Impact of Artificial Intelligence on Customer Relationship Management: a Bibliometric Analysis

Aleksy Kwilinski[1], Nataliia Trushkina[2], Yuliia Remyha[3] and Tamila Patlachuk[2]
[1]*The London Academy of Science and Business, Mary At Hill Str. 6-7, EC3R 8EE London, England*
[2]*Research Center for Industrial Problems of Development of the National Academy of Sciences of Ukraine, Inzhenernyi Lane 1a, 61165 Kharkiv, Ukraine*
[3]*State Non-commercial Company State University "Kyiv Aviation Institute", Liubomyra Huzara Avenue 1, 03058 Kyiv, Ukraine*
a.kwilinski@london-asb.co.uk, nata_tru@ukr.net, remyga_julia@ukr.net, tpatlachuk@ukr.net

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Abstract: In modern conditions, the strategic task of logistics management of companies is to form an appropriate customer relationship management system that is able to quickly respond to crisis situations, risks, threats, transformation of the business environment, as well as flexibly adapt to unstable demand and constant changes in customer needs and preferences. In this regard, it is advisable to introduce qualitatively new management and customer-oriented approaches, smart technologies, customer experience management methods, digital marketing tools, and digital innovations. At the same time, in recent years, the use of artificial intelligence as the most influential digital innovation in customer relationship management has played a significant role. Therefore, the purpose of this article is to identify the relationship between artificial intelligence and customer relationship management by characterizing the evolution of key patterns of scientific publications on this problem. To achieve the goal, a relevant sample of scientific articles was formed based on identifying periods of publication activity and bibliometric analysis of keyword coincidences to identify promising areas of research in this area. The formed sample of publications for the study includes 797 documents indexed by the database Scopus for the period 2001-2024. Bibliometric analysis and visualization of its results were carried out using the VOSviewer software product. Based on visualization maps, seven clusters were identified and characterized by the content coincidence of keywords in publications and five stages of evolutionary development of the customer relationship management system using artificial intelligence. Based on the analysis of empirical data, an exponential growth in the number of publications on the selected issues was confirmed (the annual increase in the number of scientific papers on this topic is 15.3%). The results of the analysis can be used in further research to substantiate and develop a strategy for the digital transformation of the customer relationship management system.

1 INTRODUCTION

In the era of digitalization and automation of business models and processes, the issues of information support for the customer relationship management system are becoming increasingly relevant. This is due to the digital transition in the logistics management of companies [1] due to changes in the needs, preferences, demand and behaviour of consumers. In this regard, there is an urgent need to find and apply innovative approaches, smart and intelligent systems [2], customer-oriented customer relationship management technologies [3], methods and tools of digital marketing.

As stated in the Zendesk Report [4], customer loyalty can contribute to business success due to increased fierce competition and economic uncertainty and instability. Therefore, improving the quality of customer service stimulates loyalty. Thus, 74% of customers are loyal to a particular brand or company.

A 2024 study of various aspects of digital customer interactions by CMSWire (the world's leading community of digital customer experience

professionals) [5] found that 81% of respondents consider digital customer service to be a business priority and the most important tool for companies. According to Gartner [6], 91% of companies plan to develop artificial intelligence to manage relationships with consumers in the future.

According to surveys by IBM Corporation [7], 35% of companies are already using artificial intelligence technologies in business. Another 42% of enterprises are exploring the possibilities of their implementation. Today, 28% of companies are implementing a holistic artificial intelligence development strategy, while 25% have a strategy that focuses only on limited or specific areas of activity. According to Statista [8], the global market for artificial intelligence in marketing was 15.8 billion dollars in 2021. It is predicted that by 2028, this figure will increase by 6.8 times to 107.5 billion dollars [8].

According to research, in recent years, artificial intelligence tools have been embedded in the digital marketing landscape. More than 80% of digital marketing experts say they integrate some form of artificial intelligence technology into their online marketing activities [8].

According to Statista [9], artificial intelligence was used in 2024 to manage customer experience in the following areas: open feedback analysis (50% of respondents); content creation (50%); machine learning and predictive analytics (26.6%); consumer behaviour forecasting (21.4% of respondents).

In a study conducted by AIPRM Corporation [10], artificial intelligence is most often used in business for customer service (56% of companies surveyed).

A survey conducted in 2024 identified the biggest obstacles for companies around the world in using artificial intelligence to serve customers. For example, over 40% of respondents emphasize the lack of experience to implement this tool and the need to obtain specialized knowledge. However, some organizations (23%) show resistance to adopting this technology and changing their processes [11].

Therefore, the issues of digital transformation of the customer relationship management system are extremely relevant and timely and require in-depth scientific research and development.

Given the above, it is relevant and necessary to analyze the impact of artificial intelligence on customer relationship management using a bibliometric approach.

2 LITERATURE REVIEW

In the scientific and educational community, the business environment, there is a steady attention to the issues of customer relationship management, which is due to the constant development of the process of providing logistics services in the direction of ensuring customer requirements in receiving orders, on the one hand, and profit from managing logistics activities, on the other.

Analysis of the scientific literature indicates a variety of approaches of scientists to defining the essence and content of the concept of “customer relationship management”. Scientists use different concepts, namely: “customer orientation”, “customer centricity”, “customer-oriented approach”, “customer focus”, “logistics service”, “loyalty”, “consumer service”, “customer interaction”, “customer involvement”, “customer engagement”, “customer experience”, “customer experience management”, etc. That is, there are many interpretations of these terms, which are based on various scientific concepts, theories and provisions.

In recent years, many foreign scientists (R. Abduljabbar et al. [12]; P. B. Acharjee et al. [13]; S. Chatterjee et al. [14]; S. Chatterjee & R. Chaudhuri [15]; Y. Fu, G. Guo & T. S. Huang [16]; K. Krishnareddy et al. [17]; V. Kumar et al. [18]; D. Ozay et al. [19] and others) have been investigating the issue of integrating artificial intelligence into the customer relationship management system. This, according to researchers, will provide transformative opportunities for improving customer interaction and increasing work efficiency.

Thus, many scientific publications indicate the interest of scientists in studying various aspects of customer relationship management as an important component of logistics management of companies. However, despite a wide range of research on the given topic, theoretical issues regarding customer relationship management in accordance with the challenges associated with the digital transformation of logistics management and the rapid use of artificial intelligence remain insufficiently studied.

Therefore, the purpose of the article is to identify the relationship between artificial intelligence and customer relationship management by characterizing the evolution of key patterns of scientific publications on this problem.

3 METHODOLOGY

The theoretical and methodological basis of the study is the provisions of the theories of systems, information society, network economy, digital economy; concepts of logistics and marketing management, customer relationship management.

The information base of the study is analytical materials from CMSWire, Gartner, IBM Corporation, Statista, Zendesk, which highlight the results of surveys and statistical analysis on the problems of the impact of artificial intelligence on customer relationship management.

It is worth noting that today many methods have been developed for assessing the digital transformation of business processes of companies of various industries, one of the components of which is customer-centricity (customer experience, digital logistics service, omnichannel, digital marketing and communications). Such methods include: the Deloitte digital maturity model; the digital transformation index (Arthur D. Little agency); the digital maturity index of enterprises; Digital Piano model (Global Centre for Digital Business Transformation initiated by IMD and Cisco); Digital Transformation Change Index proposed by Ionology.

The following general scientific methods were used in the research process: analysis and synthesis, expert survey, bibliometric analysis, comparison, classification, system approach, structural-logical generalization.

The study selected bibliometric analysis as a method that reveals the connection between artificial intelligence and customer relationship management. This type of analysis is based on mathematical graph theory, clustering methods, and scientific visualization, which makes it widely applicable in various fields of science [20].

Based on the structuring of a large volume of metadata of scientific publications, bibliometric analysis allows us to identify the essence of the subject area and its conceptual foundations and to substantiate the evolution of the research area [20]. The research methodology included the following main stages: data collection and analysis, selection of a visualization tool, graphical representation of the identified relationships, and interpretation of the results.

This was implemented using the VOSviewer v.1.6.19 software product. The functionality of this program involves creating keyword visualization maps based on compatibility data, maps of authors or countries based on the number of citations, etc. [21]. In addition, network visualization maps in VOSviewer are displayed in several ways (for example, by content criterion, by publication period) [20].

An important stage of bibliometric analysis, which ensures its quality, is the selection of a data source and the formation of a relevant sample of publications. The Scopus database was chosen as a data source due to the breadth of its coverage of such subject areas as computer science; business, management and accounting; decision sciences; economics, econometrics and finance; social sciences, etc. To form the data sample, the chronology of the release of 839 publications for the search query “Artificial Intelligence” (or AI) and “Customer Relationship Management” (or CRM) for the years 1989-2025 was first determined, and then the period of publication activity of the research topic, namely from 2001 to 2024. The key categories for selecting scientific publications were the title, abstract and keywords for them. Thus, the studied sample of publications included 797 works that met the above criteria, published in the period 2001-2024 and indexed by the Scopus database.

4 RESULTS

A quantitative analysis of the formed sample of research papers showed an exponential growth of research in the context of the relationship between artificial intelligence and customer relationship management during the period 2001-2024 (Fig. 1). At the same time, it can be assumed that by the end of 2025 there will also be a trend of significant growth in the number of publications on this topic compared to the previous year. On average, the annual growth of publications is 15.3%.

As the analysis shows, the following keywords are mostly used in publications: Artificial Intelligence (487 documents), Customer Relationship Management (208), Public Relations (205), Sales (197), Information Management (85), Customer Satisfaction (83), Machine Learning (78), Decision Making (78), Decision Support Systems (70), CRM (60), Learning Systems (55), Customer Experience (37), Big Data (37), Supply Chain Management (36), Marketing (34), Electronic Commerce (32), AI (31), Customer Relationship Management Systems (30 documents) etc.

In addition, it is appropriate to quantitatively analyse publications from the perspective of countries of origin. The size of the circle on the

visualization map (Fig. 2) is proportional to the volume of publications indexed in the Scopus database, and the colour of the circle corresponds to the average number of citations of scientific works. For example, the largest number of publications belongs to authors affiliated with Indian institutions and organizations (176 documents of the studied sample), the second place in this parameter is occupied by scientists from the USA (111), the third – from China (101), the fourth – from the UK (47), and the fifth place belongs to representatives from France (35 documents). However, the overwhelming number of publications of representatives of India and China is inferior to the USA, the UK and France in terms of the level of citations. Thus, each article of scientists from the USA, the UK and France is cited on average 25 times, which is more than twice the value of this parameter for researchers from India (on average 15 times) and China (12 times). The highest citation rates are among scientists from Finland, Denmark, and Cyprus, with each publication cited in other authors' works an average of 42 times.

Key publications that publish papers on the topic of customer relationship management using artificial intelligence technologies include: Lecture Notes In Computer Science Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics (31 documents); Lecture Notes In Networks And Systems (17); Communications In Computer And Information Science (15); Advances In Intelligent Systems And Computing (9); Ceur Workshop Proceedings (9 documents).

The main organizations involved in solving the selected problem are: Indian Institute of Technology Kharagpur (19 documents); Amity University (14); Symbiosis International Deemed University (10); The Hong Kong Polytechnic University (8); Indian Institute of Management Mumbai (8); University of Nicosia (8); Chinese Academy of Sciences (6); K L Deemed to be University (6); Indian Institute of Management Ranchi (6); CNRS Centre National de la Recherche Scientifique (5 documents).

By type of documents, the works can be ranked as follows: 1st place is taken by Conference Paper (350 documents or 41.7% of the total number of publications on the selected research topic); 2nd place – Article (311 or 37.1%); 3rd place – Book Chapter (92 or 11%); 4th place – Conference Review (37 or 4.4%); 5th place – Review (21 or 2.5%); 6th place – Book (18 documents or 2.1% of the total number of publications).

Mostly scientific works that consider the impact of artificial intelligence and customer relationship management are published in the following fields of knowledge: Computer Science (521 documents or 29.8% of the total number of publications on this topic); Business, Management and Accounting (260 or 14.9%); Engineering (246 or 14.1%); Decision Sciences (143 or 8.2%); Mathematics (137 or 7.8%); Economics, Econometrics and Finance (106 or 6.1%); Social Sciences (79 or 4.5%). This indicates that the research topic is interdisciplinary and multifaceted.

The main sponsors that finance scientific publications on the selected topics include the following: National Natural Science Foundation of China (21 documents); European Commission (8); Ministry of Science and Technology of the People's Republic of China (8); Fundamental Research Funds for the Central Universities (6); Horizon 2020 Framework Programme (5); Ministry of Education (5); National Key Research and Development Program of China (5); National Research Foundation of Korea (5); UK Research and Innovation (5 documents) etc.

Based on the results of the analysis of the coincidences and closeness of the relationship between the keywords of the selected sample of publications, network visualization maps were constructed (Fig. 3 and Fig. 4), and 7 clusters on the research topic were identified and characterized (Fig. 3). The first cluster (red, Fig. 3) contains the largest number of terms (namely 17 items), among which the following can be mentioned: "artificial intelligence", "customer relations", "digital transformation", "digitalization", "cloud computing", "Industry 4.0", "management", "supply chain management". It is worth noting the keyword "artificial intelligence", the frequency of its co-use in the studied sample is 487, and the strength of the connection is 2943.

The second cluster (12 items, green, Fig. 3) combines such terms as "AI", "blockchain", "customer relationship management", "e-commerce", "personalization", "predictive analytics", "customer experience", "customer engagement". In this cluster, the keyword "customer relationship management" has the highest frequency – the ratio is 208, while the strength of the association is 1631.

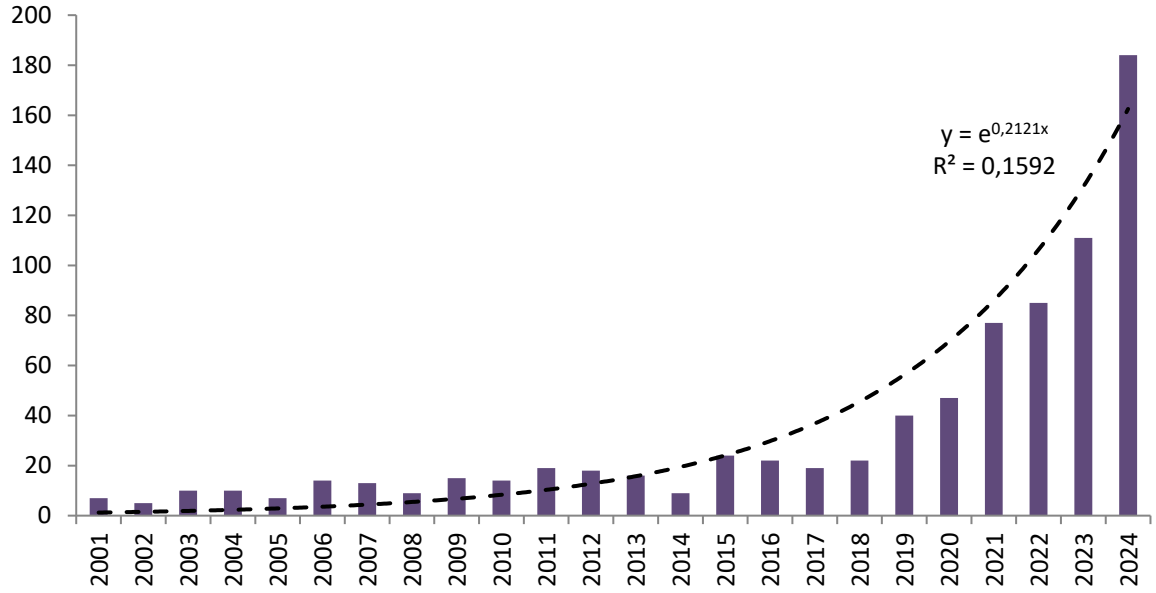

Figure 1: Dynamics of publications on artificial intelligence and customer relationship management for 2001-2024.

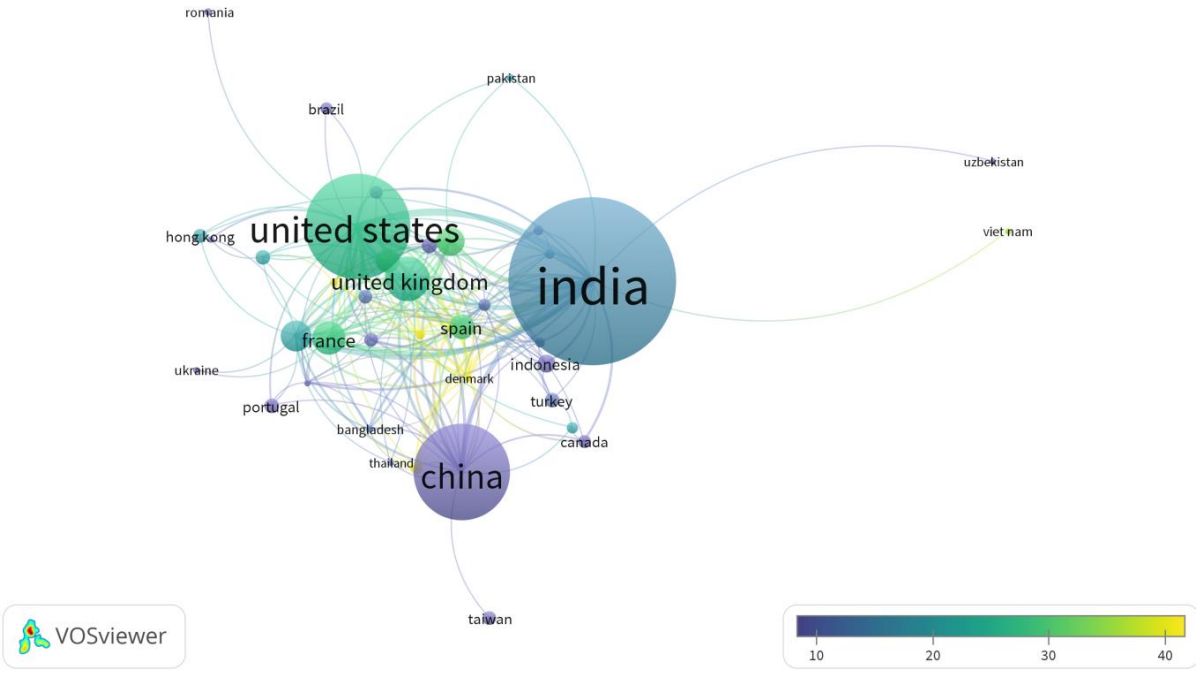

Figure 2: Countries of origin of publications on artificial intelligence and customer relationship management.

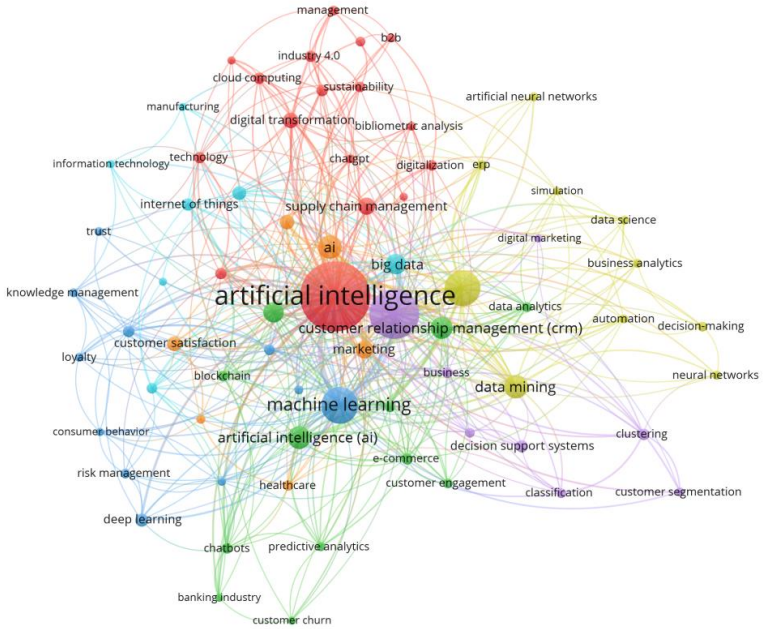

Figure 3: Visualization map of the bibliometric analysis of publications devoted to the application of artificial intelligence for customer relationship management (content aspect).

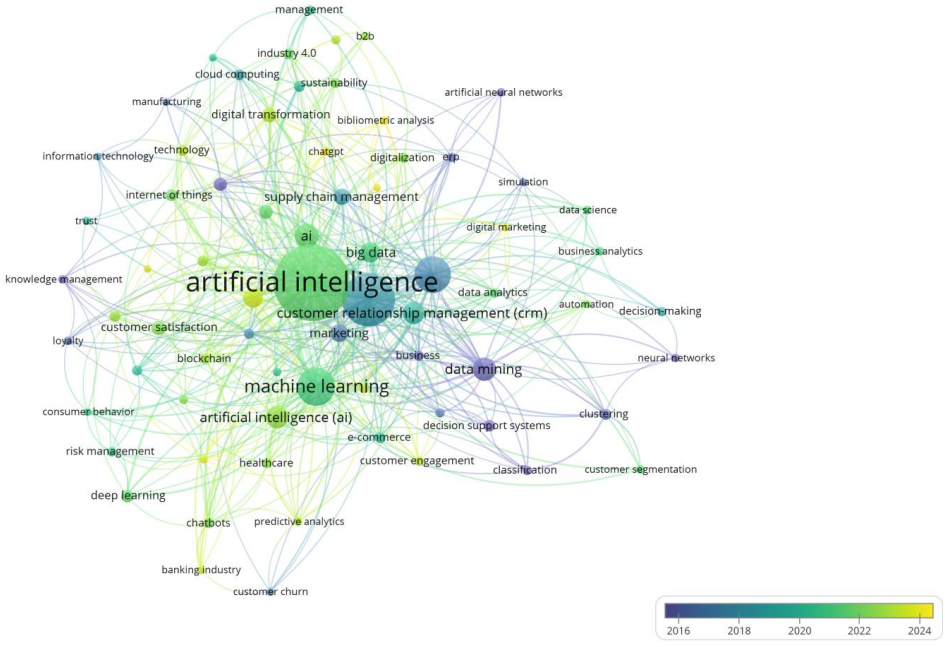

Figure 4: Visualization map of the bibliometric analysis of publications devoted to the application of artificial intelligence for customer relationship management (evolutionary and temporal aspects).

The third cluster (11 items, blue, Fig. 3) describes the connection between artificial intelligence and customer relationship management with the following terms: “consumer behaviour”, “loyalty”, “trust”, “machine learning”, “risk management”. The main key term in this cluster is “machine learning”, the frequency of its co-use in the studied sample of scientific publications is 79, and the strength of the association is 569.

The fourth cluster (10 elements, yellow, Fig. 3) is associated with the following categories: “CRM”, “business analytics”, “artificial network”, “decision-making”. The keyword “CRM” has the highest frequency of co-use – 61, while the strength of the association is 372.

The fifth cluster (8 elements, purple, Fig. 3) covers the following categories: “clustering”, “classification”, “customer segmentation”, “digital marketing” and others. The frequency of co-use of the main keyword “clustering” in this cluster is 9, and the strength of the association is 65.

The sixth cluster (7 elements, turquoise, Fig. 3) is associated with the concepts of customer service, information technology, Big Data, Internet of Things. The seventh cluster (6 categories, orange colour, Fig. 3) includes such concepts as marketing, customer satisfaction, service quality, chatbots, etc.

Thus, based on the constructed terminological map of categories and the highlighted most significant keywords related to issues of artificial intelligence in customer relationship management, it can be argued about the multidimensionality and cross-dependence of the studied areas, since there are numerous connections between the terms, as well as their high prevalence in research.

According to the results of bibliometric analysis in the evolutionary and temporal dimensions, it can be stated that in the development of scientific research related to customer relationship management using artificial intelligence tools, five most significant stages can be distinguished (Fig. 4).

The first stage of development was observed until 2016, when most publications considered general issues of forming networks and decision support systems using data analysis technologies.

In the second stage, which lasted from 2016 to 2018, the focus of scientists' research shifted to the terms “customer relationship management”, “supply chain management”, “information technologies”.

From 2018 to 2020, that is, at the third of the selected stages, the dominant key terms were “machine learning”, “customer segmentation”, “consumer behaviour”, “risk management”, “business analytics”, “e-commerce”.

The fourth stage (from 2020 to 2022) is characterized by the predominance of the terms “artificial intelligence”, “Big Data”, “cloud computing”, “customer satisfaction”, “chatbots”, “Internet of Things”.

The last, fifth stage began from 2022 to 2024. According to the results of its analysis, it can be stated that the main terms in the study were: “digital transformation”, “blockchain”, “technology”, “customer experience”, “customer engagement”, “predictive analytics”, “digital marketing”, “ChatGPT” and others.

Thus, summing up the above, we can trace the change in emphasis in scientific publications, caused by the development and improvement of information technologies from the already traditional ones: “Internet”, “software”, “information systems”, widespread at the first – third stages (Fig. 4) to the increasing importance of artificial intelligence tools at the fourth – fifth stages. The widespread use of modern technologies has led to the emergence of new phenomena and areas of scientific research, such as “digital marketing”, “e-commerce”, “customer experience”, etc., which determines the importance of simultaneously studying the subject area in the context of digital transformations.

5 CONCLUSIONS

Based on the purpose and results of the study, we can conclude that there is a high level of closeness between the concepts of “artificial intelligence” and “customer relationship management”. Thus, empirical data showed an exponential growth of research in the context of the relationship between artificial intelligence and customer relationship management (the annual increase in publications on this topic is 15.3%). It can be assumed that, in accordance with the dialectical law, the accumulated quantitative changes will turn into qualitative ones, which will lead to the complementarity and mutual stimulation of these factors.

This article performs a bibliometric analysis of key aspects of scientific publications on the application of artificial intelligence technologies to improve the efficiency of customer relationship management. Using the VOSviewer software, network visualization maps of keyword matches of publications indexed by the international

scientometric database Scopus from 2001 to 2024 were created.

According to the semantic correspondence of the keywords of the studied sample, seven clusters were identified and described, and the presence of five most significant stages of the development of scientific research dedicated to the transformation of customer relationship management systems using artificial intelligence was established.

A comprehensive analysis of the identified research areas showed that the introduction of artificial intelligence, tools, methods and technologies of digital marketing are strategic at the international level for improving the customer relationship management system. The widespread use of modern digital technologies, one of which is artificial intelligence, leads to the emergence of fundamentally new areas of scientific research, which determines the importance of simultaneously studying the subject area in the context of global digital changes.

Thus, the results of the study will allow us to obtain a holistic view of the current state and prospects for the transformation of the customer relationship management system, which can contribute to the formation of a more effective marketing strategy and sales policy of enterprises of various industries.

The practical significance of the study results lies in the fact that they can be used in substantiating and developing a strategy for the digital transformation of the customer relationship management system. This will become the direction of further scientific research.

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