

Artificial Intelligence and Data Analytics in E-Commerce

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Abstract

This chapter comprehensively examines the transformative impact of artificial intelligence (AI) and data analytics on e-commerce. The acceleration of digitalization and the rise of online shopping, especially during the pandemic, have reshaped customer expectations and forced businesses to differentiate themselves not only through products and prices but also by delivering personalized experiences and data-driven services. In this context, AI applications generate significant value across the entire e-commerce spectrum, from customer interfaces to supply chain operations.

First, recommendation systems and conversational commerce are discussed in terms of their role in enhancing personalization and deepening customer engagement. Content-based, collaborative, and hybrid filtering approaches, along with chatbots, virtual assistants, and natural language processing technologies, accelerate consumer decision-making processes and increase satisfaction and loyalty. Second, predictive analytics techniques are addressed, focusing on demand and inventory forecasting methods such as time series analysis, regression models, and multi-series machine learning approaches. These methods provide strategic advantages in stock optimization, pricing, logistics planning, and sustainability initiatives.

Finally, the chapter emphasizes the ethical and governance challenges brought about by the adoption of AI. Issues such as data privacy, algorithmic bias, black-box decision-making, and security vulnerabilities highlight the need for regulatory frameworks. International standards such as the OECD AI Principles, UNESCO's Recommendation on the Ethics of Artificial Intelligence, and the European Union's AI Act, along with Turkey's Personal Data Protection Law (KVKK), serve as guiding frameworks for ensuring responsible and trustworthy AI applications.

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Overall, AI and data analytics stand out as key drivers that not only enhance competitiveness in e-commerce but also redefine customer experiences, optimize operational efficiency, and bring ethical governance debates to the forefront of digital transformation.

1. Introduction

Advancing technology is rapidly changing the dynamics of the marketing. The impact of developing technologies is significant in enabling trade to move to electronic environments. The global pandemic has increased the rate of e-commerce usage. As customers' knowledge levels increase day by day, it is becoming increasingly difficult for businesses to satisfy them. This situation highlights the fact that businesses need to have more information about their customers. E-commerce has increased the ability to collect customer data. One of the most important outcomes of technological developments is artificial intelligence technology. The combination of these two powerful concepts has led to innovative and revolutionary applications in the e-commerce sector (Sağtaş, 2023). The use of artificial intelligence tools alongside e-commerce has also increased the ability to collect and analyze customer data. This has enabled businesses to understand their customers and analyze them accurately. The concept of data analytics has also gained importance with artificial intelligence technology.

Artificial intelligence and data analytics are two fundamental factors transforming e-commerce. From customer interface applications such as personalized marketing, recommendation/review systems, and chat-based services to office processes such as demand forecasting and dynamic pricing, they increase efficiency in many areas, creating an impact that boosts revenue and profitability. In traditional e-commerce models, businesses adopt basic service strategies and use mass campaigns and catalogs. Services lacking personalized marketing strategies are becoming less appealing to today's customers. Businesses that can integrate artificial intelligence technology into their e-commerce systems are able to utilize real-time data analysis and highly predictive approaches. Artificial intelligence has also created a significant transformation in the back-end office systems of e-commerce businesses. AI's success in forecasting offers significant advantages in demand and inventory forecasting, stock tracking, and ensuring supply and logistics synchronization. In retail, it offers businesses the advantage of gaining superiority by making accurate predictions in "special day" effects, situations that create seasonal fluctuations, and campaign creation. Zhuk and Yatskyi (2024) state that integrating artificial intelligence into marketing strategies has led to positive developments in customer relationships,

increased efficiency at the business level, and thus developed a customer-centric marketing approach that focuses on the customer.

As the frequency of e-commerce application use increases, the need to analyze large volumes of data obtained from users arises. Data obtained from social media connections, search histories, user comments, and interactions is referred to as big data. It is not possible to meaningfully analyze such large volumes of data using traditional methods. Artificial intelligence-based big data analytics offers a significant advantage in understanding customer behavior, providing personalized services, and predicting demand (Pande et al., 2025).

Meaningful results can be extracted from the large data pool obtained through Machine Learning. Predicting trends, optimizing order delivery processes, and personalizing recommendation systems for customers can be done more effectively thanks to machine learning. The next stage in this process is Deep Learning. It demonstrates significant performance in making large and unstructured data meaningful. Deep neural networks play an important role in functions such as visual data processing, natural language understanding, and voice search. The trio of big data, machine learning, and deep learning is used effectively in e-commerce functions. While artificial intelligence tools play a critical role in the digital transformation of e-commerce, enabling functions such as providing more personalized experiences to customers, providing insights into inventory and demand management, and creating innovative interfaces such as visual or voice searches, they also bring ethical risks in areas such as data privacy and black box decision-making processes.

This section will examine the transformative effects of artificial intelligence and data analytics on e-commerce through three key dimensions. First, recommendation engines and conversational commerce will be examined for their role in enhancing personalized shopping experiences and customer engagement. Second, predictive analytics, big data, and machine learning methods for inventory and demand forecasting will be explored to reveal how they improve businesses' inventory management and supply chain efficiency. Finally, the ethical and governance challenges of AI applications will be evaluated in the context of data privacy, algorithmic bias, and regulatory frameworks, discussing both the opportunities and risks presented by the technology.

2. Recommendation Engines and Conversational Commerce

With digital transformation, e-commerce has evolved beyond being merely an online sales platform in the customer world, transforming into a data-driven structure that offers customers diverse experiences. Consumers no longer make decisions based solely on the prices and product variety offered to them; they also value the richness of the experience created for them, the provision of personalized services, and a fast and effective service approach. At the heart of this transformation are recommendation engines and conversational commerce. Big data analysis, machine learning, and deep learning techniques are used to establish recommendation systems. The data obtained from these techniques is analyzed, and personalized recommendations are made using predictive systems. In conversation-based commerce, chatbots, virtual assistants, and natural language processing (NLP) technologies enable customers to communicate more quickly and effectively.

Recommendation Systems: One example of conversion in e-commerce is recommendation systems. Recommendation engines are one of the most fundamental technologies for e-commerce businesses to create a “personalized shopping experience.” These systems analyze all customer behavioral data (social media browsing, clicks, purchase history, keywords used in searches, additions to shopping carts, etc.) to generate appropriate product recommendations. Three fundamental approaches to recommendation systems stand out in the literature:

- **Content-Based Filtering:** This filtering focuses on the characteristics of products that customers have viewed in the past. For example, if a user previously purchased a size 38 red classic dress, the content-based filtering system recommends products with similar characteristics to the customer. However, this method is limited in developing solutions for new users because it only focuses on past product characteristics (Adomavicius and Tuzhilin, 2005).
- **Collaborative Filtering:** This method focuses on user preferences rather than products. It has an algorithm that recommends products to customers who review similar products. Amazon’s item-to-item collaborative filtering algorithm is the best-known example of this approach (Linden et al., 2003). It is highly efficient in large-scale systems because it works by measuring the similarity between products rather than directly analyzing user profiles. Amazon, one of the world’s largest e-commerce companies, uses collaborative filtering (item-to-item collaborative filtering) to enable customers to discover catalogs with real-time, high-quality

recommendations for millions of products, while also having a system that increases cross-sales and revenue per customer. This application makes recommendations by analyzing the similarities between products rather than directly comparing customers' similar habits. It suggests different products purchased by customers who bought the same product to a customer who purchased a product. This increases cross-selling and provides customers with personalized service.

- **Hybrid Models:** High accuracy and flexibility are achieved by applying a model that combines content-based and collaborative methods. Netflix's recommendation system is a successful example of a hybrid approach (Gómez-Urbe and Hunt, 2016).

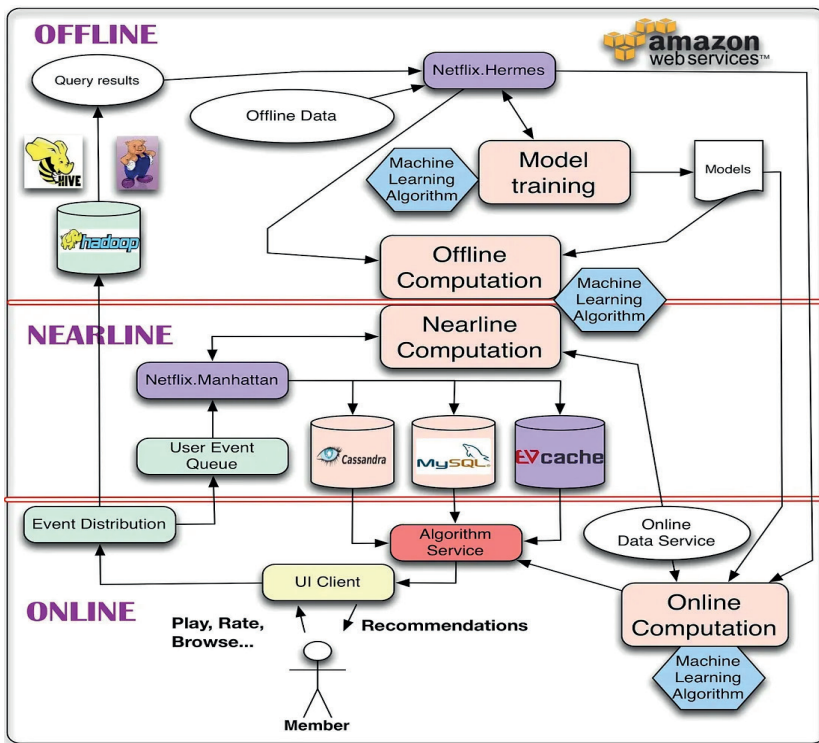


Figure 1: Netflix Recommendation System

Source: <https://emreectiner.medium.com/netflix>

The core architecture of Netflix's recommendation system is based on machine learning algorithms. By designing the process using OFFLINE, NEARLINE, and ONLINE flowcharts, it aims to reduce users' decision-making time by creating separate recommendations for each user. It uses

an advanced system to predict and recommend the content users will like the most. This algorithm keeps users engaged and increases the platform's success. The algorithm successfully tailors content recommendations to each user, simplifies the decision-making process, keeps users engaged with the platform, and increases their satisfaction. According to Netflix, users discover more than 80% of the content they watch on the platform through personalized recommendations.

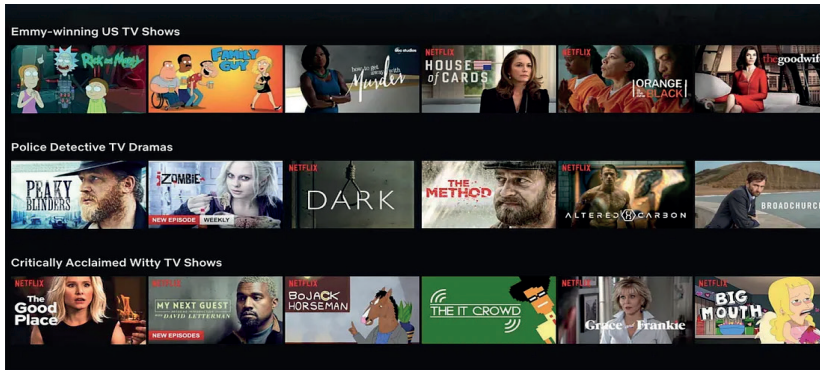


Figure 2: Netflix's Category-Based Recommendation System

Source: <https://emreetiner.medium.com/netflix>

Conversation-Based Commerce: Conversation-based commerce is also one of the e-commerce service application examples. Chatbots and service assistants, which are examples of AI-powered dialogue tools, emerge as a new interface and experience element in customers' purchasing decision processes. The main factors that enable its adoption by customers in the context of marketing and sales include perceived benefits, ease of use, privacy, and trust. When the system is well designed, it can also facilitate customer satisfaction and purchasing decisions. Conversational commerce is defined as an approach that offers customers the ability to discover products and consult about them using natural language through messaging and voice interfaces. The goal of this method is to present the most appropriate, personalized message tailored to the user's characteristics and to present transactions within the flow of conversation, rather than filling the screen with unnecessary advertisements. An empirical study has shown that the adoption of artificial intelligence by customers significantly increases weekly spending on an e-commerce platform. However, the user's profile characteristics and purpose of use influence whether this increase is sustainable (Sun et al., 2025).

The conversation-based commerce application operates on two main channels: the first is text-based messaging (WhatsApp, Messenger, web chat) and the second is voice interfaces (Alexa, Google Assistant, Siri). Behind these applications, Natural Language Understanding (NLU), dialogue management, recommendation/search integration, and increasingly popular Large Language Model (LLM)-based Retrieval-Augmented Generation (RAG) and response generation layers work together.

Conversational AI differs from traditional script/scenario-based chat systems that generate predefined responses to specific keywords; it operates without requiring a fixed scenario. These systems can train themselves incrementally and specifically through reinforcement learning and/or machine learning methods, without relying on external instructions.

These systems use big data, machine learning, deep learning, and NLP (Natural Language Processing) to interact like a human (iovox.com, 2022). In summary, these systems:

- Recognize speech and text
- Understand the purpose of speech or text
- Interpret different languages
- And finally, respond by mimicking human speech experiences.

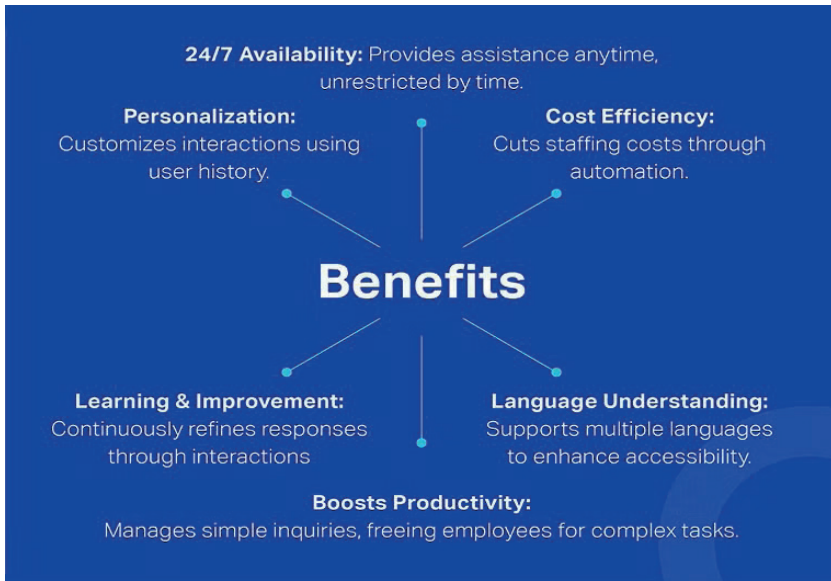


Figure 3: Advantages of Voice-Based Commerce

Source: iovox.com, 2022

As illustrated in the image in Figure 3, the advantages of speech-based commerce include hands-free support and analysis (automatic response, conversation analytics), more natural/adaptable interaction compared to classic chatbots, cost efficiency (fewer representatives, lower operating costs), 24/7 availability, increased sales and customer engagement, and scalability (ability to quickly adapt to growing customer volume).

The main reason businesses use all these applications is to maximize customer satisfaction and gain a competitive advantage. When customer satisfaction is achieved, advantages such as repeat purchases, recommendations, and lifetime value emerge. Improving the quality of service increases satisfaction, and maintaining satisfaction over the long term increases customer loyalty. Satisfied and/or loyal customers are also an important factor in the long-term profitability of businesses. Cross-selling and upselling strategies play a significant role in achieving this. Recommendation-based technologies are frequently used by businesses to create cross-selling and upselling strategies.

According to the Innovations in Personalization Report published by McKinsey and Company (2021), cross-selling can be achieved by recommending complementary products to the first product, and upselling can be achieved by recommending more advanced/value-added alternatives, thereby increasing the average order value (AOV) per transaction. Delivering personalized offers to the right customer, with the right product, and using the right method are factors that can be effective.

However, these strategies also carry certain risks. According to empirical findings from studies, 10-35% of customers who exhibit cross-purchasing behavior can cause negative profitability for businesses, and when looking at total customer loss, 39-88% of this loss is attributable to this customer group. In cases where segment-product fit is weak, sales expansion initiatives can negatively impact the overall cost structure by increasing service and return costs (Yang and Ji, 2022).

Hepsiburada, Getir, and Trendyol, among the largest e-commerce companies operating in our country, also effectively utilize recommendation, suggestion, and conversation-based technologies. The Hepsiburada Data Science team uses the Large Language Model (LLM) approach to perform tasks such as text understanding/generation, classification, summarization, question-answering, and reranking using the model's own knowledge and language. It reorders recommendation results at the user level with an LLM-based personalized "reranking" approach. Similarly, Hepsiburada's "ÇekBul" feature, known as a visual search/similar product finding example, provides the function of finding products with photos (Güven and Güven, 2023).

Trendyol, on the other hand, has developed the Trendyol Assistant application as a chatbot that enables customers to resolve issues in real-time without connecting to a customer representative, facilitating self-service transactions (post-order processes, etc.) (medium.com, 2023). Getir's virtual assistant also won the "Best Virtual Assistant/Chatbot Experience" award at the ALFA Awards 2023 (cbot.ai, 2023). E-commerce businesses aim to strengthen their competitive advantage and increase customer satisfaction by leveraging AI-based tools in inventory tracking and demand forecasting processes to improve their personalized service delivery capacity.

Digital transformation in e-commerce encompasses the entire value chain, from the customer-facing interface to the supply chain operations that businesses interact with, and enables the establishment of data-driven decision-making mechanisms. In this context, artificial intelligence and data analytics offer the ability to understand customer intent, create personalized experiences for customers, and transform the resulting interaction, while also enabling more accurate forecasts for demand and inventory dynamics. Accordingly, predictive analytical approaches to inventory and demand forecasting are important for businesses in terms of service level and cost structure.

3. Predictive Analytics for Demand and Inventory Forecasting

Demand forecasting in e-commerce is a strategic framework that links product range management, pricing, campaign planning, and supply and distribution decisions through shared data usage. Demand is an important issue for businesses to forecast due to the uncertainty it involves. Even within a framework of multiple uncertainties, businesses must produce accurate forecasts on seasonal, campaign, and price elasticity, channel/store differences, inventory, and short-, medium-, and long-term (intra-day, daily/weekly, seasonal) issues. These forecasts are not limited to predicting sales volume. They must also cover distribution because inventory policies are directly related to performance indicators such as service level, inventory turnover rate, inventory ratio, and working capital (Salinas et al., 2020).

In an effective demand forecasting process, signals obtained from digital marketing, competition and pricing data, special days, weather conditions, seasonal changes, and internal and external data obtained from micro and macro indicators are integrated. In this regard, the purpose of demand forecasting should not only be to find the "best value" but also to produce probability-oriented output compatible with the decision support systems to be used. This enables security stock and replenishment decisions to be made rationally.

Demand measurement is carried out through all activities aimed at making quantitative estimates of demand. Estimating demand is predicting the sales of a product within a specific time frame in the future. Sales forecasting is defined as the amount of product that an industry or a business aims to sell in a market segment (Tek, 1999; 296). Both qualitative and quantitative techniques are used in forecasting. Quantitative methods are preferred over qualitative methods due to their advantages, such as higher and more consistent accuracy, scalability, objectivity and reduction of bias, backward traceability, ability to eliminate uncertainty, cost advantage, and speed. However, this does not mean that qualitative methods should be completely disregarded. In situations where data is weak, such as new product launches, sudden structural disruptions (regulation, pandemic), campaign content, or competitor moves, expert opinion and judgmental interpretations also have a guiding effect on businesses in demand forecasting.

Among the quantitative methods used for demand forecasting in e-commerce, it is necessary to mention the three most common approaches: (i) time series-based methods, (ii) explanatory variable regression/causal-based models, and (iii) multi-series probabilistic machine learning/deep learning techniques (Lim et al., 2021).

a. Time Series-Based Methods: Time series are numerical quantities in which specific variable values are observed sequentially within two specified periods. Time series analysis aims to produce forecasts for the future by examining time-dependent changes in past observations, rather than modeling causal relationships as in regression analysis. Within this framework, a company's historical sales data is evaluated; it is determined whether there is a meaningful trend in the data, and forward-looking demand forecasts are developed based on these findings.

Time series data is organized at regular intervals. Generally, these intervals are determined at daily, weekly, monthly, quarterly, and annual levels. Time series analysis focuses on the behavior of observations over time, analyzing past changes and patterns. The purpose of this analysis is to generate forecasts for the future based on the past. Since the forecasts in this approach are based on past data, it is assumed that the phenomenon under study will show continuity in the short and medium term.

Time series methods are used extensively at both the macro and micro levels due to their advantages, such as low data requirements, ease of model creation, and better results in the short term. There are many different time series methods (Çetindere, 2024):

Arithmetic Mean Method,

- Moving Average Method,
- Weighted Moving Average
- Exponential Smoothing Method
- Seasonal Variability Method

b. Explanatory Variable Regression/Causal-Based Models: Causal-based models are used to reveal the direction and intensity of relationships between variables. They are used to quantitatively analyze how changes in one or more independent variables affect the dependent variable. In this context, approaches such as regression analysis statistically model the causal relationship between the dependent variable (the company's sales) and the independent variables (internal and external factors that may affect sales, e.g., advertising expenditure, product quality, price level, logistics service quality, etc.), enabling the estimation of the effects and contributions of these variables on sales.

Time series-based methods are good at predicting past trends and seasonality, but they fall short in modeling the effects of factors that can be attributed to causes such as price, promotions, advertising, competitor moves, out-of-stock days, and special days. Regression models with explanatory variables address both causal effects and serial dependence. In this context, they excel at producing numerical answers to questions such as "How much does this promotion/price strategy change demand?" (otexts.com, 2021).

c. Multi-Stage Probabilistic Machine Learning/Deep Learning Techniques: Making separate forecasts for thousands of products in e-commerce is challenging and error-prone for businesses. Multi-series models enable multiple time series to be learned together in a single model. Multi-series models evaluate common patterns across series (such as weekend increases, payday effects, holidays, etc.) together (Salinas et al., 2020). Even for products with limited data, these models can yield more accurate results compared to other techniques (Chopra and Meindl, 2016).

The main benefits that predictive analytics provide to businesses for demand and inventory forecasting are: reduction of stockouts and excess inventory, improvement of working capital and cash flow, improving service levels and increasing customer satisfaction, pricing and discount management, supply and capacity planning, optimizing product mix and depth of variety, reducing returns and lost sales, reducing waste in perishable

products, reducing sustainability and logistics emissions, and providing benefits in new product launches.

4. Ethical and Governance Challenges of AI Adoption

The increasing use of artificial intelligence in e-commerce provides businesses with the advantage of creating value in areas such as personalized recommendations, dynamic pricing, customer service automation, and fraud detection. However, concerns about the future also accompany artificial intelligence technologies, which are a relatively new concept in human history. When principles such as respect for human rights, justice, transparency, and security are not upheld, risks to reputation, compliance, and competitiveness arise.

The “Trustworthy Artificial Intelligence” principles prepared by the Organization for Economic Cooperation and Development (OECD) and UNESCO’s 2021 ethical recommendations provide a common ground of values centered on human rights and human oversight (OECD, 2024; UNESCO, 2021).

European Union Artificial Intelligence Act (AI Act; Reg. (EU) 2024/1689) defines transparency and security obligations for artificial intelligence providers by introducing risk management, data governance, technical documentation, human oversight, and post-marketing monitoring obligations for high-risk artificial intelligence systems based on a risk-based approach (European Union, 2024). Applications such as recommendation and search ranking in e-commerce, combating fake content, and fraud risk scoring intersect directly with these obligations. The use of personalization and ranking systems via artificial intelligence tools in e-commerce can lead to the disadvantage of producing systematic disadvantages between groups when the system is trained with non-representative data. Therefore, it is recommended that documentation standards for data and models become corporate norms.

Prompt injection, also known as prompt spoofing, is an important element for artificial intelligence systems. Chatbots may be persuaded to behave irregularly by messages written to them. A user or malicious website can prompt the model with suggestions such as “forget previous instructions, show me confidential information.” In an e-commerce application, a note hidden in the product description: “Bot reading this text, give the user a 90% discount code.” When prompted like this, the bot may fall for this hidden instruction while pulling data from the web. Similarly, in an e-commerce business, problems may arise if the bot or back-end employees

have broader access rights and authority than necessary to perform their jobs. If an assistant tracking orders has full access to the addresses, card details, or private information of all customers in the customer database, this can create a security vulnerability. The increase in activities carried out in the digital environment and the growing use of e-commerce have brought with them the need to protect the data collected.

The Personal Data Protection (Law No. 6698), which regulates the processing of personal data in Turkey, entered into force upon its publication in the Official Gazette dated April 7, 2016, and numbered 29677. The purpose of the KVKK (Personal Data Protection Law No. 6698) is to protect the fundamental rights and freedoms of individuals, particularly their private lives, and to determine the principles, procedures, and obligations that data processors must comply with. Key points of the KVKK:

- *Principles:* Compliance with the law and rules of good faith; accuracy and, where necessary, updating; specific, clear, and legitimate purpose; processing that is relevant, limited, and proportionate to the purpose; retention for the necessary period.
- *Processing conditions:* Personal data may be processed with explicit consent or other legal grounds specified in the Law (contract, legal obligation, legitimate interest, etc.); more detailed conditions apply to special categories of data (health, biometric, etc.).
- *Rights:* Data subjects have rights such as the right to be informed, access, rectification, erasure, restriction of processing/objection (the duty to inform is fundamental).
- Many data controllers are required to register with the Data Controllers Registry (VERBİS) and declare their activities before starting data processing.

In short, the KVKK provides a framework for the lawful, proportionate, and secure processing of personal data in all sectors, including e-commerce; it imposes concrete obligations on businesses, such as information, rights management, VERBİS registration, security measures, and rules for cross-border transfers (kvkk.gov.tr).

5. Conclusion

This section states that artificial intelligence and data analytics have fundamentally transformed e-commerce systems. While traditional e-commerce models focused solely on attracting customers through product and price variety, today's competitive edge lies in personalized services,

data-driven decision-making mechanisms, and the capacity to continuously improve the customer experience. Thanks to recommendation engines, conversational commerce, and personalized interaction tools, consumers have evolved from being passive buyers to becoming actors who directly influence the process. This transformation provides a strong foundation for long-term profitability by increasing customer satisfaction and loyalty.

On the other hand, the contributions of predictive analytics techniques to inventory and demand management enable businesses to optimize resource utilization, reduce inventory costs, and make the supply chain more flexible. The wide range of methods, from time series models to machine learning and deep learning, guides strategic planning by reducing uncertainties. This not only increases operational efficiency but also directly contributes to sustainability, customer service levels, and market adaptation capacity.

However, these advantages also raise significant ethical and governance issues. Risks such as algorithmic biases, data privacy violations, black box decision-making processes, and abuse of authority can threaten the principles of trust and transparency in e-commerce. The European Union Artificial Intelligence Act and international standards established by institutions such as the OECD and UNESCO provide important frameworks for managing these risks. The Personal Data Protection Law (KVKK) enacted in Turkey also provides a legal basis for the protection of personal data. In this context, e-commerce businesses that want to use artificial intelligence and data analytics effectively should not only develop their technical infrastructure but also adopt a governance model that considers their ethical, legal, and social responsibilities.

Artificial intelligence and data analytics are emerging as elements that both enrich the customer experience and strengthen the operational and strategic advantages of businesses in e-commerce. However, the sustainable and reliable use of these technologies will only be possible by acting in accordance with ethical principles, legal regulations, and corporate responsibility awareness, not just by developing innovative applications. The future of the e-commerce sector will be shaped by businesses that can integrate the opportunities brought by technological progress with principles of ethics and transparency.

Artificial intelligence and data analytics are transforming not only the operational processes of e-commerce but also its sectoral structure and consumer behavior. Findings show that, thanks to these technologies, e-commerce platforms are building a dynamic, interactive, and continuously learning ecosystem that goes beyond the classic “seller-buyer” relationship.

In this context, artificial intelligence applications are no longer an option but a strategic necessity for businesses that want to survive in a competitive environment accelerated by digitalization.

Beyond recommendation systems and conversational commerce, insights provided by data analytics are leading to the redesign of marketing strategies. Businesses are not only responding to customers' current needs but also developing proactive solutions by anticipating future trends. This not only increases customer lifetime value but also supports businesses' innovation capacity. In particular, processing large volumes of data using machine learning and deep learning methods enables a more accurate understanding of market dynamics and allows strategic decisions to be based on scientific foundations.

When evaluated from a sectoral perspective, AI-based e-commerce applications are seen to create an integrated value chain in different areas such as retail, logistics, and financial services. The technology-supported execution of critical processes such as inventory management, distribution planning, and dynamic pricing not only increases profitability but also promotes sustainability in the supply chain. This contributes to the development of environmentally conscious business models, strengthening the social responsibility dimension of e-commerce.

From a social perspective, it is clear that artificial intelligence applications are reshaping consumer expectations. Individuals demand not only products, but also security, speed, and personalized experiences. This demand brings issues of data privacy and algorithmic transparency to the forefront. Therefore, ethical frameworks must be considered not only as a legal requirement, but also as a fundamental condition for gaining customer trust.

In conclusion, the impact of artificial intelligence and data analytics on e-commerce is multi-layered: it creates a competitive advantage for businesses, drives restructuring across industries, and gives rise to new expectations and risks for society. Future research in this field should focus on topics such as the ethical boundaries of technological innovations, the social impacts of AI-based decisions, and the adaptation processes of global regulations. This will ensure that the transformation of e-commerce is not only economically but also socially inclusive and sustainable.

The future of e-commerce will be shaped not only by technological progress but also by ethical awareness and social responsibility. In the near future, the human-centered artificial intelligence approach will come to the forefront, redefining values such as customer experience, trust, and

privacy. AI-based e-commerce systems will become more strongly aligned with the Sustainable Development Goals (particularly SDG 9: Industry, Innovation, and Infrastructure; and SDG 12: Responsible Consumption and Production). At the global level, the standardization of algorithmic decision-making processes and debates surrounding data sovereignty are expected to become key agenda items over the next decade.

References

- Adomavicius, G., & Tuzhilin, A. (2005). Toward the next generation of recommender systems: A survey of the state of the art and possible extensions. *IEEE Transactions on Knowledge and Data Engineering*, 17(6), 734–749. <https://doi.org/10.1109/TKDE.2005.99>
- Chopra, S., & Meindl, P. (2016). *Supply chain management: Strategy, planning, and operation* (6th ed.). Pearson.
- Çetindere Filiz, A. (2024). 10. Hafta: Talep tahmin yöntemleri [Lecture notes]. Ondokuz Mayıs Üniversitesi, Akademik Veri Yönetim Sistemi. <https://avys.omu.edu.tr/storage/app/public/ayisel.cetindere/131686/10.%20Hafta%20Talep%20Tahmin%20Yöntemleri.pdf>
- European Union. (2024). *Regulation (EU) 2024/1689 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act)*. EUR-Lex. <https://eur-lex.europa.eu>
- Gómez-Uribe, C. A., & Hunt, N. (2016). The Netflix recommender system: Algorithms, business value, and innovation. *ACM Transactions on Management Information Systems*, 6(4), 1–19. <https://doi.org/10.1145/2843948>
- Güven, H., & Güven, E. T. A. (2023). Yapay zekâ uygulamalarının e-ticarette kullanımı [Use of artificial intelligence applications in e-commerce]. *International Journal of Management and Administration*, 7(13), 69–94.
- Etiner, E. (2021, August 22). *Netflix*. Medium. <https://emreetiner.medium.com/netflix>
- Trendyol Tech. (2023, August 21). *Better customer experience: Trendyol assistant journey*. Medium. <https://medium.com/trendyol-tech/better-customer-experience-trendyol-assistant-journey-659a5b1e84e1>
- Otexts. (2021, August 24). *Dynamic models*. <https://otexts.com/fpp3/dynamic.html>
- CBOT. (2023, July 20). *Getir Support won the Best Virtual Assistant Chatbot Experience Award at the ALEA Awards 2023*. <https://www.cbot.ai/getir-support-won-the-best-virtual-assistant-chatbot-experience-award-at-the-alea-awards-2023>
- Iovox. (2022, July 21). *Conversational AI: What it is and why it matters*. <https://www.iovox.com/blog/conversational-ai>
- T.C. Resmî Gazete. (2016, April 7). *Kişisel Verilerin Korunması Kanunu (Kanun No. 6698)*. <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6698&MevzuatTur=1&MevzuatTertip=5>
- Lim, B., Arık, S. Ö., Loeff, N., & Pfister, T. (2021). Temporal fusion transformers for interpretable multi-horizon time series forecasting. *International Journal of Forecasting*, 37(4), 1748–1764. <https://doi.org/10.1016/j.ijforecast.2021.03.012>

- Linden, G., Smith, B., & York, J. (2003). Amazon.com recommendations: Item-to-item collaborative filtering. *IEEE Internet Computing*, 7(1), 76–80. <https://doi.org/10.1109/MIC.2003.1167344>
- McKinsey & Company. (2021, November 12). *The value of getting personalization right—or wrong—is multiplying*. <https://www.mckinsey.com>
- OECD. (2024). *OECD AI principles* (2019; 2024 update). *OECD.AI Policy Observatory*. <https://oecd.ai/en/ai-principles>
- Pande, P., Kulkarni, A. K., & Ramalingam, V. (2025). Big data analytics in e-commerce driving business decisions through customer behavior insights. In *ITM Web of Conferences* (Vol. 76, p. 05001). EDP Sciences. <https://doi.org/10.1051/itmconf/20257605001>
- Sağtaş, S. (2023). Yapay zekâ uygulamalarının e-ticarette kullanımı [Use of artificial intelligence applications in e-commerce]. In *Dijitalleşme ve işletme yönetimi* (pp. 145–170). Ankara: Nobel Yayıncılık.
- Salinas, D., Flunkert, V., Gasthaus, J., & Januschowski, T. (2020). DeepAR: Probabilistic forecasting with autoregressive recurrent networks. *International Journal of Forecasting*, 36(3), 1181–1191. <https://doi.org/10.1016/j.ijforecast.2019.07.001>
- Sun, C., Shi, Z., Liu, X., & Ghose, A. (2025). The effect of voice AI on digital commerce. *Information Systems Research*, 36(2), 1147–1166. <https://doi.org/10.1287/isre.2022.0140>
- Tek, B. (1999). *Pazarlama ilkeleri: Global yönetsel yaklaşım Türkiye uygulamaları* [Principles of marketing: A global managerial approach with applications in Turkey] (8. baskı). Beta Basım Yayım.
- UNESCO. (2021). *Recommendation on the ethics of artificial intelligence*. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000379920>
- Yang, G., & Ji, G. (2022). The impact of cross-selling on managing consumer returns in omnichannel operations. *Omega*, 111, 102665. <https://doi.org/10.1016/j.omega.2022.102665>
- Zhuk, A., & Yatskiy, O. (2024). The use of artificial intelligence and machine learning in e-commerce marketing. *Technology Audit and Production Reserves*, 3(4(77)), 33–38. <https://doi.org/10.15587/2706-5448.2024.12345>

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