THE USE OF AI IN CUSTOMER RELATIONSHIP MANAGEMENT IN THE LOGISTICS INDUSTRY

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Purpose: The purpose of this article is to evaluate the use of artificial intelligence (AI) in customer relationship management (CRM) within the logistics industry. The research problem was formulated, to what level does the use of AI enhance customer communication in the logistics sector?

Design/methodology/approach: This study employs literature analysis method and the analysis of order fulfillment and communication with the logistics operator was carried out for manufacturing companies and a logistics company. The analysis included the process of communication in order fulfillment by logistics operators using AI tools. In addition, CRM at operators InPost and DHL were compared.

Findings: Logistics operators use AI in the order fulfillment process to create value for end consumers. Analysis of the logistics process indicated that customers notice and appreciate the quality of logistics processes in the communication between the manufacturer, logistics operator and the end customer. The level of satisfaction is directly related to the efficiency of these processes.

Research limitations/implications: The study focused exclusively on the end-customer communication process only in the logistics industry. Further research directions in customer relationship management will focus on reducing the time to market of product information and making logistics offerings more flexible in response to increasing customer demands, which forces companies to look for new AI tools in CRM in logistics.

Practical implications: Analysis of the use of AI in customer relationship management will have practical implications in the logistics industry. It will influence possible changes in the order fulfillment process. An analysis of the use of CRM by Polish operator InPost and global operator DHL shows a similarity in system operation.

Social implications: Effective use of AI in customer relationship management contributes to a more positive perception of communication using artificial intelligence in the logistics industry.

Originality/value: A research gap has been identified: the lack of analysis and evaluation of the process of using AI in customer relationship management in the logistics industry.

Keywords: customer relationship management (CRM), communication, logistics, artificial intelligence (AI), orders, logistics operator.

Category of the paper: research paper.

1. Introduction

Computer-Mediated Communication (CMC) and information systems have revolutionized interpersonal communication, offering businesses a wide array of formats and channels to send messages and interact with others across time and space (Herring, 2002). The massive amount of data generated by numerous of end devices, such as smartphones, laptops and Internet of Things (IoT) sensors, creates opportunities and challenges for companies to provide smart services (Shi et al., 2020). As AI adoption in communication has grown, its functionality has evolved from one-to-one to one-to-many encounters, thus revealing new assumptions about human communication process, including deeper socio-emotional interactions (Lee, Sundar, 2009), and autonomy - evident in algorithmic assistants, bots, AI co-authorship and AI content curation (Banas et al., 2022; Duan et al., 2022; Hepp, 2020). These aspects also underscore AI's role as an intelligent agent in communication, as opposed to the simple mediating role and degree of agency it provides to humans versus machines in business, relevant narrative and communication (Dehnert, Mongeau, 2022; Sundar, Lee, 2022). In the case of information flow, trust is key in communication, especially in computer-mediated communication (CMC), where social presence is lower than in face-to-face communication (Hohenstein, Jung, 2020). The development of trust is an attributional process influenced by the trustee's attribution of positive motivation to his message recipient (Chopra, Wallace, 2003).

The integration of artificial intelligence into CMC marks a new paradigm in which communication is augmented or generated by an intelligent system. AI-MC is already widely used in many industries. While IT systems like instant messaging represent minimal AI intervention in communication, modern systems in the logistics sector feature more advanced intervention, such as intelligent responses in messages and emails, where intelligent message and email responses generated algorithmically through natural language processing (NLP). While AI-MC is designed to shape the messages sent, and despite previous work suggesting that its presence affects conversational quality of communication, it is not established how AI mediation influences interpersonal dynamics and communication outcomes. To avoid unexpected social consequences, we need to understand the effects AI-MC has on changing interpersonal interactions. This article analyzes the process of how interpersonal communication is perceived in AI-assisted collaboration within CMC in the logistics industry. In particular, the process of logistics operator-customer communication and the perception of trust in successful and unsuccessful computer-mediated communications. The evaluation indicates that AI communication is associated with increased trust between human communicators and that in unsuccessful conversations, AI behavior tends to be interpreted similarly to that of a human participant.

The purpose of this article is to evaluate the process of using AI in customer relationship management (CRM) in the logistics industry. The research question is: To what extent does the use of AI enhance customer communication?

A research gap was identified: the lack of analysis and evaluation of the process of using AI in customer relationship management in the logistics industry. The main hypothesis was that customers have a positive perception of AI-assisted communication in the logistics industry.

2. Literature review

AI technology has developed rapidly over the past few years, especially in machine learning (ML) (Behera, Das, 2017), deep learning (DL) (LeCun et al., 2015) and natural language processing (NLP) (Morgan, Scofield, 1991; El Naqa, Murphy, 2015; Shinde, Shah, 2018). In recent years, the rapid development of wireless communication technology has profoundly transformed various aspects of human functioning, driving unprecedented connectivity and enabling innovative applications (Westerman et al., 2020). With the popularity of complex AI systems being used to augment or automate tasks that can affect the lives of many people and have a long-lasting impact, trust is often cited as a key requirement for people to adopt AI technologies (Toreini et al., 2020), often as a way to operationalize the principles of responsible and ethical AI (Mittelstadt, 2019), such as ensuring efficiency, integrity, transparency, reliability, privacy, security and serving human values. Systems with intelligent AI are becoming increasingly popular in many text-based interpersonal domains (Mieczkowski et al., 2021). Deployment of these systems has been widespread, and billions of intelligent responses are used daily in human communication. Compared to previous technology, which has taken on a more passive, mediating role, artificial intelligence is an active and dynamic technology that has the potential to change the norms and dynamics of human communication.

Previously published studies refer to the use of these technologies in human interaction as communication via artificial intelligence (AI-MC), in which messages are not simply sent by technology, but modified, extended and even generated by a computational agent to achieve communication goals (Hancock et al., 2020). These advances have enabled AI to play a key role in various industries, including logistics. Intelligent transportation encompasses various steps in the time dimension, including downloading high-resolution maps, detecting the vehicle's surroundings, predicting environmental conditions, and planning routes (Agbaji, 2021). Using advanced algorithms and data analysis, AI enables proactive logistics planning, efficient resource allocation and real-time monitoring of product flow. In addition, AI can optimize product flows by improving resource allocation and scheduling of production processes. With real-time monitoring and analysis, AI systems can prioritize maintenance tasks based on urgency, equipment criticality and resource availability (Ukato et al., 2024).

This ensures efficient deployment of human resources in production, reducing downtime and improving overall productivity. Future innovations in AI for logistics systems planning include the integration of Internet of Things (IoT) devices and autonomous systems. IoT sensors can provide real-time data on equipment status and environmental factors, enabling more accurate predictive logistics models.

IoT technology is mainly used to process vehicle information and transmit it to other vehicles, other transportation users, local and remote urban infrastructure. The Intelligent Transportation System (ITS) aims to achieve transportation efficiency by minimizing traffic problems and optimizing the transportation of people and goods. It provides users like drivers and other transportation users with the necessary comprehensive traffic information, linked to other local information in real time. Implementing ITS can reduce passenger travel time and increase passenger safety and comfort. Further development of ITS is taking place through the implementation of IoT, Big Data, Clouds and artificial intelligence methods (Kozák et al., 2023). ITS quality and deployment are expected to increase, especially in applications that will use artificial intelligence methods for monitoring (image processing - machine learning, spline neural networks, deep learning), fare management, ticketing management, transportation pricing, telematics and traffic monitoring. The greatest development of applications of artificial neural networks is associated with research, development of spline networks. They are particularly suitable and useful for processing image, audio and text information and have direct applications in transportation. For the processing of image information, the most powerful are deep learning (DL) methods and algorithms based on spliced neural networks (Zhao et al., 2020).

Traditional, manual procurement methods remain a significant obstacle to optimizing companies' supply chains. Manual processes such as paper documentation are error-prone and inefficient. Relying on outdated procurement approaches not only increases the likelihood of procurement inaccuracies, but also hinders the ability to quickly adapt to changing project requirements (Atadoga et al., 2024). This inefficiency can lead to over- or under-supply and delays in sourcing raw materials. Lengthy approval processes contribute to delays in sourcing raw materials, which affects the overall task schedule. Purchase order approvals, supplier selection and changes to production plans often require multiple levels of authorization, leading to bureaucratic bottlenecks. These delays not only impede the flow of products through the supply chain, but also increase the likelihood of cost overruns. In the fast-paced logistics industry, protracted approval processes can be a bottleneck in maintaining the momentum of the customer service process (Olorunsogo et al., 2024). The integration of artificial intelligence (AI) into logistics supply chains offers an opportunity to transform supply chains and increase overall efficiency. AI-based predictive analytics is revolutionizing the way supply chain stakeholders forecast material requirements planning (MRP). By analyzing historical data, production process schedules and external factors, AI algorithms can predict future material demand with unprecedented accuracy (Odonkor et al., 2024). This proactive approach enables

logistics operators and manufacturers to anticipate and resolve potential shortages or surpluses, optimizing inventory levels and minimizing the risk of supply chain delays due to insufficient or excess raw materials. Real-time data analysis goes beyond demand forecasting to include monitoring and analyzing supply chain data. AI applications can assimilate information from on-site sensors, cameras and other IoT devices (Mouchou et al., 2021; Ukoba et al., 2023). This data can include reports on the flow of products between different links in the supply chain, employee productivity and equipment utilization. By analyzing this data in real time, those responsible for the flow of products in the chain gain valuable information about the performance of the logistics system, allowing them to make informed decisions, identify bottlenecks and improve overall supply chain performance (Odili et al., 2024).

3. Methodology

Logistics customer service in both manufacturing and logistics companies plays an key role in ensuring on-time deliveries, efficient production management and effective flow of goods. Manufacturing companies work with a variety of customers, tailoring logistics processes to individual customers requirements, but usually work with a single logistics operator. An AI-generated contact form is used to streamline contact with potential customers. Companies specializing in production and sales in various markets can take advantage of this service. It is noted that certain criteria must be met to qualify for logistics operator services: shipment size (weight and dimensions), minimum monthly shipment volume, origin and destination locations, and the type of cargo unit. The form of contact by the company concerned is transparent. The data generated is processed by AI to generate a response. The analysis of order fulfillment and communication with the logistics operator was conducted for manufacturing companies and a logistics company. The article analyzes the communication process in order fulfillment carried out by logistics operators utilizing AI tools. The main hypothesis stated:

Customers have a positive perception of communication using artificial intelligence in the logistics industry.

The following specific hypotheses are formulated:

H1: The greater the (internal and external) capabilities of AI-based order fulfillment, the stronger the company's orientation toward creating value for end consumers.

H2. The greater the logistics operator's ability to use AI in the order fulfillment process, the greater will be the orientation toward value creation for end consumers.

H3. The greater the internal capabilities of the manufacturing company's use of AI in the order fulfillment process, the greater will be the orientation toward value creation for end consumers.

Figure 1 illustrates the core activities involved in the order fulfillment process within manufacturing companies.
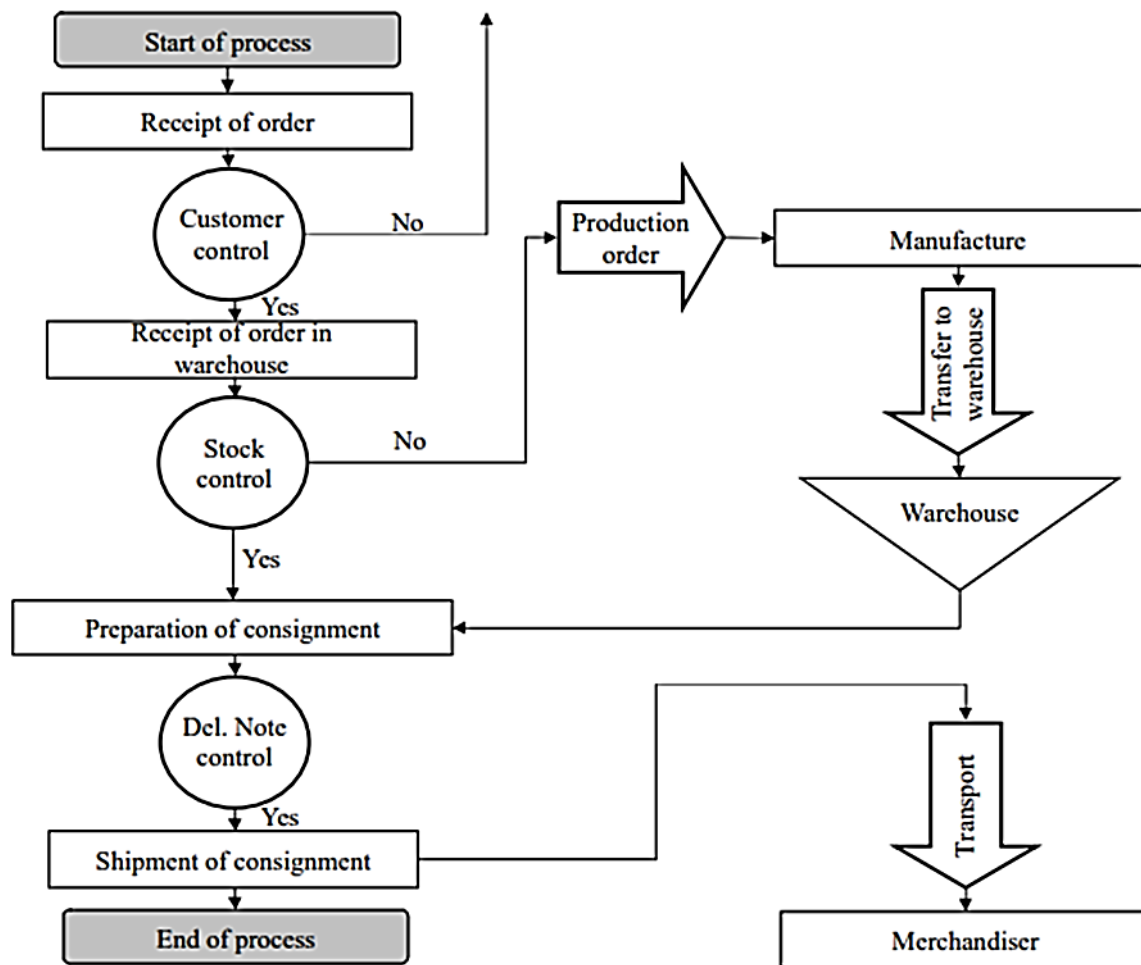

Figure 1. The main activities in the order fulfillment process in manufacturing enterprises.

Source: Espino-Rodríguez, Rodríguez-Díaz, 2014, pp. 2-24.

The ordering and customer service process differ when logistics service providers are involved. The assessment refers to the extent to which activities are performed with a high degree of communication and cooperation due to established relationships with both customers and suppliers; competitiveness and cooperation are analyzed to the extent to which supplier relationships enable the development of routines, knowledge transfer, innovation and quality development. The analysis examines how activities are developed within a relational framework through logistics process integration, and the relational framework is achieved through the development of relational capabilities through the integration of logistics systems and their intensity in the relational framework. Activities are streamlined through close collaboration with customers and suppliers via an AI-generated communication system.

4. Results

An effective enterprise CRM system is based on key elements, such as: customer turnover, i.e. gaining new customers and losing existing ones, developing customer potential, which includes focusing on the most important customers, increasing customer satisfaction, and eliminating unprofitable loss-making customers (Nguyen, 2015). The central role is played by the customer and their relationship with the company, which should be based on loyalty and attachment. In order to achieve this, it is necessary to understand customer needs, which leads to improved relationships, increased satisfaction, an expanded customer base, and increased profits for the company. Figure 2 presents a customer service diagram using communication between the store, the customer and the logistics company.
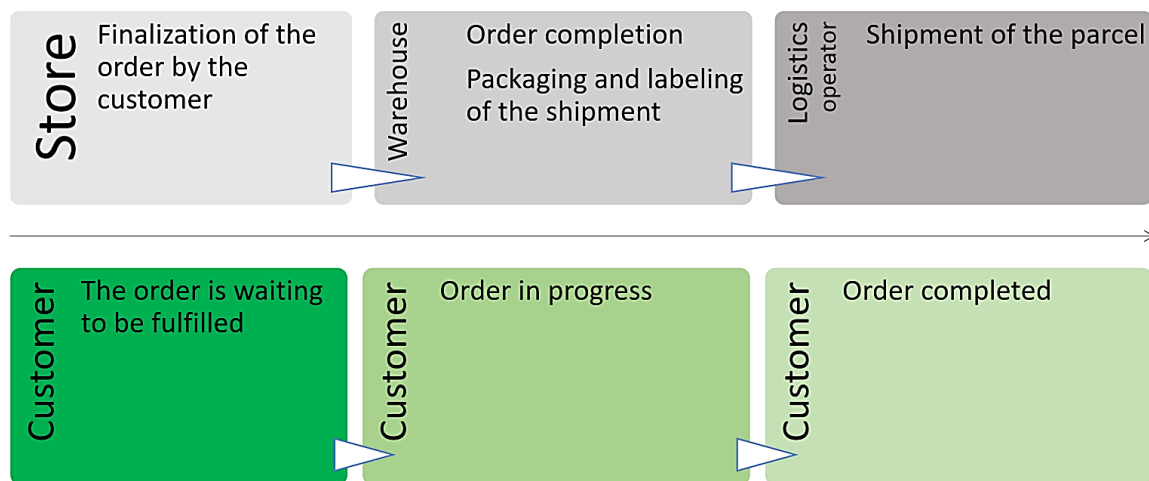

Figure 2. Customer order handling scheme on the e-commerce market.

Source: own study based on observations.

Implementing a CRM system for customer service benefits manufacturing and logistics companies. Customers keep track of their shipments, and in addition to increasing customer satisfaction, increasing sales or standardizing customer service across the organization, a well-managed CRM also makes it possible to reduce promotion or service costs. Reducing investments in unprofitable clients enables higher overall profitability. An important aspect of CRM implementation is also the automation of processes through the implementation of AI, which facilitates customer service, reduces costs and improves customer relationships that were previously unsatisfactory. However, the main motives for implementing CRM-AI are to gather a database of customer information and to be able to personalize activities, such as promotional campaigns and targeting offers directly to the customer as in the e-commerce industry. Figure 3 shows the procurement process carried out by a logistics company using AI.
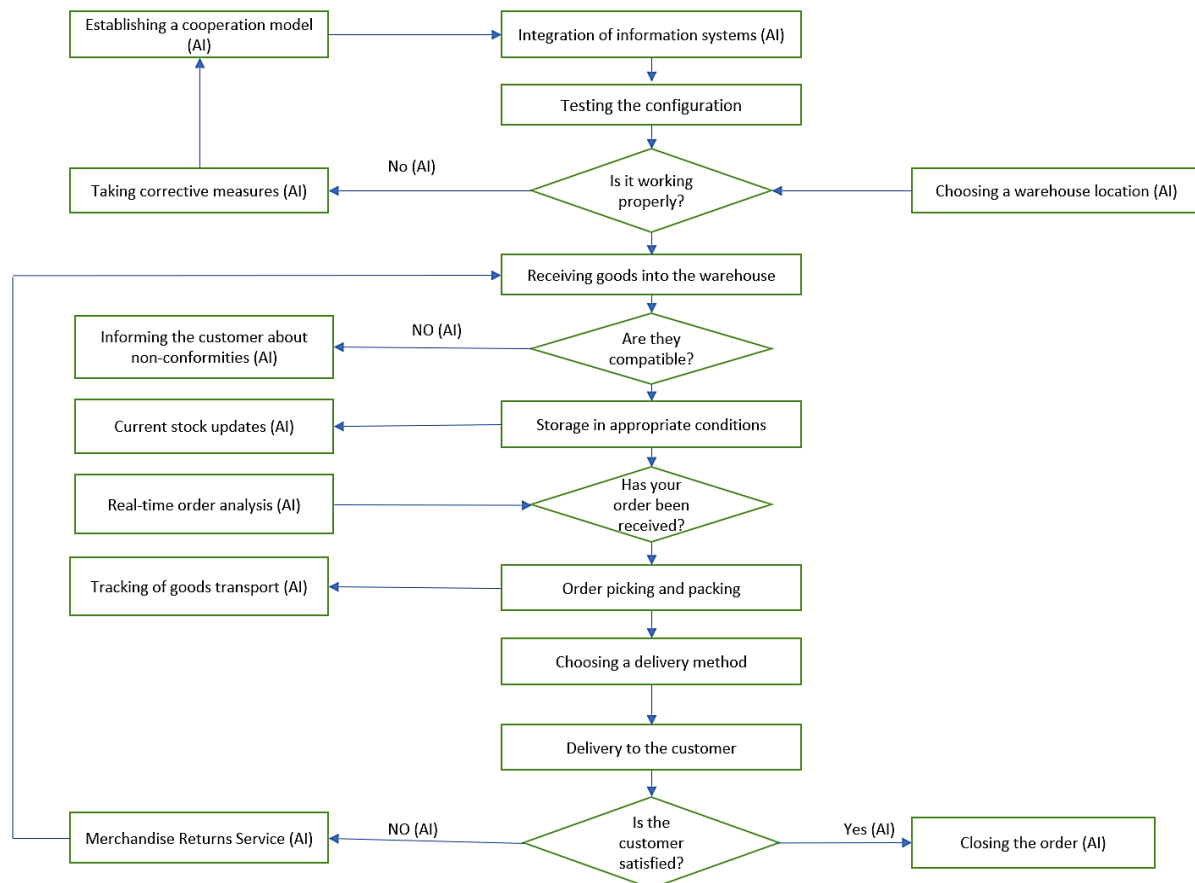
Figure 3. Customer order handling on the e-commerce market using AI.

Source: Own study based on observations.

Comprehensive order processing is covered in more detail. The logistics operator provides access to real-time data through modern information systems linked to artificial intelligence. All operations are aligned with the requirements of manufactures or retailers and tailored to the expectations of e-commerce users. The price of the service is analyzed and generated by the CRM-AI system, depending, among other things, on the choice of the location of the warehouse where the goods are stored, volume of cargo, or the delivery time expected by the customer. In addition, you can take advantage of additional logistics services, support of specialists, adjustment of eco-friendly packaging or control of expiration dates, overseas shipments and data analysis.

The logistics operator offers to make an independent calculation of the benefit price through a special calculator. There is a division into basic and advanced information. Choosing either option displays the estimated accuracy of the pricing. It can be done by entering the relevant data, the customer can get the information they need at any time. This supports businesses lacking advanced IT infrastructure and want to find out potential costs. The ease of use of the AI generator allows any potential vendor to take advantage.

The analysis of customer relationship assessment (CRM) in a manufacturing company was carried out by interviewing key customers who constantly interact with the company. For domestic and foreign customers, they cited quality as the most important factor (53.30%

and 50%, respectively). Timeliness is also important for domestic customers (23.30%), while flexibility and timeliness are important for foreign customers (20% each). The majority of domestic (80%) and foreign (70%) customers rated the contact before the transaction as, "good". "Very good" was indicated by 13.3% of domestic and 25% of foreign customers. On the other hand, "average" was answered by 6.7% of Polish customers and 5% of foreign customers. There were no negative ratings, indicating a high level of satisfaction with pre-purchase communication. Evaluation of CRM during order processing in both customer groups was overwhelmingly positive. Among foreign customers, 80% indicated a response of "good" and 20% indicated "very good". Among domestic customers, 76.7% of respondents rated communication as, "good", 20% as, "very good", while 3.3% chose the answer, "average". The analysis of CRM in a manufacturing company shows that communication with the customer is an important aspect in order to achieve satisfaction.

In addition, the CRM analysis included Polish operator InPost and global DHL. The first step in order fulfillment is to integrate systems with the customer for information flow. Once the goods are accepted into the warehouse, further actions follow the customer's guidelines obtained by the CRM. InPost adapts to users' expectations. At any time, the owner of an online store using InPost's services has access to control over his goods through modern CRM systems. The price of the service depends on the number of items entrusted to InPost and the space they occupy. In addition, you can take advantage of the assistance of specialists who improve e-commerce activities, including through marketing actions, insertion, strategic analysis, foreign operations or marketplace platforms. A contact form is provided to facilitate contact with potential customers. Businesses specializing in online sales and running an e-commerce store can take advantage of this service.

DHL's end-to-end order processing is monitored in more detail in CRM systems than InPost's, but shows similarities. DHL also provides access to real-time data through modern IT systems. All activities are in accordance with the requirements of the online store owner and tailored to the expectations of e-commerce users. The price of the service is an individual issue, depending, among other things, on the choice of the location of the warehouse where the goods are stored. In addition, you can take advantage of marketing services, support of specialists, adjustment of ecological packaging or control of expiration dates, overseas shipments and data analysis. The first stage of service by the CRM contains basic issues, while the subsequent ones concern the activities of the e-commerce company concerned. It is not possible to find out from the initial completion phase what conditions must be met in order to take advantage of the logistics operator's wide range of services.

The comprehensive handling of orders and communication with the customer through CRM by InPost and DHL is very similar. The differences are due to the courier companies' area of operation. InPost, which offers services in Poland, is a much smaller service provider compared to global DHL. The rationale for this is found in the network of warehouses where goods can be stored, but also in the volume of shipments handled.

5. Conclusions

Analysis of the logistics process indicated that customers notice and appreciate the quality of the logistics processes of communication between the manufacturer, logistics operator and the end customer. The level of satisfaction is directly related to the efficiency of these processes. At the same time, it was pointed out that inadequacies in service like an increase in the number of deliveries during shipping peaks like holidays, which could lower satisfaction levels in the future. In conclusion, based on the analysis of logistics processes carried out by the logistics operator, the skillful use of AI in customer relationship management contributes to the positive perception of communication using artificial intelligence in the logistics industry. Customers trust the real-time information provided to them about the shipment process. The more capable manufacturing companies are in utilizing AI for order fulfillment, the more the company's orientation in the order fulfillment process increases to create value for end consumers in the form of information flow.

Logistics operators are using AI in the order fulfillment process to create value for end consumers. The results of the analysis of the relationship management process between the manufacturing company, logistics operator and customer indicate several areas for improvement. Improving initial customer engagement, particularly through inquiry forms, should be a top priority, lack of timely communication may reduce fulfillment efficiency and lower customer satisfaction. The logistics operator should continuously develop the use of AI on a machine learning basis, which will reduce misinformation by improving quality control during order processing. The end-to-end order processing is supported by integrated information system that shapes customer relationships. Global logistics companies focus on integrating their systems with customer systems and making them compatible. Logistics companies are able to provide same-day shipping, but they differ in their CRM systems and use of AI in relationship management. The order is delivered to the customer via a tailored form of transportation dedicated by AI. A returns service is offered, after which the goods are returned to the warehouse. Customer service details, e.g., form of packaging and wrapping, marketing items, gratuities, are agreed with the service recipient, but communicated in advance by CRM-AI. In both cases, InPost and DHL use AI tools when handling CRM. In their reviews on logistics operators' websites, customers notice and appreciate the quality of logistics processes, and their level of satisfaction is directly related to the efficiency of these processes using CRM.

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