operational efficiency – for example, a 30–40% improvement in forecasting accuracy enabled by artificial intelligence – primarily generates a high Gross ROI. A critically important finding is that this potential efficiency does not translate into sustainable net profit without two key mechanisms: digital maturity (DMM), which determines whether technologies can operate in an integrated environment, and cyber risk management as a discount factor that protects Net ROI. Insufficient attention to cybersecurity leads to irreversible reputational losses (up to 82% of customers may be lost) and direct financial costs that may exceed operational savings. In contrast, investments in a mature security posture provide 25–29% savings on costs associated with cyber incidents.

References

1. Abrahams T. O., Ewuga S. K., Dawodu, S. O., Adegbite, A. O., & Hassan, A. O. (2024). A Review of Cybersecurity Strategies in Modern Organizations: Examining the Evolution and Effectiveness of Cybersecurity Measures for Data Protection. *Computer Science & IT Research Journal,* 5(1), 1-25. https://doi.org/10.51594/csitrj.v5i1.699
2. AI in Retail Supply Chain (2025) *ThroughPut AI*. Available at: https://throughput.world/blog/ai-in-retail-supply-chain/
3. Benjamin, L.B., Adegbola, A.E., Amajuoyi, P., Adegbola, M.D. and Adeusi, K.B. (2024). Digital transformation in SMEs: Identifying cybersecurity risks and developing effective mitigation strategies. *Global Journal of Engineering and Technology Advances*, 19(2). DOI: https://doi.org/10.30574/gjeta.2024.19.2.0084
4. Bieliaieva, N., Sova, O., Ganushchak, T., Zhuk, O., Matusova, O. (2021) Digitalization of the financial subsystem of industrial enterprise: Points of implementation. *International Conference on Sustainable, Circular Management and Environmental Engineering (ISCMEE 2021), E3S Web Conf, 255.* https://doi.org/10.1051/e3sconf/202125501045
5. Chen, W., Men, Y., Fuster, N., Osorio, C., & Juan, A. A. (2024). Artificial Intelligence in Logistics Optimization with Sustainable Criteria: A Review. *Sustainability*, *16*(21), 9145. https://doi.org/10.3390/su16219145
6. Erondu, C. I., & Erondu, U. I. (2023). The Role of Cyber security in a Digitalizing Economy: A Development Perspective. *International Journal of Research and Innovation in Social Science*, 7(11), 1558-1570. https://doi.org/10.47772/ijriss.2023.7011121
7. Hosseini Nasab, S. M. (2025). A maturity-driven selection model for effective digital transformation governance mechanisms in large organizations. *Kybernetes*, *54*(9), 5106-5132. https://doi.org/10.1108/K-10-2023-2136
8. Kalender, Z. T., & Žilka, M. (2024). A comparative analysis of digital maturity models to determine future steps in the way of digital transformation. *Procedia Computer Science*, *232*, 903-912. https://doi.org/10.1016/j.procs.2024.01.090
9. Koolen C., Wuyts K., Joosen W., Valcke P. (2024) From insight to compliance: Appropriate technical and organisational security measures through the lens of cybersecurity maturity models. *Computer Law & Security Review*, 52. https://doi.org/10.1016/j.clsr.2023.105914
10. Melnychenko S., Lositska T., Bieliaieva N.(2022) Digitalization of the HR-management System of the Enterprise in the Context of Globalization Changes. *Financial and Credit Activity Problems of Theory and Practice*,6, 41. 534–543. doi: https://doi.org/10.18371/fcaptp.v6i41.25152712
11. Metin, B., Özhan, F. G., & Wynn, M. (2024). Digitalisation and Cybersecurity: Towards an Operational Framework. *Electronics*, *13*(21), 4226. https://doi.org/10.3390/electronics13214226
12. Mirzaye S., Mohiuddin M. (2025) Digital Transformation in International Trade: Opportunities, Challenges, and Policy Implications. *MDPI*, *J. Risk Financial Manag. 18*(8), 421. https://doi.org/10.3390/jrfm18080421
13. Kurolow M., Utkirovna E. (2024) Quantifying the Impact of Cyber Security Risks on Digital Marketing ROI: A Case Study Analysis. *Internet of Things, Smart Spaces, and Next Generation Networks and Systems.* DOI: 10.1007/978-3-031-60994-7_33
14. Oriekhoe, O. I., Oyeyemi, O. P., Bello, B. G., Omotoye, G. B., Daraojimba, A. I., & Adefemi, A. (2024). Blockchain in supply chain management: A review of efficiency, transparency, and innovation. *International Journal of Science and Research Archive*, *11*(1), 173-181. DOI: https://doi.org/10.30574/ijsra.2024.11.1.0028
15. Rajenda G.Y., Raj G. (2025) Cost Reduction Strategies in Retail: Implementing AI-Driven Demand Forecasting for Inventory Optimization. *International Journal of Research in Modern Engineering and Emarging Technology*, 13, 03. https://doi.org/10.63345/ijrmeet.org.v13.i3.5
16. Salzberger A. (2025) The optimistic bias in cyber risk perception of German enterprises: do organizational and personal moderators matter?". *Organizational Cybersecurity Journal: Practice, Process & People*, Vol. 5 No. 1 pp. 5–25, doi: https://doi.org/10.1108/OCJ-02-2024-0003
17. Sova, O., Bieliaieva, N., Antypenko, N., Drozd, N. (2023). Impact of artificial intelligence and digital HRM on the resource consumption within sustainable development perspective, *E3S Web of Conferences (International Conference on Sustainable, Circular Management and Environmental Engineering (ISCMEE 2023)),* 408, 01006. https://doi.org/10.1051/e3sconf/202340801006

18. Sova, O., Bieliaieva, N., Khmurova, V., Khrapkina, V. (2023). Evaluation of the Business Process Sustainable Value Chain Based on Enterprise Cost Management. *Circular Business Management in Sustainability. ISCMEE 2022. Lecture Notes in Management and Industrial Engineering*. Springer, Cham. https://doi.org/10.1007/978-3-031-23463-7_10

19. State of AI in Retail and CPG Annual Report – 2024. *NVIDIA*. Available at: https://images.nvidia.com/aem-dam/Solutions/documents/retail-state-of-ai-report.pdf

20. Subramanian, Nachiappan & Chaudhuri, Atanu & Kayikci, Yasanur. (2020). Blockchain Applications in Retail Supply Chain. *Blockchain and Supply Chain Logistics*. DOI: 10.1007/978-3-030-47531-4_6

21. Supply Chain AI Trends - 46% of Firms Already See Breakthrough ROI from AI (2025) *Deposco*. Available at: https://deposco.com/blog/supply-chain-ai-trends-adoption/

22. Zavidna, L.D., Mykolaichuk, I.P., & Namliiev,Yu. (2024). Restructuring of business as a strategy for enterprise adaptation to wartime conditions. *International Interdisciplinary Scientific Journal "Expert"*, 1(3), 5–28. https://doi.org/10.62034/2815-5300/2024-v1-i3-001