



Marketing

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**Using Personalized Recommendations in Artificial Intelligence to Increase Sales
of Small Businesses in E-Commerce**

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Abstract. Personalized recommendations in artificial intelligence are becoming increasingly relevant for increasing sales by small businesses in e-commerce due to escalating competition in online commerce and changing customer expectations. The growing consumer preference for personalized offers is weakening traditional marketing strategies. Although such systems have already proven to be effective at the scale of large enterprises, problems with access to huge amounts of data, economic resources, and technical knowledge prevent them from benefiting small businesses.

The **purpose** of the article is to provide a theoretical and practical overview of the use of personalized recommendations in small e-commerce businesses, the effectiveness of the main methods of their implementation and the results of their use, and to identify barriers that prevent the external use of such systems when assessing their effectiveness.

Methods: analysis of scientific literature, generalization, systematization.

The **results** of the study show that the introduction of personalized recommendations in small business marketing campaigns increases revenue and provides a higher level of customer satisfaction. The use of artificial intelligence in



recommendation systems triples the relevance of offers. This, in turn, has a positive impact on conversion and customer loyalty. On the other hand, the study revealed a number of problems faced by small companies today. These include a lack of quality data, difficult integration into existing business processes, and further compliance with GDPR requirements.

The **conclusions** show that personalized recommendation systems based on artificial intelligence are one of the most promising tools for improving the efficiency of small businesses in the e-commerce sector. They help to create a unique approach to each customer, which, in turn, proves a competitive advantage for firms even with limited resources. However, maximum efficiency can be achieved only if the technological and organizational aspects of implementation and adaptation of personalization tools to the specifics of the company's activities are taken into account.

Keywords: machine learning, digital marketing, sales automation, customer retention, personalization algorithms.

Використання персоналізованих рекомендацій у штучному інтелекті для підвищення продажів малих підприємств в e-commerce

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Анотація. Персоналізовані рекомендації в штучному інтелекті стають усе більш актуальними для збільшення продажів малими підприємствами в електронній комерції через ескалацію конкуренції в онлайн-торгівлі та зміну очікувань клієнтів. Зростання споживчих переваг персоналізованих пропозицій послаблює традиційні маркетингові стратегії. Хоча такі системи вже довели свою ефективність у масштабах великих підприємств, проблеми з доступом до



величезних обсягів даних, економічних ресурсів і технічних знань заважають їм приносити користь малому бізнесу.

Мета статті – викласти теоретичний і практичний огляд застосування персоналізованих рекомендацій у малому бізнесі електронної комерції, ефективності основних методів їх упровадження й результатів застосування, а також визначити бар'єри, які перешкоджають зовнішньому застосуванню таких систем під час оцінювання їх ефективності.

Методи: аналіз наукової літератури, узагальнення, систематизація.

Результати дослідження доводять, що запровадження персоналізованих рекомендацій у маркетингові кампанії малого бізнесу підвищує дохід і забезпечує вищий рівень задоволеності клієнтів. Застосування штучного інтелекту в системах рекомендацій потроює релевантність пропозицій. Це, у свою чергу, позитивно впливає на конверсію та лояльність споживачів. З іншого боку, дослідження виявило низку проблем, із якими сьогодні стикаються малі компанії. Це недостатня кількість якісних даних, складна інтеграція в наявні бізнес-процеси й подальша відповідність вимогам GDPR.

Висновки засвідчують, що персоналізовані рекомендаційні системи на основі штучного інтелекту є одним із перспективних інструментів підвищення ефективності діяльності малого бізнесу в сфері електронної комерції. Вони допомагають створити унікальний підхід до кожного клієнта, що, у свою чергу, доводить конкурентні переваги для фірм навіть за обмежених ресурсів. Проте максимальної ефективності можна досягти лише за умови врахування технологічних та організаційних аспектів упровадження й адаптації засобів персоналізації до специфіки діяльності компанії.

Ключові слова: машинне навчання, цифровий маркетинг, автоматизація продажів, утримання покупців, алгоритми персоналізації.

Statement of the problem in general and its connection with important scientific or practical tasks. In today's digital economic competition, the struggle level



is likely higher for small e-commerce businesses. Large corporations take full advantage of advanced personalization algorithms, very powerful analytical tools, and access to large amounts of data. However, advertising based mainly on mass strategies and standard approaches to product promotion is increasingly on the decline. As consumers demand a customized approach and personalized experience with a brand, the use of artificial intelligence to create personalized recommendations is seen as providing new opportunities for small businesses, opportunities that help improve customer engagement, enhance the user experience, and ultimately increase sales conversions. However, implementation poses many challenges, including the need for high-quality data to be collected and processed, financial and technical resources to be found, as these are usually much less available in small businesses, and large-scale problems with adapting algorithms to the specifics of small businesses.

The study is relevant due to the rapid expansion of artificial intelligence in e-commerce and the need to develop effective personalization tools for small businesses. Numerous studies have been conducted on personalized recommendations in large corporations, but the issue of their effective adaptation to the needs of small businesses has not been sufficiently studied. The topic is important because consumer expectations of personalized offers are growing, making traditional marketing approaches less effective [1]. Artificial intelligence can increase the competitiveness of small businesses in the innovation competition to improve sales optimization and build long-term customer relationships. Thus, finding out the impact of personalized recommendations on the feasibility of small firms' efficiency in e-commerce should be considered an important area of research for the further development of the digital economy and marketing technologies.

Analysis of recent research and publications. Creative marketing strategies in business and modern innovative approaches are the main research areas by O. Lysak, V. Tebenko, and L. Boltyanska [2]. The authors pointed to using digital technologies to improve sales efficiency, directly translating into personalized recommendations for



small e-commerce businesses. They also emphasized that the personalization of modern marketing increases conversion and customer satisfaction.

The study by M. Semykin, S. Nisfoyan, L. Zapirchenko, B. Dmytryshyn, and G. Savelenko [3] assesses the role of logistics management and e-commerce in developing entrepreneurial trade. In the article, the authors show that personalized recommendation systems increase the efficiency of e-commerce, as such systems improve customer communication and help reduce marketing costs. In this regard, the researchers emphasize that personalization makes it possible to change commercial offers to customers' changing needs, which is very important for small businesses.

The paper by L. Romanchuk, D. Shchytyov, and M. Mormul [4] discusses the main aspects, directions, and threats of artificial intelligence in e-commerce. The authors emphasize the benefits of the artificial intelligence algorithm for personalized recommendations, such as improved customer interaction and increased customer retention. The challenges are addressed in essential areas, including data security and high implementation costs that require constant updating.

The study by A. Valkovets [5] highlights the impact of international trading platforms on marketing and business strategies. The author notes that large e-commerce platforms such as Amazon and Alibaba are actively using artificial intelligence to personalize offers, which means that small businesses can integrate such approaches into their business models. The use of recommendation algorithms in international trade has proven effective, which is already creating the preconditions for their adaptation to local markets and small businesses.

K. Kakurinov, N. Chernikova, R. Dolina [6] evaluate digital technologies in a study on managing marketing activities at enterprises. When studying the role of artificial intelligence and automated recommendation systems in improving the efficiency of online sales, the authors emphasize that even small companies can make tangible progress through these technologies. In particular, the authors recommend using cloud-based AI solutions to help reduce financial and technical barriers for small businesses.



The article examines trends in the e-commerce market development in the world and Ukraine [7]. Personalization will become one of the key factors for the success of online commerce in the future, as it will be possible to adjust marketing strategies depending on consumer behavior in real-time. The authors pay special attention to implementing personalized recommendations in small businesses and call for developing affordable technological solutions for this business segment.

V. Strelets, B. Garashchenko, V. Sokolovskyi, and A. Arzhannikova [8] argue that digital business transformation is impossible without personalized recommendation systems that optimize contact with consumers and lead to increased customer trends and loyalty. They emphasize and suggest that such personalized advice allows small businesses to compete with large businesses by responding to customer requests faster. They emphasize and suggest that such personalized advice enables small businesses to compete with large businesses by being more responsive to customer needs.

Identification of previously unsolved parts of the general problem. The article discusses the details of implementing personalized recommendations on a small scale of e-commerce. A set of factors that impede scaling to the level of small enterprises, including technical, financial, and organizational aspects, is considered. The efficiency of real business through the use of artificial intelligence in sales personalization is critically analyzed with the prospect of expanding the availability of these technologies among small businesses.

Formulation of the article's objectives (statement of the task). The purpose of the article is to provide a theoretical and practical overview of the use of personalized recommendations in small e-commerce businesses, the effectiveness of the main methods of their implementation and the results of their application, and to identify the barriers that prevent the external use of such systems when assessing their effectiveness.

The study aims to examine the theoretical foundations and practical examples of implementing personalized recommendations in small e-commerce businesses, assess



its application's effectiveness, and identify the main barriers that prevent its mass use and violate the objectivity of the evaluation of the results.

Summary of the main research material. Recommending personalized content or any product or service that is suitable for a customer based on the analysis of his or her preferences and behavioral data to help improve the conversion experience of the last customer is what personalization recommendations are. A new approach to the huge variance of data and the variations of the end customer and his or her future preferences provides incredible detail on individual preferences and the end customer based on optimal algorithms and machine learning techniques [9]. So, it changes marketing from a general strategy to customer-centered flexibility.

The recommendation system collects data on user interactions, transaction history, browsing habits, and demographic data. Based on these computational aspects, the main algorithms for creating personalized recommendations fall under collaborative filtering, content-based filtering, and hybrid approach. Collaborative filtering is effective for target users who behave similarly. There are two main classifications of this technique: user-based filtering and item-based filtering. Content-based filtering takes into account element attributes and user history. Content filtering has been proven to work perfectly for personalized advertising, as recommendations can be derived from previous interactions with certain related categories of items. This Hybrid Recommender System will use collaborative and content-based filtering to try to combine their strengths and mitigate their limitations to some extent, aiming to achieve quality, accuracy, and relevance of personalization.

The impact of personalization on consumer behavior is used in many aspects of decision-making, brand evaluation, and loyalty development. Personalized recommendation strategies make the user experience more engaging and reduce search burden, increasing customer satisfaction as they prefer to connect with people and corporate organizations that know them. This knowledge of the benefits they seek makes them feel like they are getting added value. This translates into a long-lasting relationship with them. Direct recommendations indicate a need for impulse purchases



and higher order checks, as the perceived value of products and services is greater when recommended based on their needs. Recent research suggests that these recommendations increase household retention and repeat purchases [10].

The success of personalized recommendations depends solely on the ethical and transparent handling of consumer data. This can significantly improve user engagement, but data breaches and algorithmic biases must be stopped to maintain consumer trust in such matters, thus striking the right balance between personalization and privacy while maintaining customer relationships and complying with regulatory requirements. Artificial intelligence is used in e-commerce, particularly in developing personalized recommendation systems. This feature allows online retailers to offer highly customized product offerings, optimize user experience, and increase business efficiency, all based solely on products developed using AI technologies. An important aspect of applying artificial intelligence to recommendation systems that use machine learning and neural networks is the dynamic adaptation of content and real-time decision-making. What distinguishes the modern application of artificial intelligence in recommender systems from the old rule-based ones? It is a complete transition to advanced machine learning models that learn gradually with each user interaction, preferences, and consumption of contextual data. Decision trees and support vector machines, which are based on supervised learning algorithms, have traditionally been used to recognize consumer behavior patterns. Deep learning and reinforcement learning are more sophisticated methods that further improve the accuracy of recommendations, not to mention their effectiveness. Neural networks, especially convolutional and recurrent networks, allow systems to process large amounts of unstructured data, including images, texts, and browsing history, to generate more relevant recommendations [11, p. 218-219].

In parallel with product offerings, AI drives customer segmentation and demand forecasting. Typically, customer segmentation results from predefined customer categories based on demographic and transactional data. However, these AI-based clustering methods, such as k-means and hierarchical clustering, combine conditions



to provide more detailed and dynamic segmentation that will reveal deeper customer behavior patterns. Micro-segmentation and the implementation of hyper-personalized marketing strategies become very feasible. E-commerce platforms will also benefit from AI-powered demand forecasting, as it best positions them to optimize pricing and inventory management strategies. Long-term, short-term memory networks and forecasting algorithms determine future demand levels by analyzing a firm's historical sales, seasonal and other direct or indirect economic data. Integrating AI-powered segmentation and predictive analytics will improve visibility to make more accurate decisions, eliminate shortages, and increase customer satisfaction.

While AI-based recommender systems offer tremendous benefits, most small businesses face a variety of challenges and limitations when implementing a system. The high cost of developing and implementing AI is one of the key challenges. Unlike large e-commerce corporations, which may have access to vast amounts of data and computer resources, small businesses are likely to have difficulty collecting and processing enough customer data to train AI models. In addition, AI solutions also require constant updating and maintenance, so they may require large resources that not every small business has, and there may be a lack of knowledge and experience with the technology, which will make it difficult to implement. Data privacy and security also remain an issue. Thus, companies must maintain all necessary protections related to the use of large amounts of user data, such as GDPR and CCPA, which increase the level of data governance to a truly robust level; without this, they may face legal consequences and lose the trust of their users. Another important problem area is the shift of algorithms in the application of AI-based recommendations [12].

AI models can combine biases in situations where the training data is not diverse or representative, leading to unfair or irrelevant recommendations. Small businesses cannot conduct audits and mitigate biases, hindering the successful implementation of ethical AI. Another prerequisite is that an AI system must be integrated seamlessly with specific e-commerce and customer relationship management systems.



Most small businesses implement third-party solutions that lag in compatibility with modern AI technologies.

To illustrate the main challenges and benefits of AI-powered personalized recommendations in e-commerce, Table 1 provides a comparative analysis of AI adoption in large and small businesses.

Table 1

Comparative analysis of artificial intelligence implementation in small and large businesses [9-12]

Aspect	Large companies	Small e-commerce businesses
Data availability	e-commerce	Limited data on customers and their interactions
Costs of AI implementation	Large data sets from many millions of users	Limited budget for AI solutions
Technical expertise	Significant investments in AI development and infrastructure	Limited internal knowledge in the field of artificial intelligence
Compliance with regulatory requirements	Dedicated AI teams and data scientists	Difficulty in managing data privacy risks
Accuracy of recommendations	Legal teams to ensure GDPR and CCPA compliance	Less detailed and static recommendations
Scalability	Highly personalized and dynamic offers	Challenges in scaling AI solutions

The future of AI-powered personalized e-commerce recommendations depends on how well businesses can overcome these obstacles. Cloud services for AI and AutoML tools will become much more accessible, and even small businesses with limited resources will find it easier to make cost-effective decisions. TensorFlow Recommends and Surprise have already opened the door for small businesses to take advantage of this AI integration without requiring the best of knowledge and practice. Moreover, as long as privacy-preserving AI technologies or federated learning continue to improve, businesses will be able to leverage customer data without security or compliance gaps in terms of rules and regulations.



The impact of personalized recommendations on small business performance is one of the most attractive areas currently being explored by digital marketing and e-commerce researchers [13]. It is always difficult for small businesses to compete with large corporations due to relatively fewer available resources, the vulnerability of a small customer base, and low brand awareness. However, personalized recommendations have been introduced as a driving factor in increasing efficiency on both the operational and marketing fronts and attracting potential customers. Small businesses can enhance customer offerings, optimize marketing investments, and improve customer relationships with product recommendations based on customer data and AI analytics. How personalization experiences will be applied to small businesses depends mainly on the industry, technological maturity, and, more importantly, strategic approach. Most small businesses have already implemented recommendation systems on third-party e-commerce platforms built on Shopify, WooCommerce, Magento, etc. and have standard AI recommendation features.

Other social media and email marketing automation tools, such as Klaviyo and Mailchimp, can help small businesses make recommendations based on user behavior. Smaller retailers and niche e-commerce stores are seeing a positive effect from such implementations. They tend to significantly increase their conversion and retention rates. Unlike smaller companies, large corporations invest heavily in building their AI models and often receive ready-made recommendations for integration into an existing platform [14]. The experience of some companies in industries such as fashion, beauty, and grocery stores is to increase the value of the average order and maximize customer value by using known recommendations for individuals. Superior results depend on the quality of customer data and the ability to analyze buying trends.

KPIs accompany the evaluation of personalized business recommendations to measure the systems' effectiveness and impact. One of the main KPIs is the conversion rate, which can inform us about what percentage of users purchase interacting with a recommendation; there is also the click-through rate (CTR), which evaluates products about users; and the revenue per visitor (RPV), which can be used to measure the



financial impact of recommendations. Other performance metrics take into account the reduction in the number of cart abandonments and repeat purchases. This can determine how much recommendations drive customers to make a sale and how many customers return. A/B testing sometimes also does this in small businesses and checks whether personalized recommendations are more effective than product displays and whether they also influence decisions. The result is that such changes are effectively made to these companies' KPIs in an impactful way, leading to real improvements in sustainable growth and profitability. In light of the above, Table 2 shows the improvements in small businesses' KPIs before and after recommender systems' implementation.

Table 2

KPIs before and after the implementation of AI-based recommendation systems [15].

KPI indicator	Before implementation	After implementation
Conversion rate, %	2,5	4,8
Click-through rate (CTR), %, USD	1,8	3,9
Revenue per visitor (RPV), USD	1,2	2,5
Abandoned carts rate, %	65	50
Repeat purchase rate, %	18	30

The above indicates the significant benefits of enabling personalized recommendations, which, with small improvements in accuracy and user engagement, promise substantial cash flows. A better user experience through more relevant product suggestions increases customer trust and satisfaction. At the same time, recommendations are a way for small businesses to reduce marketing costs because they accurately target their market instead of generally less effective advertising strategies.

The future of personalized recommendations for small businesses is even more promising now that significant advances have been made in developing and thus made



available to, artificial intelligence, machine learning, and real-time data processing for such businesses. While significantly impactful, the short-term outlook includes generative artificial intelligence and predictive analytics that will gradually improve the accuracy of recommendations, enabling companies to stay ahead of customer demand needs before they actively search for products. This will create new opportunities for small businesses to interact with customers through chat recommendations and voice bots. In addition, the rapidly developing e-commerce industry is also promoting augmented reality and virtual reality, in which the customer receives an augmented and personalized shopping experience, thanks to which personalized offers are created based on preference levels and the ability to interact within this virtuality [16].

The increasing availability of no-code and low-code AI platforms will also reduce the technical barriers for small businesses to implement high-level recommendation engines without high programming knowledge. Privacy-preserving AI technologies, such as federated learning, will enable companies to utilize customer data without any security concerns about complying with data protection laws. However, companies must maximize customer insights, evolve their data collection and analysis strategies, invest in scalable AI solutions, and learn about changing consumer trends.

Conclusions. Given the results obtained, it can be argued that personalized recommendations implemented in small e-commerce businesses are an effective sales tool, helping to attract customers and increase customer loyalty. After researching, we can state that these technologies will allow us to adjust the marketing strategy and increase conversion and average check value as offers become more relevant to users. Despite these advantages, small companies can and often do face challenges in implementing personalized recommendations, as they have a very narrow amount of data, a high cost of AI integration, and difficulty modifying profiling algorithms in a narrowly defined market niche. Thus, the development of e-commerce for small businesses through the AI personalization channel is very promising. However, its



effective use is associated with specific challenges and requires adapted approaches. Small businesses should use affordable cloud solutions to get the most out of personalized recommendations. This reduces technical barriers and enables step-by-step testing of recommender systems, thereby gradually optimizing them. Therefore, further research should focus on more affordable AI tools for small businesses, and the extent to which personalization affects long-term customer loyalty and business sustainability in a dynamic market also needs to be assessed.

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