

**Gabriela Hanus**

University of Economics in Katowice  
e-mail: gabriela.hanus@uekat.pl  
ORCID: 0000-0002-1028-0670

DOI: 10.15290/oes.2026.02.124.17

## THE INFLUENCE OF SOCIODEMOGRAPHIC FACTORS ON POLISH CONSUMERS' ATTITUDES TO CHATBOTS IN LOGISTICS CUSTOMER SERVICE<sup>1</sup>

### Summary

**Purpose** | The aim of this article is to identify the influence of sociodemographic factors on Polish consumers' attitudes toward chatbots in logistics customer service and, based on the obtained results, to formulate practical recommendations for enterprises employing chatbots in this area.

**Research method** | To investigate the relationship between sociodemographic characteristics and opinions on chatbots, multiple linear regression and logistic regression were used. The significance of model parameters was assessed using standard errors resistant to the heteroscedasticity of the random component.

**Results** | The results obtained confirm that sociodemographic factors significantly differentiate Polish consumers' attitudes toward the use of chatbots in logistics customer service. Women are more cautious and demanding when it comes to personalization and data protection. Age affects attitudes – younger users are more open-minded and willing to experiment, while older users expect more security and trust. The influence of education is less clear – people with lower education are more likely to see chatbots as a useful tool, while those with higher education approach them more critically.

**Originality/value/implications/recommendations** | The findings suggest that chatbot design should consider the diversity of users.

**Keywords:** consumer behavior, chatbots, logistics customer service, sociodemographic factors

**JEL classification:** O33, M31, L87

---

<sup>1</sup> Article accepted on 20.04.2026.

## 1. Introduction

More and more companies are opting to use artificial intelligence in customer service, resulting in greater operational efficiency and higher customer satisfaction [De Andrade, Tumelero, 2022]. One practical application in this area is chatbots – special computer software programmed to conduct conversations via text or voice, often using speech processing technology [Huang et al., 2024, p. 1; Nicolescu, Tudorache, 2022, p. 2]. In logistics, artificial intelligence is applied in such areas as demand forecasting, route planning and optimization, warehouse management, data analysis and process improvement, fleet monitoring and shipment tracking, supporting automation and robotization, risk and safety management, and customer service automation [Menti et al., 2023, p. 2]. Consumers interact with chatbots at various stages of the buying process. They provide quick answers to customer questions, expedite the service process, track shipments, provide stock information, or help handle complaints [www 1; www 2; Deshmukh, Gundewar, 2025, p. 1561].

The study conducted in 2024 found that most respondents are open to using chatbots in logistics customer service, viewing them as helpful for improving speed and efficiency. They mainly use text-based chatbots via websites or phone lines to track shipments and access technical support. The key advantages of such tools include 24/7 availability and fast responses. However, concerns remain about misinterpreted queries, incorrect answers, lack of human assistance, and limited capabilities [Hanus, 2024].

Therefore, to obtain a comprehensive view of the problem, the author decided to answer several research questions: How does age affect consumers' attitudes toward the use of chatbots in logistics customer service? How does the level of education influence consumers' attitudes toward the use of chatbots in logistics customer service? Are there significant differences between the attitudes of men and women toward the use of chatbots in logistics customer service? Studies on the impact of sociodemographic factors on attitudes toward chatbots have been undertaken by researchers in various countries [e.g., Mendez-Suarez et al., 2023; Rese et al., 2021; Balakrishnan et al., 2022], so it seems reasonable to recognize this issue in Poland as well. Four research hypotheses were proposed, based on the literature on the subject:

- H1:** It is assumed that sociodemographic factors significantly differentiate Polish consumers' attitudes toward the use of chatbots in logistics customer service.
- H2:** It is assumed that the older the consumers, the more negative their attitude toward the use of chatbots in logistics customer service.
- H3:** It is assumed that the higher the consumer's level of education, the more positive their attitude toward the use of chatbots in logistics customer service.
- H4:** It is assumed that there are significant differences between the attitudes of men and women toward the use of chatbots in logistics customer service.

The aim of this article is to identify the influence of sociodemographic factors on Polish consumers' attitudes toward chatbots in logistics customer service and, based on the obtained results, to formulate practical recommendations for enterprises employing chatbots in this area.

The paper is divided into several sections. The first one contains a review of literature related to the research subject. The second one presents the research methodology and data collection, and the third one describes and discusses the empirical results obtained. The conclusions summarize the study and indicate where the research results can be applied. The limitations of the study and further research directions are also pointed out.

## 2. Literature review

This literature review focuses on discussing the impact of sociodemographic factors on consumer attitudes toward chatbot technology used in customer service in general. Due to a limited number of available scholarly sources on the application of chatbots strictly in the context of logistics, this analysis covers the broader area of their functioning in customer relations, taking into account different service sectors. This type of approach is justified because factors influencing the perception and acceptance of chatbots – such as age, gender, and education level – are often universal and can also be applied in the context of logistics services. Thus, although direct research on logistics is sparse, it is possible to draw general conclusions that form the basis for further, more focused empirical analysis presented later in the paper. This scarcity of studies focusing explicitly on logistics customer service constitutes a clear research gap, which the present study aims to address.

A study by Mendez-Suarez, Monfort, and Hervas-Oliver [2023] found that consumers' acceptance of artificial intelligence was related to their attitudes toward innovation. Those with negative attitudes toward innovation also showed negative opinions about chatbots and artificial intelligence. The results also revealed the role of sociodemographic factors as moderators of this relationship: younger people and those with higher socioeconomic status presented more positive attitudes toward AI-based products. This effect was further amplified by gender. Being male was shown to amplify the effect of age and socioeconomic status on perceptions of AI. These findings confirmed previous studies that suggested greater skepticism among older people toward new technologies. Also, higher levels of education and socioeconomic status promoted greater acceptance of technological innovations [Mendez-Suarez et al., 2023].

A study by Mogaji, Balakrishnan, Nwoba, and Nguyen [2021] examined consumer interactions with banking chatbots in emerging markets, where technology development and adoption was a challenge due to a young population structure, low internet penetration, and high institutional distrust. The study was based on qualitative interviews with 36 Nigerian residents and aimed to understand how consumers in emerging markets use chatbots to complete banking transactions. Based on the Unified Theory of Acceptance and Use of Technology (UTAUT), the study also revealed the influence of sociodemographic factors on consumer adaptation to this technology. Above all, age and technological experience were shown to play a key role in facilitating the use of chatbots. The perceived expertise, responsiveness, and security were also of particular importance to users and were key to chatbot acceptance. The study found no significant differences between men and women in terms of their intentions and attitudes toward chatbots. It also indicated that familiarity with this technology or prior experience fostered greater comfort with chatbots [Mogaji et al., 2021].

A study by Rese, Ganster, and Baier [2021] aimed to understand the acceptance of chatbots among retail consumers, focusing on demographic differences in attitudes toward this technology. The survey sample consisted of 205 respondents, with an equal gender distribution (49% female and 51% male), and the average age of participants was 22. The survey showed that about

half of the participants were already familiar with the term “chatbot”. Gender was shown to have a significant effect on attitudes toward this technology. Men appeared to be more “tech-savvy”, indicating more frequent chatbot use, while women, who had a higher level of engagement with the fad, were more likely to express concern over the assumption that chatbots could lead to job losses. Among the respondents, 78% said they would use a chatbot because it offers innovative solutions, unusual experiences, and a personalized experience. However, about a third of respondents said they would not want to talk to a chatbot. The results also showed that women preferred text-based communication with a chatbot mostly when shopping online, while men used chatbots mainly for simple information queries [Rose et al., 2021].

A study by Balakrishnan, Abed, and Jones [2022] focused on the role of meta-UTAUT factors, such as perceived anthropomorphization, perceived chatbot intelligence, and social efficacy, in the acceptance of chatbot-based services. The results of the study showed that both age and gender have different effects on attitudes toward chatbots, as well as on intentions to continue using them. Using age as a control variable showed that people of different ages interpreted perceived anthropomorphization in various ways and had varied attitudes toward chatbots. Younger people showed a greater tendency to accept the anthropomorphization of chatbots than older people. In addition, the study revealed that perceived social presence and its impact on users’ attitudes and further intentions were significantly higher in the female groups. Regarding age, the results showed that the relationship between enabling conditions and attitude was stronger for the older group than for the younger group, although these differences were not statistically significant. In terms of gender, women generally exhibited stronger relationships between the analyzed variables than men, however, these differences did not reach statistical significance [Balakrishnan, 2022].

Kasilingam’s [2020] study aimed to understand how various demographic factors, such as age and gender, affect users’ attitudes and intentions to use chatbots in the context of mobile shopping. The study found that gender has a significant impact on the acceptance of chatbots. Men were more innovation-oriented and perceived chatbots as less risky compared to women. Women, on the other hand, were more likely to be concerned that chatbots

could take away jobs. In addition, an analysis of differences between age groups showed that younger people found chatbots more useful and enjoyable to use during mobile shopping. Perceived risk and trust were also shown to have different effects on intentions to use chatbots depending on age. For younger users, perceived risk had a greater impact on their intentions, while for older users, trust in chatbots played a key role. In addition, younger people with more experience using mobile apps showed stronger intentions to use chatbots and were more likely to test new technologies [Kasilingam, 2020].

A study by Almahri, Bell, and Gulzar [2024] examined the acceptance and use of chatbot technology by university students in the UK, using an extended version of the Unified Theory of Acceptance and Use of Technology (Extended UTAUT2). The analysis aimed to determine the extent to which chatbots' personality traits and demographic variables, such as gender, age, and education level, moderate the relationships between the model's key factors and Behavioral Intention (BI) and actual technology use (Use). The survey included 431 undergraduate and graduate students majoring in computer science, and data was collected using a Likert scale questionnaire. Structural equation modeling (SEM) and multi-group analysis (MGA) in SmartPLS3 software were used to analyze the results. The results of the study showed that gender was a significant moderator of two key relationships in the model. It was confirmed that gender moderates the relationship between habituation and intention to use this technology and also between perceived ease of use and intention. These results suggest that men and women differ in the way in which habituation and perceived ease of use influence their intention to use chatbots. Age, on the other hand, proved to be a moderator of two other relationships. Age was confirmed to moderate the relationship between intention to use and actual use of this technology, and between expected performance and intention to use. Importantly, education levels did not moderate any of the relationships examined [Almahri et al., 2024].

A study by Ragheb, Tantawi, Farouk, and Hatata [2022] analyzed factors influencing the acceptance of AI-based chatbot technology among university students in Egypt. The study aimed to identify the determinants of intentions to use this technology and to assess whether demographic variables (age and gender) act as moderators in these relationships. Using structural

equation modeling (SEM), the authors found that performance expectations, effort expectations, and social influence had a significant direct effect on students' intention to use chatbots. That was, the higher the students rated this technology's usefulness, ease of use, and social pressure to use it, the stronger their intention to implement and use it. At the same time, the results of the analysis showed no significant moderating effects from demographic factors. The interactions between gender and the independent variables (performance expectations, effort expectations, and social influence) were not statistically significant. Similarly, age showed no significant effect on the relationship between these variables and intention to use technology. The results obtained suggest that the determinants of chatbot acceptance are universal in nature and their effectiveness in predicting behavioral intentions does not significantly depend on the age or gender of users [Ragheb et al., 2022].

### 3. Research methods

To achieve these goals and verify the hypotheses, a diagnostic survey method using a questionnaire was used in the research process. The study was conducted using the Computer-Assisted Web Interview (CAWI) technique. Direct quantitative research covered individual consumers over 18 years of age. Purposive and quota-based sampling was performed to reach many respondents who used chatbots at least occasionally to identify statistical dependencies. As a result, they accounted for nearly 80% of the research sample. Using the electronic version of the survey made it possible to collect 553 valid (complete) questionnaires. The study was conducted in March 2024 in Poland. The goals and scope of direct research determined the choice of the research method, the sampling technique, and the method of analyzing the collected information.

The questionnaire consisted of a concise introduction, instructions for the respondents, eight relevant questions, and respondents' personal data (Table 1). The survey involved 51.4% of women and 48.6% of men. One-quarter of the respondents were aged 18 to 24 while the 25 to 34, 35 to 44, and 45 to 54 age groups each accounted for about 20%. The smallest group included people

aged 60 and over, which may be due to their limited digital competencies. Most respondents lived in a city (71.4%) and reported secondary education (46.1%) or higher education (30.6%). Nearly 60% of the people surveyed assessed their income situation as at least good.

General analyses of selected questions were discussed in a previous study by the author. The survey measured respondents' attitudes and behaviors regarding the use of chatbots in logistics customer service. Consumer attitudes were not captured as a single composite indicator but were assessed through multiple questions covering different dimensions, including general attitudes toward chatbots (five or seven-point Likert scale: positive to negative), frequency and channels of use (daily, weekly, monthly, occasionally, never; websites, phone lines, instant messengers, mobile apps, social media, email), purposes of use (e.g., tracking shipments, technical support, problem solving, product information, ordering services), preferred type of interaction (text-based, voice-based or indifferent), and factors influencing positive attitudes (e.g., 24/7 availability, speed of response, intuitive interface, problem-solving ability, accuracy, personalization). Concerns, limitations and reasons for non-use such as misinterpretation of queries, lack of human support, limited functionality, privacy issues and preference for human interaction were also recorded [Hanus, 2024].

In this paper, only questions designed to identify the influence of sociodemographic factors on customers' attitudes, experiences, and expectations toward the use of chatbots in logistics customer service were included for additional analysis. Among other things, the respondents were asked about their general attitudes toward the use of virtual assistants in logistics, ranging from enthusiastic to strongly negative. Preferences for the form of contact were also investigated, i.e., whether users prefer interacting with a chatbot or speaking directly with a service employee. One of the questions referred to the frequency of use of chatbots in a logistical context to assess the extent of their actual use (Table 2). The respondents were also able to indicate the factors they believe have the most influence on positive attitudes toward chatbots, such as 24/7 availability, speed of response, relevance of information, and the ability to solve a problem effectively (Table 3). In another question, the respondents were asked to indicate their main concerns about using this

technology – these included the lack of personalization, misinterpretation of queries, and concerns about data security (Table 4). In addition, the extent to which respondents agreed with statements regarding the impact of chatbots on personalization of service, customer loyalty, and quality of communication with the company were assessed (Table 2).

To examine the relationship between opinions about chatbots and sociodemographic characteristics, multiple linear regression and logistic regression were used, where opinions were taken as dependent variables and sociodemographic characteristics as independent variables.

In Table 2, multiple linear regression model was applied to analyze the impact of gender, age, and education on: attitude toward chatbots, frequency of chatbot use, preference for interacting with chatbots rather than service employees, perceived impact of chatbots on service personalization, perceived impact on customer loyalty, and perceived ease of communication with the company.

In Table 3, logistic regression model was used to assess the relationship between sociodemographic variables and factors influencing positive customer attitudes toward chatbots, including instant availability, speed of response, interface usability, personalization, multitasking capability, relevance of responses, and problem-solving effectiveness.

In Table 4, logistic regression model was estimated to examine the association between sociodemographic characteristics and customer concerns related to chatbot use, such as lack of personalization, misinterpretation of queries, lack of human support, data security concerns, limited functionality, and interface-related difficulties.

It should be noted that the interpretation of regression coefficients requires attention to the coding of dependent variables. In the adopted scales, lower values correspond to more positive attitudes or more frequent use of chatbots. Meanwhile, positive values indicate a more negative attitude or less frequent use. Robust standard errors were applied to account for potential heteroskedasticity. All analyses were conducted using Stata 17.

It should be noted that it was impossible to ensure that respondents gave independent answers in the online survey, and as such, the study results should be treated with some caution. It should be noted that participation was voluntary and informed consent was obtained from all respondents.

## 4. Results and discussion

To verify the hypotheses and achieve the objectives of the study, the relationship between the most important sociodemographic characteristics of consumers, selected based on the literature, and their attitudes toward chatbots in logistics customer service were examined.

### 4.1. Age

The study found that people aged 65 and over have significantly more negative attitudes toward chatbots and are significantly less likely to use this technology than those aged 35–44. In contrast, those aged 55–59 use it more often.

People aged 60–65 and 18–24 are more skeptical about replacing humans with chatbots and rate the personalization of chatbot conversations significantly lower than the reference group. Moreover, those above 60 years of age do not believe that using these technologies affects customer loyalty and facilitates communication with the company. Younger and middle-aged people have more neutral or positive evaluations (Table 2).

An analysis of the effect of age on indicating factors that influence positive customer attitudes toward chatbots showed that young people aged 18–24 were significantly less likely than the reference group (35–44) to indicate personalization and relevance of responses, but more likely to indicate chatbots' multitasking, which may point to an understanding and appreciation of the system's performance. In contrast, respondents aged 55–59 were significantly less likely to indicate 24/7 availability and quick responses. People aged 60–65 were less likely to indicate quick responses and respondents over 65 were significantly more likely to indicate intuitive interface and accuracy of responses as key factors (Table 3).

Analyzing the effect of age on respondents' concerns about using chatbots in logistics customer service, it was noted that people aged 18–24 are less likely to indicate difficulties in interacting with a chatbot due to an unfriendly interface. Respondents of this age are also less likely to indicate other concerns. It can be assumed that younger people are more familiar with this technology, have fewer problems using it, and are open to automation.

In turn, those aged 55–59 and 60–65 are less likely to indicate a lack of human support as a problem. The first group is also less likely to point to the limited functionality of chatbots and the difficulty of interacting with this technology due to an unfriendly interface. In contrast, the oldest people are significantly more likely than younger people to point to data security issues, privacy breaches, and personal data leaks as their biggest concerns about using chatbots (Table 4).

The results are consistent with Mendez-Suarez et al. [2023] and Kasilingam [2020], who showed that younger and more technologically literate people demonstrate more positive attitudes.

## 4.2. Education

The study found that people with high school education show more positive attitudes toward chatbots than those with college education. On the other hand, those with a high school education and below are more likely to prefer chatbots to human contact. It was also noted that those with vocational education are more positive about the personalization of chatbots than those with higher education. Regardless of education, respondents gave a fairly similar assessment of the impact of chatbots on customer loyalty. People with vocational education are more positive about the communication function of chatbots compared to those with higher education.

An analysis of the influence of education on indicating the factors that affect positive customer attitudes toward chatbots showed that those with vocational education were significantly more likely to indicate the accuracy of answers as a key factor than those with higher education, which may indicate that the former trust chatbots more if the answers are correct and specific (Table 3).

An analysis of the effect of education on respondents' concerns about the use of chatbots in logistics customer service showed that those with vocational and high school education were significantly less likely to indicate a lack of human support as a concern (Table 4).

Notably, scholars such as Mendez-Suarez et al. [2023] showed that higher levels of education promote greater acceptance of innovations, which contrasts with the results of their study. The difference may be due to the context of use – people with higher education may have higher expectations of the quality of interactions, hence a greater distance from simplified forms of communication. This is also supported by the Almahri et al. [2024] study, which did not show that education was a moderator of attitudes; this may suggest that its influence depends strongly on the context and user expectations.

#### 4.3. Gender

Based on the results of the author's own empirical study, presented in Table 2, it was found that women's attitudes toward the use of chatbots in logistics customer service are slightly more negative than men's, and the use of this technology is less frequent among them. Furthermore, women are less likely than men to prefer contact with chatbots instead of talking to a human. This suggests a greater attachment of women to human contact in customer service. With regard to the statements of whether chatbots provide a more personalized experience, as well as whether interaction with chatbots affects customer loyalty, and whether chatbots facilitate communication, the differences between men and women are virtually zero. This means that both gender groups have similar opinions on the functionality and benefits of chatbots in logistics customer service. It is worth noting that none of the differences observed above reaches the level of statistical significance; nevertheless, a clear trend emerges that women demonstrate a slightly greater distance from chatbots than men (Table 2).

In contrast, statistically significant gender differences were shown when selecting the most important factors influencing positive customer attitudes toward chatbots in logistics customer service. Women were significantly less likely than men to indicate that it was the chatbot's immediate 24/7 availability

(Table 3). This may reflect women's greater distance from the purely technical advantages of automation.

Analyzing the effect of gender on respondents' concerns about the use of chatbots in logistics customer service, it was shown that women were significantly more concerned about the lack of personalization in chatbot responses, which may reflect higher expectations for a personalized approach. They were also significantly more likely than men to indicate issues of data security, privacy violations, and personal data leaks, which may reflect their greater sensitivity to ethical and privacy issues (Table 4).

Similar results were reported in a study by Kasilingam [2020], where women were more wary of chatbots and were more likely to fear negative consequences (loss of jobs, and privacy risks). Also, Rese et al. [2021] indicated that while men are more likely to use chatbots for simple tasks, women have higher expectations of this form of contact and are more emotionally involved. On the other hand, Almahri et al. [2024] and Balakrishnan et al. [2022] indicated that gender moderates the effect of habit and ease of use on intention to use, which also confirms the results of our study – women may expect more intuitive, "human" solutions.

## 5. Conclusions

The theoretical and cognitive goal of this article is to identify the influence of sociodemographic factors on Polish consumers' attitudes to chatbots in logistics customer service. The practical goal is to formulate recommendations that can be used by enterprises using chatbots in logistics customer service.

The results of our research are in line with the main trends in the literature. Women have been shown to be more cautious and have higher requirements for personalization and data security, which is confirmed by almost all cited studies. Age is also a strong moderator – younger people are more willing to experiment and have fewer concerns, while older people need more trust and security. Education, on the other hand, influences attitudes in a less clear-cut way: people with lower education may accept chatbots as a helpful tool, while

those with higher education may have a more critical attitude. The results obtained confirm that sociodemographic factors significantly differentiate the attitudes of Polish consumers toward the use of chatbots in logistics customer service.

The conducted research made it possible to test the established research hypotheses. Most of them were supported by the results. Only the third hypothesis, which assumed that the higher the level of education of the consumer, the more positive their attitude toward the use of chatbots in logistics customer service, was not supported by the findings and was therefore rejected.

The findings suggest that chatbot design should take into account the diversity of users: the different technological perceptions of men and women, generational differences in expectations, and the need to tailor interfaces to users' competencies.

In further research, it is worth considering the development of a consumer typology based on their attitudes toward chatbots in logistics customer service.

The limitations of the study include the limited nature of the survey questionnaire. Furthermore, the study was conducted using the CAWI method, which limits control over the independence and conditions of respondents' answers. The sample selection used, focused on people with previous experience in using chatbots, may limit the possibility of generalizing the results. What is more, the study is also limited by low  $R^2$  values in regression models, which indicates the limited explanatory power of sociodemographic variables and the possibility of other, unaccounted factors influencing the results.

## References

- Amer Jid Almahri F.A., Bell D., Gulzar Z., 2024, *Chatbot Technology Use and Acceptance Using Educational Personas*, "Informatics", vol. 11(2), 38, DOI: 10.3390/informatics11020038.
- Balakrishnan J., Abed S.S., Jones P., 2022, *The Role of Meta-UTAUT Factors, Perceived Anthropomorphism, Perceived Intelligence, and Social Self-Efficacy in Chatbot-Based Services?*, "Technological Forecasting and Social Change", vol. 180, 121692, DOI: 10.1016/j.techfore.2022.121692.

- De Andrade I.M., Tumelero C., 2022, *Increasing Customer Service Efficiency through Artificial Intelligence Chatbot*, "Revista de Gestão", vol. 29(3), pp. 238–251, DOI: 10.1108/REGE-07-2021-0120.
- Deshmukh S., Gundewar S., 2025, *A Comparative Analysis of Rule-Based and AI-Driven Systems for Improving Customer Satisfaction and Engagement in E-Commerce Using Chatbots Powered by Artificial Intelligence*, [in:] *6th International Conference on Mobile Computing and Sustainable Informatics (ICMCSI)*, pp. 1561–1564.
- Hanus G., 2024, *Polish Consumers' Attitudes to the Use of Chatbots in Logistics Customer Service*, "Optimum. Economic Studies", vol. 4(118), pp. 88–109, DOI: 10.15290/oes.2024.04.118.06.
- Huang D., Markovitch D.G., Stough R.A., 2024, *Can Chatbot Customer Service Match Human Service Agents on Customer Satisfaction? An Investigation in the Role of Trust*, "Journal of Retailing and Consumer Services", vol. 76, 103600, DOI: 10.1016/j.jretconser.2023.103600.
- Kasilingam D.L., 2020, *Understanding the Attitude and Intention to Use Smartphone Chatbots for Shopping*, "Technology in Society", vol. 62, 101280, DOI: 10.1016/j.techsoc.2020.101280.
- Méndez-Suárez M., Monfort A., Hervás-Oliver J.L., 2023, *Are You Adopting Artificial Intelligence Products? Social-Demographic Factors to Explain Customer Acceptance*, "European Research on Management and Business Economics", vol. 29(3), 100223, DOI: 10.1016/j.iedeen.2023.100223.
- Menti F., Romero D., Jacobsen P., 2023, *A Technology Assessment and Implementation Model for Evaluating Socio-Cultural and Technical Factors for the Successful Deployment of Logistics 4.0 Technologies*, "Technological Forecasting and Social Change", vol. 190, 122469, DOI: 10.1016/j.techfore.2023.122469.
- Mogaji E., Balakrishnan J., Nwoba A.C., Nguyen N.P., 2021, *Emerging-Market Consumers' Interactions with Banking Chatbots*, "Telematics and Informatics", vol. 65, 101711, DOI: 10.1016/j.tele.2021.101711.
- Nicolescu L., Tudorache M.T., 2022, *Human-Computer Interaction in Customer Service: The Experience with AI Chatbots – A Systematic Literature Review*, "Electronics", vol. 11(10), 1579, DOI: 10.3390/electronics11101579.
- Ragheb M.A., Tantawi P., Farouk N., Hatata A., 2022, *Investigating the Acceptance of Applying Chat-Bot (Artificial Intelligence) Technology among Higher Education Students in Egypt*, "International Journal of Higher Education Management", vol. 8(2), DOI: 10.24052/IJHEM/V08N02/ART-1.
- Rese A., Ganster L., Baier D., 2020, *Chatbots in Retailers' Customer Communication: How to Measure Their Acceptance?*, "Journal of Retailing and Consumer Services", vol. 56, 102176, DOI: 10.1016/j.jretconser.2020.102176.

www 1, <https://www.chatbot.com/blog/chatbots-for-order-tracking> [date of access: 1.06.2024].

www 2, <https://acropolium.com/blog/chatbots-in-logistics> [date of access: 1.06.2024].

## Appendix

**TABLE 1**

Characteristics of the research sample (n = 553)

| Variables          | Characteristics   |
|--------------------|---|
| Sex                | Female: 51.4%<br>Male: 48.6%  |
| Age                | 18–24 years: 25.0%<br>25–34 years: 20.4%<br>35–44 years: 18.8%<br>45–54 years: 20.8%<br>55–59 years: 7.2%<br>60–64 years: 4.9%<br>65 years and over: 2.9% |
| Place of residence | City: 71.4%<br>Rural areas: 28.6%   |
| Education          | Primary: 4.2%<br>Middle school: 1.4%<br>Vocational: 17.7%<br>Secondary: 46.1%<br>Higher: 30.6%  |
| Income situation   | Very good: 8.8%<br>Good: 51.2%<br>Mediocre: 35.8%<br>Bad: 2.2%<br>Very bad: 2.0%  |

Source: own study based on the survey.

**TABLE 2**

Relationship between demographic characteristics, attitudes toward chatbots, and their use in logistics customer service

|   | (1)                               | (2)                               | (3)                                      | (4)                              | (5)                               | (6)  |
|---|-----------------------------------|-----------------------------------|--|----------------------------------|-----------------------------------|--|
| Variable  | Attitude toward chatbots          | Frequency of use                  | Preference for interacting with chatbots | More personalized experiences    | Impact on customer loyalty        | Easier customer communication with the company |
| <b>Gender [reference category: Male]</b>                |                                   |                                   |  |                                  |                                   |  |
| Female  | 0.119<br>(0.115)                  | 0.031<br>(0.083)                  | 0.189<br>(0.157)                         | -0.001<br>(0.081)                | -0.010<br>(0.080)                 | -0.007<br>(0.077)                              |
| <b>Age [reference category: 35–44 years]</b>            |                                   |                                   |  |                                  |                                   |  |
| 18–24 years   | -0.051<br>(0.191)                 | 0.109<br>(0.144)                  | 0.247<br>(0.262)                         | 0.031<br>(0.138)                 | 0.125<br>(0.138)                  | 0.0723<br>(0.127)                              |
| 25–34 years   | -0.238<br>(0.178)                 | 0.053<br>(0.143)                  | -0.002<br>(0.260)                        | 0.090<br>(0.132)                 | 0.151<br>(0.130)                  | 0.0362<br>(0.121)                              |
| 45–54 years   | -0.006<br>(0.178)                 | -0.072<br>(0.137)                 | -0.064<br>(0.242)                        | -0.142<br>(0.128)                | -0.081<br>(0.128)                 | 0.023<br>(0.124)                               |
| 55–59 years   | -0.322<br>(0.281)                 | <b>-0.492**</b><br><b>(0.205)</b> | 0.043<br>(0.311)                         | 0.109<br>(0.172)                 | 0.083<br>(0.183)                  | -0.188<br>(0.132)                              |
| 60–65 years   | 0.193<br>(0.328)                  | 0.162<br>(0.234)                  | 0.249<br>(0.379)                         | <b>0.363*</b><br><b>(0.210)</b>  | <b>0.361*</b><br><b>(0.194)</b>   | 0.145<br>(0.210)                               |
| 65+ years   | <b>0.739***</b><br><b>(0.277)</b> | <b>1.241***</b><br><b>(0.149)</b> |  | 0.221<br>(0.232)                 | <b>0.838***</b><br><b>(0.193)</b> | <b>0.390**</b><br><b>(0.170)</b>               |
| <b>Education [reference category: Higher education]</b> |                                   |                                   |  |                                  |                                   |  |
| Middle school education                                 | -0.487<br>(0.344)                 | 0.257<br>(0.321)                  | -0.650<br>(0.682)                        | -0.247<br>(0.420)                | -0.244<br>(0.424)                 | -0.169<br>(0.196)                              |
| Basic   | 0.0968<br>(0.331)                 | 0.176<br>(0.245)                  | -0.283<br>(0.486)                        | -0.201<br>(0.240)                | 0.005<br>(0.227)                  | 0.150<br>(0.202)                               |
| Vocational  | -0.307<br>(0.198)                 | 0.071<br>(0.154)                  | -0.281<br>(0.245)                        | <b>-0.241*</b><br><b>(0.138)</b> | -0.230<br>(0.147)                 | <b>-0.278**</b><br><b>(0.139)</b>              |
| Secondary   | <b>-0.241*</b><br><b>(0.145)</b>  | 0.0454<br>(0.117)                 | <b>-0.435**</b><br><b>(0.203)</b>        | -0.135<br>(0.108)                | -0.145<br>(0.102)                 | -0.152<br>(0.102)                              |
| N   | 553                               | 553                               | 436                                      | 553                              | 553                               | 553  |
| R <sup>2</sup>  | 0.030                             | 0.074                             | 0.019                                    | 0.020                            | 0.036                             | 0.026  |

Resistant standard errors are given in the brackets (\*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1).  
 Negative values: a more positive attitude / more frequent use.  
 Positive values: a more negative attitude / less frequent use.

Source: own study based on the survey.

**TABLE 3**

Relationship between demographic characteristics and factors influencing positive customer attitudes toward chatbots

|   | (1)                         | (2)                        | (3)                              | (4)                       | (5)                      | (6)                        | (7)                |
|---|-----------------------------|----------------------------|----------------------------------|---------------------------|--------------------------|----------------------------|--------------------|
| Variable  | Instant availability        | Fast responses             | Intuitive, easy-to-use interface | Personalization           | Multi-tasking            | Relevance of responses     | Problem resolution |
| <b>Gender [reference category: Male]</b>                |                             |                            |                                  |                           |                          |                            |                    |
| Female  | <b>-0.373*</b><br>(0.225)   | 0.074<br>(0.204)           | -0.028<br>(0.243)                | -0.238<br>(0.280)         | -0.281<br>(0.253)        | -0.071<br>(0.284)          | -0.116<br>(0.262)  |
| <b>Age [reference category: 35–44 years]</b>            |                             |                            |                                  |                           |                          |                            |                    |
| 18–24 years   | 0.192<br>(0.393)            | 0.518<br>(0.337)           | 0.333<br>(0.418)                 | <b>-0.918*</b><br>(0.500) | <b>0.778*</b><br>(0.421) | <b>-0.835*</b><br>(0.441)  | -0.212<br>(0.412)  |
| 25–34 years   | -0.147<br>(0.358)           | 0.198<br>(0.315)           | -0.560<br>(0.422)                | -0.733<br>(0.450)         | 0.305<br>(0.396)         | -0.610<br>(0.443)          | -0.536<br>(0.423)  |
| 45–54 years   | -0.411<br>(0.343)           | -0.204<br>(0.308)          | 0.112<br>(0.381)                 | -0.121<br>(0.390)         | -0.199<br>(0.420)        | -0.360<br>(0.425)          | 0.200<br>(0.371)   |
| 55–59 years   | <b>-1.691***</b><br>(0.455) | <b>-1.183**</b><br>(0.469) | 0.090<br>(0.540)                 | 0.323<br>(0.556)          | -0.089<br>(0.604)        | -0.727<br>(0.604)          | -0.756<br>(0.636)  |
| 60–65 years   | -0.886<br>(0.566)           | <b>-1.316**</b><br>(0.620) | -0.302<br>(0.718)                | -1.314<br>(1.109)         | -0.523<br>(0.832)        | -0.865<br>(0.825)          | -0.757<br>(0.816)  |
| 65+ years   | 0.262<br>(1.204)            | 0.919<br>(1.205)           | <b>2.531**</b><br>(1.035)        | 0.678<br>(1.068)          | 0.539<br>(0.977)         | <b>2.926***</b><br>(1.052) | 1.176<br>(1.007)   |
| <b>Education [reference category: Higher education]</b> |                             |                            |                                  |                           |                          |                            |                    |
| Middle school   | 0.058<br>(0.658)            | -0.831<br>(0.595)          |                                  | 0.384<br>(0.929)          | 0.407<br>(0.648)         | -0.075<br>(1.105)          | -1.047<br>(1.156)  |
| Basic   | -0.159<br>(0.365)           | -0.574<br>(0.349)          | -0.219<br>(0.427)                | -0.735<br>(0.575)         | -0.395<br>(0.457)        | 0.603<br>(0.502)           | -0.048<br>(0.446)  |
| Vocational  | 0.426<br>(0.287)            | 0.135<br>(0.256)           | -0.165<br>(0.325)                | 0.231<br>(0.341)          | -0.182<br>(0.323)        | <b>0.821**</b><br>(0.375)  | 0.139<br>(0.326)   |
| N   | 436                         | 436                        | 420                              | 436                       | 436                      | 436                        | 436                |
| R <sup>2</sup>  | 0.068                       | 0.068                      | 0.030                            | 0.041                     | 0.036                    | 0.041                      | 0.026              |

Resistant standard errors are given in the brackets (\*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1).

Source: own study based on the survey.

TABLE 4

Relationship between demographic characteristics and customer concerns about chatbot use

|  | (1)                       | (2)                       | (3)                         | (4)                       | (5)                        | (6)  |
|--|---------------------------|---------------------------|-----------------------------|---------------------------|----------------------------|--|
| Variable   | Lack of personalization   | Misinterpretation         | Lack of human support       | Data security concerns    | Limited functionality      | Difficulties interacting with chatbots (interface) |
| Gender [reference category: Male]                |                           |                           |                             |                           |                            |  |
| Female   | <b>0.446**</b><br>(0.223) | -0.258<br>(0.180)         | -0.171<br>(0.181)           | <b>0.489**</b><br>(0.202) | 0.034<br>(0.177)           | -0.011<br>(0.222)                                  |
| Age [reference category: 35–44 years]            |                           |                           |                             |                           |                            |  |
| 18–24 years                                      | -0.509<br>(0.374)         | 0.364<br>(0.312)          | 0.168<br>(0.295)            | -0.034<br>(0.334)         | 0.259<br>(0.293)           | <b>-1.040***</b><br>(0.390)                        |
| 25–34 years                                      | 0.347<br>(0.322)          | -0.319<br>(0.280)         | -0.032<br>(0.278)           | -0.377<br>(0.320)         | 0.159<br>(0.275)           | -0.547<br>(0.334)                                  |
| 45–54 years                                      | -0.251<br>(0.347)         | <b>-0.547*</b><br>(0.287) | <b>-0.531*</b><br>(0.284)   | 0.375<br>(0.306)          | -0.010<br>(0.280)          | -0.311<br>(0.331)                                  |
| 55–59 years                                      | -0.699<br>(0.579)         | 0.354<br>(0.444)          | <b>-1.364***</b><br>(0.467) | -0.583<br>(0.512)         | <b>-1.032**</b><br>(0.455) | <b>-1.041*</b><br>(0.558)                          |
| 60–65 years                                      | -0.448<br>(0.583)         | -0.115<br>(0.487)         | <b>-1.179**</b><br>(0.534)  | -0.012<br>(0.547)         | -0.132<br>(0.470)          | -0.444<br>(0.538)                                  |
| 65 + years                                       | -1.163<br>(0.782)         | 0.122<br>(0.605)          | -0.485<br>(0.586)           | <b>0.981*</b><br>(0.596)  | -0.597<br>(0.661)          | -0.696<br>(0.718)                                  |
| Education [reference category: Higher education] |                           |                           |                             |                           |                            |  |
| Middle school                                    | 1.299<br>(0.819)          | -0.755<br>(0.824)         | -0.461<br>(0.708)           | 0.478<br>(0.736)          | -0.998<br>(0.844)          | -0.215<br>(1.063)                                  |
| Basic  | -0.091<br>(0.702)         | -0.569<br>(0.489)         | 0.302<br>(0.491)            | -0.765<br>(0.630)         | -0.367<br>(0.510)          | 0.561<br>(0.591)                                   |
| Vocational                                       | 0.549<br>(0.384)          | -0.106<br>(0.335)         | <b>-0.614*</b><br>(0.326)   | -0.034<br>(0.368)         | -0.267<br>(0.316)          | 0.198<br>(0.365)                                   |
| Secondary  | 0.033<br>(0.280)          | -0.199<br>(0.235)         | <b>-0.425*</b><br>(0.229)   | -0.053<br>(0.258)         | -0.047<br>(0.227)          | -0.068<br>(0.278)                                  |
| N  | 553                       | 553                       | 553                         | 553                       | 553                        | 553  |
| R <sup>2</sup>                                   | 0.031                     | 0.022                     | 0.052                       | 0.029                     | 0.025                      | 0.022  |

Source: own study based on the survey.

**TABLE 5**

Assessment of research hypotheses based on empirical results

| Hypothesis   | Result                   |
|--|--------------------------|
| <b>H1:</b> It is assumed that sociodemographic factors significantly differentiate Polish consumers' attitudes toward the use of chatbots in logistics customer service. | supported by the results |
| <b>H2:</b> It is assumed that the older the consumers, the more negative their attitude toward the use of chatbots in logistics customer service.                        | supported by the results |
| <b>H3:</b> It is assumed that the higher the consumer's level of education, the more positive their attitude toward the use of chatbots in logistics customer service.   | rejected                 |
| <b>H4:</b> It is assumed that there are significant differences between the attitudes of men and women toward the use of chatbots in logistics customer service.         | supported by the results |

Source: own study based on the survey.