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AUTOMATION OF BUSINESS PROCESSES AND ITS IMPACT ON THE FINANCIAL PERFORMANCE OF RETAIL ENTERPRISES: EXPERIENCE OF GERMANY AND UKRAINE

Abstract. This work explores the influence of automation and digitalization on the financial performance of retail enterprises through a comparative analysis of Germany and Ukraine. By examining secondary data and recent reports, the research identifies how the adoption of advanced technologies—such as AI, robotics, and e-commerce tools—affects revenue growth, profitability, and operational efficiency. The work reveals that German retailers benefit from a higher level of automation supported by advanced infrastructure, favorable government policies, consumer readiness, and access to capital, resulting in stronger financial outcomes. In contrast, Ukrainian retail businesses are still in the early stages of digital transformation, constrained by infrastructural limitations and a less developed regulatory and financial environment.

The analysis focuses on six major dimensions: technological infrastructure, government policies, consumer behavior, access to capital, workforce readiness, and digital skills. Based on recent economic data and modeled through a multivariate regression framework, the results reveal a strong positive association between the level of technological and institutional development and retail profitability indicators. Descriptive statistics show substantial cross-country differences, with Germany exhibiting more advanced infrastructure and investment levels. These findings underscore the importance of coordinated policy, investment in innovation, and human capital development in driving the digital transformation and financial resilience of the retail sector.





Keywords: information technologies, information systems, retail trade, retail automation, technological innovation, automation impact.

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АВТОМАТИЗАЦІЯ БІЗНЕС-ПРОЦЕСІВ ТА ЇЇ ВПЛИВ НА ФІНАНСОВІ РЕЗУЛЬТАТИ ПІДПРИЄМСТВ РОЗДРІБНОЇ ТОРГІВЛІ: ДОСВІД НІМЕЧЧИНИ ТА УКРАЇНИ

Анотація. Ця робота досліджує вплив автоматизації та цифровізації на фінансові показники підприємств роздрібною торгівлі шляхом порівняльного аналізу Німеччини та України. Вивчаючи вторинні дані та останні звіти, дослідження визначає, як впровадження передових технологій, таких як штучний інтелект, робототехніка та інструменти електронної комерції, впливає на зростання доходів, прибутковості та операційної ефективності. Робота показує, що німецькі роздрібні торговці вииграють від вищого рівня автоматизації, що підтримується розвиненою інфраструктурою, сприятливою державною політикою, готовністю споживачів і доступом до капіталу, що призводить до кращих фінансових результатів. Навпаки, український роздрібний бізнес все ще перебуває на ранніх етапах цифрової трансформації, обмежений інфраструктурними обмеженнями та менш розвиненим регуляторним і фінансовим середовищем.

Аналіз зосереджений на шести основних вимірах: технологічна інфраструктура, державна політика, поведінка споживачів, доступ до капіталу, готовність робочої сили та цифрові навички. Результати, засновані на останніх економічних даних та змодельовані за допомогою багатовимірної регресійної моделі, виявляють сильний позитивний зв'язок між рівнем технологічного та інституційного розвитку та показниками прибутковості роздрібною торгівлі. Описова статистика демонструє суттєві відмінності між країнами, причому Німеччина демонструє більш розвинуту інфраструктуру та рівень інвестицій. Ці висновки підкреслюють важливість скоординованої політики, інвестицій в інновації та розвитку людського капіталу для стимулювання цифрової трансформації та фінансової стійкості сектору роздрібною торгівлі.





Ключові слова: інформаційні технології, інформаційні системи, роздрібна торгівля, автоматизація роздрібною торгівлі, технологічні інновації, вплив автоматизації.

Formulation of the problem. The retail sector has undergone significant changes in recent years due to advances in automation and digitalization. Technologies such as artificial intelligence, robotics, and e-commerce platforms have transformed the way retailers work, enabling them to increase efficiency, reduce costs, and improve customer engagement. However, the adoption of these technologies varies significantly across countries, depending on economic development, infrastructure, and regulatory environments.

How does the level of automation and digitalization affect the financial performance of retailers in different regions, including Germany and Ukraine? To answer this question, the following objectives need to be met:

1. To compare the adoption of automation and digitalization in the retail sectors in Germany and Ukraine.
2. To analyze the relationship between automation and financial performance (e.g., revenue growth, profitability, cost efficiency).
3. To identify factors that influence the differences in performance between the two countries.

Analysis of research and publications. Studies of automation and digitalization adoption in developed and developing economies highlight significant differences. For example, Eurostat [1] reported that 85% of retailers in Germany have implemented advanced digital tools, while in Ukraine this figure is below 40% [2]. These differences are explained by factors such as the quality of infrastructure, access to capital, and consumer readiness [3].

This work relies on secondary data from authoritative sources, including government statistics, industry reports, and academic journals. Data on the level of automation and digitalization were obtained from Eurostat, the State Statistics Service of Ukraine, and industry reports from McKinsey and PwC. Financial indicators were analyzed using retail statistics and corporate financial statements.

Objective. The objective of this work is to examine the correlation between higher levels of automation and the financial performance of retail enterprises, as well as to identify the key factors influencing the strength and extent of this relationship.

The main material.

Germany and Ukraine represent two fundamentally different economic environments, which significantly influence the pace and nature of retail automation. Germany, as one of the world's largest and most developed economies, boasts a stable institutional framework, high levels of investment in innovation, and a mature digital infrastructure. In contrast, Ukraine, while demonstrating rapid growth in digital sectors, is still transitioning toward a more robust and technology-driven



economy, facing structural and financial challenges. These differences shape the opportunities and limitations retail enterprises face in adopting automation technologies.

Automation in Germany. Germany is a global leader in the automation and digitalization of retail. The country's well-developed infrastructure, high internet penetration [4], and strong regulatory framework have facilitated the adoption of advanced technologies. For example, German retailers such as Aldi and Zalando have implemented inventory systems and automated warehouses managed by artificial intelligence, which has led to significant cost savings and increased profitability [5].

The German retail automation market was valued at approximately \$27.01 billion in 2024 and is projected to reach \$48.91 billion by 2030, growing at a compound annual growth rate (CAGR) of 10.4% during the forecast period [6].

The German Retail Automation Market Growth by year is shown in fig.1.

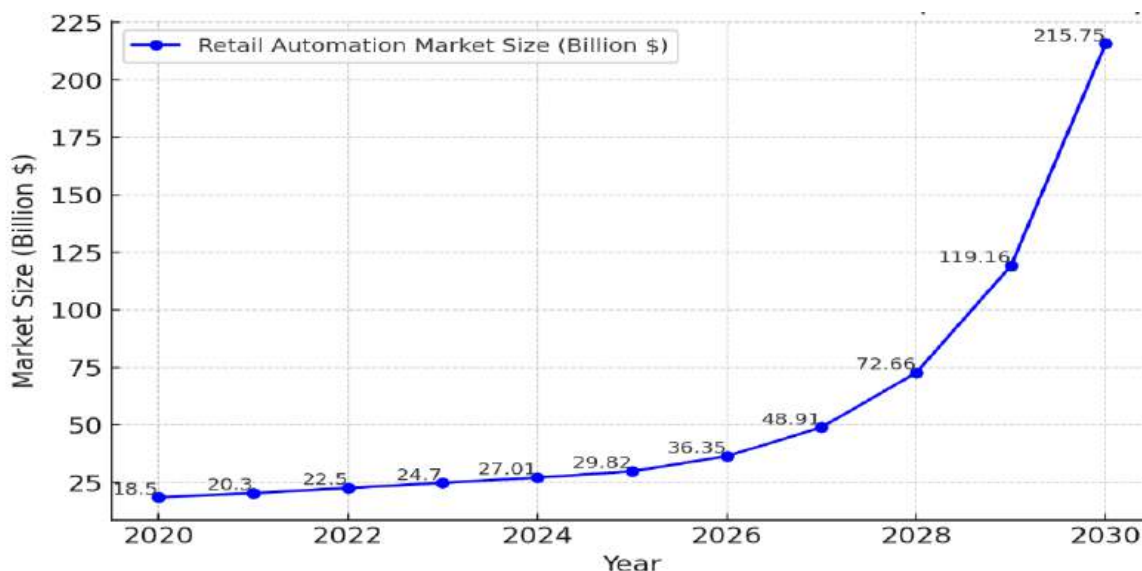


Fig. 1. German Retail Automation Market Growth

Source: developed based on [6]

German retailers have been proactive in adopting various automation technologies. For instance, the implementation of self-checkout systems has streamlined the customer purchasing process, reducing the need for extensive cashier staff and enhancing operational efficiency [7]. Additionally, the use of electronic shelf labels (ESLs) has enabled dynamic pricing and real-time product information updates, further optimizing store operations [8]. Automation in warehouse operations has led to significant improvements in inventory management and order fulfillment [9]. Automated storage and retrieval systems (ASRS) and autonomous guided vehicles (AGVs) have reduced manual labor, minimized errors, and accelerated the supply chain processes, contributing to cost savings and



improved financial performance [10]. The increasing investment in retail automation technologies reflects the industry's commitment to modernization. Retailers are allocating substantial budgets to integrate advanced systems, anticipating long-term benefits such as reduced operational costs, enhanced customer experiences, and increased competitiveness in the market.

Automation and Digitalization in Ukraine. In contrast, the Ukrainian retail sector is in the early stages of digital transformation. While e-commerce is growing rapidly with a growth of 35% in 2022 [11], the adoption of automation technologies remains limited due to infrastructure issues and limited access to capital. However, some Ukrainian retailers, such as Rozetka, are successfully using digital platforms to expand their market reach and improve customer engagement.

A study analyzing the digital maturity of Ukrainian retail enterprises in 2017–2019 revealed that the sector is in the early stages of digital transformation [12]. The assessment focused on digital infrastructure, personnel digital skills, and the level of digital tools usage in marketing activities. The findings highlighted a significant lag in digitalization processes compared to market needs, emphasizing the necessity for strategic improvements in these areas. Projections indicate that investments in Ukraine's digital infrastructure are expected to reach \$3 billion by 2025 and \$6 billion by 2030. Additionally, investments in the digitalization of production, business, and industry are projected to be \$5 billion by 2025 and \$14 billion by 2030. These investments are anticipated to enhance productivity and contribute to GDP growth through digitalization efforts [13].

The Projected Digital Investments in Ukraine are shown in fig.2. Red curve represents Digital Infrastructure Investment (Billion \$). Green curve represents Digitalization Investment (Billion \$).

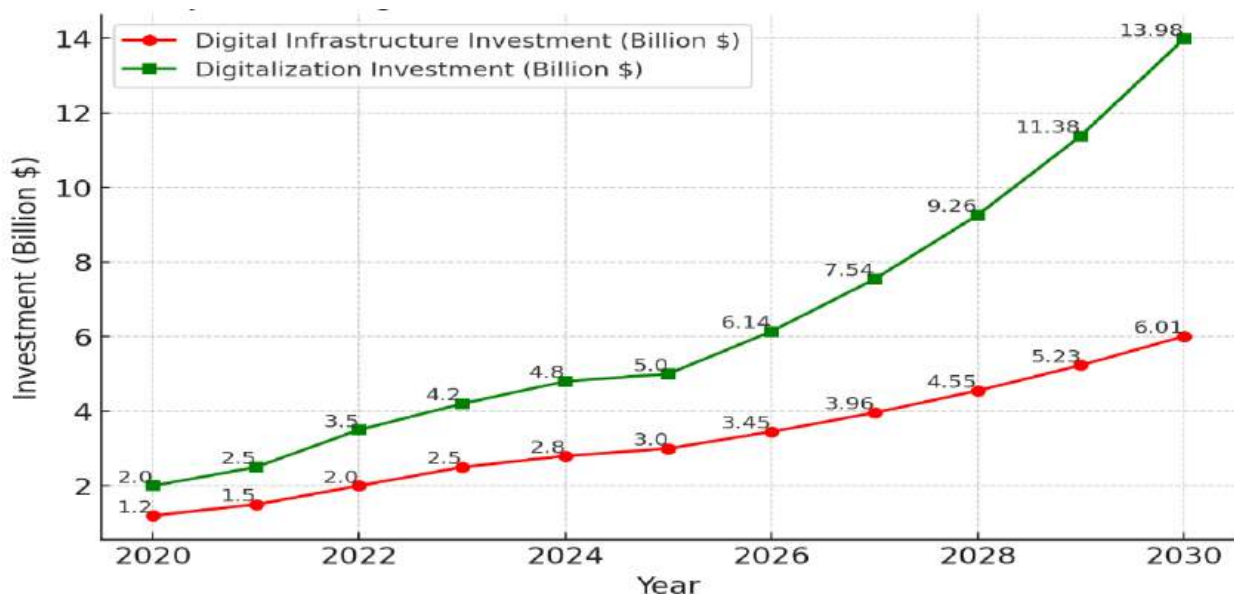


Fig. 2. Projected Digital Investments in Ukraine

Source: developed based on [13]



The share of individuals purchasing online in Ukraine has been increasing, reflecting a growing acceptance of digital commerce. However, when compared to the European Union, Ukraine still exhibits lower percentages in e-commerce participation, indicating room for growth in digital retail adoption [14]. Ukrainian retailers are progressively integrating automated solutions into their operations to address challenges such as staff shortages. This includes automation in warehouses and marketplaces, with future plans to enhance automation in interactions with counterparties and to increase omnichannel capabilities to meet evolving customer preferences [15].

Financial performance. Germany and Ukraine exhibit significant differences in innovation levels, which directly impact their retail enterprises. According to the Global Innovation Index (GII) 2024 [16], Germany ranks 9th globally with a GII score of 58.1, reflecting a well-developed innovation ecosystem. In contrast, Ukraine ranks 60th, with a GII score of 29.5, indicating room for improvement in innovation capacity.

One of the key indicators of innovation investment is research and development (R&D) expenditure as a percentage of GDP. Germany allocates approximately 3.14% of its GDP to R&D, underscoring a strong commitment to technological advancement. Meanwhile, Ukraine's R&D expenditure remains relatively low at 0.28% of GDP, which may slow down the development and implementation of innovative technologies in various sectors, including retail [17].

The Research and Development expenditure (% of GDP) by years for Germany (green) and Ukraine (blue) are shown in fig.3.

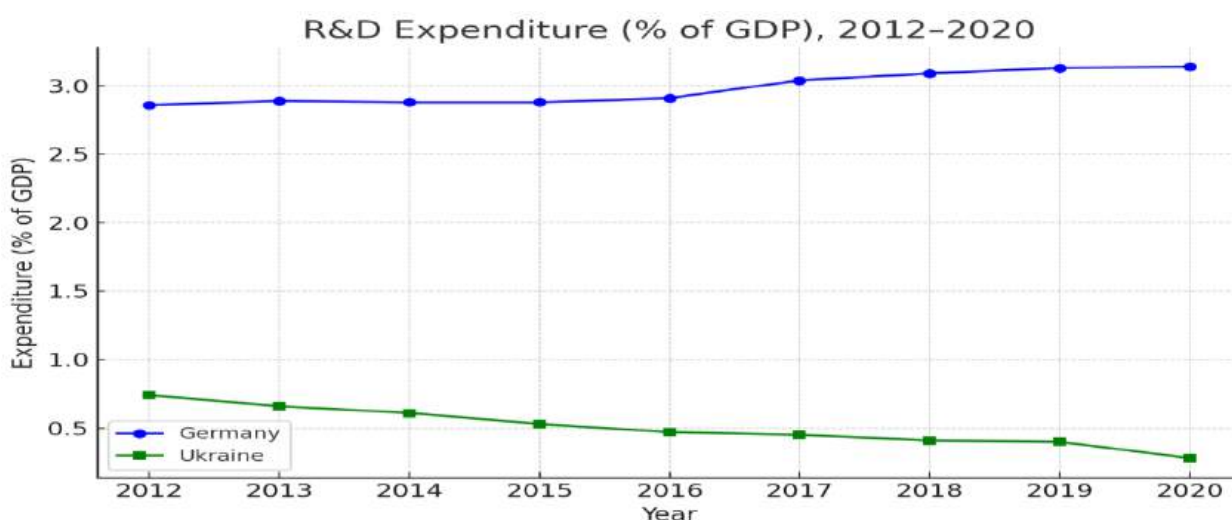


Fig. 3. Research and development expenditure (% of GDP)

Source: developed based on [17]

The financial performance of retailers in Germany and Ukraine reflects the difference in technology adoption. German retailers report higher revenue growth (an average of 5% per year) and profitability (an average of 8%) compared to



Ukrainian retailers (an average of 3% revenue growth and 4% profitability) [18]. These findings are consistent with research by McKinsey [19] and PwC [20], which highlight a positive correlation between technology adoption and financial performance.

Difference factors. Germany benefits from a highly developed infrastructure, including widespread access to high-speed internet and 5G networks, as well as an efficient logistics system. These factors make it easier for retailers to adopt technologies like AI-driven inventory systems and automated warehouses. In contrast, Ukraine faces infrastructure challenges, especially in rural areas where high-speed internet and modern logistics are not as accessible. This limits the ability of Ukrainian retailers to implement advanced technologies.

Government policies also play a role. Germany's policies are supportive of digital transformation, offering tax incentives and subsidies for automation, as well as strong intellectual property protections. This creates a favorable environment for businesses to innovate. In Ukraine, the lack of a clear digitalization strategy for the retail sector and bureaucratic hurdles makes it harder for retailers to implement new technologies.

Consumer behavior further influences the pace of innovation. German consumers are highly tech-savvy and demand more digital services, such as self-checkout and AI-driven personalization. This drives retailers to invest in automation to meet customer expectations. In Ukraine, although e-commerce is growing rapidly, many consumers still prefer traditional shopping methods, and cash transactions are still common. As a result, there's less immediate pressure for retailers to adopt fully automated systems.

Access to capital is another key difference. In Germany, retailers can easily access funding through loans, venture capital, or government subsidies, making it easier to invest in automation. However, in Ukraine, the financial environment is less stable, and retailers have limited access to financing, which hampers their ability to adopt new technologies.

Finally, the workforce and digital skills gap plays a part. Germany has a highly skilled workforce with specialized training in areas like automation and digital management, which facilitates the adoption of new technologies. In Ukraine, while there is strong IT talent, there is a gap in the skills needed for the retail sector to implement automation effectively.

The following table shows the ratios of factors in Germany and Ukraine, based on the analyzed sources.

1. TI – Technological Infrastructure
2. GP - Government Policies
3. CB - Consumer Behavior
4. AC - Access to Capital
5. WDS - Workforce and Digital Skills



Table 1

Ratios of factors

Factor	Germany	Ukraine
TI	\$95 billion invested in digital infrastructure (5G, fiber, cloud) 98% internet coverage	\$4.2 billion invested 82% internet coverage (urban), ~55% (rural)
GP	\$12 billion/year in digital subsidies and automation tax incentives	~\$0.6 billion/year in digitalization programs
CB	81% of population regularly shops online Avg. annual e-commerce spending: \$2,300/person	45% of population shops online Avg. e-commerce spending: ~\$430/person
AC	\$72 billion available in retail-related loans/investments Average interest rate: 2.4%	~\$3.5 billion in financing Average interest rate: 16.5%
WDS	1.4 million employees in digital/automation roles 70% of retail workforce received tech upskilling	~180,000 employees with basic digital training Only 28% of retail workers trained

Source: developed by the authors based on the sources [1-5]

After conducting an analysis of the above factors, a regression model of financial performance FP (e.g. net profit or return on sales) was obtained:

$$FPf_{it} = \beta_0 + \beta_n Factor_{n,i,t-1} + \sum_k \gamma_k Controls_{k,i,t-1} + \varepsilon_{i,t}$$

where:

- $Factor_n$: factors TI, GP, CB, AC, WDS.
- $Controls_{k,i,t-1}$: Share of control variables such as enterprise size, sector, region.
- All independent variables are lagged by one year to reduce endogeneity.

Correlation analysis indicates moderate relationships between independent variables in regression model. Notably, TI and FP exhibit a positive Pearson correlation coefficient of 0.44 and a Spearman coefficient of 0.39, implying a monotonic association between automation investments and improved financial outcomes. Additionally, AC and WDS show moderate correlations with FP, while the inter-correlations among independent variables remain within acceptable bounds (none exceeding 0.6), suggesting low multicollinearity.

Conclusions. This work demonstrates that automation and digitalization have a significant impact on the financial performance of retail businesses. While advanced adoption of these technologies in Germany has contributed to higher revenue and profitability growth, the Ukrainian retail sector faces challenges in achieving similar results due to infrastructural and economic constraints. Future research should explore strategies to bridge this gap.





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