

Using Artificial Intelligence for Retail Value Chain

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ABSTRACT

The present study aims to prove hypotheses regarding artificial intelligence integration in retail value chains in the post-Soviet economic space. Hypotheses were proven within a comprehensive research project based on the use of quantitative research methods (questionnaires), which allowed studying the opinions of 512 retail managers in Azerbaijan, Kazakhstan, and Tajikistan. A specially designed questionnaire eliminated ambiguity in results interpretation by including both simple closed questions with a single choice and questions using a Likert scale. All the formulated hypotheses were proven, leading to the conclusion that the retail market of the post-Soviet economic space is not ready for the introduction of robotization and full automation of retail stores. The study results can be used by retail managers in the post-Soviet economic space as they choose the direction of artificial intelligence integration.

KEYWORDS:

Artificial Intelligence, Chatbot, Robotization, Retail, Value Chains

INTRODUCTION

The beginning of the third millennium was marked by the unprecedented development of information technology, which accelerated globalization processes and changed almost all aspects of human society. In the modern economic space, information has acquired the status of a production factor on par with land, labour, and capital, which explains the desire of producers to increase the volume of information used and to significantly accelerate its processing (Akkaya & Ovatman, 2022). Retail trade is a sector experiencing rapid growth in the global economy, distinguished by its high social significance and the substantial amount of information associated with it. Significant volumes of information represent a distinctive feature of retail trade and, in the context of intensified competition and general turbulence of the economy, have caused a sharp increase in real sector demand for modern

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value chain technologies with the use of artificial intelligence (AI). The COVID-19 pandemic and the ensuing quarantine restrictions adopted by most world governments to prevent the spread of the pandemic were additional incentives to introduce AI-related technologies into retail commerce. The recommended social distancing up to full lockdowns in certain regions led to a sharp increase in buying activity in online stores and, accordingly, an increase in the volume of information in the retail trade. This, in turn, actualized the need to improve the system of information processing and analysis. In addition, the COVID-19 pandemic led to a significant increase in the demand for fully automated stores, which exclude contact of sales staff with both the customer and the product offered (Xu et al., 2020). This predetermined a peak increase in retail demand for modern developments in process automation based on robotics, image recognition systems, consumer identification systems, and, consequently, AI, linking modern high-tech solutions into a coherent value chain. Indeed, AI, at the beginning of the century considered the domain of mostly science fiction, has become a tool to improve the competitiveness of retail amidst the uncertainty caused by the turbulence of the modern economy and the impact of a range of negative and poorly predictable factors (Liu et al., 2018). The attractiveness of this innovative toolkit at the current stage of economic development in the face of fierce competition causes a sharp increase in social demand for science-based approaches to building a retail value chain using AI.

Literature Review

The analysis of theoretical sources has revealed that AI technologies have transformed the landscape of retail trade, enriching reality through the interaction of consumers and retailers via online interfaces (Kautish & Khare, 2022). This has been aimed at achieving excellence amidst uncertainty and competitive struggle (Mandal, 2022). Nowadays, the analysis of theoretical sources has shown that the popularity of AI topics in the scientific literature may soon surpass the popularity of this topic among science-fiction writers. A significant number of publications are devoted to general, review issues of AI applications in retail (Cao, 2021; Kreutzer & Sirrenberg, 2020) and to individual highly specialized studies (Querejeta Lomas et al., 2021; Pereira et al., 2022), often focused on a particular type of store (Jain & Gandhi, 2021; Margaje & Rasal, 2021; Rodgers et al., 2021; Xu et al., 2020) or on the specifics of a particular region (Bedi et al., 2022; Ersoy, 2022; Van Tuan et al., 2021). At the time of theoretical literature analysis, academic researchers' interest in ethical (Giroux et al., 2022; Mahmoud et al., 2020) and legal issues in AI application in retailing was very high, as modern scientific thought recognizes the need to apply ethical standards in AI application (Jaheer Mukthar et al., 2022). In doing so, Perrault et al. (2019) identified 12 major ethical issues that must be addressed when implementing AI, including:

- Fairness, as the use of a dataset that is non-discriminatory and free of elements that in one way or another could lead to algorithmic bias;
- Interpretability, as the extent to which a user understands the reason for the decision and the ability to predict future outcomes;
- Explainability, which should be understood as an active characteristic of an algorithm that brings clarity to the processes involved when providing an output;
- Transparency, defined in this context as the level of information provided by an artificial intelligence-based system in the decision-making process;
- Accountability, including the accountability of all stakeholders involved in the development of the algorithms concerning the consequences arising from the use of the algorithms;
- Data privacy, involving users' understanding of how their data are processed in the use of artificial intelligence-based systems (Perrault et al., 2019).

The use of systems based on artificial intelligence in mobile shopping applications (Gharaibeh & Gharaibeh, 2022) has recently gained attention in economic science. Stanciu and Rîndașu (2021)

explored the key benefits and risks, as well as the real-world practical implications of using mobile shopping apps together with AI-based solutions to increase engagement, improve online shopping, and encourage impulse purchases. The authors presented the results of a detailed study of 117 mobile shopping apps using statistical methods, factor analysis, and analysis of variance (one-way ANOVA test) (Stanciu & Rîndașu, 2021). While paying tribute to the achievements of previous studies, it should be noted that researchers have focused on privacy issues, as well as the legal and ethical implications of introducing mobile applications using AI in retail businesses; the economic component, however, has remained outside the scope of existing research.

Li (2022) assessed AI models and their applications in wireless networks for sales management in the new format of retail trade by blending online and offline contexts. The proposed model demonstrated the comprehensive data transmission process using wireless sensor networks such as mobile phones, tablets, and laptops within the scope of corporate and transactional sales processes. Corporate sales differ from transactional sales in several aspects. Corporate sales involve high risk, multiple stakeholders, lengthy sales cycles, substantial investments, and complex relationships. By contrast, transactional sales carry low risk, involve a limited number of stakeholders, have shorter sales cycles, and focus primarily on marketing and sales activities (Duissebayeva, 2018). Studies have shown that artificial intelligence is currently in demand in corporate sales within the new format of retail business. This provides a fundamental basis for effectively organizing the creation of retail opportunities in manufacturing enterprises and enhancing global competitiveness in the market. However, the practical implementation of AI in transactional sales within the retail business remains challenging and multifaceted, aligning with the conclusions of Hanaysha et al. (2021). Their study highlighted that price, store image, and location exhibit a significant positive correlation with purchase decisions in the retail market, thereby expanding the understanding of the role of marketing and sales elements, particularly in the context of retail trade in developing countries.

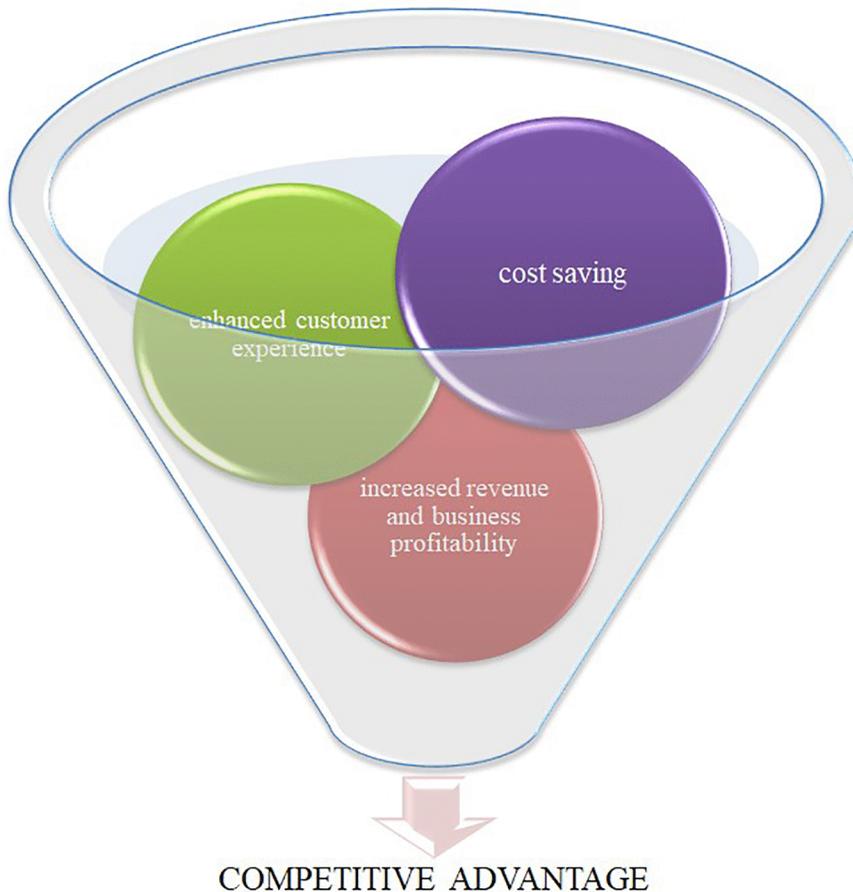
Anica-Popa et al. (2021) addressed the advantages, problems, and special conceptual framework for the integration of AI in retailing. They focused on identifying and highlighting the main advantages and challenges of implementing innovation based on AI in retail to provide a competitive advantage in three main areas developed by Hetu (2020) (Figure 1).

Based on an in-depth analysis of theoretical sources, Anica-Popa et al. (2021) identified and classified the main benefits of implementing AI in retail (Figure 2), which allowed the authors to develop a high-level value chain integration architecture (CECoR) based on AI and provide an additional explanatory scenario of the developed integration architecture (Anica-Popa et al., 2021).

In addition, due to the nature of AI, its implementation in retail can have implications that go beyond the technical domain of learning algorithms and big data processing. The conceptual structure of the value chain must rely on consistent risk management, a brief overview of which is also offered by Anica-Popa et al. (2021). Although Anica-Popa et al.'s contribution to the study of the value chain through AI is acknowledged, it is important to recognize the general nature of their research, which restricts the practical implementation of its findings in the real economy. To address the gap concerning the application of AI in supply chain management (SCM), Mohsen (2023) analyzed scholarly activity on the use of AI in SCM across different active countries. The researcher identified that the application of AI in SCM exhibits a growth trajectory and has a positive impact on forecasting market trends in the realm of Supply Chain 4.0, providing more personalized experiences to end consumers and fostering an interactive environment in countries such as India, the United Kingdom, the United States, France, China, and Australia. Additionally, despite the potential advantages of implementing AI in SCM, it necessitates significant resources and expertise to integrate AI into the retail sector, aligning with the conclusions of Rege (2023). According to a study conducted by Mordor Intelligence (2023), the majority of AI solution providers in the retail industry are located in North America, primarily due to the presence of developed countries such as the United States and Canada. Many retailers in this region are adopting AI technologies in both online and offline stores to optimize their supply chain operations and inventory management, aiming to enhance the customer experience and understand

Figure 1. Key elements of retailers' competitive advantage through innovation using artificial intelligence

Note: Figure developed by the authors according to Hetu (2020).



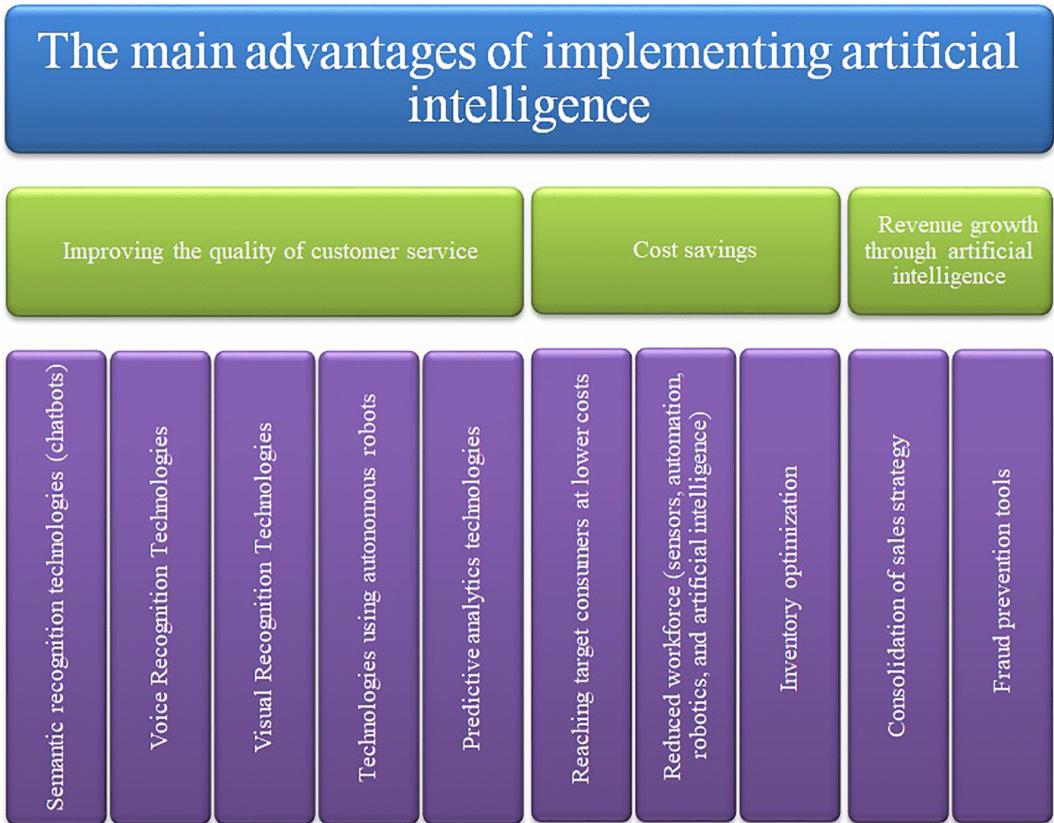
consumer purchasing patterns (Nurakhova et al., 2020). However, the adoption of AI in the retail market is fragmented. For instance, in the post-Soviet space, the penetration of AI remains low, with only around 20% of companies utilizing Industry 4.0 technologies, which is three times lower than the global average. The main inhibiting factors (Dobrinsky, 2021) include the lack of awareness among decision-makers and owners regarding the real business impact of using AI, a shortage of qualified personnel, and low labour costs, particularly in countries such as Azerbaijan in the Caucasus region, as well as Kazakhstan and Tajikistan in Central Asia, respectively.

An original approach to the study of AI in the retail value chain is proposed by Hunt and Rolf (2022), who investigated the benefits, problems, and consequences of integrating AI from a labour union perspective (Hunt & Rolf, 2022). According to the authors, investments in digitalization benefit businesses and consumers, but they pose threats to workers in the form of intensification and deterioration of working conditions, as well as the potential to undermine existing collective bargaining agreements in retail (Hunt & Rolf, 2022).

An analysis of theoretical sources reveals that the problem of using artificial intelligence in retailing has great relevance in modern science. The available research covers a wide range of issues related to the introduction of AI in retailing, with a significant part of the research having a pronounced interdisciplinary character. At the same time, the analysis of theoretical sources revealed a clear lack

Figure 2. The main advantages of implementing artificial intelligence in retail enterprises

Note: Figure developed by the authors according to Anica-Popa et al. (2021).



of research on the value chain with the help of AI, taking into account the specific features of the economy in the post-Soviet economic space.

Problem Statement

In the context of the disruptive consequences of the Covid-19 pandemic on the global economy and the relevance of economic and technological transformation characterized by developmental challenges, particularly in less developed economies with innovation deficits, there is a need to explore the use of AI in the landscape of retail business. AI represents an efficient means of discovering new technological solutions in resource-rich environments. Therefore, this article analyzes efforts to stimulate the utilization of AI for optimizing the value-creation retail supply chain, thereby transitioning from a resource-intensive model of economic development to a knowledge-based model, aiming for sustainable development within the specific conditions of the post-Soviet economic space. As a result of the analysis of theoretical sources, the key research hypotheses of this study were formulated as follows:

- H1: the most effective and accessible direction of knowledge management at the current stage of economic development of post-Soviet countries is chatbot technology;
- H2: the use of artificial intelligence for inventory management in the retail value chain of the post-Soviet economic space is advisable mainly for large retail chains, as small and medium-sized retailers are not technologically ready to implement these technologies;

- H3: consumers and retail market operators of the post-Soviet economic space are not ready for the introduction of a large part of the promising areas of optimizing operations using artificial intelligence, including the active introduction of robotics and the creation of automated stores;
- H4: attracting customers using artificial intelligence technology is most appropriate for large retail chains, as well as for small and medium-sized retailers focused on online sales.

Thus, the main motivation for this article was the increasing social demand for the results of research on the use of AI to optimize the retail value chain and the insufficient development of this topic about the specific conditions of the post-Soviet economic space.

This study aimed to create hypotheses that would identify the most favourable areas for incorporating AI into the retail value chain. Achievement of the research goal was possible through a consistent solution of the following scientific tasks: (1) to analyze the theoretical sources on the topic of research; (2) to determine the main methods of research; (3) to determine the information base of the study and to form appropriate information base tools; (4) to test the hypotheses developed on the example of retailers in Azerbaijan, Kazakhstan, and Tajikistan; and (5) to identify the most promising areas of value chain optimization using AI.

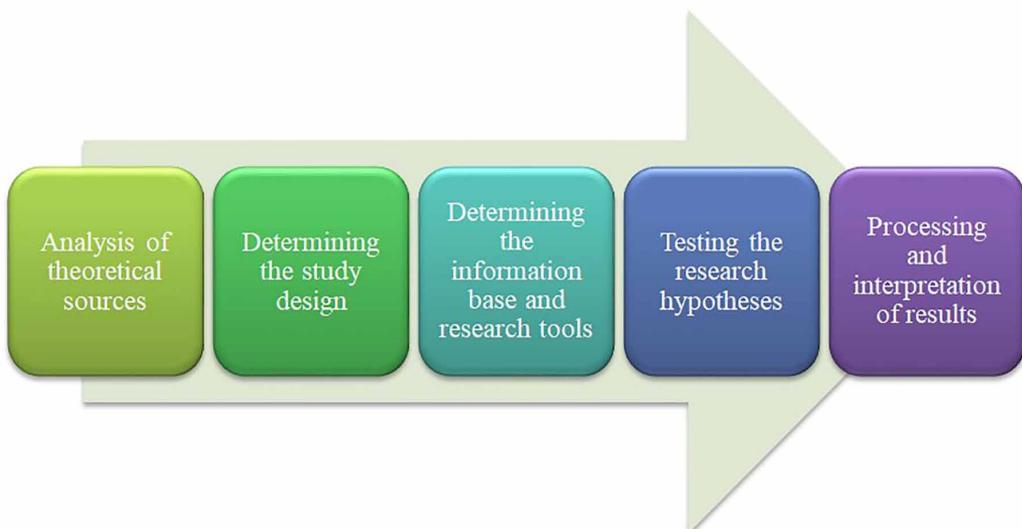
METHODS AND MATERIALS

Research Design

This study accomplished its primary scientific goals by executing a comprehensive multi-country research project. The project involved gathering and analyzing primary information through a combination of on-site data collection and desk-based research methods at various stages of the study. The study design is shown schematically in Figure 3.

When crafting the research design, emphasis was placed on prioritizing a straightforward and sequential approach to address the research problems effectively. At the same time, research design priorities were determined by implementation constraints, since a complex multitasking

Figure 3. Study design



design undoubtedly allows one to reduce the research time but is significantly more costly, which is unacceptable under the conditions of a limited budget.

Basic Research Methods

The choice of the main research methods and instruments was based on the following factors: (1) effectiveness of the methods and instruments used; (2) comprehensibility and accessibility; and (3) cost-effectiveness due to the limited research budget. Furthermore, while selecting research methods and instruments, the study considered limitations arising from the ongoing COVID-19 pandemic and unresolved military conflicts among countries within the post-Soviet economic space. Consequently, the research toolkit adheres to the principles of social distancing and accounts for the constrained data collection circumstances. Taking into account these factors and major constraints, the authors chose an electronic survey of retailers using Google Forms as the main method of the “field” study stage. The following information channels were used comprehensively to distribute invitations to participate in the study:

- personalized channels: sending invitations to specific merchants by email;
- non-personalized channels: distribution of invitations on specialized information resources, groups and communities of social networks, etc.

The collection of primary information was realized using a questionnaire consisting of two main blocks:

- Block 1: informational block.
- Block 2: analytical block (hypothesis testing).

At the same time, to facilitate understanding and increase the comfort of a respondent during the research, the questionnaire was formed mainly with closed questions with a single choice (Appendix A).

Hypothesis confirmation regarding value chain optimization using AI (Block 2) is implemented using a 5-point Likert scale, providing: (1) a high level of understanding by respondents; (2) significant questionnaire efficiency; and (3) the comparative ease of questionnaire processing and interpretation of results (Sangthong, 2020). The following was chosen as the primary scale of measurement when using the 5-point Likert scale: (1) strongly disagree–1 point; (2) disagree rather than agree–2 points; (3) difficult to answer–3 points; (4) agree rather than disagree–4 points; (5) strongly agree–5 points.

In developing questions to determine the most promising areas of value chain optimization using AI, the experience of predecessors (Guha et al., 2021; Nagy & Hajdú, 2021) was widely used and adapted to the perception of respondents. Confirmation of a retailer’s consent to participate in the research was included in the questionnaire, so consent to participate in the research is confirmed by the respondents for all valid questionnaires. The questionnaire is completely anonymous and excludes the receipt of personal data, so permission for the processing of personal data is not required. The questionnaire was developed in English and translated into Azerbaijani, Kazakh, and Tajik for better perception by respondents.

The processing and interpretation of the primary information were carried out with the use of encryption methods (for processing the questionnaires) and graphical data display (for the interpretation of the obtained data). General scientific and traditional economic-statistical methods, as well as methods of correlation analysis, were used to analyze the data obtained.

The normality and reliability of the sample were assessed using the mean, standard deviation, and the item total correlation method.

The mean value μ is calculated according to the formula 1, where x represents the value of the analyzed parameter and n represents the number of values.

$$\mu = \frac{1}{n} \sum_{i=1}^n x_i \quad (1)$$

The standard deviation (σ) is calculated by formula 2, where x represents the value of the analyzed parameter, n represents the number of values, and μ represents the mean value.

$$\sigma = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - \mu)^2} \quad (2)$$

The Pearson correlation coefficient for assessing the normality and acceptability of questions according to the “item total correlation” method is calculated according to formula 3.

$$r_{xy} = \frac{\sum_{i=1}^m (x_i - \underline{x})(y_i - \underline{y})}{\sqrt{\sum_{i=1}^m (x_i - \underline{x})^2 \sum_{i=1}^m (y_i - \underline{y})^2}} = \frac{cov(x, y)}{\sqrt{s_x^2 s_y^2}} \quad (3)$$

To allocate priority areas, an ABC analysis based on the Pareto principle was used. All calculations and distributions of this study were implemented using the software capabilities of Microsoft Excel. Interpretation of the results using the method of graphical representation of data, as well as other graphical study objects, was implemented using the software tools of Microsoft Office.

Database

The choice of enterprises to test hypotheses using personalized invitation distribution channels was justified by the need to obtain an evidence base to test the research hypotheses and by the low number of value chain studies using AI in the selected countries. In addition, the existing specificity of retail trade in post-Soviet countries necessitates significant adaptation when using the foreign experience of both Western and Asian models of entrepreneurship. Therefore, to prove the hypotheses, post-Soviet countries were selected: Azerbaijan, Kazakhstan, and Tajikistan. The selection of enterprises to prove hypotheses using personalized channels was made randomly in specialized databases at the national level (State Revenue Committee Ministry of Finance of the Republic of Kazakhstan, 2021; State Tax Service under the Ministry of Economy of the Republic of Azerbaijan, 2022; Unified State Register of the Tax Committee under the Government of the Republic of Tajikistan, 2022).

To gather information through customized channels, a total of 300 retailers were carefully chosen, with an allocation of 100 retailers per country. When forming the sample, the only criterion was for an enterprise to be in retail trade. In addition, invitations to participate in the research were actively distributed through non-personalized channels, including specialized portals, forums, groups, and communities in social networks, etc.

Research Limitations

The main implementation limitation of this study was the limited budget, which had a significant impact on the methodological design, the choice of research methods and instruments, as well as on the sample size. Moreover, the selection of instrumentation and the volume of data were influenced by quarantine restrictions imposed due to the COVID-19 pandemic, as well as the internal market

instability within the analyzed countries caused by unresolved military conflicts between Azerbaijan and Armenia, Kyrgyzstan and Tajikistan, and mass protests in Kazakhstan.

RESULTS

Using personalized invitation channels, 300 invitations were sent to respondents, with 64% of invited companies responding positively, resulting in 192 questionnaires, 6 of which were deemed invalid due to incomplete or incorrect completion. In addition, invitations to participate in the survey were actively distributed on specialized forums, in professional groups, and in communities of social networks, as well as through other non-personalized channels, which resulted in 337 more completed questionnaires, 326 of which were deemed valid. As a result, a total of 512 questionnaires were deemed eligible for further investigation. Among them, 139 questionnaires were collected from retailers in Tajikistan, while 182 and 191 questionnaires were obtained from retailers in Azerbaijan and Kazakhstan, respectively. The structure of respondents by country is presented in Figure 4.

The distribution of respondents by country in this study exhibits a notable degree of coherence, aligning closely with the overall distribution of retailers within the chosen countries.

Due to differences in the legislative definition of small- and medium-sized enterprises in different countries, the structure by the size of enterprises in this study was based on the subjective assessment of respondents (question RQ2). The structure of respondents according to the size of enterprises is presented in Figure 5.

Various forms of retail establishments were identified to ascertain the degree of specialization. Universal stores encompass a wide range of food and non-food items, such as supermarkets and department stores. Specialized stores, on the other hand, focus on offering products from a single merchandise category. Moreover, there exist specialized stores, such as “near-home” establishments, which offer a broader range of products, encompassing limited non-food items essential for daily needs, such as sanitary and hygiene products, personal care items, and similar commodities. The primary formats of retail trade based on the level of store specialization are depicted in Figure 6, providing a clear representation of the degree of specialization within the retail industry in the post-Soviet economic space.

The structure of respondents in terms of implementing retail activities in physical or online stores is shown in Figure 7.

Figure 4. Structure of respondents by country

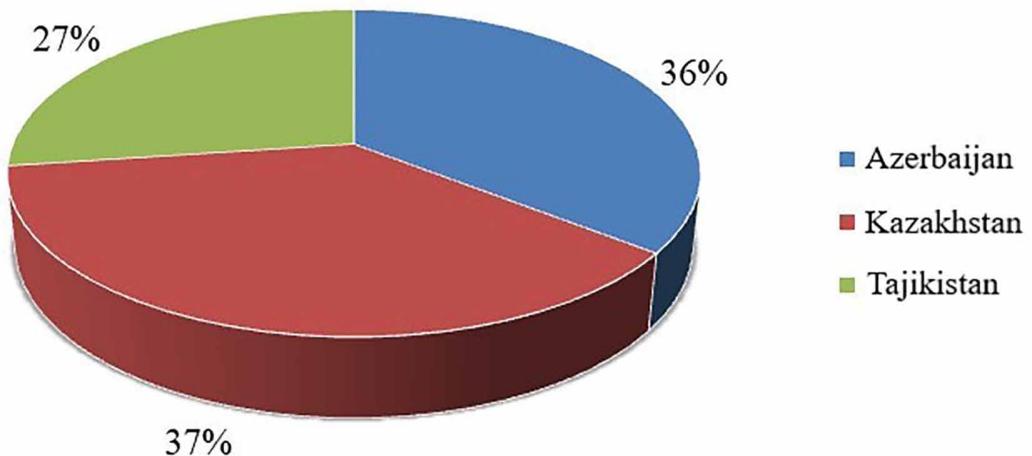


Figure 5. Structure of respondents by size of enterprises

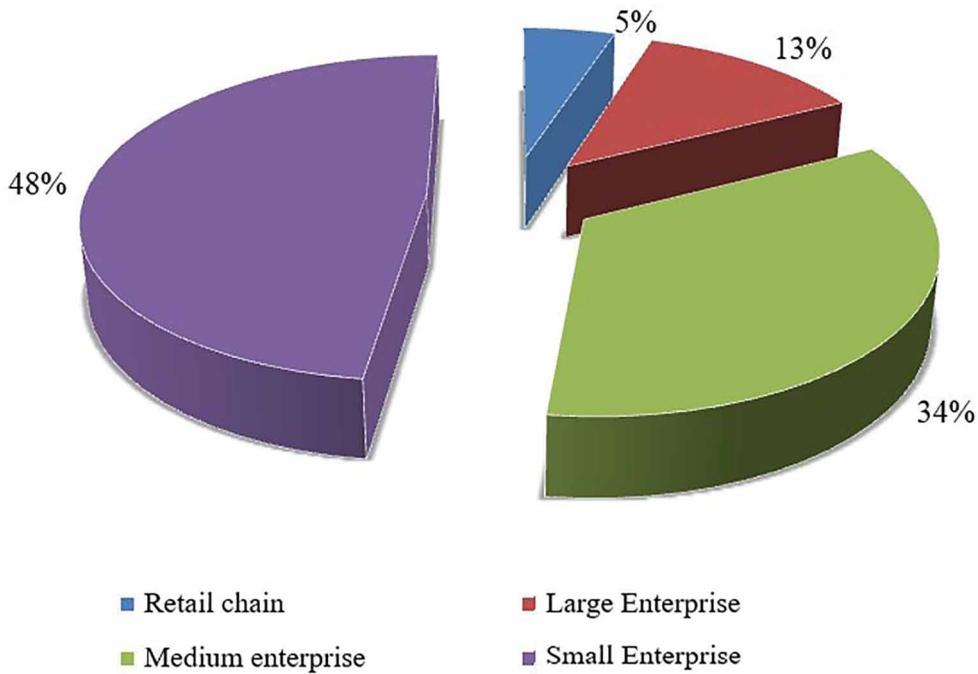
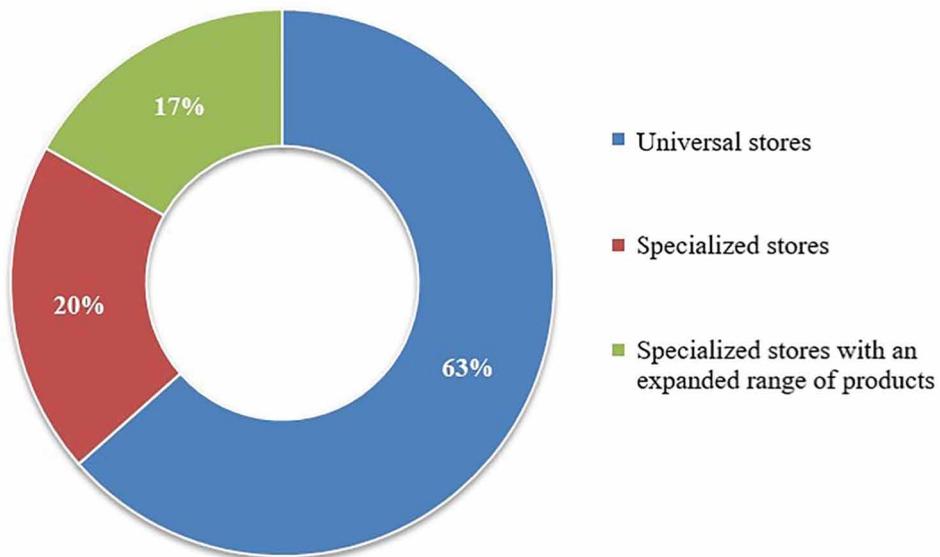


Figure 6. Structure of respondents by level of specialization



The structure of respondents in terms of length of presence in the market is shown in Figure 8.

As can be seen, businesses with less than 1 year of retail operations represent only 10% of the total number of respondents, which is primarily due to the crisis phenomena in the global economy and individual national economies, significantly reducing the attractiveness of retail to start a new

Figure 7. Structure of respondents in terms of implementing retail activities in physical or online stores

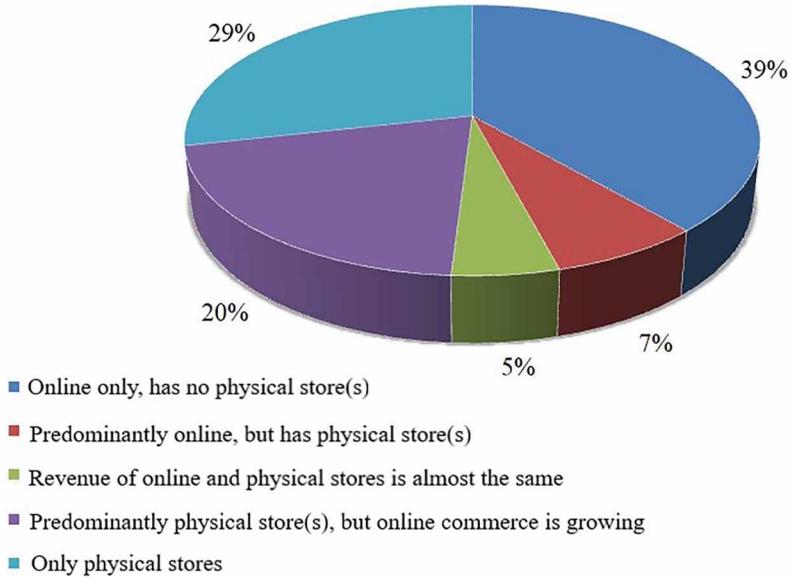
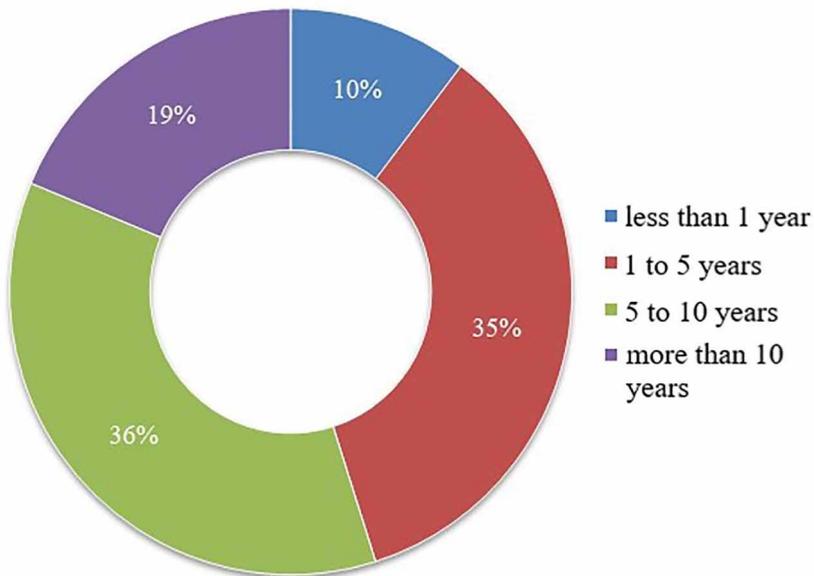


Figure 8. Structure of respondents in terms of length of presence in the market



business. The proportion of businesses that have been carrying out retail trade activities for 1 to 5 years and 5 to 10 years is almost equal (35% and 36%, respectively), and almost 1/5 of the respondents (19%) are representatives of businesses that have been carrying out retail trade activities for more than 10 years.

The results of evaluating the acceptability and normality of the sample using the mean, standard deviation, and item-total correlation coefficient are shown in Table 1.

Table 1. Analysis of acceptability and normality of the sample

Question	Mean, μ	Standard Deviation, σ	Item-Total Correlation, r_{xy}
Competition in the retail industry has increased significantly in recent years (RQ6)	4.41	0.581	0.278
Innovative technologies must be introduced to ensure the sustainable development of retailers in today's environment (RQ7)	4.47	0.552	0.268
Artificial Intelligence technology can provide a competitive advantage for retailers in today's economic environment (RQ8)	3.33	0.869	0.381
Our company uses artificial intelligence technology in the value chain (RQ9)	2.14	0.789	0.271
Our company is ready to implement artificial intelligence technologies in the value chain (RQ10)	2.87	0.779	0.222
Consumers and domestic market infrastructure are fully prepared for the introduction of robotics (RQ11)	2.95	0.803	0.323
Consumers and domestic market infrastructure are fully ready for the introduction of automated stores (RQ12)	2.06	0.782	0.273
The use of artificial intelligence in retail in our country is constrained by the lack of available technological solutions (RQ13)	4.4	0.673	0.366
At this stage, the most promising area for artificial intelligence introduction in the activities of domestic retailers is customer engagement optimization (RQ14)	4.48	0.58	0.379
Chatbot technology is one of the most promising technologies of artificial intelligence application in domestic retail trade (RQ15)	4.47	0.545	0.407
Artificial intelligence technology has the potential to replace humans in retail in our country (RQ16)	2.92	0.815	0.286
Artificial intelligence technologies will dominate retail in the next 3 years (RQ17)	2.96	0.818	0.306
Artificial intelligence technologies will become dominant in the domestic retail trade not earlier than in 5 years (RQ18)	3.09	0.861	0.303
Artificial intelligence technologies in retail trade are more a trend than a necessity (RQ19)	2.98	0.819	0.21
The introduction of AI technologies in our country is hindered by insufficient access to investment (RQ20)	2.96	0.818	0.342

According to the analysis of the normality and acceptability of the sample, the mean value of the scores on the 5-point Likert scale ranges from 2.06 to 4.48, with a standard deviation not exceeding 0.869; therefore, the sample is normal and acceptable. Analysis of reliability and acceptability of the sample using the “item-total correlation” method allowed establishing that almost all values of the “item-total correlation” coefficient belong to the values of sufficient correlation ($0.2 < r_{xy} < 0.39$), except for the value for question RQ15 ($r_{xy} > 0.4$), indicating a high correlation. Hence, drawing from the analysis, one can infer the sample's acceptability, normality, and reliability.

As the study results showed, most respondents confirmed the tightening of competition in the industry in recent years (mean, $\mu_{RQ6}=4.41$). Most respondents agree that to ensure the sustainable development of retailers in the current environment it is necessary to introduce innovative technologies (mean $\mu_{RQ7}=4.47$). The respondents' confidence in the ability of AI technology to provide a competitive

advantage for retailers in the current economic situation was significantly lower than in the previous question (mean $\mu_{RQ8}=3.33$). A more detailed analysis of respondents' answers to question RQ8 is presented in Figure 9.

The bivariate distribution of responses to questions RQ2 and RQ8 showed that the greatest confidence in the ability of AI technology to provide a competitive advantage for retailers in the current economic situation is demonstrated by representatives of retail chains and large retailers.

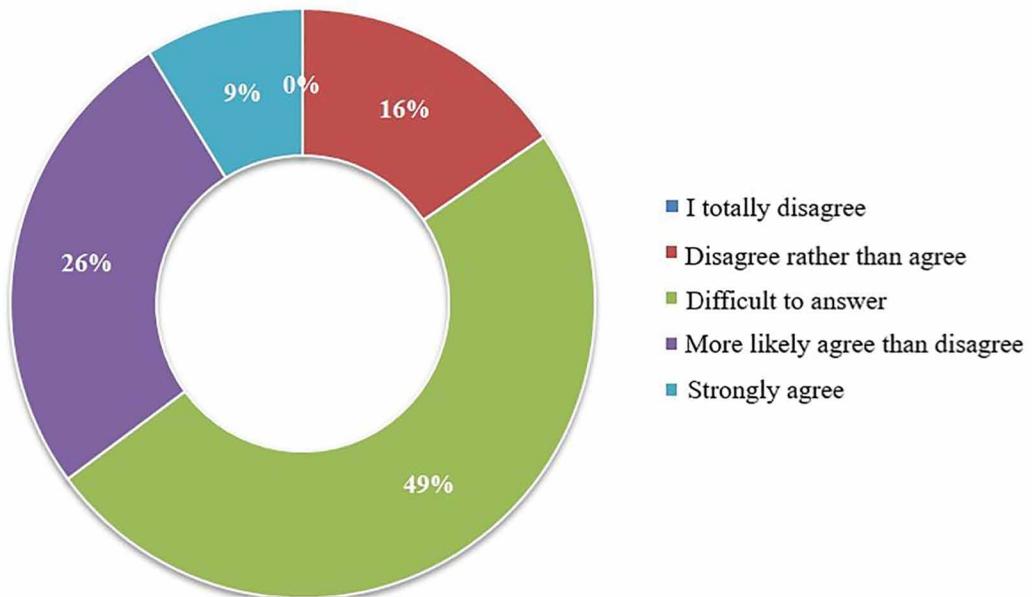
Most enterprises have not confirmed the use of AI technologies in the value chain at the time of the study (mean $\mu_{RQ9}=2.14$). At that time, according to the bivariate distribution of answers RQ2 and RQ9, almost all enterprises that confirmed the use of technology belong to the networks of retail stores and large trade enterprises. Only one positive answer was given by a representative of a medium enterprise—an online retailer (Kazakhstan).

The analysis of readiness to implement AI technologies in the value chain (RQ10) showed results comparable to those of RQ9. Even though the readiness to implement AI technologies in the value chain is slightly higher than the level of implementation (mean $\mu_{RQ9}=2.87$), the predominant number of confirmations was received from retail chains and large retailers. This proves hypothesis 2—the use of artificial intelligence for inventory management in the retail value chain of post-Soviet economic space is advisable mainly for large retail chains.

Analysis of the readiness of consumers and the infrastructure of the domestic retail market to implement robotics (RQ11) and fully automated stores (RQ12) showed that most respondents confidently denied the readiness of consumers and infrastructure (mean $\mu_{RQ11}=2.95$ and $\mu_{RQ12}=2.06$). This proves H3—consumers and retail market operators of the post-Soviet economic space are not sufficiently prepared for the introduction of operations' optimization using artificial intelligence, including the active introduction of robotics and creation of automated stores.

Most respondents confirmed that the use of AI in retail in the post-Soviet economic space is constrained by the lack of technological solutions available to most market operators (mean, $\mu_{RQ13}=4.4$). At the same time, the prevailing majority considers the optimization of customer engagement to be the most promising direction of future technology development (mean, $\mu_{RQ14}=4.48$). The bivariate

Figure 9. Respondents' assessment of the ability of artificial intelligence technology to provide a competitive advantage for retailers in the current economic situation



distribution showed that a strong agreement in RQ14 was mostly expressed by large enterprises and retail chains, as well as medium-sized enterprises focused on online sales. Thus, hypothesis 4 is proven—customer engagement using artificial intelligence technologies is most appropriate for large retail chains and small and medium-sized retailers focused on online sales.

Most respondents do not agree that AI technology can replace humans in the domestic retail trade (mean $\mu_{RQ16}=2.92$). In addition, a large number of respondents does not agree with the statement about the possibility of the dominant position of AI technology in retail in the short term (up to 3 years) (mean $\mu_{RQ17}=2.96$). An attempt to assess the possibility of AI technology dominating retail in the medium term (5 years) showed a high level of uncertainty among respondents (mean $\mu_{RQ18}=3.33$), while most respondents had difficulty answering.

The RQ19 showed that the unfavourable outlook for the advancement of AI technology in retail value chains in the short term and the high level of uncertainty in the medium term is not based on distrust of the technology itself but on an assessment of industry and market readiness. As the survey results showed, most respondents did not consider AI technology to be a trend rather than a necessity (mean $\mu_{RQ19}=2.98$).

In addition, the majority agreed with the statement that chatbot technology is one of the most promising technologies for the application of AI in domestic retail trade (mean $\mu_{RQ5}=4.47$). Consequently, hypothesis 1 is proven—the most effective and accessible direction of knowledge management at the current stage of economic development of post-Soviet countries is chatbot technology. Thus, study results prove all formulated hypotheses.

DISCUSSION

The motivation for the presented research came from the increasing demand for research related to the use of AI to optimize the retail value chain. Despite the popularity of AI in the global scientific literature (Khalifa et al., 2021; Perrault et al., 2019; Weber & Schütte, 2019; Xie, 2021), the research has not taken into account the specifics of the retail market in the post-Soviet economic space. The results obtained in this study are based on the developed methodology within the specified hypotheses, which rely on the works of Hunt and Rolf (2022) and Hetu (2020). Specifically, an extended classification (Hetu, 2020) was utilized in hypothesis development, whereby three primary directions for enhancing the value chain through AI were identified: (1) knowledge management, (2) inventory management, and (3) operations optimization. Furthermore, the work of Hunt and Rolf (2022), was employed to identify a fourth direction: (4) customer interaction. The research objectives of this study were focused on evaluating the prospects of integrating AI into the value chain of retail stores by representatives of the retail industry. The operationalization at the empirical level of the hypotheses, supported by correlation analysis, economic-statistical methods, and graphical interpretation of results, implies that the implementation of retail activities is directed towards internet-based stores and a hybrid format, encompassing online and offline trade, utilizing AI within major retail networks. This is due to the challenging prospects for the advancement of AI technologies in value chains within the retail industry in the next 3-5 years, owing to the weak development of innovation economies within the domestic markets of the post-Soviet space. As a result, for the retail industry, the benchmark for the use of AI is partial automation, wherein robots address business practice issues from the demand and supply perspectives. Similarly, in a study by Nagy and Hajdú (2021), an online survey was conducted among 439 Hungarian retailers, utilizing the technology acceptance model as a theoretical foundation and focusing on consumers' behavioural intentions to adopt and use AI-based internet stores, including trust, perceived usefulness, perceived ease of use, and attitude. The researchers concluded that retailers should currently focus on creating a personalized customer journey, satisfying customer demands, and providing a superior online shopping experience, considering the significant positive impact of the recent COVID-19 crisis on e-commerce. In these efforts, AI can be a highly effective tool directed towards developing personalized products and expediting their fulfilment, aligning

with earlier findings by Dhaliwal and Arora (2021). In this context, Kautish and Khare (2022) assert that the implementation of AI on business platforms, especially in developing countries, can enable companies to survive on a global scale, ensure transparency with customers, and optimize data exchange for everyday transactions.

Also of note is a study by Guha et al. (2021) on the impact of AI on retailing, including such factors as the degree to which the AI-enabled technology is customer-centric, the degree of ethical concerns, the amount of value created, and the availability of AI-enabled technology. In addition, based on the results of Guha et al. (2021), the introduction of AI technology will be more effective if it focuses primarily not on replacing but on supplementing managers' judgments. Moreover, the authors argue that more value can be gained from integrating AI into retailing by implementing applications focused not on attracting customers, but on optimizing inventory and improving financial performance (Guha et al., 2021), transforming data into valuable knowledge and intelligence for companies, which is in line with the findings (Lichtenthaler, 2021).

While acknowledging the scientific contributions of previous research in developing the topic of integrating AI into the retail value chain, it should be noted that the present study results contradict the claim of Guha et al. (2021) regarding the value of AI aimed at attracting customers. The conclusions formed in this study affirm its priority at this stage of industry development (Guha et al., 2021). At the same time, this contradiction may be due to the specific economic development of the post-Soviet economic space, which was not considered by Guha et al. (2021).

In addition, a study by Oosthuizen et al. (2021), investigated the application of AI technologies in the retail value chain. The authors conceptualized applications using AI according to the execution of one of the following tasks in the value chain: knowledge management, inventory management, operations optimization, and customer engagement. It should be noted that this conceptualization was used in the present study to examine the value chain through AI in the post-Soviet economic space. The study results cannot be repeated because, unlike desk studies that rely on the analysis of previous research, this paper uses primary information obtained by questioning retail market operators within the post-Soviet economic space.

The study by Purcărea et al. (2021) is devoted to the relationship between the influence of using AI in retailing on purchasing behaviour and consumers' perception of AI. This study not only influenced the choice of tools but also contributed to the awareness of the need to consider regional (national) market specifics when studying the integration of AI in retail value chains. Using quantitative research methods to obtain information, Purcărea et al. (2021) proved that Romanians' purchasing and consumer behaviour changes significantly towards the next normality, with consumers' perception of AI representing a central indicator to determine the successful use of AI in the context of offline-to-online convergence (Purcărea et al., 2021). It should be noted that, despite the significant influence of Purcărea et al. (2021) in terms of highlighting national specificity, the present work is fundamentally different from the work of predecessors, as it is focused on the study of retailers' opinions.

Thus, as the analysis results show, this study partially confirms and deepens the results of previous research, and, at the same time, proves several hypotheses that have not previously received widely known confirmation. The presence of minor contradictions in the study of Guha et al. (2021) can be the result of the influence of the studied markets' national specifics, which minimizes the need for further research on the revealed contradiction.

CONCLUSION

As a result of a detailed study of theoretical sources on the problem of integrating AI in the retail value chain, the main study hypotheses were formulated and operationalized at the empirical level.

- H1: The most effective and accessible direction of knowledge management at the current stage of economic development of post-Soviet countries is chatbot technology.

- H2: The use of artificial intelligence for inventory management in the retail value chain of the post-Soviet economic space is advisable mainly for large retail chains because small and medium-sized retailers are not technologically ready for the implementation of these technologies.
- H3: Consumers and retail market operators of the post-Soviet economic space are not ready enough to implement operations optimization using artificial intelligence, including the active introduction of robotics and the creation of automated stores.
- H4: Attracting customers using artificial intelligence technology is most appropriate for large retail chains, as well as for small and medium-sized retailers focused on online sales.

To prove these hypotheses, multistage complex research was carried out based on the use of quantitative methods, including correlation analysis, economic-statistical methods, and the method of graphical interpretation of the results. The retail trade enterprises of the post-Soviet economic space: Azerbaijan, Kazakhstan, and Tajikistan were selected. During the survey, 512 valid questionnaires were received, which is sufficient when conducting quantitative research. The study result should be considered as proof of all the previously formulated hypotheses. Thus, according to the study results it can be concluded that the retail market of the post-Soviet economic space is not sufficiently ready for the introduction of robotization and full automation of retail stores. At the same time, certain areas of AI integration in the retail value chain, including inventory management and optimization of operations at this stage of market development, are attractive mainly for retail chains and large retailers. It has been identified that to attract customers and increase sales, AI is being implemented and utilized in both online and offline stores. The most popular and accessible area for integrating AI at the current stage of retail market development in the post-Soviet space is the technology for automating business processes and increasing sales through service personalization using chatbots, enabling retailers to reduce operational costs. It is indicated that AI technologies in the retail market of the post-Soviet economic space offer the following advantages: cost savings, prompt and informed handling of consumer queries, and the fostering of innovation through advanced business practices, including intelligent chatbots. It is expected that these identified benefits of AI technologies will enhance the behavioural experience of consumers and elevate the significance of product optimization.

The conclusions derived from this research, based on the analysis and assessment of the innovative potential of the retail market in the post-Soviet economic space, exemplified by Azerbaijan, Kazakhstan, and Turkmenistan, will support informed decisions regarding specific policy instruments. These decisions aim to foster bottom-up initiatives that have the potential to contribute to sustainable growth and the modernization of the innovation economy. In addition, the presented research results can assist managers of trade enterprises in choosing the direction of AI integration. The results can also help academic researchers to define the research field of future studies, such as the perception of AI in retail trade by consumers of the post-Soviet economic space.

The future direction of this research is intended to focus on a detailed examination of collaboration among stakeholders in the supply chain: suppliers, manufacturers, retailers, and consumers. This examination will explore aspects such as personalization, sustainability, innovativeness, and learning to understand the entire system that is shaped by the actions of all interacting participants.

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APPENDIX A

Table A. Respondent questionnaire

Code	Question				
	Informational block				
RQ1	Your company's main activities are: (1) in Kazakhstan (2) in Azerbaijan (3) in Tajikistan				
RQ2	Your business is: (1) a chain of retail stores; (2) a large enterprise; (3) a medium-sized enterprise; (4) a small business.				
RQ3	Your business is: (1) a general merchandise retailer; (2) a specialty retailer; (3) a specialty retailer with an expanded assortment				
RQ4	Your business conducts its activities: (1) only online, has no physical store(s) (2) predominantly online, but has physical store(s) (3) the revenues of online and physical stores are almost identical (4) predominantly physical store(s), but online commerce is developing (5) physical stores only				
RQ5	Your company is in the retail market:				
	(1) less than 1 year				
	(2) 1 to 5 years				
	(3) 5 to 10 years				
RQ5	(4) more than 10 years				
	Analytical block				
	Determine your level of agreement with the suggested statements: 5 - Strongly agree; 4 - rather agree than disagree; 3 - Difficult to answer; 2 - Disagree rather than agree; 1 - Disagree completely.				
	RQ6	In recent years, competition in the retail industry has intensified considerably			
	5	4	3	2	1
RQ7	To ensure the sustainable development of retailers in modern conditions it is necessary to introduce innovative technologies				
	5	4	3	2	1
RQ8	Artificial intelligence technology can provide a competitive advantage for retailers in today's economic environment				
	5	4	3	2	1
RQ9	Our company uses artificial intelligence technology in the value chain				
	5	4	3	2	1
RQ10	Our company is ready to implement artificial intelligence technologies in the value chain				
	5	4	3	2	1

continued on following page

Table A. Continued

Code	Question				
	Informational block				
RQ11	Consumers and domestic market infrastructure are fully prepared for the introduction of robotics				
	5	4	3	2	1
RQ12	Consumers and domestic market infrastructure are fully prepared for the introduction of automated stores				
	5	4	3	2	1
RQ13	The use of artificial intelligence in retail in our country is constrained by the lack of available technological solutions				
	5	4	3	2	1
RQ14	At this stage, the most promising direction for the introduction of artificial intelligence in the activities of domestic trade enterprises is to optimize the attraction of customers				
	5	4	3	2	1
RQ15	Chatbot technology is one of the most promising technologies for applying artificial intelligence in domestic retail				
	5	4	3	2	1
RQ16	Artificial intelligence technology can replace humans in retail in our country				
	5	4	3	2	1
RQ17	Artificial intelligence technology will dominate retail in the next 3 years				
	5	4	3	2	1
RQ18	Artificial intelligence technology will dominate the domestic retail industry no earlier than 5 years from now				
	5	4	3	2	1
RQ19	Artificial intelligence technology in retail is more of a trend than a necessity				
	5	4	3	2	1
RQ20	The introduction of artificial intelligence technology in our country is hampered by insufficient access to investment				

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