Artificial intelligence in customer relationship management: literature review and future research directions

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Abstract

Purpose – Due to the recent development of Big Data and artificial intelligence (AI) technology solutions in customer relationship management (CRM), this paper provides a systematic overview of the field, thus unveiling gaps and providing promising paths for future research.

Design/methodology/approach – A total of 212 peer-reviewed articles published between 1989 and 2020 were extracted from the Scopus database, and 2 bibliometric techniques were used: bibliographic coupling and keywords' co-occurrence.

Findings – Outcomes of the bibliometric analysis enabled the authors to identify three main subfields of the AI literature within the CRM domain (Big Data and CRM as a database, AI and machine learning techniques applied to CRM activities and strategic management of AI–CRM integrations) and capture promising paths for future development for each of these subfields. This study also develops a three-step conceptual model for AI implementation in CRM, which can support, on one hand, scholars in further deepening the knowledge in this field and, on the other hand, managers in planning an appropriate and coherent strategy.

Originality/value – To the best of the authors' knowledge, this study is the first to systematise and discuss the literature regarding the relationship between AI and CRM based on bibliometric analysis. Thus, both academics and practitioners can benefit from the study, as it unveils recent important directions in CRM management research and practices.

Keywords Bibliometric analysis, Research agenda, Artificial intelligence, Machine learning, Big data, Customer relationship management

Paper type Literature review

1. Introduction

Customer relationship management (CRM) activity involves collecting, managing and intelligently using data with the support of technology solutions to develop long-term customer relationships and exceptional customer experience (CX) (Boulding *et al.*, 2005; Payne and Frow, 2005; Rababah, 2011). The data obtained from all customer contact points, if well managed, can support companies in generating personalised marketing responses, creating new ideas, tailoring products and services and, thus, delivering high customer value and gaining competitive advantage (Kumar and Misra, 2021; Payne and Frow, 2005; Paquette, 2010). In the digital age, the increasing volume, velocity and variety of data, as well as their processing capacity, have led to new technology solutions, including the advancement of artificial intelligence (AI) techniques (Brynjolfsson and McAfee, 2017). AI refers to a system's ability to interpret a large quantity of data correctly, learn from such data and use these learnings to reach specific goals and tasks (Kaplan and Haenlein, 2019).

Both companies that develop CRM systems and those that use CRM enjoy advances in AI technology solutions, which have become essential to survive in the CRM context (Pearson, 2019). In fact, new CRM features, such as personality insight services, website morphing, chatbot services, programmatic advertising and emotional, image and facial recognition technologies, require considerable data to be crunched in real time, which would be almost impossible to implement without AI's advancements (Pearson, 2019).

Alongside the relevance of AI in the business world, academia also claims that AI is the next step towards a novel and more capable management of customer relations (Kumar *et al.*, 2020; Lokuge *et al.*, 2020; Vignesh and Vasantha, 2019). As CRM "is the outcome of the continuing evolution and integration of marketing ideas and newly available data, technologies, and organisational forms" (Boulding *et al.*, 2005), AI plays a fundamental role because AI solutions applied to CRM enable companies to better assimilate and analyse customer data (Brynjolfsson and McAfee, 2017; Libai *et al.*, 2020), making

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them increasingly able to anticipate, plan and take advantage of upcoming opportunities (Mishra and Mukherjee, 2019).

Despite AI becoming increasingly pervasive in managerial contexts, management scholars have provided little insights into AI during the past two decades (Raisch and Krakowski, 2020). The AI literature has mainly evolved along two separate disciplines: computer science and operations research, whose scholars have mainly investigated operational tasks that machines can handle, and organisation and management research, where managerial tasks reserved for humans are analysed (Raisch and Krakowski, 2020). Recently, the growing awareness of AI importance and the potential impact it might have on CRM have led to a large proliferation of publications, resulting in an accumulation of knowledge on the topic that is quite scattered and fragmented (Schröder *et al.*, 2021). This is also attributed to the fact that there are several definitions of CRM, each looking at CRM from a different perspective as a strategy, a process or an information system (Khodakarami and Chan, 2014; Richards and Jones, 2008). When dealing with AI–CRM relationship, these different perspectives drive different fields of knowledge, from business management to innovation science, causing advances in research to occur in isolated silos with few interdisciplinary exchanges (Loureiro *et al.*, 2021). Furthermore, as CRM includes sales, marketing, service and operations activities, its interfunctionality has made the AI–CRM research even more fragmented in different business areas. On such grounds, it seems worth for both the business and academic worlds to systematise the literature on AI in CRM into a full body of structured knowledge, which can guide managers as well as inspire scholars' future research.

Previous reviews in the field have focused on specific aspects, such as the challenges and applications of Big Data and AI on customer journey modelling (Arco *et al.*, 2019; Chatterjee *et al.*, 2019), or the potential impacts of Big Data and AI, respectively, on the key success factors of CRM (Zerbino *et al.*, 2018) and consumers' decision-making (Klaus and Zaichkowsky, 2020).

To the best of our knowledge, a wide-ranging review dedicated to mapping the literature concerning AI in the CRM domain is still lacking. Based on these premises, this paper aims to trace the state-of-the-art of AI in CRM and, thus, identify rising themes and promising paths for future research. For this purpose, the authors conduct a methodical, transparent and replicable review of AI in CRM, using bibliometric techniques to map the research field without subjective bias (Zupic and Čater, 2015). In particular, the current study combines bibliographic coupling to analyse references and establish intellectual linkages among articles and keywords' co-occurrence to comprehensively understand the leading keywords, allowing the construction of structural images of the research domain.

Our study contributes to advancing the domain of AI in CRM (Donthu *et al.*, 2021), addressing new important directions for future research. Furthermore, it offers relevant insights to practitioners.

The rest of the paper is organized as follows. Section 2 describes the methodology, including the search strategy and data collection. Section 3 provides the results with data analysis and visualisation, whereas Section 4 discusses the main contributions and future research paths. Finally, Section 5 presents the conclusions, contributions and limitations of the study.

2. Methodology

To achieve the research goal, we performed a literature review combined with a bibliometric analysis. Bibliometrics is described as "the mathematical and statistical analysis of bibliographic records" (Pritchard, 1969) and is used to establish intellectual linkages among articles and keywords, thus providing a big picture of rising trends and potential research opportunities (Boyack and Klavans, 2010; Marchiori and Franco, 2020). Bibliometric techniques offer the advantage of introducing quantitative rigor compared to narrative literature reviews, which might be invalidated by the subjective bias of the researcher (Tranfield *et al.*, 2003).

The first stage of the method concerns the search and collection of the articles to be analysed, which should truly represent the field of AI in CRM (McCain, 1990), and the second stage employs several bibliometric analyses to map the field and identify the most important themes within it.

2.1 Search strategy and data collection

To identify the appropriate articles for our aim, we executed a search on the Scopus database by using keywords related to AI in CRM. Using the AND operator, we combined the search string for AI ("artificial intelligence" OR "AI" OR "machine learning" OR "deep learning" OR "Big Data") with that for CRM ("customer relationship management" OR "CRM" OR "customer management" OR "customer experience" OR "CX" OR "customer journey") in the title, abstract and keywords.

The definitions and motivations behind the choice of these keywords are listed as follows. Following Kumar *et al.* (2020), we considered AI to be a generic term referring to a technology that can imitate humans and carry out tasks in an intelligent manner. *The term Artificial Intelligence is a little bit loose, but it is essentially about using machine learning - and specifically deep learning - to enable applications* (Brynjolfsson and McAfee, 2017). Especially regarding AI in CRM, the prevalence of AI applications concerns machine learning (ML) and its successor technologies, particularly deep learning (Libai *et al.*, 2020). Thus, as the terms "machine learning," "deep learning" and "artificial intelligence" are related and often used interchangeably, we included all of them in the search string (Borges *et al.*, 2020). In particular, we considered ML as a branch of AI that can learn from data, detect patterns and make decisions with minimal human intervention (Kumar *et al.*, 2020) and deep learning as a technological evolution of ML that can learn from data as well as from its mistakes without human intervention (Zaki, 2019). AI is often connected with the term Big Data (Arco *et al.*, 2019), as Big Data is considered raw fuel of AI and significantly impacts AI capabilities and value creation (Deshpande and Kumar, 2018; Saidulu and Sasikala, 2017). Thus, to exclude papers potentially related to AI, we also included "Big Data" in the search string.

Regarding the keywords used for CRM, given that CRM is linked and often interchanged with the terms "customer experience" and "customer journey", we included the latter in the search string (Buckley and Webster, 2016). CRM activities involve collecting and intelligently using data to build enduring customer relationships and a consistently superior CX by leveraging the comprehension of the customer journey

(Buckley and Webster, 2016; Lemon and Verhoef, 2016; Payne and Frow, 2005).

CRM and CX are often so much linked together that some companies (e.g. Oracle) see the management of CX as part of advanced CRM (Lemon and Verhoef, 2016). However, CRM concerns planning, implementing, monitoring and improving customer relationships, whereas CX management mainly focusses on how to improve CX at a touchpoint level (Holmlund *et al.*, 2020).

Similarly, customer journey literature and CRM are often interrelated, as CRM is considered by CRM providers (e.g. salesforce), as well as academics, as a source for customer journey mapping, allowing data centralisation and making them available to different touchpoints (Payne and Frow, 2005). Moreover, given the speed of the current generation of servers and the sophistication of Big Data analytics tools, some have hypothesised that customer journey analytics will be the next CRM (Fluss, 2017).

The search was performed in November 2020, and we obtained 1,032 articles. Filtering this initial data set out, English articles belonging to the Engineering and Business, Management and Accounting categories and articles and reviews underwent a double-blind peer-review process, and excluding duplicates, we finally retrieved 212 articles (Figure 1). These articles ranged from 2001 (2 articles) to 2020 (68 articles, available in November). Only one article was published before 2001, in 1989. Figure 2 represents the temporal distribution of articles in the field of AI in CRM and shows a steep recent growth in the literature.

2.2 Bibliometric analysis: bibliographic coupling and keyword analysis

After identifying the articles focussed on the theme under investigation, we performed two bibliometric analysis – bibliographic coupling and keywords' co-occurrence – to trace the state-of-the-art of AI in CRM contexts. VOS viewer version 1.6.15 was used to construct and display the bibliographic maps (Van Eck and Waltman, 2010). The VOS viewer has already been used to review the literature on industrial marketing (Valenzuela Fernandez *et al.*, 2019), information technology management (Khan and Wood, 2015), the interconnection between Big Data and business strategy (Ciampi *et al.*, 2020) and Big Data and co-innovation (Bresciani *et al.*, 2021) through bibliometric analyses. The 212-article data set and relative cited reference data were imported into VOS viewer. Before applying the bibliometric analysis, the completeness of the information within the data set was checked and missing cited reference data were added manually.

First, we conducted a bibliographic coupling of sampled articles to cluster papers based on shared references. This was achieved by counting how many times two articles cited the same references. Bibliographic coupling and co-citation analysis are the two most important science mapping techniques. A co-citation network is formed when two articles (nodes) are cited together by another document, whereas a bibliographic coupling network is formed when both articles (nodes) refer to a third document within their references, forming a link (Van Eck and Waltman, 2020). While co-citation analysis focusses on older literature and bibliographic coupling focusses on more recent research, we opted for bibliographic coupling as we dealt with very recent papers (Schröder *et al.*, 2021). In the bibliographic coupling network, each link has a strength, depicted by a positive numeric value; the higher this value, the stronger is the link (Van Eck and Waltman, 2020). Thus, the more citations both articles have in common, the stronger is their bibliometric connection. Based on the bibliometric mapping performed by VOS viewer, 99 articles strongly connected within our data set were classified into clusters that likely addressed the same themes (Waltman *et al.*, 2010; Schröder *et al.*, 2021).

Second, we analysed the keywords' co-occurrence to discover the most important research topics and the conceptual structure underlying the field of AI in CRM at the time of conducting this study (Callon *et al.*,1983; Niknejad *et al.*, 2021). For this purpose, the number of sample articles in which two keywords appear together was counted. In particular, the keywords' co-occurrence network is formed when the keywords (nodes) appear together, forming a link (Van Eck and Waltman, 2020). Then, the most frequently related keywords were classified into clusters using bibliometric mapping.

To better interpret keyword mapping, we applied an overlay network visualisation, in which items appear in coloured scales with the "average publication year" and the "average normalized number of citations received by the article in which a keyword occurs" (Van Eck and Waltman, 2020). These longitudinal visualisations enabled the assessment of the evolution of the conceptual structure of the research domain of AI in CRM. For the co-occurrence analysis, both the author keywords and index keywords of the sampled articles were considered. Before applying the bibliometric analysis, the extracted keywords were refined and standardised for 1,560 keywords (Khan and Wood, 2015; Kim *et al.*, 2018). In particular, we removed synonyms and derivative words and standardised words with similar meanings. For example, "database", "data-base" and "database system" were

Figure 1 Search and selection of articles considered in this study

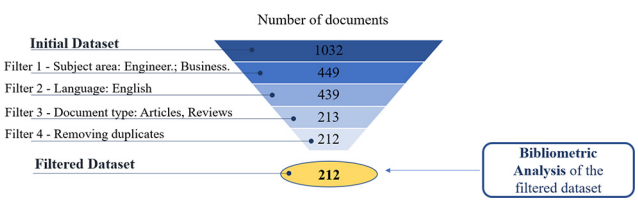
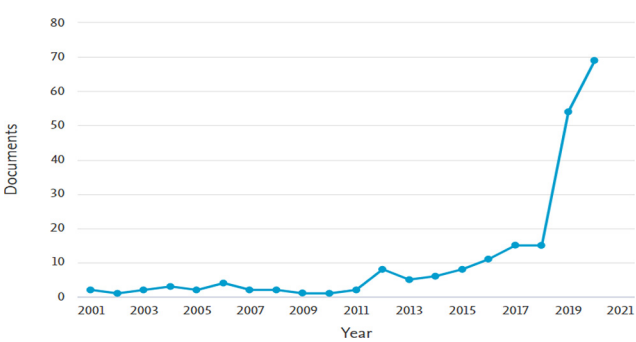


Figure 2 Temporal distribution of the filtered initial data set



standardised into "database". Moreover, terms separated by hyphens were standardised. For instance, "social-media" was grouped into "social media" and "omni-channel" into "omnichannel". Abbreviations in brackets were considered as additional keywords. In addition, where appropriate, in the keywords containing "and" and "&", these were removed and the keywords were separated.

While bibliographic coupling looks at the background, keywords' co-occurrences look at the content of the sampled articles. Thus, by combining the results of the keywords' co-occurrence and bibliographic coupling, we recognised the thematic structure of the clusters. To perform this step, we mapped in a spreadsheet the relevant features of the sampled articles with reference to the following: article purpose, research questions/hypotheses, methodology, context, theoretical background, gaps in the literature, key findings and type of involved technology. Mapping these aspects supported us in identifying the theme that characterises each cluster and, at the same time, paved the way for identifying the gaps and research opportunities.

3. Results

3.1 Bibliographic coupling

Table 1 shows that the article with the strongest link (29 citations and 92 total link strengths) is Zerbino *et al.*'s (2018), which studies Big Data-enabled CRM. Within the same line of enquiry, the highest link strength paper is Hallikainen *et al.*'s (2020), which explores the use of Big Data analytics in CRM with a focus on B2B firms. These findings indicate that Big Data can be considered the cornerstone of AI applications in CRM systems (Borges *et al.*, 2020; Deshpande and Kumar, 2018; Saidulu and Sasikala, 2017).

The article by Chatterjee *et al.* (2019), ranking seventh in terms of total link strength within the sampled articles, is among the first to discuss approaches and challenges of AI–CRM integration, which is defined as a "hybrid modern system" required by firms to better analyse customers' data strategically, improve their overall business process and ensure accurate decision-making without human intervention.

In addition, among the 10 articles with higher total link strengths, most are very recent as well as already heavily cited (Table 1). Three of these articles look at the state-of-the-art and research opportunities of using text or image mining techniques in service research (Villarroel Ordenes and Zhang, 2019) and, in particular, in CX management (McColl-Kennedy *et al.*, 2019; Holmlund *et al.*, 2020). This evidence supports the increasing scholarly attention focussed on investigating AI techniques, such as text and image mining, and shows that applying these techniques to CX can offer significant insights in that matter.

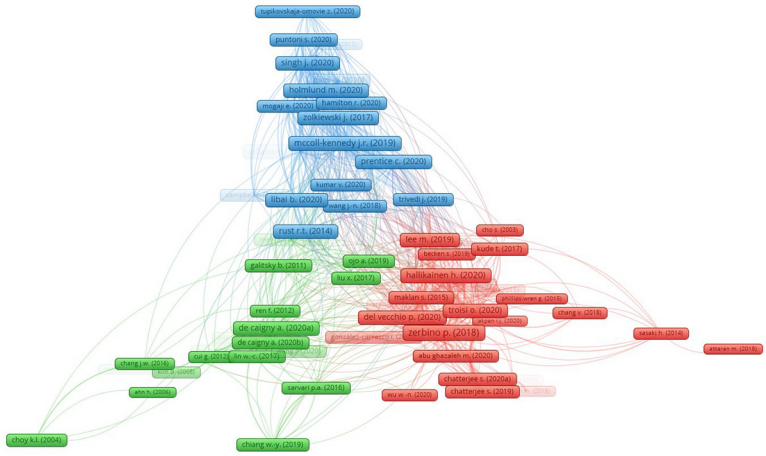
The bibliographic coupling of the articles shows that papers are clustered around three main groups, depicted by three colours (Figure 3). In particular, the node size is proportional to the total link strength of each article, whereas the line thickness represents the co-occurrence frequency of pairs. In addition, the position of a node gives insights into the nodes' connections: the closeness of two articles indicates that they have several citations in common (Marchiori and Franco, 2020).

The following two articles at the centre of the graph form the pillars in this research domain: Rust and Huang (2014), a study on how the IT and service revolution are transforming marketing science by enhancing the ability to provide more personalised services and deepen customer relationships, and Liu *et al.* (2017), a study on the use of linguistic-based text analytics (text mining and sentiment analysis) to derive latent brand topics and classify brand sentiments on social media.

Table 1 More related articles in the data set (based on total link strength)

Author (s)	Title	Year	Links	Total link strenght	Citations
Zerbino *et al.*	Big Data-enabled Customer Relationship Management: A holistic approach	2018	36	92	29
McColl-Kennedy *et al.*	Gaining Customer Experience Insights That Matter	2019	38	69	38
Villarroel Ordenes & Zhang	From words to pixels: text and image mining methods for service research	2019	33	65	6
Hallikainen *et al*	Fostering B2B sales with customer big data analytics	2020	27	62	10
Prentice & Nguyen	Engaging and retaining customers with AI and employee service	2020	35	58	1
Holmlund *et al.*	Customer experience management in the age of big data analytics: A strategic framework	2020	27	57	10
Chatterjee et al. (Chatterjee *et al.*, 2019)	Are CRM systems ready for AI integration?: A conceptual framework of organizational readiness for effective AI-CRM integration	2019	23	54	1
Lee *et al.*	Multisensory experience for enhancing hotel guest experience: Empirical evidence from big data analytics	2019	32	53	11
Libai *et al.*	Brave New World? On AI and the Management of Customer Relationships	2020	27	53	8
Hoyer *et al.*	Transforming the Customer Experience Through New Technologies	2020	24	52	6

Figure 3 Bibliographic coupling network, with a minimum of one citation



Source: VosViewer 1.6.15

Turning to the three formed clusters, the red cluster is the largest (38 articles), followed by the green and blue clusters (32 and 29 articles, respectively).

In the red cluster, articles deal with the management of Big Data and their impact on CRM (Hallikainen *et al.*, 2020; Zerbino *et al.*, 2018), with a particular focus on knowledge management and information assets for, from and about customers (Chatterjee *et al.*, 2020a, 2020b; Del Vecchio *et al.*, 2020; Talón-Ballestero *et al.*, 2018).

In contrast, in the green cluster, there are articles proposing AI-based techniques that support CRM business activities, such as customers' life event prediction (De Caigny *et al.*, 2020a, 2020b), customer churn prediction (De Caigny *et al.*, 2020a, 2020b), high-value customer identification (Chang *et al.*, 2016; Chiang, 2019) and sentiment analysis (Liu *et al.*, 2017; Mukherjee and Bala, 2017).

Finally, in the blue cluster, we find articles that deal with how to integrate Big Data insights into automated processes related to key customer touchpoints to improve customer value (Spiess *et al.*, 2014) and how to use AI to deliver coherent streams of connections through different touchpoints for effective customer engagement (Singh *et al.*, 2020). In the centre, still in blue, some articles examine how AI might affect the core characteristics of CRM (Libai *et al.*, 2020) and improve operational efficiency and customer service (Prentice and Nguyen, 2020), in particular with the use of bots (Trivedi, 2019).

To further investigate the degree of connectivity among articles, we analysed the citations among them. Table 2 lists the articles according to the number of *local* citations (i.e. how many times an article cites or is cited by other articles within the sample) and *global* citations, which refers to the total citations for the article. As presented in Table 2, global citations are

Table 2 Top 10 most local cited articles

Author(s)	Title	Year	Local citations	Global citation
Rust *et al.*	The service revolution and the transformation of marketing science	2014	5	141
Mccoll-Kennedy *et al.*	Gaining Customer Experience Insights That Matter	2019	5	38
Kumar *et al.*	Influence of new-age technologies on marketing: A research agenda	2019	5	23
Gupta *et al.*	Digital Analytics: Modeling for Insights and New Methods	2020	5	5
Arco *et al.*	Embracing AI and Big Data in customer journey mapping: From a literature review to a theoretical framework	2019	5	1
Phillips-Wren and Hoskisson	An analytical journey towards big data	2015	4	43
Libai *et al.*	Brave New World? On AI and the Management of Customer Relationships	2020	4	8
Zerbino *et al.*	Big Data-enabled Customer Relationship Management: A holistic approach	2018	3	29
Holmlund *et al.*	Customer experience management in the age of big data analytics: A strategic framework	2020	3	10
Galitsky & De La Rosa	Concept-based learning of human behavior for customer relationship management	2011	2	39

remarkable, revealing how the issue of AI in the management of customer relationships is relevant, cross-cutting and draws the attention of academics in other research areas (Niknejad *et al.*, 2021).

3.2 Keywords' co-occurrence

Out of the dataset of 1,560 keywords, the top 55 keywords with at least 4 occurrences defined as the "number of articles in which a keyword occurs" were selected (Van Eck and Waltman, 2020) (Figure 4). The keyword's number of occurrences defines the node size. The most frequently related keywords are classified into three clusters. The lines represent the connections among the keywords, and the colours identify the clusters to which the keywords belong. In addition, keywords closer to each other have a stronger relationship than farther keywords (Van Eck and Waltman, 2020). Table 3 supports the results of Figure 4 by presenting the occurrences (weight) of the keywords among the different clusters.

If we look at the results of the cluster analysis, we can distinguish among three main conceptual streams in the academic discussion regarding AI and CRM, which are coherent with the previous three clusters identified with the bibliographic coupling analysis.

In the red cluster, the most frequently occurring keywords are *Big Data*, *information management* and *social media*. In addition, in this cluster, there are several keywords related to networks and data processing (such as *internet, social media, social networking, database, mathematical models and computer software*). In particular, the strong link between *Big Data* and *sentiment analysis* highlights a rising interest in the applications of sentiment analysis on Big Data produced through telecommunication networks and social media.

In the green cluster, the most common keywords are *machine learning, sales* and *marketing*. In general, in this cluster, there are keywords of systems/techniques/models based on ML and AI (mainly related to classification and regression) bounded to keywords of business activities and practices related to CRM (such as sales, marketing, public relations, commerce and forecasting).

In the blue cluster, the most frequently occurring keywords are *artificial intelligence, customer experience* and *customer relationship management*, which are also strongly related. In general, in this cluster, there are keywords of data science (such as *Big Data analytics, business intelligence, Internet of Things, data mining and data analysis*) related to keywords of customer-centric vision (such as *customer relationship management, customer experience, customer journey, customer management and customer loyalty*).

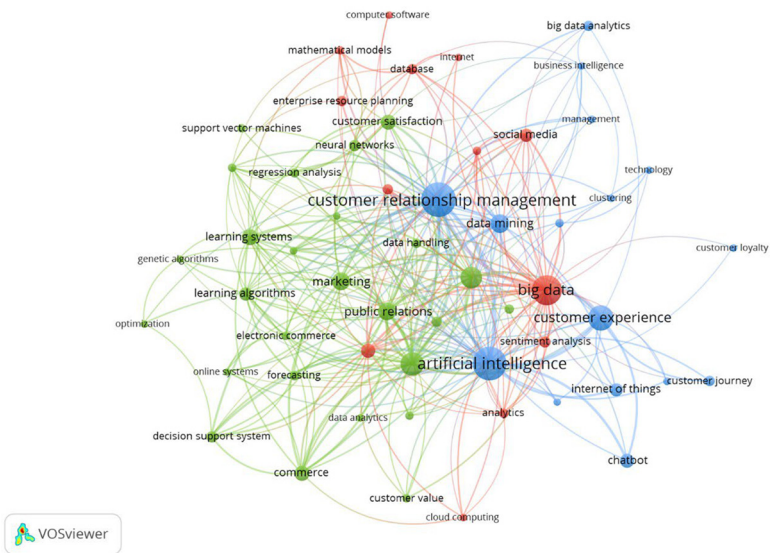
We also examined the keywords' co-occurrence by adopting a temporal perspective to trace the development of the conceptual structure of the field over time. For this purpose, we examined the average publication year of keywords (Van Eck and Waltman, 2020). Figure 5 represents the overlay visualisation of the keywords' co-occurrence network, where a colour scale indicates the average publication year of keywords. Figure 5 shows that the keywords corresponding to the red cluster are the oldest, whereas those in the blue cluster are the most recent ones, showing a very recent academic interest.

In addition, we examined the development of the conceptual structure of the field of AI in CRM, looking at the co-occurrence of keywords by considering the importance within the academic community. For this purpose, we considered the "average normalized number of citations received by the articles in which a keyword occurs" (Van Eck and Waltman, 2020) (Figure 6):

> [. . .] the normalized number of citations of an article equals the number of citations of the article divided by the average number of citations of all articles published in the same year and included in the data that is provided to VOS viewer (Van Eck and Waltman, 2020).

Thus, normalisation accounts for the fact that older articles have had more time to receive citations (Van Eck and Waltman, 2020). In general, keywords within the blue cluster are the most cited, although with some exceptions.

Figure 4 Keywords' co-occurrence network, with a minimum of four occurrences



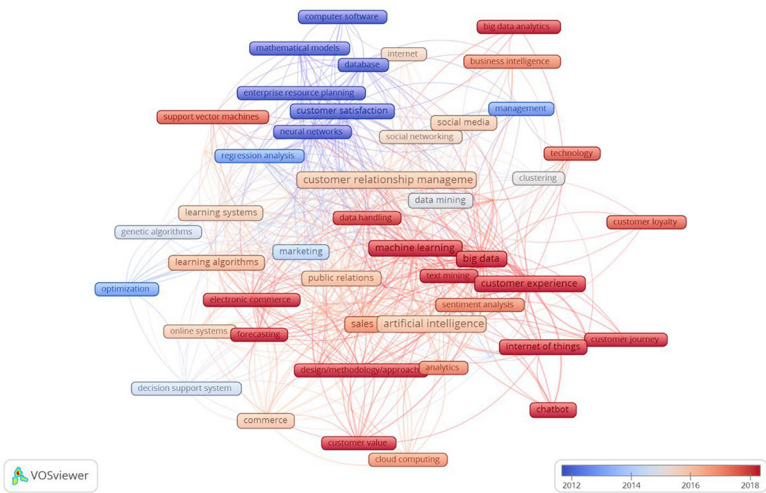
Source: VosViewer 1.6.15

Table 3 Occurrences of keywords

Red cluster	Weight	Green cluster	Weight	Blue cluster	Weight
Big Data	50	Sales	32	Customer Relationship Management	68
Information Management	12	Machine Learning	28	Artificial Intelligence	66
Social Media	10	Marketing	19	Customer Experience	37
Sentiment Analysis	8	Public Relations	18	Data Mining	20
Database	7	Learning Systems	15	Chatbot	12
Decision Making	7	Customer Satisfaction	14	Internet Of Things	11
Enterprise Resource Planning	7	Commerce	13	Big Data Analytics	7
Analytics	6	Learning Algorithms	10	Customer Journey	7
Mathematical Models	5	Decision Support System	8	Customer Management	5
Social Networking	5	Neural Networks	8	Business Intelligence	4
Cloud Computing	4	Deep Learning	7	Clustering	4
Computer Software	4	Data Handling	6	Customer Loyalty	4
Internet	4	Forecasting	6	Data Analysis	4
		Regression Analysis	6	Management	4
		Text Mining	6	Privacy	4
		Behavioral Research	5	Technology	4
		Customer Value	5		
		Design/Methodology/Approach	5		
		Electronic Commerce	5		
		Support Vector Machines	5		
		Data Analytics	4		
		Decision Trees	4		
		Genetic Algorithms	4		
		Online Systems	4		
		Optimization	4		
		Predictive Modeling	4		

Note: The table divides 55 top keywords into the three clusters to which they belong and presents the occurrences (weight) of each keyword from 4

Figure 5 Overlay visualisation – average publication yearSource: (colour printing)

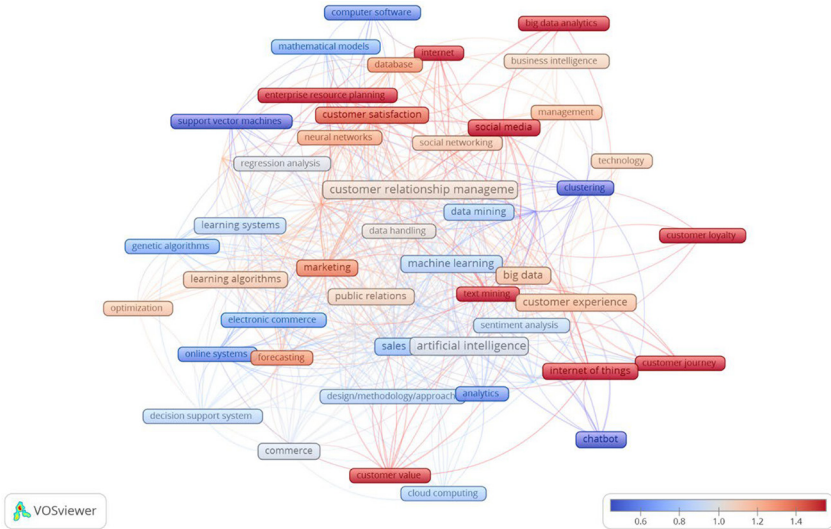


Source: VosViewer 1.6.15

Overall, the results of these analyses make it possible to draw some interesting insights about the rising trends within the field of AI in CRM.

Within the red cluster, the keyword with the most recent average publication year is *Big Data* (i.e. 2018), higher than that of *artificial intelligence* (i.e. 2015,8). *Big Data* also has a higher average normalised citation index than *artificial intelligence* (1,14 versus 0,97). This shows that the red cluster, despite being the oldest, is still evolving; thus, new research opportunities on information management

Figure 6 Overlay visualisation – average normalised citationsSource: (colour printing)



Source: VosViewer 1.6.15

when dealing with Big Data, as well as its impact on CRM, arise.

In addition, as shown in Figures 5 and 6, keywords such as *text mining*, *Big Data analytics*, *customer journey* and *Internet of Things* are very recent, and the articles in which they occur are widely cited, meaning that they are strong rising themes within the field of AI in CRM.

Text mining, which appears in the green cluster, is an AI-powered technique for transforming unstructured text into structured data suitable for analysis or driving ML algorithms. Furthermore, it is strongly related to *sales* and *deep learning*. The former relationship highlights the rising trend of using text mining to spot and prevent decreasing sales (McColl-Kennedy *et al.*, 2019), while the latter emphasises the increasing interest in deeper text analytics enabled by deep learning (Ojo and Rizun, 2019). However, deep learning in the CRM domain is still in its infancy. The keyword *deep learning* occurred only seven times in the sample, with a paper average publication year of 2019,7.

The keyword of *Big Data analytics* belongs to the blue cluster and is strongly related to *customer relationship management*, *customer experience* and *business intelligence*. The differences among Big Data analytics, ML and AI applied to CRM should be stressed. Big Data analytics develop insights from data and information within CRM systems to support decision-making. ML optimises decision-making by creating predictions, whereas AI produces actions and makes decisions independently (Grover *et al.*, 2018; Holmlund *et al.*, 2020).

The *customer journey* keyword also belongs to the blue cluster and is strongly related to *artificial intelligence*, *customer experience* and *privacy*, but the node size and position show that it has not yet caught much scholarly attention. However, Figures 5 and 6 show that the *customer journey* keyword is very recent, and the articles in which it occurs are widely cited, meaning that customer journey has become an important research topic unbound from CRM. In addition, the strong nearness between *privacy* and *customer journey* keywords depicts the nascent consideration of the privacy issue that necessarily occurs when AI is deployed in the interaction between brand and users (Puntoni *et al.*, 2020).

The *Internet of Things* keyword is strongly related to *artificial intelligence*, *customer relationship management and customer experience*. The Internet of Things (IoT) powered by AI is dramatically transforming CX and CRM. While IoT deals with interacting devices through the internet, AI makes devices learn from their data and experience. IoT supports organisations to innovate CRM in terms of trackage of customers' behaviour in real time and automation of data sourcing, enhancement of situational awareness, sensor-driven decision analytics for retailing and marketing and automated monitor and replying to the customer (Lokuge *et al.*, 2020; Ng and Wakenshaw, 2017).

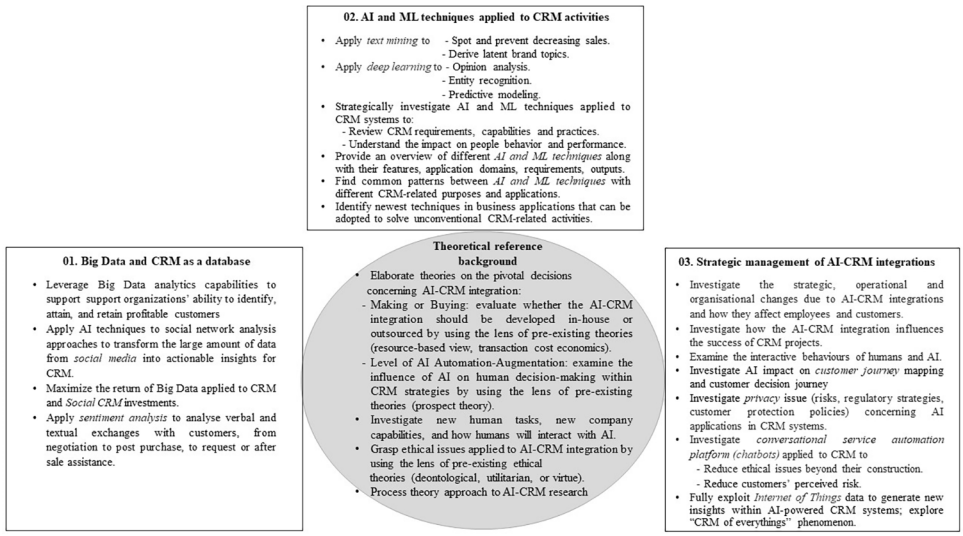
Finally, *chatbot*, an AI-enabled tool frequently used in organisations to facilitate processes, especially those related to after sales and personalisation (Przegalinska *et al.*, 2019), has not yet captured much scholarly attention (Figure 6).

4. Discussion

The results illustrate a sharp fit among the three clusters resulting from bibliographic coupling, which holds articles sharing common references, and the three clusters resulting from the keywords' co-occurrence, which groups the most frequently related keywords. On this basis, combining the findings of bibliographic coupling and keywords' co-occurrence, we identified three subfields of research on AI in CRM and captured promising paths for future development, as summarised in Figure 7.

The first subfield of research, labelled "Big Data and CRM as a database", considers CRM as a database on business prospects and customers and focusses on the information management of Big Data within CRM. This subfield is the oldest to be studied, even though it is not yet mature. Within this subfield, we identified two main themes: *information management and social media*.

Figure 7 Promising paths for future research related to AI in CRM



Information management is concerned with the analytical part of CRM (Buttle, 2009). It involves collecting, organising and using information related to customers and supports executives in developing insights into consumer preferences and behaviour (Thakur and Chetty, 2019) . Given the growing interest in value creation from incorporating Big Data into CRM decisions, companies are recognising the value of data to obtain an increasing amount of detailed information about their customers and the power of Big Data analytics to improve the decision-making process (Bernardino and Neves, 2016). However, the advent of Big Data has led to even more challenges as companies struggle to develop analytical capabilities, intended as abilities that organisations use for extracting useful information from data, which can support organisations' ability to identify, attain and retain profitable customers (Kumar *et al.*, 2020; Mikalef *et al.*, 2020; Wang and Feng, 2012). Investigating this issue is not only interesting for companies' managers but also for all other entities who are involved in information management (e.g. data managers, data architects, regulators and suppliers) (Kumar *et al.*, 2020).

The results also maintain a rising interest in social CRM (SCRM) (Anshari *et al.*, 2015; Chang, 2018; El Fazziki *et al.*, 2017) and SCRM analysis (He *et al.*, 2015). In today's competitive business environment, companies increasingly need to listen to, as well as understand, customers' expectations, opinions and conversations on social media networks and analyse them within a CRM system to obtain meaningful insights regarding their business opportunities. In this view, Del Vecchio *et al.* (2020) demonstrated how the integration of Big Data analytics and netnography is relevant for the development of an effective CRM strategy. However, the application of AI techniques to social network analysis approaches to transform the considerable data available on social media into actionable insights for CRM is still little explored in the literature, and fresh research along this perspective is more than welcome.

In addition, as companies are increasingly investing resources in Big Data and social media without completely acknowledging the return on these investments, scholars should deepen this issue, investigating how to measure first, and then maximise the return on Big Data applied to CRM and SCRM investments. In this context, scholars might supplement the performance methods usually used in marketing with those frequently used in information system research to improve the assessment of these investments (Maklan *et al.*, 2015).

Findings have also proved a growing interest in the application of sentiment analysis on Big Data obtained through social media networks (El Fazziki *et al.*, 2017; He *et al.*, 2015). Sentiment analysis can be a powerful weapon to increase customers' vision not only outside the company but also within, exploiting CRM capabilities in collecting and analysing customer data. Organisations can use sentiment analysis to analyse verbal and textual exchanges with customers throughout the customer journey, from negotiation to post purchase, to request or after sale assistance, and new research along all these perspectives is recommended. In accordance with Kietzmann and Pitt (2020), we also encourage academics to use AI to obtain value from the text and other contents created by companies and their customers.

The second subfield of research focuses on "*AI and ML techniques applied to CRM activities*" and in accordance with Wang and Hajli (2017), we observe that this constantly growing body of research has mostly addressed the development, analysis and comparison of different AI and ML techniques. However, to completely benefit from AI and ML techniques within CRM systems, business organisations need to approach them from a strategic viewpoint rather than from a mere technical viewpoint (Iansiti and Lakhani, 2020). In particular, CRM requirements, capabilities and practices must be reviewed, and their impacts on people's behaviour and performance must be understood, ensuring that the new technological applications fit the organisational context and CRM strategy (Catalan-Matamoros, 2012).

In addition, articles within this subfield compare innovative ML-enabled techniques, developed for specific functional applications, such as high-value customer identification, customer churn prediction and customer lifetime value prediction, with long-established techniques. In particular, the two most promising techniques identified in the study are *text mining* and *deep learning*. The fruitful areas of practical development of text mining are the prevention of sales decreases and derivation of latent brand topics. Areas of rising managerial and academic interest regarding the use of deep learning in CRM are opinion analysis, entity recognition and predictive modelling.

In fact, some studies have validated a specific technique in a real-world setting (Spiess *et al.*, 2014; Chatterjee *et al.*, 2020a, 2020b; Mogaji *et al.*, 2020); however, these examples are still few and isolated, and the literature does not yet provide an overarching big picture that presents and compares these new techniques and their applications. As the selection of a technique depends on many factors (e.g. sector, marketplace, level of personalisation or customer intrusion), it would be useful to provide an overview of the different techniques along with their features, application domains, requirements and outputs, thus providing guidelines to support managers to choose the most suitable technique that optimally uses the available data within a specific context.

Researchers can also advance the theory in the field by finding common patterns between techniques with different CRM-related purposes and applications or by identifying new techniques in business applications that can be adopted to carry out unconventional CRM-related activities. For instance, a convolutional neural network (CNN) has been adopted to analyse textual information (De Caigny *et al.*, 2020a, 2020b), but it can also be applied to a different data source (e.g. time-series data) or for a different purpose (e.g. sentiment and intent analyses of customer reviews). Therefore, future research can investigate the incorporation of time-series data into customer churn prediction models based on a CNN or of time-series data in sentiment and intent analyses of customers' reviews based on a CNN.

The third subfield of research, labelled as "*Strategic management of AI-CRM integrations*", looks at AI–CRM integration from a broader strategic viewpoint, rather than analysing specific technological applications. This subfield considers CRM as a tool that drives strategy through actionable insights, rather than as a database, and focusses on AI applied to CRM within a customer-centric vision. This third cluster contains the most recent papers, which start to debate AI considering the challenges, benefits and advantages it can provide to CRM processes and considering the required organisational, cultural and strategic changes. The shift in perspective from technology development to strategy advancement reflects the growing interest in conducting a renewed examination of how technology interacts with the CRM strategy. AI will have a disruptive impact on the strategy development process. For instance, AI can identify future events in the market, estimate product demand (Arco *et al.*, 2019; Campbell *et al.*, 2020; Kumar *et al.*, 2020), implement a dynamic customer strategy (Yi, 2018), optimise targeting decisions, customise messaging to specific target audiences and identify bestselling characteristics to address (Kumar *et al.*, 2019). As other tasks will be redefined, AI will lead to several possibilities for CRM strategies and process innovations (Tekic *et al.*, 2019). However, this literature is still in its infancy, with very few case studies. For instance, researchers can deeply investigate the strategic, operational and organisational changes that AI–CRM integration entail (Wang and Hajli, 2017), how these changes will affect employees as well as customers (Kumar *et al.*, 2020) and how AI–CRM integration will influence the success of CRM projects. In examining these aspects, scholars should broaden their perspective and consider hybrid organisational systems, which include both humans and AI, exploring their interactive behaviours (Raisch and Krakowski, 2020).

In addition, we identify three main themes that can be addressed in the future: customer journey, chatbots and IoT.

Customer journey mapping and customer decision journey might be impacted by the fresh knowledge made available by AI, characterised by higher accuracy, suitability and timeliness, thus leaving room for investigation (Lemon and Verhoef, 2016). AI can allow a deeper dive into customer decision journeys, identifying an opportunity for an intervention or change (Lemon and Verhoef, 2016) as, for instance, automatically identifying potential anomalies in customer behaviour or negative sentiments. As AI will infer customer behaviours, trends and preferences (Marinchak *et al.*, 2018), privacy issues will become a priority. Chatterjee *et al.* (2020a, 2020b) are among the first to investigate the adoption of AI-integrated CRM systems from a privacy perspective, paving the way for an interesting path for future research. To the best of our knowledge, no study has yet deeply investigated risks, regulatory strategies and customer protection policies concerning AI applications in CRM systems.

Another promising research theme concerns chatbots, which are increasingly used in customer service to tackle requests or complaints, even though customers are still perceiving some risks in their use. Recently, academics have started exploring the implementation processes, impacts, drivers and challenges of chatbot application in marketing (Sujata *et al.*, 2019) and CRM (Anjali Daisy, 2020), providing insights to reduce the customers' perceived risk in its use (Trivedi, 2019). However, no studies have yet investigated the ethical issues beyond conversational service automation platform construction (chatbots). In addition, chatbots used together with other technologies, such as smartphones, virtual assistants and augmented reality, will increase the omnichannel strategy intricacy (Wilson-Nash *et al.*, 2020), and AI will help to predict the optimal combination of channels to reach customers (Hopkinson and Singhal, 2018). The use of AI to deliver coherent streams of interaction across diverse touchpoints is another relevant research issue that calls for further research (Singh *et al.*, 2020).

Another rising theme is IoT, which is considered a key disruptive technology for CRM in the future (Lokuge *et al.*, 2020). Allowing the collection of customers' real-time data, IoT makes the relationship with CRM intriguing. How firms might use IoT to design and build exceptional CX, how IoT can bring CRM to a higher level, the so-called "CRM of everything" and how real data can generate insights to take actions are some of the open questions that need to be

researched (Abu Ghazaleh and Zabadi, 2020; Lokuge *et al.*, 2020).

Taking an overarching perspective, the reviewed articles contribute to advancing knowledge in the field of AI in CRM by categorising phenomena, providing intellectual insights or developing frameworks to create an overall understanding. However, papers that advance theories formulating propositions or test theories remain scant. Thus, we wish future contributions to expand the theoretical reference background to better comprehend how AI is shaping CRM.

In this light, more research that elaborates strategic management theories on pivotal decisions concerning AI–CRM integration is required. For example, in terms of making or buying decisions, both the resource-based view (RBV) theory (Barney, 1991) and the transaction cost economics (TCE) (Williamson, 1979) theory can serve as theoretical lenses to evaluate whether AI–CRM integration should be developed in-house or outsourced. In particular, following RBV, the AI application should be implemented internally if it is considered a fundamental capability for developing knowledge in managing customer relationships and maintaining competitive advantage (Grover *et al.*, 2018; Zerbino *et al.*, 2018). Following the TCE theory, considerations related to asset specificity, opportunism, frequency of transaction and environmental/behavioural uncertainty should be taken into account when deciding between developing AI internally or outsourcing. Turning now to the decision on the level of AI automation–augmentation, management scholars should examine the extent to which AI results influence human decision-making within CRM strategies to clarify the real impact of different levels of AI automation–augmentation on CRM performance. To date, in most cases, within the CRM domain, the final decision still remains with humans. However, the more AI applications are automated, the more they will lead the decision-making process. In this view, humans should interact with AI algorithms to drive the CRM decision-making process. For example, AI analyses consumers' past behaviours to transfer the most promising sales opportunities to vendors. Based on this issue, the prospect theory, which maintains that human decision-making depends on choosing among options that can themselves rest on biased judgments (Kahneman *et al.*, 1979), can be adopted as a theoretical perspective to examine the influence of AI on human decision-making. Some may fear that the automation afforded by AI technologies will replace humans, whereas others state that they will elevate employees' roles, which will allow them to invest their time in creative tasks rather than in mere operating processes (Campbell *et al.*, 2020). What is certain is that humans will have less and less interface with unprocessed data, and their tasks will increasingly be impacted by AI (Rust, 2020). Thus, future research should also investigate what humans' new tasks will be, what capabilities a company must have to remain competitive and how humans will interact with AI. Furthermore, humans should be able to transparently identify the logic behind a given decision and to verify the morality of the action; thus, AI must be programmed with a rule-based system of ethics. However, we observed a lack of studies on ethics applied to AI–CRM integration. Future studies can also grasp ethical issues by using the lens of different pre-existing ethical theories, such as deontological, utilitarian or virtue ethics (Manna and Nath, 2021) and, thus, help managers find the right balance between ethical concern consideration and AI application effectiveness.

Finally, only a few studies have used a longitudinal perspective for analysing how AI–CRM integration projects are implemented and develop over time; thus, we recommend that future studies should adopt a process theory approach in investigating this subject.

5. Conclusion

Answering the call of Raisch and Krakowski (2020) to develop comprehensive perspectives on the AI debate in management, this study identifies and describes three subfields that shape and characterise this literature within the CRM domain: Big Data and CRM as a database, AI and ML techniques applied to CRM activities and strategic management of AI–CRM integrations.

The findings suggest that CRM is evolving from a data-driven strategy to an AI-driven strategy (Colson, 2019). In addition, very recently, scholars have been approaching the topic with a broader strategic perspective to harness the power of AI to improve CRM, rather than only investigating specific technological applications to maximise the operational efficiency or CX within a single CRM activity. However, further development of the two subfields "Big Data and CRM as a database" and "AI and ML techniques applied to CRM activities" might be beneficial to support the growth of the third subfield.

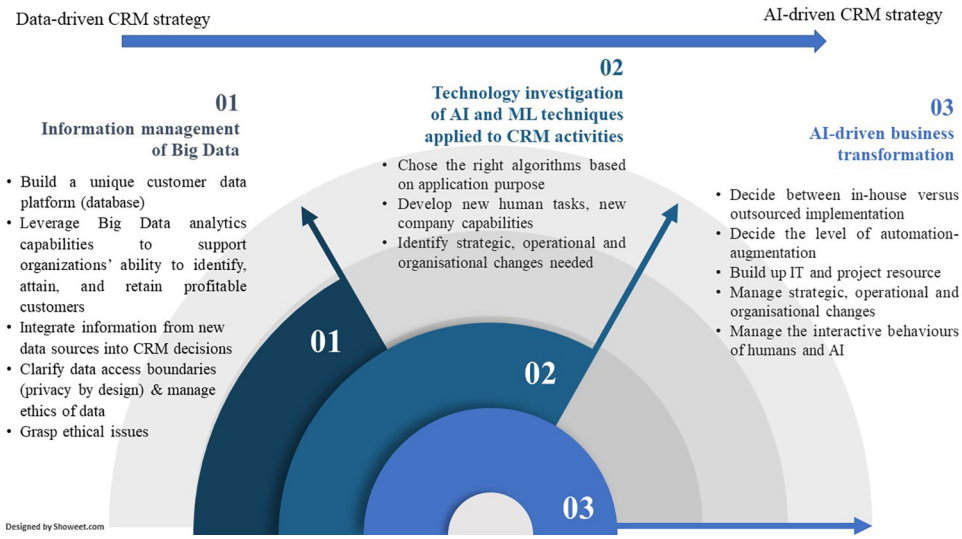
Based on our findings, we developed a conceptual model (Figure 8) that integrates the identified subfields and proposes a three-step strategy for AI implementation in CRM:

1. information management of Big Data;
2. technology investigation of AI and ML techniques applied to CRM activities; and
3. AI-driven business transformation.

The model sets out the initiatives and actions that should be deployed in each step to achieve an AI-driven CRM strategy. For this purpose, managers need to set the strategic goals of business transformation from the beginning and start by creating a unique customer data platform from which new information can be integrated into CRM decisions. Subsequently, they can investigate specific algorithms meant to solve narrow business challenges related to customer relationships; in this context, managers need to reflect upon new employees' competencies, keeping in mind the strategic, operational and organisational changes. Finally, once specific applications have been successfully implemented, managers can move to the last step, where an overarching AI-driven CRM strategy is fully realised. The model can assist executives and managers in identifying the appropriate and consistent business strategy for the effective integration of AI into CRM systems.

This study makes several significant contributions to theory and practice. First, from an academic viewpoint, this study traces the development of research on AI in CRM, depicting the main subfields that have characterised the recent evolution of this fragmented literature. These findings are underpinned by a robust literature review and bibliometric techniques that allow mapping of the research field without subjective bias. Accordingly, this study empowers scholars to gain a one-step overview of AI in CRM and positions their intended contributions within this field (Donthu *et al.*, 2021). Second, this study outlines the main underdeveloped issues on this topic and addresses avenues for future novel research. The results will enable academics from various domains (e.g. Big Data, AI, customer relationship and marketing management) to

Figure 8 Three-step strategy for AI implementation in CRM



work further to develop a common understanding of the relationship between AI and CRM, which will ultimately advance knowledge and benefit organisations. Third, this study develops a three-step conceptual model for AI implementation in CRM, which might support scholars in further deepening the knowledge in this field, also through empirical analysis. The model is far from encompassing all actions for an effective implementation; consequently, further research is required to enrich it and make it contingent to different business contexts.

From a managerial viewpoint, this study offers insights for organisations and managers willing to enable CRM systems to take advantage of the opportunities offered by AI, providing guidelines to capture the main directions along which AI–CRM integration is evolving and managerial practices to make this integration forceful and productive. The proposed model serves as a guideline tool for executives and managers to plan an appropriate and consistent strategy for AI implementation in CRM and improve efficiency in the information management of Big Data, technology investigation of AI and ML techniques and AI-driven business transformation. In addition, the model can provide practical knowledge for organisations to conduct a self-introspection of their strategy and assess if they are missing actions for an effective implementation of AI into CRM systems.

Despite these contributions, our study has some limitations that can also offer avenues for extending research. First, limitations are mainly related to the shortcomings of citing behaviour, because bibliographic coupling does not capture the objectives or motivations that guided the authors in citing prior articles (Vogel and Güttel, 2013; Soranzo *et al.*, 2016). Furthermore, articles with more references are over-weighted as they probably present more intersections with the references of other articles (Agostini and Nosella, 2019). Second, future work can operationalise and test the proposed conceptual model, identifying possible moderators, mediators and controlling factors to build a comprehensive and thorough understanding.

In conclusion, we hope that our study can be a source of inspiration for future studies to advance knowledge of AI in the CRM domain, as it provides useful knowledge to design and publish fresh research and highlights emerging themes that can offer significant theoretical and empirical contributions to the field of CRM and beyond.

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