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Recent Trends of Customer Relationship Management in AI: A Scientometric Analysis

Keywords: customer relationship management; artificial intelligence; AI-CRM system; customer segmentation

JEL: M10; M15; M31; L81; O32; O33

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Abstract

Theoretical background: The popularity of AI in recent years has led to its integration with various industrial sectors. This spectrum of AI applications has brought numerous topics that are underexplored and need to be taken up. One such area is the integration of AI with customer relationship management (CRM) systems. In consequence, this research is valuable for the scientific community.
Purpose of the article: The purpose of the research is to conduct scientometric analysis in the field of AI in CRM and to identify the most crucial areas of research, identify motor and niche themes in the AI-CRM and indicate future research trends.
Research methods: The methodology was divided into three parts: data collection, descriptive analysis, scientometric analysis. In the research, "R programming" and "Biblioshiny" were used to conduct scientometric analysis. This made it possible to generate charts and a table based on gathered data and then analyse the results.
Main findings: The results show there is a growth in AI-CRM systems subject since 2019. Keywords like "CRM", "public relationship" or "data mining" were often used in research articles. Future research trends can be define among others: acceptance and trust for AI powered technology, impact on companies' environment or relationship with customer.

Introduction

Nowadays, marketing is widely supported by numerous systems and technological tools that enhance its impact and functioning. One of such systems is customer relationship management (CRM) which is defined as a process of learning more about customers' behaviours to have better and stronger relationships with them

(Farquad et al., 2014). It might be also said CRM is the adoption of information to develop relationships with new customers, retain old ones and finally increase customer loyalty, retention and profitability (Wei et al., 2013). In turn, artificial intelligence (AI) is defined as the system's ability to correctly interpret external data, to learn from this and to use it to achieve specific goals and tasks through flexible adaptation (Libai et al., 2020). It is visible that a combination of CRM and AI (AI-CRM integrated systems) is evolving, and this potential seems to be powerful. It is useful for enhancing the loyalty of customers, increasing revenue and competitive advantages (Chatterjee et al., 2019).

As studies show there exist certain trends in AI-CRM systems such as forecasting (Lamrhari et al., 2022), predictive analytics (Wassouf et al., 2020), support decision-making process (Lee et al., 2016) or strategy and planning (Jayasree, 2013). There are some AI tools that support CRM systems and are especially beneficial from the organisation point of view. For instance, deep learning helps e-commerce companies identify which advertisements will be suitable for the customer. What supports decision making or machine learning helps the same companies learn from data and create solutions adjusted to challenges (Khrais, 2020). Moreover, data mining techniques significantly influence better decision-making processes by doing many tasks for example sentiment analysis, document classification or spam detection (Kumar & Ravi, 2016).

What is more, there are also many examples of well-known companies that have implemented AI tools in their tasks. Organisations like Google, Amazon, L'Oréal are examples of using AI in business operations (Kumar et al., 2019). Based on this research, such companies concentrate their doings on personalisation and prediction by creating adjusted content and storing information about customers. According to this study, it is also said there stand some conditions of implementing AI in CRM systems like mature, big amounts of data, scientific staff investments or infrastructure. When it comes to the data it is important to have the latest and updated data that give successful results. Furthermore, such data should be well arranged and organised (Chatterjee et al., 2019).

Predicting the future of AI-CRM integrated systems is challenging. Optimistic views in this field highlight the potential for creating new job opportunities. However, there are also concerns of replacing employees because of the high effectiveness of AI tools. The role of AI in CRM seems to be significant but despite this hype a potential in CRM remains largely unknown and underexplored (Youn & Jin, 2021). In literature, most authors focus on specific use of AI-CRM integrated systems, such as customer profiling in hotel industry (Dursun & Caber, 2016), replenishment systems based on cloud systems in franchise businesses (Lee et al., 2016), data mining techniques in hairdressing industry (Wei et al., 2013) or the impact on healthcare innovations (Kumar et al., 2023). This creates a vibrant base of AI implementations, but on the other hand there is a lack of papers regarding overall view of possible applications. The gap seems to spread as the AI-systems are constantly developing

and gaining popularity among business management and managers (Khrais, 2020). With regard to the above, the research gap can be defined as follows: the use of AI in relationship management is not well enough understood.

Therefore, it is important to keep research in this subject and observe development of new technologies and its influence on CRM. For sure it could be observed that the number of AI-CRM systems studies has increased in recent years especially in the field of sales, CRM and public relations according to the most used words. It is hard to say in which part of the world scientists are interested in this topic but there are some groups of countries that tend to write about CRM and AI more frequently.

Research problems with respect to AI-CRM-related issues include:

1. In which countries are the most AI-CRM-related articles published?
2. What are the most relevant authors in this area?
3. What is the annual scientific production of articles in the AI-CRM area?
4. What are the key words related to AI-CRM topics?
5. What are the major themes and niche themes in the AI-CRM publication area?
6. What future research trends can be identified?

The main goal of the research is to conduct scientometric analysis in the field of AI in CRM and to identify the most crucial areas of research. In this study the research group analysed and systematised this field focusing on the most significant articles from the Scopus base.

Literature review

Areas of AI applications in CRM

Artificial intelligence will usher the world into the Industrial Revolution 4.0, characterised by fully automated factories utilising cutting-edge technologies such as 5G and "blockchain, gene editing, Internet of Things sensors, nanotechnology, or 3D printing, accelerate a blurring of boundaries between digital, biological, and physical spheres" (Krafft et al., 2020). Artificial intelligence enables numerous enhancements across various sectors of the global economy, encompassing both the service industry and finance. Data mining enables better and faster segmentation of current and future customers, allowing for the best possible personalization of products or services directed towards them (Jayasree, 2013). A multitude of tools, such as chatbots, automate customer service by gathering relevant information and understanding customer expectations for products, as well as addressing their queries. Another significant application area of AI lies in predicting the near future (trends) and the associated risk analysis, for instance, when applying for a loan at a bank. One of the most significant aspects is big data analysis and the ability of AI to uncover seemingly hidden patterns that might not be detectable with standard tools due to their complexity (Chen et al., 2016).

To summarise, the convergence of AI with the realms of services and finance has ushered in a new era of efficiency, personalization, and foresight. Through data mining, predictive analysis, and the harnessing of big data, AI has not only revolutionised customer experiences but has also equipped businesses with invaluable tools for making informed decisions in an increasingly complex global economy. As this trajectory continues, the symbiotic relationship between AI and these industries promises to yield even more remarkable and transformative outcomes.

Benefits of applying AI in CRM

As can be observed, there are many areas of AI applications in CRM. Moreover, due to these applications, it is possible to overcome elemental obstacles in customer relationship management and provide many benefits not only for companies but also for customers.

For example, in franchising, there is a need to collect and analyse large amounts of data in order to react effectively and promptly to changing market needs (Lee et al., 2016). In this study researchers implemented a Cloud-based Responsive Replenishment System (CRRS), Dr I-Kids Education Center (DKEC), an educational franchise from Hong Kong, continuously provided appropriate data to implement the system based on fuzzy logic. After implementing the CRRS, with a Cloud-based Customer Relationship Management Module (CCRMM), built by the research team, the organisation saw an improvement in Key Performance Indicators (KPIs over the next following months). This included an 18.1% reduction of replenishment cycle times, a 14.6% cut in out-of-stock occurrences and a 6.3% reduction in inventory costs (Lee et al., 2016).

Another study discussed the effects of AI on customer relationship management tasks. AI-CRM will support companies in predicting potential customer lifetime value (CLV) and based on this information it will be used to gather data about the customer acquisition process in order to acquire more profitable customers. New AI-based technologies will also enable more precise and effective targeting, further developing customised offerings. AI-CRM will gather rich data on individual customers, providing a holistic view of their needs and behaviour. Consequently, companies are able to formulate value offerings that respond to their needs (Libai et al., 2020).

In reference to an article about an organisation's readiness to integrate AI and CRM systems (Chatterjee et al., 2019), five different applications of AI-CRM that will be beneficial can be distinguished.

1. Tasks automation – this could significantly reduce time consumption and by supporting these tasks, the AI-CRM system will provide accurate recommendations to the organisations, enabling precise customer targeting and improved relationship building.

2. Customisation and segmentation – the AI-CRM system will be able to learn historical patterns and habits history that help categorise customers more effectively.

3. Customer service – the AI-CRM system will enable gathering appropriate insights from big data bases which is helpful in building appropriate target profiles to interact with. This would enhance customers' satisfaction and retention.

4. Organisation guidance – the AI-CRM system will assist in creating a pragmatic roadmap for companies. It could be a form of guidance for employers and employees on how to do their tasks to achieve better results more effectively.

5. Virtual assistance – the AI-CRM system will serve as a virtual assistant that will be able to send responses to customers in the form of emails. This will automate the entire process of customer service and problem-solving.

AI-CRM systems could be beneficial after implementation in the organisation. They support realisation of simple tasks by automation or even could assist in customer service instead of traditional employees. With the development of new AI technologies, many other benefits of AI tools will be observed, and it would be possible to solve many other problems and difficulties.

Challenges in implementing AI in CRM

As mentioned before, implementing AI in CRM is beneficial and can be perceived as a main strength in a company position. It is an opportunity to overcome difficulties and challenges in customer relationship management and data analysis. But with usage of technology, there also can occur some issues. The company needs to adjust the current system, software, applications and technologies to cooperate with AI (Kumar et al., 2019). The technological environment must be flexible to ensure that AI can function and learn correctly.

When it comes to the crucial part of CRM in a company – human resources – adapting with new technology can cause severe problems also in CRM aspects, such as technology turbulence (Chatterjee et al., 2022) or the lack of trust (Chatterjee, Chaudhuri et al., 2021). The aim of implementing AI is to facilitate and simplify data analysis, so it is crucial to receive training in terms of co-working with AI systems. Chatterjee S. indicates that managers should provide appropriate infrastructural facilities (such as training) to ensure that the employees are not constrained to using technology (Chatterjee, Chaudhuri et al., 2021) and to motivate them to co-work with it on a daily basis. In Chatterjee, Rana et al. (2021). the adoption of AI-integrated CRM systems (AICS) was influenced by the intentional stance of users toward the system. The stance itself was shaped by their attitudes and the perceived usefulness of the technology, moderated by its perceived ease of use. By comparison, the influence of trust on AICS adoption was not statistically significant.

What is more, the outcome data that is generated by AI-integrated systems, must be well interpreted by employees or managers (Kozak et al., 2021) as it can cause problems if there is lack of knowledge in data science in human resources. In another research (Youn & Jin, 2021) which examined the effects of chatbot relationship type (assistant vs. friend), participants could distinguish between the intended relationship

types. There was no significant difference in trust between the assistant and friend chatbot conditions. Instead, trust was influenced through how competent the chatbot was perceived to be. Customers may consider security and privacy as questionable (Chatterjee, Ghosh et al., 2021) in terms of their data and personal information that is given to the system to adjust personalisation and recommendations algorithms.

Another issue of integrating AI, is a technical part of CRM, is that IT systems, unless with specific qualities, can lack data or the quality of the database itself. Small companies with limited data and access to customer information can receive incomplete or patchy feedback from the system because the AI needs vast amounts of data, as it relies on data maturity, to create patterns and habits of customers (Kumar et al., 2019).

Potential of AI application in the future

It can be expected that future applications of AI will primarily align with the current research and subsequently lead to optimised customer value and experiences. AI in CRM can pre-emptively identify signs before customers leave and assist in client retention (Gür Ali & Arıtürk, 2014). In other words, AI technology can identify the customers desire to change the company provider focusing on the warning signs as contrasted to the fully made decision. Deep Neural Networks outperform traditional methods in predicting customer churn (Domingos et al., 2021). To improve, future research and development efforts should focus on predicting customer loyalty using deep learning and designing self-configuring deep learning architectures (Domingos et al., 2021). By grouping consumer traits such as shared aspects affecting decision-making, AI can make revolutionary advice for businesses. Data mining and AI-enhanced segmentation tools, like the RFM analysis, could provide improved customer profiling based on behavioural and value metrics (Dursun & Caber, 2016). With further technological development, companies should increasingly benefit from enhanced analysis of both large and unstructured data in developing their CRM capabilities (Libai et al., 2020; Zdravković et al., 2021). Moreover, a complex relationship exists between the input data and its analysis since not all the collected data is useful for building customer relationships, while there is a need for its constant acquisition (Lam, Ho, Wu et al., 2014). Artificial intelligence can rely on existing algorithms, build decision trees, or use data mining in real time while simultaneously storing vast amounts of data. Databases are essential for businesses in the marketing segment and its qualitative analysis can help in identifying customer knowledge, useful for future strategies and interactions with consumers (Chiang, 2018). New research shows AI could also support customer and sales teams with detailed insights into individual needs and preferences (Libai et al., 2020), which suggests an opportunity for more personalised customer experiences. Ultimately, it should be expected that further AI development will lead to improved CRM effectiveness (Chatterjee, Chaudhuri et al., 2021) and customer relations.

Research methods

This area contains methods and tools used in the research study about AI applications in CRM. The methodology is divided into three main parts: data collection, descriptive analysis and scientometric analysis. At the end of the research technique, it is provided a research diagram to visualise steps that were indicated to conduct the study. All parts of the study follow PRISMA approach to guarantee transparent evaluation of the process of systematic review (Sohrabi et al., 2021). The researchers considered peer-reviewed journals accessible through the comprehensive Scopus scientific database. They justified this selection by highlighting Scopus's vast collection of abstracts and citations from scholarly publications, its robust query language features, and user-friendly interface (Burnham, 2006).

Data collection

Time horizon set for the review process of data collection is 2013–2023 with the main focus on articles from the last five years because of the data size and innovations presented in the newest studies as the major changes are still occurring. The data used for the analysis is extracted from the Scopus database, which is commonly used for bibliometric research and scientometric analysis in academic use (Zhu & Liu, 2020). The papers extracted from Scopus are all articles written in English, excluding conference papers, books, etc., limited by several subject areas, for instance, physics and astronomy, medicine, chemistry and nursing, which is necessary to restrict the research in a manageable way. The date of extraction of the database is 26 June 2023.

The database itself is set with keywords around the field of AI such as artificial intelligence, AI, machine learning, deep learning, data mining and robotic process automatization correlated with customer relationship management and CRM for short. The set query is indicated below.

KEY (("artificial intelligence" OR "AI" OR "machine learning" OR "deep learning" OR "data mining" OR "robotic process automation") AND ("customer relationship management" OR "CRM")) AND PUBYEAR > 2012 AND PUBYEAR < 2024 AND ( ) AND (EXCLUDE (SUBJAREA , "MEDI") OR EXCLUDE (SUBJAREA , "PHYS") OR EXCLUDE (SUBJAREA , "ENER") OR EXCLUDE (SUBJAREA , "MATE") OR EXCLUDE (SUBJAREA , "ENVI") OR EXCLUDE (SUBJAREA , "BIOC") OR EXCLUDE (SUBJAREA , "AGRI") OR EXCLUDE (SUBJAREA , "CHEM") OR EXCLUDE (SUBJAREA , "PHAR") OR EXCLUDE (SUBJAREA , "CENG") OR EXCLUDE (SUBJAREA , "EART") OR EXCLUDE (SUBJAREA , "IMMU") OR EXCLUDE (SUBJAREA , "NURS") OR EXCLUDE (SUBJAREA , "HEAL") OR EXCLUDE (SUBJAREA , "VETE")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (DOCTYPE , "ar")).

The final number of articles in the database is 164 and contains articles from such fields as business, marketing, management science and AI technology overall. After extracting the database from Scopus in a CSV file format, it was converted into an Excel file.

Descriptive analysis

The descriptive analysis involves in-depth reading and comprehensive examination of designated sections of articles, followed by extracting key conclusions, areas and trends in the step of literature reviewing. To provide it, the articles are grouped by two criteria: citations and journal impact score. Papers with at least four citations and journal impact score minimum by ten and more are selected for descriptive, specific analysis to assemble information about main fields of AI applications and trends. Exception to this are the articles from 2023, all of them are included in the descriptive analysis as they can have no citations or journal impact score because of the publication date. The number of articles analysed is 65 and it was divided into researchers to investigate the area.

Scientometric analysis

To provide scientometric analysis, researchers used R programming and Biblioshiny, which is free-access software written in R language and powered by bibliometrix. It is used as a data visualisation tool for quantitative research in bibliometrics and scientometrics (Aria & Cuccurullo, 2017). It converts the data and gathers it into research areas to provide charts and tables based on the number of citations, most relevant authors, most relevant sources, most frequent words, etc. enabling the visualisation of information extracted from the database.

In this paper we use Biblioshiny charts such as most cited countries, most relevant authors, annual scientific production, most frequent words, co-occurrence network and thematic map. The main aim of applying Biblioshiny as a part of this research is an ability to gather information into fields and to detect the trends and future promising areas of AI applications in CRM that cannot be selected by descriptive analysis.

In Figure 1, a process diagram is provided to indicate all steps that were made in the research to investigate the AI applications in customer relationship management.

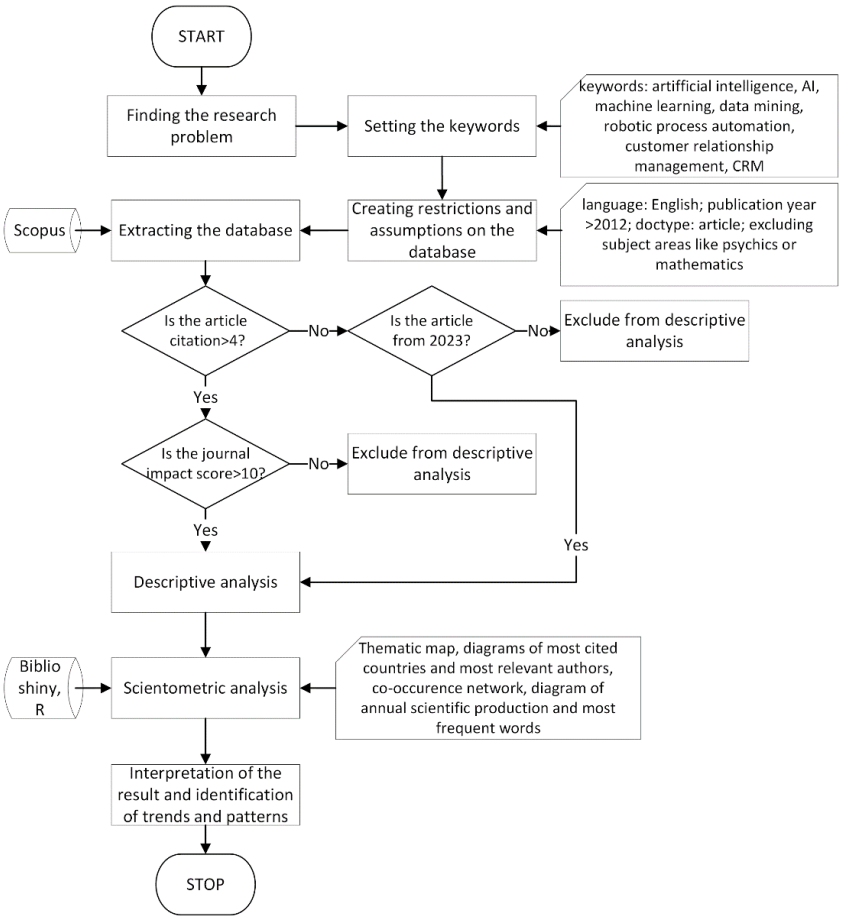

Figure 1. Process diagram of methodology

Source: Authors' own study.

The primary objective of the research is to thoroughly conduct scientometric analysis within the domain of AI in CRM and subsequently pinpoint the most critical areas of research. Within the framework of this study, the research group meticulously examined and methodically organized this field, directing their attention to the most noteworthy articles sourced from the Scopus database.

Results

The last few years have witnessed a remarkable surge in interest in harnessing AI in the field of marketing and customer relationship management. Dynamic technological advancements have enabled novel approaches to data analysis and consumer

trend prediction, influencing the efficacy of business strategies. In this context, we have conducted a comprehensive scientific analysis that not only unveils pivotal patterns in scholarly publications but also sheds light on the role of AI in shaping today's CRM landscape. The following chapter presents our analysis, highlighting the outcomes of key studies and conclusions that offer insights into the evolving use of AI in the CRM domain. We will focus on key keywords, term co-occurrence, thematic maps, and the impact of AI on the effectiveness of marketing activities and customer relationship management. Through this study, we aim to cast new perspectives on the field's evolution and the indicators driving its current direction. The analysis sheds light on pivotal trends in the field, while also providing tools for a better understanding of how AI plays a significant role in today's marketing environment and customer relationships.

Descriptive analysis involves the process of visually representing the data obtained from the database through various forms such as charts, diagrams, and maps. This method of presentation allows for a clearer understanding of patterns, trends, and relationships within the data, aiding in effective communication of insights to stakeholders, researchers, and decision-makers. One visual representation, as illustrated in Figure 2, elucidates the distribution of citations among different countries. In the context of this analysis, the focus is on citations related to the field of AI in customer relationship management. The data highlights that India emerges as the most prominently cited country in this subject area, boasting a substantial number of 711 citations. It can depend on the number of articles which are published every year or the amount of data that is researched in the presented topic.

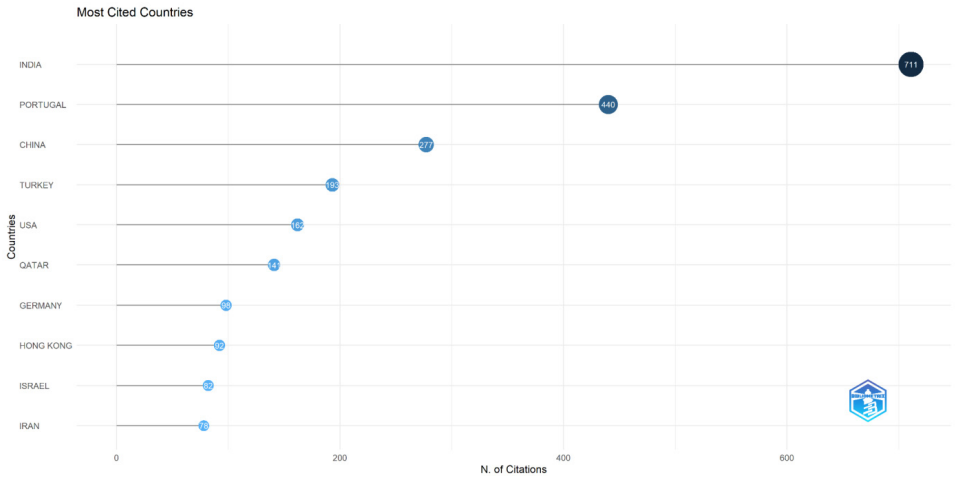

Figure 2. Most cited countries

Source: Authors' own study based on R programming and Biblioshiny analysis.

Analysing the given data regarding the most frequently cited countries and their connection to the number of publications and authors, the following trends can be observed.

Taking the top position in the ranking in terms of citation count is India, reaching an impressive number of 711 citations. This clearly indicates the significant contribution of this country to the research under analysis. Interestingly, authors from India also dominate in terms of publication count, suggesting their scholarly activity and substantial influence on research topics. Portugal secures the second place in the line-up, recording 440 citations. Its exceptionally high position is owed to an article authored by Mostafa M.M. for a local institute, which garnered remarkable 434 citations. This example vividly illustrates how a single publication can greatly impact a country's position in the ranking. Following in the order of countries in the ranking, we have China with 277 citations, Turkey with 193 citations, the USA with 162 citations, Qatar with 141 citations, Germany with 98 citations, Hong Kong with 92 citations, Israel with 82 citations, and Iran with 78 citations. It is worth noting that each of these countries has specific factors influencing their positions, whether through outstanding authors, renowned research institutions, or groundbreaking scientific discoveries. To sum up, the presented data showcases the distribution of citations among different countries. The roles of India and Portugal as leaders in this field are highlighted. Beyond just the citation count, the influence of individual authors and their work on a country's position is also evident, further underscoring the significance of specific scientific achievements. The analysis of Figure 2 allowed to answer research question number 1 indicating countries where the most articles are related to AI-CRM systems published. It has been shown that the majority of articles on this topic, when considering the top three most cited, originate from India, Portugal, and China.

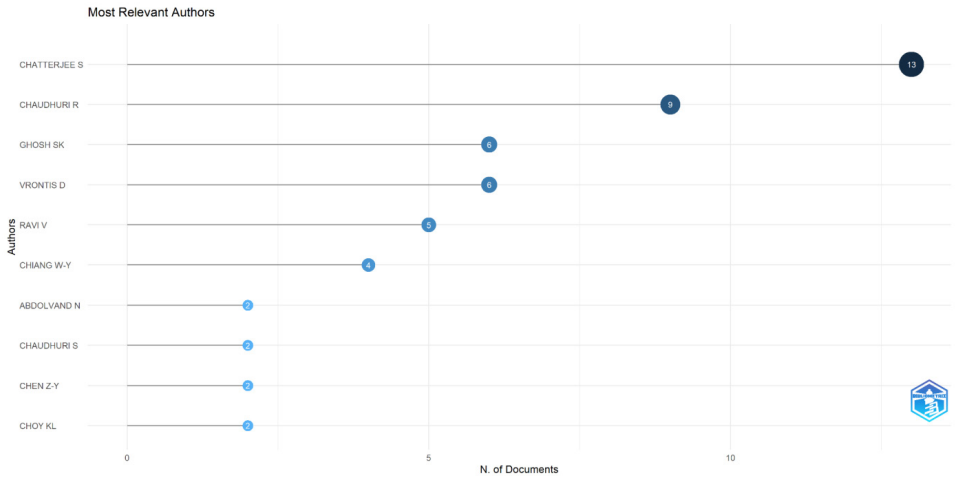

Figure 3. Most relevant authors

Source: Authors' own study based on R programming and Biblioshiny analysis.

The three leading authors – Chatterjee S., Chaudhuri R., and Ghosh S.K. – are from India and published three articles in the collaboration. Figure 3 illustrates the most relevant authors of the articles given in the database. Chatterjee S. and Chaudhuri R. published two more articles with different authors. These two diagrams demonstrate that the subject of using AI to develop customer relationships is a common area of research in India, which also indicates the Figure 2 representing countries' scientific production. It can be observed that also China, the USA and Iran are the areas of research. Only six researchers have more than two citations in articles related to the utilisation of AI within CRM. The analysis of Figure 3 allowed to answer research question number 2 indicating the most relevant authors in the area of AI-CRM systems. It has been shown that the three leading, most relevant authors come from India.

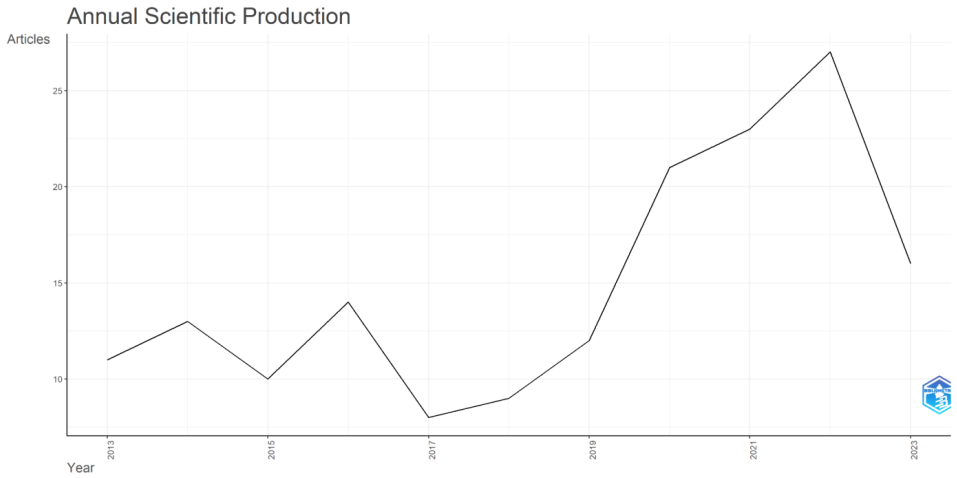

Figure 4. Annual scientific production

Source: Authors' own study based on R programming and Biblioshiny analysis.

Since 2019, we have witnessed a dynamic increase in researchers' interest in the capabilities of AI and its potential applications in the realms of marketing and customer relations. The number of publications has notably surged, rising from a few dozen annually to over 25 in 2022. We anticipate this trend will continue into 2023 and subsequent years. A detailed breakdown of the published articles in these recent years is illustrated in Figure 4. This surge in the popularity of AI as a research tool and in practical applications within the domains of marketing and customer relationship management stems from several key factors. Primarily, the proliferation of AI as a technology has become increasingly evident in recent years, leading to heightened interest among researchers. Additionally, the introduction of the ChatGPT

language model by OpenAI and its public release at the end of 2018 has contributed to a significant increase in discussions and controversies surrounding the utilisation of AI, further directing researchers' attention to the topic. As AI becomes progressively advanced and versatile, we anticipate its influence on the fields of marketing and customer relationship management to continually grow. New innovations and discoveries in the realm of AI are likely to lead to an even greater upsurge in the number of scholarly publications and the development of increasingly sophisticated tools and strategies in the realms of CRM and marketing. The analysis of Figure 4 allowed to answer research question number 3 indicating the annual scientific production of articles in the AI-CRM area. It has been shown that there is a rising trend since 2019 in researchers' interest in the AI-CRM systems topic.

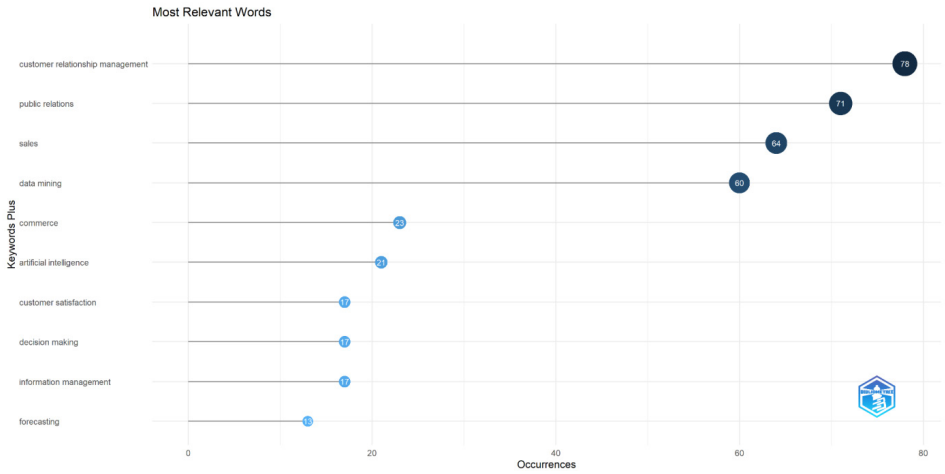

Figure 5. Most relevant words

Source: Authors' own study based on R programming and Biblioshiny analysis.

Analysing the most frequently occurring keywords in the examined articles based on Figure 5 suggests a strong co-occurrence of the terms CRM (78), public relations (71), sales (64), and data mining (60). Data mining is increasingly being integrated into CRM and sales due to its capability for highly precise offer customization based on the data left by customers in their previous activities. The second group of keywords with close to twenty occurrences each included: commerce, AI, customer satisfaction, decision-making, and information management. These topics provide a deeper insight into the direction in which the utilisation of AI and machine learning is progressing. The mentioned technologies facilitate the analysis of vast amounts of data, enabling future predictions and, when utilising chatbots, ensuring customer satisfaction throughout the entire sales process. Furthermore, the strong presence of terms like commerce and AI indicates a convergence of technologies

aimed at enhancing customer experiences and business efficiency. The emphasis on customer satisfaction and decision-making suggests that the integration of AI is focused not only on predictive capabilities but also on aiding effective and informed decision-making processes. This aligns with the overarching theme of leveraging AI to drive better outcomes across customer relations and sales domains. As the symbiotic relationship between data-driven approaches like data mining, AI, and customer-centric strategies like CRM and public relations continues to evolve, it is evident that harnessing these technologies is instrumental in shaping the future landscape of marketing and sales. The interconnectedness of these terms highlights the holistic approach necessary to succeed in an increasingly data-rich and technologically advanced business environment. The analysis of Figure 5 allowed to answer research question number 4 indicating the key words related to AI-CRM topics. It has been shown that there is a strong co-occurrence between terms: "CRM", "public relations", "sales" or "data mining".

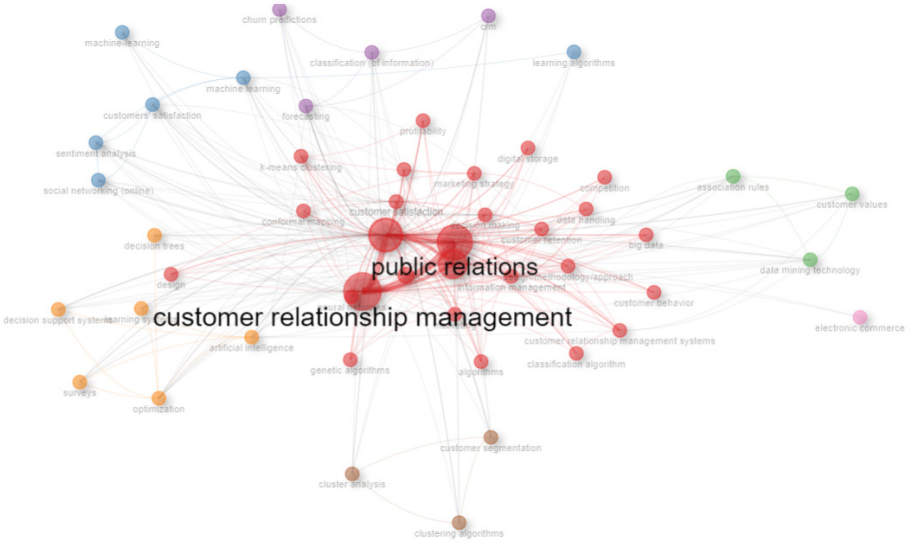

Figure 6. Co-occurrence network

Source: Authors' own study based on R programming and Biblioshiny analysis.

By delving into the analysis of the most frequently used words and the co-occurrence network within our database, we have unearthed noteworthy insights. Among the recurring keywords, several prominent terms have come to light, including "customer relationship management", "public relations", "sales", and "data mining". It is evident that these terms exhibit a robust correlation in their occurrences, suggesting an inherent connection between them. Furthermore, our exploration has led to the identification of thematic clusters, where a compelling interrelation exists among the

included keywords. As an illustration, the phrase "artificial intelligence" consistently emerges alongside words like "optimization", "learning systems", "decision trees", and "decision support systems". This observation underscores the interwoven nature of these concepts and their recurrent occurrence within the same context. Turning our attention to Figure 6 the co-occurrence network linked to CRM, we find a trove of valuable insights awaiting both researchers and businesses. This network analysis offers a unique vantage point, enabling a comprehensive grasp of relationships. Moreover, it serves as a potent tool for pinpointing pivotal subjects, establishing priorities, navigating challenges, and seizing opportunities. Incorporating these findings into practical applications, organisations can enhance their proficiency in managing customer relationships. By tapping into the synergy between CRM and PR, they can cultivate a favourable brand image. The symbiotic relationship between these two realms becomes readily apparent through this examination. As a result, companies can harness this synergy to not only effectively manage customer interactions but also to craft a positive and compelling brand identity. The analysis of Figure 6 allowed to answer research question number 5 indicating the major themes and niche themes in the AI-CRM publication area. It has been shown that there is a connection between words "customer relationship management", "public relations", "sales" or "data mining". What is more, phrase such as "artificial intelligence" is correlated with "optimization", "learning systems", "decision trees", "decision support systems".

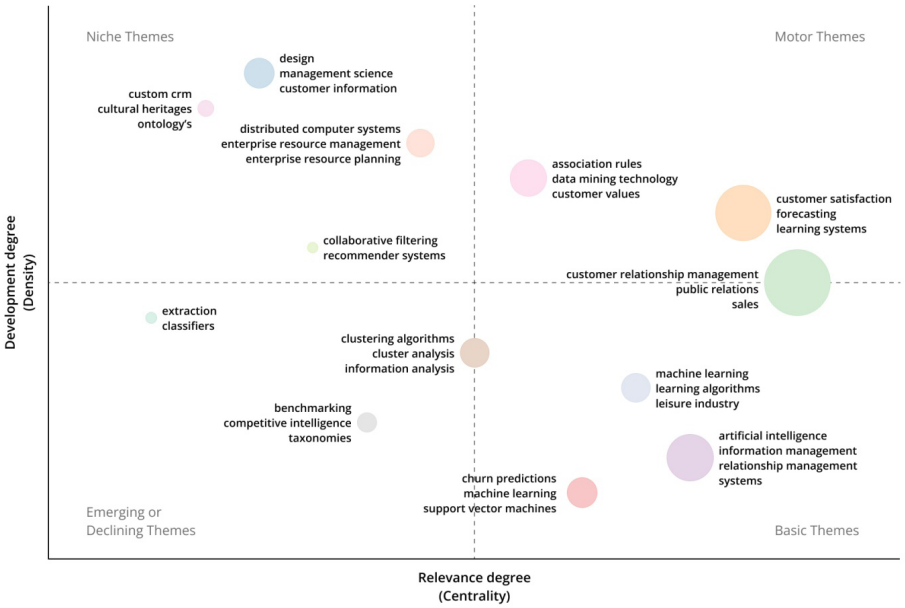

Figure 7. Thematic map

Source: Authors' own study based on R programming and Biblioshiny analysis.

In the thematic map, data is ordered by two factors: development degree (vertical axis) and relevance degree (horizontal axis). As can be observed, the map contains twelve ranges of subjects in different colours represented by circles. Figure 7 indicates the thematic map of articles included in the database. The size of the circle depends on the thematic size of articles and subjects in the given database. Most of the circles are concentrated in the bottom right corner of the map (low development degree / high relevance degree). There are three medium-sized circles in the area illustrating the subjects of AI, churn prediction and machine learning, and two on the borders of the corner such as clustering algorithms and customer relationship management. The largest thematic groups are three keywords of the database: "artificial intelligence" (expanded by information management and relationship management systems), "machine learning" (expanded by learning algorithms and leisure industry) and "customer relationship management" (expanded by public relations and sales) and customer satisfaction (expanded by forecasting and learning systems) which was not a keyword in the database. This connection illustrates the scale and importance of customer satisfaction raised in the articles about including AI in CRM. The thematic map describes the number of topics brought up in the articles. As can be seen, technical subjects such as clustering algorithms, distributed computers and churn prediction are connected to business topics in the field of customer satisfaction or management science. It not only indicates that in the worldwide literature there is a wide range of articles and research about developing customer relationship management by implementing AI and machine learning, but also that companies can use AI as a part of their marketing strategy. By taking into account technical assistance such as AI, an organisation can adapt sales and public relations management to prioritise customer satisfaction and their values.

The analysis of scientific literature has confirmed that the utilisation of AI in marketing, especially in the CRM domain, has a positive impact on the effectiveness of marketing activities (Chatterjee et al., 2023; Kumar et al., 2021). Further discussion shows the existing and potential benefits from AI utilisation in the field. Data marketing in large databases, for example, while relying on POS (point of sale) data can help discover "customer knowledge" (Chiang, 2018). In other words, machine learning can help businesses direct new marketing strategies. Based on the study conducted by Khobzi and Teimourpour (2015), LCP segmentation grounds on the user activity, relaying on the behavioural patterns which, in turn, can be useful for the AI in the marketing application. Businesses may use all these factors in their marketing advances or communication with clients. Artificial intelligence in CRM can analyse large amounts of data, notice shared traits between groups of people, their reactions, and monitor whether the causal relationship exists between the information sent to customers or their interactions with the company and the actual purchase.

Research has shown that personalising customer experiences through AI increases customer engagement and brand loyalty. Furthermore, AI enables more precise demand forecasting, leading to improved resource planning and optimization. Our

analysis has affirmed our hypothesis that the use of AI in marketing, particularly in the CRM realm, contributes to enhancing business outcomes. AI allows for more personalised customer communication, accurate demand predictions, and more efficient marketing processes, resulting in higher effectiveness of marketing efforts and customer relationship management. The analysis of Figure 7 allowed to answer research question number 6 indicating future trends in the field of AI-CRM systems. It indicates that AI will be especially useful in fields of marketing strategies, communication with clients forecasting, planning and optimization.

Discussions

Even though some marketing techniques are primitive, AI and CRM can change the field, affecting interaction of brands with clients. AI tools have the power to influence consumer decision making since voice assistants such as Siri and Alexa can provide consumers with specific Google search results, which differ from other consumer individual searches. Besides, when smart houses make purchases instead of customers, they rely on technical algorithms for decision-making as contrasted to biased consumer choice of brands due to packaging or advertising. These changes, as well as increased popularity of chatbots and online shopping, require companies to adopt. According to Pang and Chan (2017), "the updating mechanism should be incorporated into the algorithm in order to capture the changing trend on customer preferences. By using AI and relying on its ability to store and analyse large amounts of data, businesses can not only increase the speed of decision-making but also improve the quality of the services, as well as decreasing churn rates. However, the updating mechanism is not easy to incorporate, as human factors may interfere with new technologies or oppose new changes. On the example of client data, aside from stable variables such as demography, drivers motivating clients to purchase the product were proposed by Chen and Fan (2013). Such proposition creates concern on how to approach the data for the classification, analysis, and storage. IT and, specifically, AI tools can be useful in marketing and CRM due to their ability to identify which data to store, which to group, and change the filters depending on the situation or set parameters. This is why one of the discoveries of the article is the shared interactions of topics AI, CRM, and machine learning. Companies should focus on balance, not forgetting about the employees and client values while hunting for sales. At least five benefits of the shared CRM and AI usage identified in one of the main sources of this article include routine task automation, lead customization, customer retention, team guidance and virtual assistance (Chatterjee et al., 2019). Despite the popularity of the latter, virtual assistants or chatbots assisting in shopping can incorrectly perceive customer intentions or interfere between client and business relationships. In some cases, chatbots and automated shopping algorithms processes lead to decrease of personnel or their lack. Due to such an ethical concern, it is essential for

businesses to balance the AI presence with social corporate responsibility. Authors make an assumption that AI may be used not only for the customer interaction, but to establish growth inside the company, relying on trust to create a learning culture.

Conclusions

This analysis provides a comprehensive overview of the AI-related research conducted in the field of CRM, which has been observed as a research gap. The article answers the following research questions about the countries where the most articles are published in the AI-CRM area, identifies the most relevant authors in this area, analyzes the annual scientific production of articles in the AI-CRM, identifies related keywords in the AI-CRM area, defines the major themes and niche themes. The article answers the following research questions about the countries where the most articles are published in the AI-CRM area, identifies the most relevant authors in this area, analyzes the annual scientific production of articles in the AI-CRM, identifies related keywords in the AI-CRM area, defines the major themes and niche themes. The literature review has shown that AI could be used in many fields of CRM like service industry and finance, customer segmentation, personalisation of products and offerings or forecasting. This scientometric analysis identifies prioritised areas in research. It turned out that such applications benefit both customers and companies. It was observed to achieve reduced inventory cost, shorter replenishment cycle time or reduced out-of-stock occurrence after AI tools integration with CRM (Lee et al., 2016). Nonetheless, there could also be a lot of challenges in implementing AI in CRM. Companies must adjust existing systems, software and applications to work with AI, which can be costly. Highly skilled employees are crucial also for effective adoption and moreover social acceptance is important too. Customers might find it challenging to trust and use new AI technology. There are also some predictions that AI applications will lead to optimising customer value and experience by identifying their desires or aspects affecting decision-making. These possibilities will be developed, and also current problems will be solved more effectively, for example, customer service without real assistants.

Research findings indicate that there are some countries with significant contribution to the research under analysis. The top position belongs to India, which is interesting because of its significant advantage among other countries. It could be an absorbing field of research in the future to study developing directions in science in India. It is also observable that three of the most relevant authors come from India which confirms that this country would be a good scientific direction. A noticeable trend is the growing popularity of AI-CRM subjects, with a notable increase in publications since 2019. Since that year there has been a dynamic increase in production of publications in this field. It could be associated with ChatGPT popularisation. Keywords like: “CRM”, “public relation”, and “data mining” are frequently mentioned in research articles. There is also significant interest in AI-related terms, decision-making and customer satisfac-

tion. Figure 7 shows that there is also a big group of words in connection: "artificial intelligence", "machine learning" and "customer relationship". These results indicate there is a potential to use AI tools in CRM or in general in marketing because of the interests of other scientists in these fields. We introduce a research agenda to advance the scholarly debate on AI in CRM literature studied with a focus on applications that can enhance customer satisfaction and retention and with these create a balance between AI powered tools and inhuman customer service.

Table 1. Future research trends

Future research trends	Research questions
Acceptance and trust for AI powered technology	How to create a technology environment to provide trustful space for customers?
	Should virtual assistants be perceived as a human or machine?
	How can a company assure the security of data that needs to be stored to provide data analysis?
Impact on companies' environment	How can AI technology boost employee's effectiveness and job performance?
	How can organisations create a competitive environment to benefit from it?
Relationship with customer	Can a company completely automatise customer service and maintain healthy and beneficial relationship with customers?
	How can AI help to prioritise customer issues?

Source: Authors' own study based on R programming and Biblioshiny analysis.

The research used Scopus as its scientific base for analysing AI-CRM systems. Following studies should be focused on skills and jobs of the future. According to the UNESCO article (Ramos, 2022), AI tools and global digitalization have changed the type and distribution of job tasks and the skills. The analysis shows that future employees need to master digital skills as well as "soft" skills (for example, communication or teamwork-related skills). The topic of the skills of the future in the era of AI would show requirements from the employees' point of view.

In Table 1, the results are presented, indicating future research trends and defining the corresponding research questions, providing answers to the final, sixth research question defined in this article. The results of the study helped fill the research gap and explore the thread of using AI in relationship management. The significance of this research lies in the unexplored nature of AI-CRM systems. Its insights could help popularise AI applications in CRM, driving further exploration and understanding in the field (Thakkar et al., 2020).

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