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Artificial-intelligence-powered customer service management in the logistics industry

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ABSTRACT

Objective: The article aims to show how people perceive future implications for logistics customer service resulting from the implementation of new technologies in the form of game-changer artificial intelligence (AI) solutions in the spirit of economy 4.0 and society 5.0.

Research Design & Methods: The research process used a nomothetic approach based on the methodology of mixed research. The qualitative approach included a research study of monographs, publications, reports, and netographic sources. We used the technique of critical content analysis based on the co-occurrence of terms. In turn, we based the quantitative approach on the diagnostic survey method with the computer-assisted web interviewing (CAWI) technique. The sample size was 233. For further analysis, we used the statistical package for the social sciences (SPSS).

Findings: The research shows that customer service in logistics already uses different forms of AI-based solutions (like Chabtbots, Voicebots, and voice assistants). Even customers positively evaluate those solutions, among others, for efficiency, competence, and service quality. Moreover, customers are aware of AI-based solutions and know that their usage will deepen in the future, as it is a game changer for the competitiveness of customer service in logistics.

Implications & Recommendations: The conducted research indicates the need to constantly improve the digital competences of the users of last-mile logistics services in the context of technologization of transaction processes. Different areas of business will widely use AI-based solutions, because there is a need to develop systems which will help with the human-machine communication. This technology should be constructed as safe for people and easy to use; both with regard to users and customers. As a result of these processes, there is a greater need to educate people about AI-based solutions to develop awareness and improve future outcomes.

Contribution & Value Added: The article's main advantage is determining new possibilities in the area of logistics customer service as a result of the dissemination of solutions in the AI field, which may be a helpful instrument for enterprises in managing the last-mile scenario in the future.

Article type: research article

Keywords: artificial intelligence; automation; logistics; logistics customer service; Industry 4.0

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INTRODUCTION

The development of the Internet and the newer solutions and tools hugely impact the development of logistics both in Poland and worldwide (Liu, 2019). The digitalization of almost everything results in a constant migration of people between meetspace and cyberspace. According to the World Economic Forum, in the future, the growing demand for e-commerce will lead to an increase in demand not so much for classic last-mile services but for innovations in their implementation. The push for logistics to go digital comes from artificial intelligence (AI), which logistics business managers view as a game-

changing sixth sense in the virtual realm. Artificial intelligence is a branch of computer science that deals with the creation of machines and algorithms that can exhibit intelligence characteristics such as reasoning, learning, pattern recognition, planning, natural language processing, and decision-making. Artificial intelligence became a kind of trigger for a new business reality after a series of incremental changes represented by the emergence of individual technological solutions over the years, which include automation, robotic process automation (RPA), and blockchain technology used to track shipments. Importantly, RPA is a technology that enables the automation of business processes using special computer robots, meaning that RPA is about programming robots that can perform repetitive actions according to specific rules and algorithms. Moreover, AI also increased transactions' security and authenticity level in the supply chain as the internet of things (IoT) helps track and monitor the location, temperature and condition of goods in transport and virtual reality (VR) and augmented reality (AR) provide customers with interactive experiences (Menti *et al.*, 2023). In recent years, as a game changer, AI has started to play an increasingly important role in logistics (Du *et al.*, 2023). With the development of technology and increasing customer demands, almost every company must be able to provide fast, reliable, and effective customer service.

In terms of quality and efficiency, customer service allows the company to build a strong brand that stands out from the competition and allows it to attract more regular customers, which leads to increased profits and obtaining and maintaining a competitive advantage in the long term. In this context, AI offers tools that can help companies improve the quality of logistics customer service, and even take it to a completely new, unprecedented level. Thus, it is important to study AI's impact on the changes taking place in logistics last-mile customer service. We aimed to indicate how people perceive future implications for logistics customer service resulting from the implementation of new technologies in the form of game-changer artificial intelligence (AI) solutions in the spirit of economy 4.0 and society 5.0. We predicted that in the future, in many cases, existing technologies in customer service give way to AI-based solutions. After all, the development of AI and its applications in logistics offer many benefits for companies. Thanks to AI algorithms, companies can improve customer service quality, increase the speed of order fulfilment, reduce costs, and improve overall efficiency. Nevertheless, AI is not without flaws and limitations. In this context, it is necessary to remember possible risks such as data security and the possibility of reducing employment in companies. In this article, we will understand logistic last-mile customer service an element of after-sales service in the context of e-commerce, when customers expect appropriate service in the field of delivery logistics (Janjevic *et al.*, 2021).

Following the article's goal, we pose the following research questions:

1. How does awareness of using AI solutions affect the customer experience in last-mile logistics?
2. In which representations will the use of AI-based solutions accelerate the reconfiguration of last-mile logistics services in 10-15 years?
3. How will the use of AI solutions affect the improvement of logistics customer service processes in the future?

In the research process, we adopted a nomothetic approach based on the methodology of mixed research. The qualitative approach included a research study of monographs, publications, reports, and netographic sources. We used the technique of critical content analysis based on the co-occurrence of terms. In turn, we based the quantitative approach on the diagnostic survey method with the CAWI technique.

The research novelty of the article is the perspective of logistics companies' customers. We based the research on customers of online stores but in the context of logistic customer service. Previous research focused on assistance during transactions (Xu *et al.*, 2020) and mainly concerned chatbots solutions (Chen *et al.*, 2023). However, it is also important for customers to be aware that they are interacting with AI-based services. The awareness of non-human service can affect the customer's attitude and thus direct her to certain behaviours, which is worth investigating.

The next part of the article will present a literature review of technologies used in the logistics processes, including AI-based solutions. Then, we will describe the research methodology. Next, we

will focus on results and discussion with existing research outcomes. Finally, we will end the article with conclusions and future research recommendations.

LITERATURE REVIEW

Recent years marked by the fourth industrial revolution (Behie *et al.*, 2023; Hassoun *et al.*, 2023; Kunrath *et al.*, 2023) have seen the use of various technologies in the activities of individual enterprises and entire supply chains. Among many digital technologies, AI began to show new, hitherto unavailable possibilities, becoming the basis for the upcoming changes (Noble *et al.*, 2022; Chaabi, 2022). Their representation has led to the fifth industrial revolution, which results from the experiences of the digitalized world of Industry 4.0 and the pandemic (Sarfraz *et al.*, 2021). These experiences made it necessary to implement technological innovations, while taking into account the social aspect, which is not so much a distinguishing feature as a distinctive component. This social aspect can relate to people's role in the use of modern technologies, their safety, and the ability to control innovation. However, such a socialized version of technologization may be necessary to build a world that will be better from the society's perspective, *i.e.* in terms of protecting human health and the environment (Iqbal *et al.*, 2022; Cortés-Leal *et al.*, 2022). According to many researchers, the excessive use of technology may pose a threat to social life (Giza & Wilk, 2021). Therefore, perhaps we should approach the concept of full automation with caution and smoothly transition to the concept of society 5.0 (Huang *et al.*, 2022), which may prove more needed in the development of civilization than a technocracy of machines. A review of the literature indicates that artificial intelligence may be a breakthrough in building society 5.0 (Taj & Jhanjhi, 2022; Shahidan *et al.*, 2021).

However, the variety of nomenclature requires the systematization of digitization, digitalization, and technologization concepts (Gobble, 2018). Digitization refers to the transfer of data to the digital sphere, *i.e.* it refers to the digital version of data. Digitalization concerns entire processes conducted in the digital sphere. Finally, technologization means the introduction of technological elements, *e.g.* information systems, which primarily intend to serve general development (Vasyltsiv *et al.*, 2021). For business development to be possible – thus to create unique customer value that affects loyalty (Wijaya, 2017) – it is worth to mention that AI algorithms as technological, environmental, and sociocultural representations will significantly impact a number of organizations' management processes (Wang *et al.*, 2022) and in particular logistics customer service (Ngai *et al.*, 2021). Concerning that researchers assume that up to 75 billion devices in the network will function in the world by 2025 (Turban, 2018), the combination of AI technology and the internet of things will be a kind of technological game changer in the virtual space of the smart society. Here are some examples illustrating how AI supports customer service in logistics companies today: chatbots, predictive analytics, natural language processing (NLP), and voice assistants. Therefore, various forms of AI are becoming an important part of solutions supporting logistic customer service processes.

Considering the above, customers' knowledge and awareness about the ongoing changes in logistics customer service is becoming more and more important (Xu *et al.*, 2020). Despite the many existing applications of AI in logistics customer service, this technology is still vulnerable to failures and problems (Li *et al.*, 2023; Yang *et al.*, 2023). Customers certainly understand it. However, companies are still trying to educate customers and thus increase AI awareness. An important aspect is that customers very often misunderstand the service, *e.g.* when using chatbots (Nguyen & Prentice, 2020). This may be due to the fact that these systems are not very empathetic or do not meet all behavioural expectations (Lajante *et al.*, 2023). However, if customers' experience is positive they are likely to see the benefits of AI support as well (Jan *et al.*, 2023). The sensitivity of AI-based systems is particularly important when building customer loyalty (Balinado *et al.*, 2021; Javed & Mu, 2020). Therefore, we can assume that AI may play an important role in customer service processes regarding the logistics services experience at the last-mile stage and thus shape the customer-supplier relationship in the perspective of 10-15 years.

Customer experience management is certainly easier when you can fully control the customer service process. This is possible thanks to the CRM class systems (customer relationship management). Thanks to the databases concerning customer contacts, it is possible to individualize the offer with

greater precision and adapt to the expectations of individual recipients (Agnihotri *et al.*, 2017). Research points that there already exist AI-driven models of CRM systems (Li & Xu, 2022). This may be just the beginning of changes in the field of logistics customer service that may appear in the future. Moreover, AI supports customer service not only through direct contact with the customer but also through supply network planning (Pengfei *et al.*, 2023), cost reduction, accuracy of delivery time scheduling (Rosendorf *et al.*, 2021), and data collection management (Jucha, 2021). Therefore, we may assume that the adoption of AI-based solutions will significantly reconfigurate the processes of last-mile logistics services, thus becoming a game changer.

RESEARCH METHODOLOGY

At the turn of 2021 and 2022, we prepared and implemented a research project based on primary sources. We wanted to answer how the innovative AI-digital solutions introduced in the process of logistics customer service influence the current and will influence future customer choices regarding the last-mile services offered by international representatives of the Polish courier-express-parcel (CEP) industry. It was an explanatory study of a descriptive and explanatory nature. We aimed to identify the important attributes of AI digital technologies used in last-mile logistics services. Because of the scope of the measurement method, this study was fragmentary, deterministic, and representative of the selected study population.

The surveyed group were residents of Poland aged over 16, who during the three months before the study at least once participated in the process of purchasing goods through Polish and foreign entities operating on the Internet. Based on the established selection criteria, we determined the minimum sample size, taking into account the fraction. In the calculation processes, we assumed the population of Poland to be 31 811 795 people as of 31 December 2020, regarding people over 16 years old. We further defined the fraction of the value of the proportion related to online transaction execution using research results from Statistics Poland regarding online activities. For people aged 16 and over and using the Internet regularly (at least once a week) and searching there for information about goods and services, the size of the fraction was 0.814 and 0.186 for other people. Moreover, the measurement assumed the possibility of a random error within +/- 5%, taking into account the confidence level of 0.95. The calculations resulted in a sample size n_{min}=233 units. We conducted calculations using an Excel spreadsheet.

Obtaining data from primary sources was possible thanks to the use of the diagnostic survey method with the user-centric CAWI technique. We used the artificial measurement tool, *i.e.* questionnaire consisting of 43 closed questions, including 14 based on the scaling of attitudes according to Rensis Likert. We uploaded the electronic questionnaire to the ebadania.pl platform. We then exported raw data results collected on the ebadania.pl to a .por format and imported them to SPSS for further analysis.

In the first stage of the analysis, we defined the variables distribution, *i.e.* the values of response variants obtained from individual questions in the questionnaire. The collected answers allowed us to conclude that women dominated among the study participants (53.2% of the respondents; men – 46.8% of the respondents). Because of respondents' age, the largest group were respondents aged up to 55. In detail, the groups were 35-44 years (19.3%), 25-34 years (16.3%), 45-54 years (16.1%), respectively, and 16-24 years (12.3%). City dwellers dominated the sample (59.9%); compared to rural dwellers (40.1%).

In the second stage, we verified the tested sample and determined its representativeness For this purpose, we used the method of comparative analysis of the existing population of Polish residents and respondents forming the study sample in the area of selected comparative characteristics. In this process, we applied a non-parametric significance test, *i.e.* a test of conformity based on the χ^2 statistics. Assuming that the statistics have a $\chi^2\alpha$ with distribution k=(r-1), in which k is the number of degrees of freedom and r is the number of class intervals. In turn, we calculated the empirical value of the χ^2 statistics based on the data obtained in the study. The formula for the critical set was $P(\chi^2 < \chi^2\alpha) = \alpha$, in which $\chi^2\alpha$ is the critical value determined from the distribution tables χ^2 for k = r-1 the degree of freedom and p = α. As a result of the calculations, we obtained the data presented in Table 1.

Table 1. Verification of the sample in relation to the population based on the significance test χ^2

Variable	Value χ^2 Real	Value χ^2_α Theoretical	Test realization $\chi^2<\chi^2_\alpha$
Sex	0.103	3.841	concordance
Age	2.204	12.592	concordance
Place of residence	4.197	11.07	concordance

Note: a α – confidence level
Source: own study.

The verification analysis allowed us to confirm that the distribution of variables characterizing the study sample was consistent with the population of Polish residents in terms of sex, age, and place of residence. However, because we used non-random sampling (snowball method) in the process of sampling units, we could not assess the sample's representativeness in the statistical sense in the inference procedure. However, thanks to the results of the χ^2 significance test and the sample size, we could make summaries and assumptions about the choices, indications, and opinions of Polish residents aged 16 and over, buying on the Internet and using CEP services on the territory of Poland when making deliveries in the last-mile area.

After determining the representativeness of the study sample, in the third stage of the analysis, we referenced the answers to the essential questions and the metrics and compiled the results in the form of contingency tables. Wherever it was possible and made logical sense and was statistically significant, we indicated the existence of stochastic dependence or independence of random variables. For this purpose, we used the χ^2 independence test with the significance level α at <= 0.05. We conducted calculations using SPSS software. Thus, we could indicate the variables' mutual dependence. We used Cramér's V coefficient to measure the verification value. We made every effort in the process of preparing, conducting, and analysing the study results. However, we are aware of certain limitations resulting from the available research budget and the limited time devoted to the research project.

RESULTS AND DISCUSSION

The research helped us examine how well people understand innovative logistics solutions involving AI algorithms and specific technology used in customer service processes. Most of the survey participants admitted that shopping is a pleasure for them (71.4%). The surveyed respondents most often used smartphones (96.3%), laptops (88.8%), and tablets (65.4%) when shopping online. The use of mobile devices allows for greater freedom in choosing the time and place of purchase. When asked about the knowledge and use of innovative technological solutions in purchasing processes, the respondents answered that they often and very often used them (68.8%). Among the innovative solutions that they were aware of, knew, and used in transaction and service processes, the respondents most often indicated cloud computing solutions (55.3%), ubiquitous connectivity (55.1%), chatbots/voicebots as representatives of AI solutions (43.3%), VR solutions (34.7%), and work on large data sets (big-data-as-a-service; BdaaS and big data analytics; BDA) (42.2%). When asked about where they had seen innovative technology concepts applied in transaction and service processes, they indicated trade (79.8%), transport (58.2%) and the logistics of handling purchase transactions (47.8%).

We asked the respondents who had contact with the AI representation at least once in the purchasing and delivery process, *i.e.* they communicated with the bot before the purchase and used its services in the delivery tracking process, to evaluate such interaction by assigning a score from -3 points to +3 points; -3 meant the lowest grade and +3 the highest. When assigning points, the respondents indicated that they value interaction with the bot the most for efficiency (2.14), helpfulness (2.13), competence (2.11), empathy (2.07), communicativeness (2.04), speed of action (2.00), answers accuracy (1.99), quality of service (1.91), competence in providing information (1.87), offer (1.80), and understanding the client's situation (1.26). Such results indicate that respondents accepted the implementation of AI solutions. Although participants in the purchasing and delivery process appreciated the ability to communicate with the bot for its efficiency, they indicated that techno-communication

solutions will not replace humans in terms of human understanding of reality, way of thinking, and identifying and solving complex problems.

According to the respondents, the dissemination of AI in logistics services will transform customer service, which will take various forms in 10-15 years. Analysing the forecasts for the dissemination of representation in the AI field, the respondents pointed to the progressing process of increasing the number of autonomous delivery vehicles (93.3%). Most frequently, people sharing this opinion were women (31.6%) (men (19.2%)), people aged 35-44 (12.5%), and city dwellers (30.0%). Moreover, the respondents indicated an increase in the delivery speed due to algorithmizing represented by business intelligence (BI) (90.4%). Most frequently, people sharing this opinion were women (37.7%) (men (23.3%), people aged 45-54 (11.1%), and city dwellers (36.9%).

Table 2. Representations of the use of AI in logistics customer service processes in 10-15 years

Variable	Gender			Age			Place of residence		
	χ^{2a}	p^b	V^c	χ^2	P	V	χ^2	p	V
Every sphere of human existence will involve information selection and analysis	141.095	0.001	0.463	100.209	0.001	0.195	288.660	0.001	0.331
Integrated communication systems	35.637	0.001	0.233	175.911	0.001	0.299	191.285	0.001	0.311
Increasing the automation of transaction processes (reducing the need for human sellers)	49.672	0.001	0.275	130.473	0.001	0.257	321.701	0.001	0.404
Increasing the number of robots in delivery processes	111.526	0.001	0.412	134.151	0.001	0.226	157.417	0.001	0.245
AI will increase the delivery speed	80.334	0.001	0.349	69.079	0.001	0.162	213.588	0.001	0.258
Increasing the devices' ability to communicate with each other (IoT), which will exclude humans from purchasing processes	40.865	0.001	0.249	123.377	0.001	0.254	278.158	0.001	0.375
The number of autonomous vehicles making deliveries will increase	138.216	0.001	0.458	223.063	0.001	0.291	202.089	0.001	0.277
You will not need to have documents, a face/pupil scan will be enough to verify the person authorized to pay/collect the parcel	55.874	0.001	0.291	145.760	0.001	0.235	264.135	0.001	0.317

Note: [a] χ^2 – test value with α=0.05; [b] p – asymptotic significance; [c] relationship strength calculated using V-Cramer.
Source: own study.

According to the respondents, in the future, it will not be necessary to have documents, because a face or pupil scan will be enough to verify the person authorized to collect the parcel (84.4%). This opinion was more frequent among women (35.3%) than men (26.0%), people aged 35-44 (14.3%), and inhabitants of rural areas (31.6%). Moreover, according to the respondents, in the future we can expect an increase in the automation of transaction processes (reducing the need for human sellers) (81.1%). This opinion was more frequent among women (29.8%) than men (27.1%), people aged 35-44 (12.5%), and city dwellers (28.8%). The respondents also declared that every sphere of human existence will be subject selecting and analysing information (80.1%). This opinion was more frequent among women (38.9%) than men (24.3%), people aged 35-44 (12.8%), and city dwellers (34.2%). Moreover, according to the respondents, the number of robots participating in delivery processes will increase in the future (64.0%). This opinion is shared by the majority of women (38.3%) than men (23.1%), people aged 35-44 (16.4%), and city dwellers (39.9%). Moreover, respondents stated that integrated communication systems will become a commonplace (61.5%). Although devices' possibility to communicate with each other (IoT) will increase, people will still participate in purchasing processes as customers (56.3%). The $\chi 2$ test of independence with the strength of the relationship determined by V-Cramer confirmed the existence of the indicated relationships (Table 2).

Respondents believe that AI will change the way people and machines function in the socio-economic space. According to the majority of respondents (84.2%), the speed of transactional and warranty processes will 'definitely' and 'rather' increase thanks to autonomous and intelligent systems

capable of self-configuration, self-control, and self-repair. This opinion was more frequent among women (37.1%) than men (30.1%), people aged 25-34 (12.4%), and city dwellers (39.9%).

Table 3. A new image of people in the socio-economic space shaped by AI

Variable	Gender			Age			Place of residence		
	χ^{2a}	p^b	V^c	χ^2	P	V	χ^2	p	V
People will be integrated with the world of machines (transhumanism) thanks to implanted chips that allow for constant communication with the environment (applications allowing you to control both virtual and real space), which will enable the download of current information about transactions at every stage.	34.522	0.001	0.229	73.739	0.001	0.193	160.211	0.001	0.285
The socio-economic space will be fully reactive to the individual needs and expectations of specific people, creating a new type of adjustment in the field of sales and logistics customer service, the so-called techno-customization.	51.727	0.001	0.280	77.269	0.001	0.198	265.067	0.001	0.366
Each person will have their individual guardian (assistant program – angel) supporting them in functioning both in the digital and real layer.	70.840	0.001	0.328	123.100	0.001	0.250	181.908	0.001	0.304
The speed of transactional and warranty processes will increase thanks to autonomous and intelligent systems with the ability to self-configure, self-control, and self-repair.	11.844	0.001	0.134	93.275	0.001	0.217	148.116	0.001	0.274

Note: [a] χ^2 – test value with α=0.05; [b] p – asymptotic significance; [c] Relationship strength calculated using V-Cramer.
Source: own study.

Moreover, the socio-economic space will be fully reactive to the individual needs and expectations of specific people, creating a new type of adjustment in the field of sales and logistics customer service, the so-called techno-customization, which three out of four respondents emphasized (76.3%). This opinion was slightly more frequent among women (37.7%) than men (22.8%), people aged 25-34 (24.6%), and city dwellers (38.6%). The respondents believed that in the future, each person will have their guardian supporting them in functioning both in the digital and real layer, which more than half of the respondents indicated (68%). This opinion was slightly more frequent among women (36.5%) than men (33.2%), people aged 35-44 (12.8%), and city dwellers (40.2%). It may also be that every human will be integrated with the world of machines (transhumanism) thanks to implanted chips that will allow for constant communication with the environment (applications allow you to control both virtual and real space), which, subsequently, will allow for the download of current information about transactions stage on each of them as emphasized by nearly half of the respondents (42.7%). This opinion was slightly more frequent among women (37.7%) than men (26.2%), people aged 25-34 (12.3%), and city dwellers (36.3%). The $\chi 2$ test of independence with the strength of the relationship determined by V-Cramer (Table 3) confirmed the existence of the indicated relationships.

Due to the new subject matter, there are not that many studies that we could use for the sake of comparison. Thus far, researchers focused on AI's cognitive aspects. The aforementioned research concerned the sphere of the possibility of using AI in customer service, or the possibility of supporting these processes. However, researchers have not delved deeply into the context of AI-supported systems working with customers, which is mainly due to the low applicability level of such solutions resulting from the implementation cost.

However, considering other research conducted in the AI context, researchers indicate the use of AI-based technologies in the field of customer service, where chatbots do not fulfil their tasks when the issues are too complicated (Xu *et al.*, 2020). Moreover, research also indicates that customers pay attention to the service provided by employees which they treat as a positive aspect;

they feel appreciated and distinguished (Nguyen & Prentice, 2020). This is an important element, because by comparing the service provided by AI-supported systems and systems that still use human work, we can find common features and improve processes. Certainly, a significant change will be the introduction of systems that will be closer to being operated by an employee (Hsu & Lin, 2023). Moreover, scholars also state that generative AI can help with process automation which will speed up customer service (Korzynski *et al.*, 2023).

However, studies also indicate that trust in bots is increasing (Chen *et al.*, 2023). An important aspect is also the transaction's subject. In our research it is mainly about obtaining information to provide the service. In the case of products, their attributes affect the customers' reflections on the chatbots' services (Ruan & Mezei, 2022). Research (Prentice *et al.*, 2020) shows that this may also be related to AI's analytical capabilities. Providing up-to-date and error-free information to the customer may turn out to be the key to service satisfaction. An additional aspect is the use of AI to analyse data obtained after the customer service process to effectively improve this process. Artificial intelligence provides the opportunity to analyse customer satisfaction from individual stages of logistics customer service, indicating areas that require improvement (Barik *et al.*, 2023). Furthermore, researchers continuously point to the possibility of using AI in analytics to enable the prediction of risky events. Thus, they advocate building resilient supply chains, resistant to situations caused primarily by unforeseen situations (Modgil *et al.*, 2021).

Summing up, the study results indicate that customers of logistics services are aware of the presence of AI solutions. Their experience in this area is positive. They value AI solutions used in the process of providing last-mile logistics services for efficiency, helpfulness, competence, empathy, communicativeness, speed of action, precision, service quality, competence, personalization, and understanding of the customer's situation. These positive experiences indicate a promising future for companies that have adopted or will adopt AI solutions. Thus, we may assume that in the future, logistics processes supporting sales will be AI-dominated because of this positive customer response. Study participants believe that AI-based technological innovations will take various forms, ranging from exclusive software, through automation and robotization, to integrating man with the world of machines. The usability and possibilities of artificial intelligence solutions aiding customers in logistics will boost the transformation and reconfiguration of last-mile logistics services. Well-chosen solutions will improve the functioning of companies and customer satisfaction.

CONCLUSIONS

Modern logistics is a process of continuous improvement and adapting to changes taking place in the world, both locally and globally. The pace of logistics development and pressure put on it has reached an unprecedented level in recent years. The already high-speed digitalization represented by AI resulted in the dynamic development of automation, which is conducive to increasing companies' efficiency, effectiveness, and productivity (Korzynski *et al.*, 2023). These activities undoubtedly illustrate that economy 4.0 (Qin, 2016) and the upcoming economy 5.0 are changing the economic face of societies moving towards society 5.0.

The analysis of literature and research indicates that customer service logistics widely applies AI solutions, which customers are aware of and accept. Technologization in verification processes and automation of transactional processes gradually contributes to the reconfiguration transformation of logistics customer service processes. The speed of transactional and warranty processes is increasing thanks to autonomous and intelligent systems capable of self-configuration, self-control, and self-repair, which means that AI is becoming an indispensable and integrating link. Chatbots, predictive analytics, NLP, and voice assistants as a representation are increasingly used today.

Regarding the first research question 'How does awareness of using AI solutions affect the customer experience in the last mile?,' we can answer that the solutions in the field of new technologies like chatbots/voicebots described in theory as representations of AI solutions, are known and used in transactional and transport practice as well as in the logistics of purchasing transactions, which we see reflected

in the answers of the survey participants. The customers of last-mile logistics services positively evaluated AI in the lateral representation. They especially appreciated the efficiency, helpfulness, competence, empathy, communicativeness, speed of action, response precision, and service quality.

In turn, in response to the second research question, *i.e.* 'In which representations will the use of AI-based solutions accelerate the reconfiguration of last-mile logistics services in 10-15 years?,' we can indicate that according to customers of logistics services, there will be an increase in the number of autonomous delivery vehicles, the applicability of BI and personal verification systems, the automatisation level of transaction processes, the number of robots participating in delivery processes and integrated systems of communication. Customers are aware and anticipate that the current use of AI solutions will deepen as a result of the growing adoption of solutions based on the experience of system users, and this will contribute to the reconfiguration of logistics services.

Finally, in response to the third research question, 'How will the use of AI solutions affect the improvement of logistics customer service processes in the future?,' we can answer that AI will become an integral part of the ecosystem of solutions supporting logistics customer service processes. Thus, AI tools and systems will become an integral part of solutions supporting logistic customer service processes. Today's high demand for data will certainly increase in the future and thus AI will be necessary. Efficient flow of up-to-date and reliable data and its processing affects and will affect the implementation of service logistics processes. Delivering the right products, in good quantity and condition, at the right time, to the right place, to the right customer is and will increasingly depend on algorithms that allow companies to control and supervise processes and bring machines and devices to life. However, although AI algorithms and robots or autonomous vehicles can perform repetitive activities, they will not replace people in making decisions and solving complex, unusual problems. According to the customers of last-mile logistics services participating in the study, AI will change the way people and machines function in the socio-economic space. The speed of transaction and warranty processes will increase thanks to autonomous and intelligent systems. Moreover, the logistics process of customer service will be subject to change, which is more and more often marked by techno-customization, which means a smaller share of people and a larger share of IT systems and machines, which may manifest itself in the fact that each person will have their individual guardian (assistant-guard program) supporting them in functioning both in the digital and real world, or each person will be integrated with the world of machines (transhumanism) thanks to implanted chips that will allow them to maintain constant communication with the environment. Regardless of the variants of potential solutions used, they will undoubtedly be AI-based.

The answers to the three research questions posed above allow us to conclude that the presence of solutions represented by AI force the transformation of logistics customer service systems towards greater automation and robotisation, which requires knowledge, skills, and digital competences supporting human-machine cooperation. The conducted research indicates the need to take care of education to improve digital competences in the context of the technologization of transaction processes, both among employees and users of the supply logistics system. The presence of solutions represented by AI algorithms make it necessary to have such knowledge, skills, and competences (Wach *et al.*, 2023) that will allow for human-machine collaboration.

To sum up, the futuristic vision is becoming physical reality today. The analysed secondary sources and the material collected in the course of the survey allow us to conclude that we achieved the our aim, *i.e.* we showed how people perceive future implications for logistics customer service resulting from the implementation of new technologies in the form of game-changer AI solutions in the spirit of economy 4.0 and society 5.0. The intensification of the spread of AI-based solutions as a game changer in logistics will require reorganization of business models. Already today, customers of last-mile logistics services using AI-based solutions evaluate them positively, emphasizing the advantages of service components. In the context of the next 10-15 years, they indicate an increase in AI-based applications and the level of automation of logistics customer service processes, both in technical and executive as well as relational and communication terms. The central point of activities will be a human supported by a powerful accelerator speeding up the decision-making process based on the obtained and processed information. More and more frequently, the AI-based solutions will handle logistics processes and robots will perform them. People's role will change from contractors to facilitators. This requires

proper preparation of both entrepreneurs and customers from the technical and communication side. We hope that the material collected in the article will be helpful in this regard.

Finally, taking into account the dynamic technological development in the field of AI methods and techniques, scholars should repeat research in this area within five and ten years to re-verify current observations and conclusions. Moreover, it would be worth considering the possibilities of strategic use of AI in business processes, as also indicated by Akter *et al.* (2023). This may also be related to research on business implications, *i.e.* what are the possibilities of using AI in B2B contacts, which are subject to many additional aspects (Li *et al.*, 2021). Therefore, a look from client's and the company's side could be an interesting contribution to our research results.

REFERENCES

Agnihotri, R., Trainor, K.J., Itani, O.S., & Rodriguez, M. (2017). Examining the role of sales-based CRM technology and social media use on post-sale service behaviours in India. *Journal of Business Research*, *81,* 144-154. https://doi.org/10.1016/j.jbusres.2017.08.021

Agnusdei, G.P., Gnoni, M.G., Sgarbossa, F., & Govindann, K. (2022). Challenges and perspectives of the Industry 4.0 technologies within the last-mile and first-mile reverse logistics: A systematic literature review. *Research in Transportation Business & Management*, *45,* Part C, 100896. https://doi.org/10.1016/j.rtbm.2022.100896

Akter, S., Hossain, M.A., Sajib, S., Sultana, S., Rahman, M., Vrontis, D., & McCarthy, G. (2023). A framework for AI-powered service innovation capability: Review and agenda for future research. *Technovation, 125,* 102768. https://doi.org/10.1016/j.technovation.2023.102768

Balinado, J.R., Prasetyo, Y.T., Young, M.N., Persada, S.F., Miraja, B.A., & Redi, A.A.N.P. (2021). The Effect of Service Quality on Customer Satisfaction in an Automotive After-Sales Service. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(2), 116. https://doi.org/10.3390/joitmc7020116

Barik, K., Misra, S., Ray, A.K., & Shukla, A. (2023). A blockchain-based evaluation approach to analyse customer satisfaction using AI techniques. *Heliyon, 9*(6), https://doi.org/10.1016/j.heliyon.2023.e16766

Behie, S.W., Pasman, H.J., Khan, F.I., Shell, K., Alarfaj, A., El-Kady, A.H., & Hernandez, M. (2023). Leadership 4.0: The changing landscape of industry management in the smart digital era. *Process Safety and Environmental Protection, 172,* 317-328. https://doi.org/10.1016/j.psep.2023.02.014

Chaabi, M. (2022, September). Roadmap to Implement Industry 5.0 and the Impact of This Approach on TQM. In *International Conference on Smart Applications and Data Analysis* (pp. 287-293). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-20490-6_23

Chen, Q., Lu, Y., Gong, Y., & Xiong, J. (2023). Can AI chatbots help retain customers? Impact of AI service quality on customer loyalty. *Internet Research (Vol. and No ahead-of-print)*. https://doi.org/10.1108/INTR-09-2021-0686

Cortés-Leal, A., Cárdenas, C., & Del-Valle-Soto, C. (2022). Maintenance 5.0: Towards a Worker-in-the-Loop Framework for Resilient Smart Manufacturing. *Applied Sciences, 12*(22), 11330. https://doi.org/10.3390/app122211330

Du, P., He X., Cao, H., Garg, S., Kaddoum, G., & Hassan, M.M. (2023). AI-based energy-efficient path planning of multiple logistics UAVs in intelligent transportation systems. *Computer Communications, 207,* 46-55. https://doi.org/10.1016/j.comcom.2023.04.032

Giza, W., & Wilk, B. (2021). Revolution 4.0 and its implications for consumer behaviour. *Entrepreneurial Business and Economics Review, 9*(4), 195-206. https://doi.org/10.15678/EBER.2021.090412

Gobble, M.A.M. (2018). Digitalization, Digitization, and Innovation. *Research-Technology Management*. https://doi.org/10.1080/08956308.2018.1471280

Hassoun, A., Kamiloglu, S., Garcia-Garcia, G., Parra-López, C., Trollman, H., Jagtap, S., Aadil, R.M., & Esatbeyoglu, T. (2023). Implementation of relevant fourth industrial revolution innovations across the supply chain of fruits and vegetables: A short update on Traceability 4.0. *Food Chemistry, 409,* 135503. https://doi.org/10.1016/j.foodchem.2022.135303

Hsu, Ch.-L., & Lin, J.Ch.-Ch. (2023). Understanding the user satisfaction and loyalty of customer service chatbots. *Journal of Retailing and Consumer Services, 71,* 103211. https://doi.org/10.1016/j.jretconser.2022.103211

Huang, S., Wang, B., Li, X., Zheng, P., Mourtzis, D., & Wang, L. (2022). Industry 5.0 and Society 5.0 – Comparison, complementation and co-evolution. *Journal of Manufacturing Systems, 64,* 424-428. https://doi.org/10.1016/j.jmsy.2022.07.010

Iqbal, M., Lee, C.K.M., & Ren, J.Z. (2022, December). Industry 5.0: From Manufacturing Industry to Sustainable Society. In 2022 *IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)* (pp. 1416-1421). IEEE. https://doi.org/10.1109/IEEM55944.2022.9989705

Jan, I.U., Ji, S., & Kim, Ch. (2023). What (de) motivates customers to use AI-powered conversational agents for shopping? The extended behavioral reasoning perspective. *Journal of Retailing and Consumer Services, 75,* 103440. https://doi.org/10.1016/j.jretconser.2023.103440

Janjevic, M., Merchán, D., & Winkenbach, M. (2021). Designing multi-tier, multi-service-level, and multi-modal last-mile distribution networks for omni-channel operations. *European Journal of Operational Research, 294*(3), 1059-1077. https://doi.org/10.1016/j.ejor.2020.08.043

Javed, M.K., & Wu, M. (2020). Effects of online retailer after delivery services on repurchase intention: An empirical analysis of customers' past experience and future confidence with the retailer. *Journal of Retailing and Consumer Services, 54,* 101942. https://doi.org/10.1016/j.jretconser.2019.101942

Jucha, P. (2021). Use of artificial intelligence in last mile delivery. In *SHS Web of Conference* (*92*, p. 04011). EDP Sciences. https://doi.org/10.1051/shsconf/20219204011

Korzynski, P., Kozminski, A.K., & Baczynska, A. (2023a). Navigating leadership challenges with technology: Uncovering the potential of ChatGPT, virtual reality, human capital management systems, robotic process automation, and social media. *International Entrepreneurship Review, 9*(2), 7-18. https://doi.org/10.15678/IER.2023.0902.01

Korzynski, P., Mazurek, G., Altmann, A., Ejdys, J., Kazlauskaite, R., Paliszkiewicz, J., Wach, K., & Ziemba, E. (2023b). Generative artificial intelligence as a new context for management theories: analysis of ChatGPT. *Central European Management Journal, 31*(1), 3-13. https://doi.org/10.1108/CEMJ-02-2023-0091

Kunrath, T.L., Dresch, A., & Veit, D.R. (2023). Supply chain management and industry 4.0: A theoretical approach. *Brazilian Journal of Operations and Production Management, 20*(1), 1263-1263. https://doi.org/10.14488/BJOPM.1263.2023

Lajante, M., Tojib, D., & Ho, T. (2023). When interacting with a service robot is (not) satisfying: The role of customers' need for social sharing of emotion. *Computers in Human Behavior*, *146*, 107792. https://doi.org/10.1016/j.chb.2023.107792

Li, B., Liu, L., Mao, W., Qu, Y., & Chen, Y. (2023). Voice artificial intelligence service failure and customer complaint behavior: The mediation effect of customer emotion. *Electronic Commerce Research and Applications, 146,* 107792. https://doi.org/10.1016/j.elerap.2023.101261

Li, F., & Xu, G. (2022). AI-driven customer relationship management for sustainable enterprise performance. *Sustainable Energy Technologies and Assessments, 52,* 102103. https://doi.org/10.1016/j.seta.2022.102103

Li, S., Peng, G., Xing, F., Zhang, J., & Zhang, B. (2021). Value co-creation in industrial AI: The interactive role of B2B supplier, customer and technology provider. *Industrial Marketing Management, 98,* 105-114. https://doi.org/10.1016/j.indmarman.2021.07.015

Liu, S., & Wang, J. (Eds.) (2019). *The Internet Society in China: A 2016 Raport.* Springer.

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, 190,* 122469. https://doi.org/10.1016/j.techfore.2023.122469

Modgil, S., Singh, R.K., & Hannibal, C. (2021). Artificial intelligence for supply chain resilience: learning from Covid-19. *The International Journal of Logistics Management, 33*(4), 1246-1268. https://doi.org/10.1108/IJLM-02-2021-0094

Ngai, E.W.T., Lee, M.C.M., Luo, M., Chan, P.S.L., & Liang, T. (2021). An intelligent knowledge-based chatbot for customer service. *Electronic Commerce Research and Applications, 50,* 101098. https://doi.org/10.1016/j.elerap.2021.101098

Noble, S.M., Mende, M., Grewal, D., & Parasuraman, A. (2022). The Fifth Industrial Revolution: How Harmonious Human–Machine Collaboration is Triggering a Retail and Service [R]evolution. *Journal of Retailing, 98*(2), 199-208*.* https://doi.org/10.1016/j.jretai.2022.04.003

Pengfei, D., He, X., Cao, H., Garg, S., Kaddoum, G., & Hassan, M.M. (2023). AI-based energy-efficient path planning of multiple logistics UAVs in intelligent transportation systems. *Computer Communication, 207,* 46-55. https://doi.org/10.1016/j.comcom.2023.04.032

Prentice, C., & Nguyen, M. (2020). Engaging and retaining customers with AI and employee service. *Journal of Retailing and Consumer Services, 56,* 102186. https://doi.org/10.1016/j.jretconser.2020.102186

Prentice, C., Weaven, S., & Wong, I.A. (2020). Linking AI quality performance and customer engagement: The moderating effect of AI preference. *International Journal of Hospitality Management, 90,* 102629. https://doi.org/10.1016/j.ijhm.2020.102629

Qin, J., Liu, Y., & Grosvenor, R. (2016). A Categorial Framework of Manufacturing for Industry 4.0 and Beyond. *Procedia CIRP, 52,* 173-178. https://doi.org/10.1016/j.procir.2016.08.005

Rosendorf, A., Hodes, A., & Fabian, B. (2021). Artificial Intelligence for last-mile logistics - Procedures and architecture. *Online Journal of Applied Knowledge Management (OJAKM), 9*(1), 46-61. https://doi.org/10.36965/OJAKM.2021.9(1)46-61

Ruan, Y., & Mezei, J. (2022). When do AI chatbots lead to higher customer satisfaction than human frontline employees in online shopping assistance? Considering product attribute type. *Journal of Retailing and Consumer Services, 68,* 103059. https://doi.org/10.1016/j.jretconser.2022.103059

Sarfraz, Z., Sarfraz, A., Iftikar, H.M., & Akhund, R. (2021). Is covid-19 pushing us to the fifth industrial revolution (Society 5.0)?. *Pakistan Journal of Medical Sciences, 37*(2), 591. https://doi.org/10.12669/pjms.37.2.3387

Shahidan, N.H., Latiff, A.S.A., & Wahab, S.A. (2021). Moving Towards Society 5.0: A Bibliometric and Visualization Analysis. In *Society 5.0: First International Conference, Society 5.0 2021, Virtual Event, June 22-24, 2021, Revised Selected Papers 1* (pp. 93-104). Springer International Publishing. https://doi.org/10.1007/978-3-030-86761-4_8

Taj, I., & Jhanjhi, N.Z. (2022). Towards Industrial Revolution 5.0 and Explainable Artificial Intelligence: Challenges and Opportunities. *International Journal of Computing and Digital Systems, 12*(1), 295-320. https://doi.org/10.12785/ijcds/120124

Turban, E., Outland, J., King, D., Lee, J.K., Liang, T., & Turban, D.C. (2018). *Electronic Commerce 2018: A Managerial and Social Networks Perspective* (Vol. 97). Cham: Springer.

Vasyltsiv, T., Mulska, O., Panchenko, V., Kohut, M., Zaychenko, V., & Levytska, O. (2021).Technologization Process and Social and Economic Growth: Modelling Impact and Priorities for Strengthening the Technological Competitiveness of the Economy. *Regional Science Inquiry, 13*(1), 117-134.

Wach, K., Duong, C., Ejdys, J., Kazlauskaitė, R., Korzynski, P., Mazurek, G., Paliszkiewicz, J., & Ziemba, E. (2023). The dark side of generative artificial intelligence: A critical analysis of controversies and risks of ChatGPT. *Entrepreneurial Business and Economics Review, 11*(2), 7-30. https://doi.org/10.15678/EBER.2023.110201

Wang, X., Lin, X., & Shao, B. (2022). How does artificial intelligence create business agility? Evidence from chatbots. *International Journal of Information Management, 66,* 102535. https://doi.org/10.1016/j.ijinfomgt.2022.102535

Wijaya, A.P. (2017). Role of Experience in Customer Self Congruity to Maintaining Loyalty: A Study on Fashion Store. *Entrepreneurial Business and Economics Review, 5*(3), 189-198. http://doi.org/10.15678/EBER.2017.050310

Xu, Y., Shieh, Ch.-H., van Esch, P., & Ling, I-L. (2020). AI customer service: Task complexity, problem-solving ability, and usage intention. *Australasian Marketing Journal, 28*(4), 189-199. https://doi.org/10.1016/j.ausmj.2020.03.005

Yang, B., Sun, Y., & Shen, X.-L. (2023). Understanding AI-based customer service resistance: A perspective of defective AI features and tri-dimensional distrusting beliefs. *Information Processing & Management, 60*(3), 103257. https://doi.org/10.1016/j.ipm.2022.103257

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