Annals of "Dunarea de Jos" University of Galati
Fascicle I. Economics and Applied Informatics
Years XXXII – nº1/2026
ISSN-L 1584-0409 ISSN-Online 2344-441X
www.eia.feaa.ugal.ro

DOI https://doi.org/10.35219/eai15840409582

Chatbots and Customer Relationship Automation in E-Commerce

Maria Cristina Enache★

ARTICLE INFO

Article history:
Received January 21, 2026
Accepted February 12, 2026
Available online April 30, 2026

JEL Classification
D12, L86, D83

Keywords:
e-commerce, chatbotLLM, artificial intelligence

ABSTRACT

This paper analyzes the automation of customer relationships in e-commerce using chatbots, highlighting the conceptual, functional and economic differences between rule-based solutions and hybrid chatbots based on intent recognition. Starting from a case study in the field of food delivery, the paper examines how these technologies influence operational efficiency, user experience and business process control. The conclusions show that, for small and medium-sized enterprises, rule-based chatbots often represent the most cost-effective solution, while hybrid chatbots become economically justified in contexts characterized by high volume and high diversity of interactions.

1. Introduction

The e-commerce industry is undergoing continuous transformation, and artificial intelligence (AI) has become one of the main factors that differentiate successful online stores from those that are losing ground. Automating customer relationships through chatbots and virtual assistants is no longer a future trend, but a present necessity for companies that want to remain competitive in an increasingly crowded digital environment.

Artificial intelligence, in the context of e-commerce, involves the use of algorithms and machine learning models to automate, optimize, and personalize customer interactions. From product recommendations to post-sales support, AI enables online stores to respond quickly and efficiently to consumer needs.

The global market for AI solutions in e-commerce is experiencing accelerated growth, with estimates indicating a value of over 9 billion dollars by 2025 [9]. This evolution is driven by customers' increasingly high expectations regarding speed, availability, and quality of the services offered. Modern consumers expect near-instant responses, regardless of the time of day or communication channel. Studies show that a response provided within the first five minutes significantly increases the chances of completing a purchase, and 24/7 support is a decisive criterion for most customers. In a context where cross-border commerce is rapidly expanding, automation becomes the ideal solution for managing large volumes of requests in multiple languages without disproportionate operational costs. Moreover, a poor support experience leads a high percentage of customers to permanently abandon an online store.

AI chatbots are software applications capable of simulating human conversations using advanced technologies such as natural language processing (NLP), machine learning (ML), and large language models (LLMs). Unlike traditional rule-based solutions, modern chatbots can understand context, handle language variations, and learn from previous interactions. There are several types of chatbots used in e-commerce: rule-based chatbots, suitable for simple questions; AI-based conversational chatbots that provide dynamic and personalized responses; and hybrid solutions that combine the speed of rules with the flexibility of artificial intelligence. In addition, advanced virtual assistants can be trained on company-specific data and can act as true "digital colleagues," providing constant support and personalized recommendations to customers.

Implementing AI chatbots brings significant benefits from both an operational and financial perspective. Non-stop availability and fast response times increase customer satisfaction, while automating repetitive requests drastically reduces support costs. Chatbots can handle hundreds or thousands of conversations simultaneously, offering scalability that is impossible to achieve through traditional human support. Multilingual support also facilitates international expansion, while personalized recommendations directly contribute to increasing conversion rates and average order value. Another important advantage is

★Dunarea de Jos University of Galati, Romania. E-mail address: mpodoleanu@ugal.ro (M. C. Enache)

consistency of experience: each customer receives accurate and uniform information, strengthening trust in the brand.

The use of chatbots covers the entire customer journey, from the exploration stage to post-purchase support. During the purchase phase, they can offer personalized recommendations, guide users through the product selection process, and support upselling and cross-selling strategies.[1]

After order completion, chatbots become extremely useful in managing requests such as "Where is my order?", processing returns, and providing technical support. By rapidly supplying information and usage guides, they can significantly reduce the number of returns caused by misunderstandings or usage errors.

Implementing an effective chatbot requires a structured approach. Clearly defining objectives, choosing the right platform, and building a solid knowledge base are essential. Integration with backend systems, such as CRM or the e-commerce platform, transforms the chatbot into a real business tool capable of delivering real-time data.

However, there are also challenges. Initial costs can be high for customized solutions, and the lack of emotional intelligence remains a limitation of the technology. Therefore, the best results are achieved when chatbots are integrated into a human–bot collaboration model, with the possibility of rapid escalation to a human agent.

The future of e-commerce is closely linked to the evolution of conversational artificial intelligence. Interactions will become increasingly multimodal, combining text, voice, and images, while voice commerce will gain a growing share. Chatbots will evolve from simple reactive tools to predictive solutions capable of anticipating problems and offering proactive solutions. Hyper-personalization will transform every interaction into a unique experience, adapted to each customer's behavior and history. [2]

2. Customer relationship automation in e-commerce through rule-based chatbots

One of the most accessible forms of customer relationship automation in e-commerce is the use of rule-based chatbots. These represent a first level of digitalization of the interaction between company and customer, being built on clearly defined conversational flows, without learning capability or advanced semantic interpretation. A relevant example is the implementation of a chatbot for order placement in a pizzeria-type online store. In a traditional context, the first contact between customer and merchant involves human interaction: phone call, social media message, or email. By introducing a rule-based chatbot, this first point of contact is fully automated. The customer is greeted with a standardized message and directed to a main menu, where they can quickly select the type of request: placing an order, checking opening hours, finding out delivery costs, or obtaining contact details. This automation eliminates waiting times and reduces pressure on human staff, while offering a predictable and consistent experience for the customer.

The central function of the chatbot is automating the ordering process. In the analyzed example, the chatbot takes on the role of a human operator and guides the customer step by step through a predefined flow: product selection, option selection, quantity setting, and final price calculation.

From a functional perspective, each customer decision is captured via buttons, and the chatbot stores the information in internal variables. These variables are then used to perform automatic calculations, such as determining unit price, subtotal, and delivery cost. Thus, the customer relationship is automated not only at the conversational level, but also at the operational level, by eliminating manual calculations and human errors. An important advantage of rule-based chatbots is the consistency of the information provided. In the pizzeria example, pricing rules, conditions for free delivery, and additional costs are integrated directly into the chatbot's logic. The customer always receives the same information, formulated identically, regardless of the moment of interaction. This consistency contributes to increased trust in the brand and reduces disputes related to prices or commercial conditions, an essential aspect of customer relationship automation in e-commerce.[3]

Another key element of automation is structured data collection. The chatbot requests the information necessary to complete the order through an automated form: name, phone number, address, and email. The built-in validations (for example, minimum number of characters or fixed number of digits) ensure the quality of the collected data without human intervention. From the customer relationship perspective, this process is perceived as fast and clear, while from the company's perspective, the data is received in a standardized format, ready for further processing. Customer relationship automation does not stop at interaction with the end user. In the analyzed example, the chatbot automatically sends order details to the pizzeria via email. Thus, the information flow between customer and company is fully automated, without the need for transcriptions or additional confirmations.

This functionality reduces order processing time and minimizes the risk of errors, indirectly contributing to a better customer experience. Although effective in automating standard processes, rule-based chatbots have clear limitations. They cannot interpret freely formulated requests, cannot handle ambiguities, and cannot adapt the conversational flow based on context or emotion. If a customer asks a question that is not provided for in the structure, the chatbot redirects them to the main menu, which can generate frustration.

This limitation highlights the fact that customer relationship automation through rule-based chatbots is particularly suitable for repetitive, well-defined processes, but cannot fully replace human interaction or advanced conversational solutions. The automation of the customer relationship within the analyzed pizzeria is based on a controlled conversational model, which combines the identification of user intentions with the deterministic management of the dialogue flow. From a computer science perspective, this model allows for a clear separation between the semantic understanding of user requests and the logical control of business processes.

Conceptually, the interaction between the customer and the chatbot is organized around a finite set of intentions, each corresponding to a well-defined user goal. These include placing an order, requesting information about the menu, obtaining details about delivery and opening hours, and requesting human assistance. A global fallback intent is also defined, used to handle invalid or unexpected inputs. This classification of intentions allows the system to correctly interpret user requests, even when they are formulated differently but express the same goal.

To support these intentions, the chatbot uses a set of entities that represent the essential information necessary to process an order. In the case of the pizzeria, the entities include the type of product ordered, its size, the desired quantity, and the delivery address. These entities are extracted either through guided selections or from text messages entered by the user and are subsequently used in the application of commercial rules. Their role is strictly functional, contributing to the correct configuration of the order and avoiding ambiguities in the ordering process.

In addition to entities, the system uses internal variables to manage conversational and operational logic. Variables are used to calculate the total price of the order, determine the shipping cost, store customer contact information, and handle error situations. For example, the total price is automatically determined based on the selected product, size, and quantity, while a dedicated variable is used to monitor the number of invalid inputs and trigger, if necessary, the transfer of the conversation to a human operator.

Error management is achieved through a two-level fallback mechanism. Local fallback occurs when the user provides an invalid response in a specific scenario, requiring the current action to be resumed. Global fallback is used when the conversation becomes incoherent or when errors persist, at which point the chatbot offers the user the option to resume the interaction from a main menu or to be redirected to human support. This approach helps maintain conversation coherence and reduce user frustration.

The overall conversational flow is organized around a single-entry point, followed by a main menu that provides access to the main functionalities of the system: placing an order, consulting the menu, obtaining delivery information and contacting an operator. Each option triggers a distinct conversational flow, modeled as a sequence of logical states, which allows for strict control of the interaction.

The order placement scenario represents the central component of the chatbot. The objective of this scenario is to fully automate the ordering process, from product selection to sending the order to the pizzeria. The conversation is guided through a series of well-defined steps, in which the user is asked, in turn, for the type of pizza, size, quantity and delivery address. After collecting this information, the system automatically applies the price calculation rules and requests final confirmation of the order. Once confirmed, the order is considered completed and sent to the pizzeria through established internal channels.

In addition to the ordering scenario, the chatbot manages secondary scenarios dedicated to providing menu and delivery information. These scenarios are designed to quickly respond to frequent requests, displaying available product categories, brief descriptions, and delivery conditions, such as operating hours or the threshold for free delivery. By automating these interactions, the volume of requests addressed to human staff is significantly reduced. The conversational design follows clear turn-taking principles, designed to ensure readability and predictability of the interaction. Each message has a single purpose, each conversational block contains a single question, and the user is constantly informed about the next step in the conversation. This structure reduces ambiguity and facilitates the successful completion of tasks.

As for the chatbot's personality, it is aligned with the pizzeria's brand identity. The tone is friendly, the language is clear and concise, and the answers are formulated in a way that inspires promptness and trust. Although these elements seem superficial, they play an important role in the user's perception of the reliability of the system. Overall, this conversational model demonstrates how intentions, entities, internal variables, and flow control mechanisms can be integrated into a coherent customer relationship automation system. The approach used allows for tight control over business processes while maintaining a smooth and predictable interaction, appropriate for the e-commerce context of an online pizzeria.

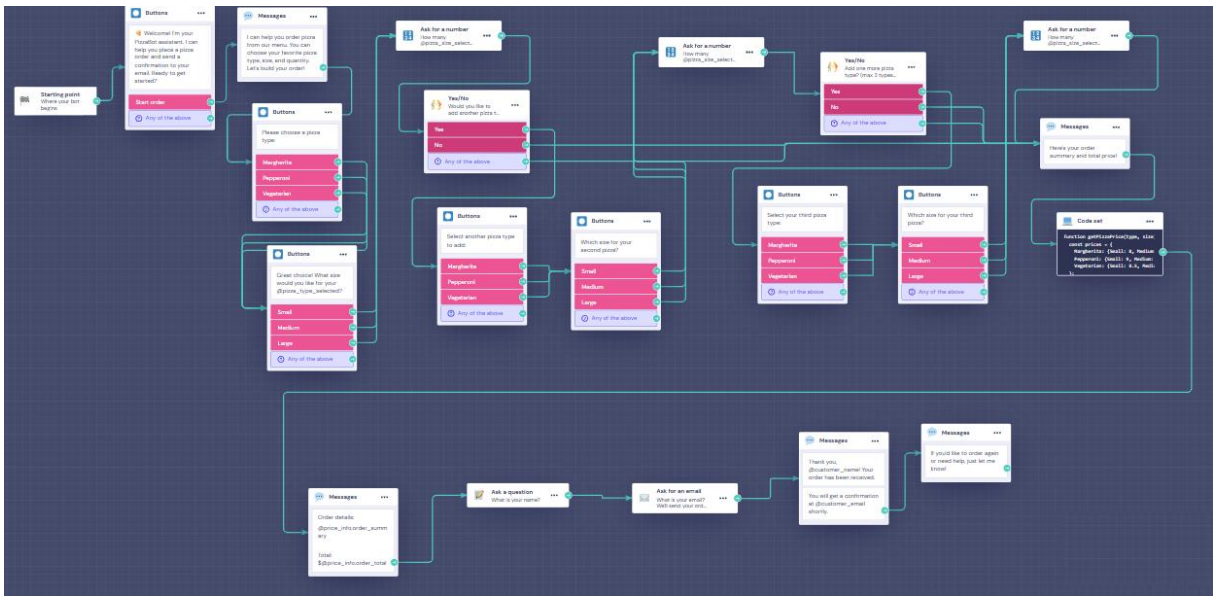

Figure 1. Decision flow

The flow in the image contains approximately 25–30 blocks, structured mainly from Buttons and Message components. Around 8–10 Buttons blocks are identified, each with multiple options, used for guided decisions such as the type and size of pizza. Message components appear about 7–9 times and are used for introduction, transitions, displaying the summary and completion messages. The flow also includes several controlled input components, namely 2–3 "Ask for a number" blocks, a block for entering the name and a block for collecting the email address. Approximately 3–4 Yes/No blocks are used for validation and decision control. The business logic is centralized in a single Code block, responsible for calculating the price and managing variables.

3. Customer relationship automation in e-commerce through hybrid chatbots

After implementing rule-based chatbots, the next level of maturity in customer relationship automation in e-commerce is represented by hybrid chatbots, which combine deterministic flows with natural language processing. A representative example is the use of the Dialogflow platform, which enables interpretation of user intents while maintaining control over critical business processes. Unlike rule-based chatbots, where the customer must choose exclusively from buttons, a hybrid chatbot allows users to freely formulate requests. For example, in a pizzeria-type online store, the customer can write “I want to order a large pizza with delivery” or “I would like two Margherita pizzas,” without following a strictly predefined path. Dialogflow processes these messages through intent recognition mechanisms and entity extraction. Thus, the chatbot identifies that the user wants to place an order, the product type, quantity, or delivery option, even if the information is provided in a different order than the standard flow. Functionally, the hybrid chatbot automates the customer relationship through a combination of flexible dialogue and strict business logic. Once the “Place order” intent is identified, Dialogflow collects the necessary parameters: product type, size, quantity, and additional options. If some information is missing, the chatbot initiates clarification questions, similar to a human agent. For example, if the user says only “I want a pizza,” the system automatically asks for the desired size or type. This approach makes the interaction seem natural, while remaining controlled through the previously defined intent structure. Although Dialogflow uses NLP to interpret language, price calculations, delivery rules, and validations remain deterministic. Business logic is managed through webhooks that connect the chatbot to a backend or intermediary service.

In the pizzeria example, rules such as free delivery above a certain threshold or a fixed transport cost are applied automatically based on the collected values. Thus, the hybrid chatbot combines conversational flexibility with the safety and predictability of commercial rules. An important advantage of the hybrid chatbot is extending automation beyond the ordering process. Dialogflow can handle requests such as “Where is my order?”, “Can I change the address?”, or “What are the pizzeria’s opening hours?”, even if they are phrased differently by different customers. By mapping these requests to distinct intents, the chatbot provides quick and accurate responses or triggers queries to internal systems. In this way, the customer relationship is automated throughout the entire order lifecycle, not only during the purchase stage. Similar to the rule-based chatbot, the hybrid solution collects customer data in a structured manner. The difference is that Dialogflow can recognize data provided spontaneously in conversation. For example, if the user writes “deliver to Pizza Street 10, my name is Andrei,” the system can automatically extract the address and name without displaying a classic form.

This functionality reduces friction in interaction and makes the process faster, while still maintaining the necessary validations for data accuracy. Although the hybrid chatbot offers a superior experience compared to rule-based solutions, it remains dependent on the quality of intent design. If a request is not correctly mapped or if there are ambiguities between intents, the chatbot may respond incorrectly or ask unnecessary clarifying questions.

In addition, although NLP enables more natural conversation, the hybrid chatbot does not generate entirely new responses, but selects predefined responses or templates, which limits the degree of contextual adaptation.

In the context of e-commerce, the hybrid chatbot represents an important step in the maturation of customer relationship automation. It significantly reduces operational effort, improves user experience, and allows handling a larger volume of requests without losing control over critical processes.

Compared to rule-based chatbots, the hybrid solution offers a more natural and flexible interaction, but does not yet reach the level of adaptability and contextualization of chatbots based on large language models. The example of the hybrid chatbot implemented with Dialogflow demonstrates how customer relationship automation in e-commerce can evolve from simple rigid flows to controlled conversational interactions. This approach is ideal for companies that want to improve customer experience without giving up predictability and control.

Naturally, this solution creates the bridge to the next level of automation: LLM-based chatbots, which can manage complex and personalized conversations at scale.

4. Comparative analysis between rule-based and hybrid intent-based chatbots in the pizzeria case

The chatbot for the online pizzeria can be implemented either as a strictly rule-based system or as a hybrid system that combines deterministic flows with user intent recognition. Both approaches aim to automate the same operational processes — placing orders, providing menu and delivery information, and handling repetitive requests — but differ significantly in terms of conversational architecture and control mechanisms. In a rule-based chatbot, such as those implemented with platforms like Landbot, the conversation is modeled exclusively through predefined flows. User interaction is guided by menus, buttons, and forms, and each step of the conversation corresponds to an explicit transition in a finite state machine. In the pizzeria case, the ordering process is divided into clear stages, and the user cannot advance without providing the information requested at each step. This approach provides a high level of control and eliminates ambiguity, ensuring that the data collected is complete and valid. In contrast, an intent-based hybrid chatbot, such as the one built with Dialogflow, allows the user to formulate requests in natural language, without strictly following a pre-established path. The system uses natural language processing mechanisms to identify the user's intent and extract relevant entities, such as the type of pizza or the desired quantity. However, although the interaction appears more flexible, the control of the process remains deterministic at the business logic level, through the use of webhooks and explicit rules.

From the perspective of managing the conversation state, the rule-based chatbot maintains a clear and explicit representation of the progress of the dialogue. Each stage of the command is known and controlled, which facilitates testing, debugging and extending the system. In contrast, the hybrid chatbot manages state in a less rigid way, allowing information to be collected in a variable order. In the pizzeria example, the user can specify the product and quantity simultaneously, and the system fills in the missing information later. This flexibility reduces friction in the interaction, but requires additional mechanisms for validating and correlating the collected data.

The application of business rules highlights another point of differentiation. In the rules-based chatbot, price calculation, application of delivery fees, and verification of promotional thresholds are integrated directly into the conversational flow. Each rule is triggered at a precise point in the conversation. In the hybrid chatbot, these rules are applied in the backend, after the intents and entities have been identified. Thus, the hybrid chatbot more clearly separates the language understanding component from the rule execution component, providing a more modular architecture.

Error handling also differs between the two approaches. In the case of the rules-based chatbot, errors are handled by redirecting the user to previous steps or to a main menu, according to predefined scenarios. This mechanism guarantees conversation recovery, but can be perceived as rigid. In the hybrid chatbot, errors are handled by fallback intents, which allow for more natural clarification requests. However, the effectiveness of this mechanism depends on the quality of the intent definition and training examples.

From a maintainability and extensibility perspective, the rule-based chatbot requires explicit modifications to the conversational flows to add new products or scenarios. This approach is predictable, but can become difficult to manage as complexity increases. The hybrid chatbot allows for faster introduction of linguistic variations and new types of requests, by expanding the set of intents, without significantly modifying the basic conversational structure. In conclusion, for the case of the online pizzeria, the rule-based chatbot is suitable for strictly standardized processes, where control and correctness are a priority. The intent-based hybrid chatbot offers a more natural interaction and increased flexibility, being better adapted to the diversity of user expressions. From a computer science perspective, the optimal solution often consists of a combination

of the two approaches, where critical flows are managed deterministically and the conversational interface benefits from intention recognition to reduce interaction rigidity.

Based on the analyzed indicators — initial cost, implementation time, error rate, maintenance cost and the need for human intervention — it is observed that rule-based chatbots offer a high level of operational efficiency for standardized processes, with low investment. Hybrid chatbots provide superior conversational flexibility, but this advantage is accompanied by higher costs and increased operational complexity.

Table 1. Comparative table between rule-based chatbots and hybrid (intent-based) chatbots based on efficiency indicators

Analysis indicator	Rule-based chatbot	Hybrid (intent-based) chatbot
Implementation time	Short – conversational flows can be built quickly using low-code platforms	Medium–long – requires semantic design, testing, and iterative adjustments
Error rate	Low – the process is strictly guided and deterministic	Medium – higher in the initial stages, dependent on NLP quality
Maintenance cost	Low – changes are explicit and easy to control	Medium–high – requires continuous intent tuning and ambiguity management
Need for human intervention	Low – limited to exceptional or non-standard situations	Medium – more frequent in cases of semantic errors or ambiguous requests

5. Conclusion

From a business perspective, especially a small or medium-sized enterprise, the choice between a rules-based chatbot and a hybrid intent-based chatbot must be evaluated in terms of operational efficiency and total cost of implementation and operation. While both solutions aim to automate customer interactions, they involve different levels of technical complexity and investment, with a direct impact on profitability. A rules-based chatbot, implemented through low-code platforms such as Landbot, involves a low initial cost and a short implementation time. This type of system does not require training data, natural language processing models or complex backend development. Conversations are explicitly built as predefined flows, and business rules are integrated directly into the dialog structure. From an economic point of view, this translates into a low total cost of ownership and a fast return on investment, essential aspects for companies with limited resources. In contrast, a hybrid intent-based chatbot, such as those built with Dialogflow, involves a higher initial cost. Its implementation requires defining and training intentions, configuring entities, developing backend components to enforce business rules, and testing the semantic behavior of the system. This process requires specialized technical skills and a significantly longer development time, which increases initial costs and delays the time to obtain economic benefits.

From an operational efficiency point of view, the rule-based chatbot offers a high level of predictability and control. Standardized processes, such as placing an order or providing information about the schedule and delivery, are managed with a very low error rate, since the user is guided step by step and cannot deviate from the pre-established flow. Indicators such as the rate of incomplete or incorrect orders and the need for human intervention are generally reduced. This operational stability has a positive impact on indirect costs, such as staff time or losses due to errors. Hybrid chatbots can provide greater efficiency in interactions characterized by significant linguistic variations, because they allow users to formulate requests in natural language. However, this flexibility comes at a cost. In the initial phases of operation, the rate of semantic errors and ambiguous interpretations can be higher, which increases the need for continuous adjustments and maintenance. From the company's perspective, this is reflected in a higher operational cost and an increased dependence on technical staff.

A relevant indicator for comparing the two solutions is the maintenance cost. In the case of the rule-based chatbot, changes are explicit and easy to control, consisting of updating conversational flows or business rules. In the case of the hybrid chatbot, maintenance involves not only updating business rules, but also recalibrating intentions and managing semantic overlaps, which involves additional effort and higher recurring costs. From the perspective of economic scalability, the hybrid chatbot becomes justified mainly in situations where the volume of interactions is very high or the diversity of user requests is high. For small companies, which operate relatively simple and well-defined processes, the additional benefits of intent recognition usually do not compensate for the higher implementation and operating costs. In conclusion, the analysis of efficiency indicators — initial cost, implementation time, error rate, maintenance cost and human intervention required — indicates that, for most small and medium-sized companies, the rules-based chatbot represents the most economically efficient solution. The hybrid intent-based chatbot offers a more flexible conversational experience, but becomes cost-effective only above a certain threshold of complexity and operational volume.

From this perspective, the technological choice must be directly correlated with the size of the company, the structure of the processes and the economic objectives pursued.

References

Valcerzyk, D. (2025). The use of artificial intelligence in e-commerce customer communication. *European Research Studies Journal, 28*(1), 249–264

Cheng, X., Bao, Y., Zarifis, A., Gong, W., & Mou, J. (2024). Exploring consumers' responses to text-based chatbots in e-commerce: The moderating role of task complexity and chatbot disclosure. *Electronic Commerce Research and Applications, 64*, 101163. https://doi.org/10.1016/j.elerap.2023.101163

Chintalapudi, S. M. (2025). A systematic literature review on AI chatbots in automating customer support in e-commerce. *Issues in Information Systems, 26*(1), 403–417.

Gao, J. (2025). The influence of AI chatbot problem-solving capability on user intentions in e-commerce. *Journal of Business Research, 176*, 114921. https://doi.org/10.1016/j.jbusres.2025.114921

Khennouche, F., Elmir, Y., Djebari, N., Himeur, Y., & Amira, A. (2023). Revolutionizing customer interactions: Insights and challenges in deploying generative chatbots for FAQs. *arXiv preprint arXiv:2311.09976*.

Mashaabi, M., Alotaibi, A., Qudaih, H., Alnashwan, R., & Al-Khalifa, H. (2022). Natural language processing in customer service: A systematic review. *arXiv preprint arXiv:2212.09523*.

Nichifor, E., Trifan, A., & Nechifor, E. M. (2021). Artificial intelligence in electronic commerce: Basic chatbots and the consumer journey. *Amfiteatru Economic, 23*(56), 87–101. https://doi.org/10.24818/EA/2021/56/87.

Vebrianti, R., Aras, M., Sukarni Putri, M. S., & Swandewi, I. A. (2025). AI chatbots in e-commerce: Enhancing customer engagement, satisfaction and loyalty. *paperASIA, 41*(2B), 248–256.

Precedence Research. (2024). *Artificial intelligence in e-commerce market size, share and trends 2024–2034*. https://www.precedenceresearch.com/artificial-intelligence-in-e-commerce-market

SellersCommerce. (2024). *AI in e-commerce statistics: Growth, trends and forecasts*. https://www.sellerscommerce.com/blog/ai-in-ecommerce-statistics/