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CRM Analytics in Banking: A Survey of Data-Driven Customer Engagement Tactics

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Abstract: *Customer Relationship Management (CRM) has emerged as a significant strategic tool of the modern-day banking institutions in the midst of the fast digitalization. The old CRM systems of data capture of customer interaction are being eliminated by the new data-driven analytics solutions that are founded on artificial intelligence (AI), machine learning (ML), and big data technologies. The CRM analytics enable the banks to get to know the customers better in terms of their behavior, preferences, as well as financial needs, and personalize with them in a timely and relevant way. By integrating predictive and prescriptive analytics, sentiment analysis, and recommendation systems, financial institutions are able to increase customer acquisition and retention and lifetime value and identify cross-selling and upselling opportunities. Additionally, CRM analytics is crucial in banking operations, which include credit evaluation, risk, fraud, and competence. Bank's high-tech data-based solutions allow the customer to be profiled, churned, and proactively reach out to the customer within the omnichannel interfaces. Irrespective of this, there still exist issues of data governance, privacy, ethical concerns and the use of trained professionals. The essay covers the current CRM analytics in the banking industry, its framework, methodology, and technology employed to maximize customer touchpoints. It also highlights the empirical evidence, emergent patterns, and voids and offers data about how banks can use analytics-based strategies to boost competitive edge and sustainable customer relationships.*

Keywords: CRM Analytics, Data-Driven Banking, Customer Engagement, Machine Learning, Predictive Analytics, Customer Retention, Personalization

I. INTRODUCTION

Customer Relationship Management (CRM) is now an important part of any modern bank's strategy in this age of rapid digitalization. Formerly geared toward maintaining a record of the contacts with the customers, CRM has evolved into a central component in helping the bank to surpass the stiff competition, especially as the fintech companies and tech-enhanced service providers emerge [1][2]. As the customer demands continue to evolve due to the reality of real-time, personalized services on the digital platforms, banks are increasingly being compelled to forego the rule-based CRM systems, to smart and data-driven CRM analytics solutions [3]. The advent of big data, AI, and ML is motivating this shift because it allows banks to move away from a reactive service delivery approach and toward a proactive and predictive interface with their customers [4].

The analytics of customer relationship management have grown in importance in providing customers with personalized, relevant, and timely experiences. Advanced techniques of analysis enable the banks to know more about the customers' behaviors, spending habits, financial needs and events of the lifecycle. These insights are used to enable the institutions to enhance customer acquisition, retention, and customer lifetime value [5]. Furthermore, CRM analytics contributes to such important functions as credit risk scoring, fraud detection, complaint resolution, and targeted marketing. Using automated recommendation engines and predictive modeling, banks have the ability to recognize cross-selling and upselling opportunities, reduce operational risk and eventually achieve an increase in profitability and customer confidence.

The banking customer engagement strategies have also changed dramatically within the last ten years. In the early CRM

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initiatives [6]The interventions were highly manual, rule-based and generic service delivery, and they tended to give slow responses and lacked personalization [7]. As the digital change has occurred, banks have moved to the omnichannel of engagement systems, which are backed by automation and predictive analytics. The latest CRM products include the ability to perform customer segmentation, predict churn, sentiment analysis of social media and call history, and recommend systems that are customer-specific [8][9]. These technologies enable banks to predict customers' needs, enhance the responsiveness of services, and foster long-term relationships by means of personalized interactions on both physical and online touchpoints.

A solid technology foundation allows for the present CRM analytics ecosystem to exist. Financial institutions are able to manage massive volumes of data generated from a variety of sources, such as mobile banking, social media, automated teller machines, and in-branch interactions, by utilizing big data platforms [10]. Machine learning systems and predictive/prescriptive analytics help to forecast, model behavior, and make automated decisions. Real-time decision engines are responsive as they give customers and bank employees real-time recommendations and alerts [11]. Also, the CRM solutions now increase in scale, integration and flexibility due to cloud computing and open banking API ecosystems, allowing them to be collaborative with fintech partners and easily deploy analytics-driven services.

A. Structure of the Paper

The paper is organized as follows: Section II discusses CRM analytics concepts, system architecture, and benefits, Section III discusses the approaches that are data-driven, such as big data, predictive/prescriptive analytics, and NLP-based sentiment analysis, Section IV looks at customer engagement strategies including personalization, segmentation and prediction of churn, Section V gives a literature review with Section VI giving the conclusion of main findings and recommendations of further research and practice.

II. CRM ANALYTICS IN THE BANKING DOMAIN

CRM analytics within the banking sector aims at using data-oriented intelligence to improve customer knowledge, interaction and retention. The combination of sophisticated analytics systems can help banks to process transactional, behavioral, and social data in order to customize services, anticipate customer demands, and enhance relationships. Such an intelligence-based strategy facilitates active decision-making, enhanced customer satisfaction, and loyalty, which ultimately leads to profitability and competitive edge within the financial sector.

A. Concept of CRM Analytics

Customer Relationship Management (CRM) analytics can be defined as a methodical procedure of applying technology in order to gather, examine and comprehend information concerning customers in order to know and react to their demands. As it has been pointed out in the paper, CRM is one process that employs technology as an empowerment to capture, analyze, and share current and potential customer information in order to identify the needs of customers more accurately and to create valuable customer relationships. It is a blend of market intelligence, customer behavior intelligence, and intelligence based on data to aid in marketing, sales, and service activities. CRM analytics make organizations make better decisions and build customer relationships by incorporating information across various sources, including campaigns, transactions, and customer interactions [12]. A few suitable and efficient CRM application tactics can boost a bank's market competitiveness, such as:

- **Changing Mindsets:** A leader's position is crucial in bringing about a shift in perspective. Banking institutions should seek for seasoned individuals with strong leadership abilities who can inspire and persuade their colleagues to make beneficial changes. With the help of leadership coaching [13]Financial institutions are better able to address the problem of a lack of CRM expertise by providing training to their own staff, so it is imperative that these institutions prioritize employee career development and leadership training.
- **Organizational Learning Philosophy:** The modern banking business relies heavily on organizational learning philosophies (OLPs), which can be seen as a fast-adaptive culture. Utilizing OLP to its full potential entails doing

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things like holding frequent discussion sessions in tandem with CRM tactics, which allows businesses to take use of the hopes, concerns, opinions, and experiences of both consumers and employees.

- **Re-integration of Operational CRM:** Many banks have strong mathematical CRM skills, but they are weak in how to use and collaborate on CRM. In order to address the issue of low-quality customer data, it may be best to implement an integrated CRM system and interact with channel management [14]. When it comes to saving money and making transactions faster, online banking is a major game-changer.
- **Increasing Switching Cost:** The goal of developing tactics like focus distinction, customer intimacy, and exceptional service is to increase the switching cost for customers so that banks can retain more customers and increase the share of wallet from existing customers. Using competitive pricing and marketing strategies, and offering more reward points are two other options. Customers can feel appreciated by implementing any or all of these tactics.
- **Focus on Private and Premier Banking:** Providing first-rate private and premier banking services is vital, but reaching the pinnacle of CRM development requires a commanding presence in the private market. Customer relationship management's fundamental and final objective is the acquisition and retention of profitable customers. To entice more private banking customers, banks should market, package, and implement referral programs that offer more personalized and appealing products and services.

B. Components and Architecture of CRM Analytics Systems

Data analytics is essential in enhancing Customer Relationship Management (CRM) by converting unprocessed customer data into useful information that leads to valuable engagement [15]. It helps organizations to learn more about their customer preferences, preferences and needs so that they can create a more personal experience and targeted marketing strategies [16].The process starts with customer identification of the market customers (new or old customers) in order to facilitate targeted segmentation and acquisition. The information is then fed into the CRM system, as depicted in Figure 1, which is the main platform where customer data and interactions can be managed.

Organizations perform customer analysis, profiling, classification, and service evaluation through the CRM to come up with meaningful information. These lessons justify a systematic process of follow-up with the view to enhancing customer interaction and ensuring continued relationships. The results of the follow-up procedures inform the product sales strategies development, in such a way that the offerings are in accordance with the customer needs. Two-way communication between the bank and the CRM ensures that the information about customers is accurate and up to date and improves the work of decision-making throughout the process.

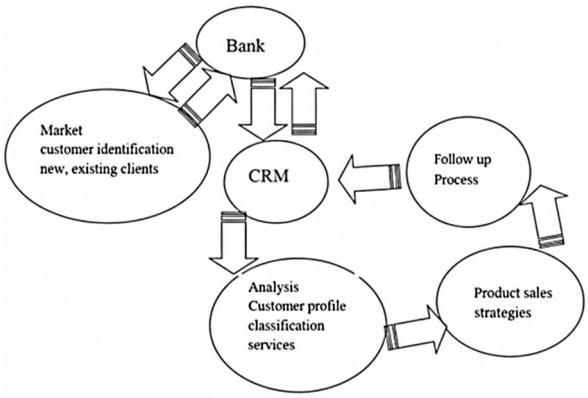

Fig. 1.CRM process in banking system[17]

C. Benefits of CRM in Banking

The following section identifies the main CRM features that assist organizations in tracking customer behavior, customer interactions, and customer information organization [18], and growth to aid in effective decision-making and long-term relationship development in Figure 2.

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Fig. 2. Benefits & Importance of CRM in Banking[19]

- **Track Preferences:** Tracking customers likes, their interests, and behavioral tendencies in order to tailor services and get better engagement
- **Track Purchases:** Documenting and managing customer history of purchasing in order to learn about buying behavior and assistive sales management.
- **Manage Communications:** Maintaining the cohesiveness and order among all communications channels, including email, phone, and electronic contacts, so as to guarantee regular and efficient customer contact.
- **Manage Customer Contacts:** Keeping a current database of customer contact data to facilitate interactions and relationship management.
- **Track Growth:** Evaluating customer growth, activity trends and general business development to facilitate strategic planning and performance analysis.

III. DATA-DRIVEN APPROACHES IN CRM

CRM data-driven strategies enable banks to make smart, evidence-based decisions using the power of Big Data, predictive analytics, and natural language processors. The practices enable understanding the customer behavior better, their approach to individual customer interaction, and their active retention. Combining machine learning and sentiment analysis, banks are able to derive actionable data on a large amount of data, improve the quality of services, and increase customer trust [20]. In general, data-driven CRM customizes the old banking to a dynamic and insight-based ecosystem that is customer-satisfied and loyal.

A. Big Data and Its Role in Banking CRM

The Customer Relationship Management (CRM) within the banking sector has an arrival aspect in the realm of Big Data because it enables the provision of a deeper insight into the behavior of the customer and their preferences and financial activity. It is through the analysis of big data of transactional and feedback information that banks are able to know how their customers are spending, how they are utilizing their channels, and their satisfaction with the services, so that they can offer more and more personalized services. Big Data helps banks predict what customers need, hence enhancing customer satisfaction and loyalty as they provide personalized services to the clients, which can be done through product cross-selling and providing personalized financial advice. Moreover, it enhances risk management, fraud detection by finding the hidden correlations between transactions and real-time fraud detection [21]. The integration of Big Data analytics can help the banks to shift to more efficient, customer-related, intelligence-oriented treatment of CRM, using it to improve customer communications and the economic situation of their operations. Lastly, Big Data may assist banks in converting raw data into useful information, which can create trust, satisfaction, and customer relationships in the long term.

B. Predictive and Prescriptive Analytics for Customer Insights

The essential tools that banks must target to understand their clients and interact with them can involve predictive analytics and prescriptive analytics. Predictive analytics is aimed at predicting customer behavior based on historical and real-time data, which helps the organization predict the trends, preferences, and possible risks of churn [22]. Prescriptive

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analytics takes it a step further and suggests the most efficient measures that define the optimal engagement, satisfaction, and general customer experience. Collectively, these strategies enable banks to convert the conventional CRM systems into intelligent ones that enable proactive decision-making, personal interactions, and lifelong learning.

Table I below is the summary of the main aspects, methods, uses, and results of predictive and prescriptive analytics in banking:

Table 1: Predictive vs. Prescriptive Analytics in Banking

Aspect	Predictive Analytics	Prescriptive Analytics
Purpose	Forecast customer behavior and identify trends	Recommend optimal actions to maximize engagement and satisfaction
Techniques	Machine learning models (e.g., XGBoost), deep learning algorithms	Optimization algorithms, decision models, scenario analysis
Data Used	Historical and real-time customer data	Insights derived from predictive analytics
Applications	Identify preferences, detect churn risks, personalize experiences	Optimize marketing campaigns, loyalty programs, and communication channels
Integration with AI	Supports NLP-based sentiment analysis and chatbots	Provides actionable recommendations for interventions
Outcome	Proactive retention strategies	Maximized engagement and satisfaction

C. NLP and Sentiment Analysis in Customer Feedback

Banks aiming to be able to grow sustainably and achieve a competitive advantage must operate with operational excellence. Banks are able to be more profitable financially and establish a better customer relationship through streamlined processes that lower costs, increase service quality, and boost profitability. In the process of achieving these objectives, regulatory compliance and ethical standards also represent another key requirement, which banks have to take into account, as NLP implementations have to be reliable and legally valid [23]. These plans help in terms of customer retention and an increase in margins in the long term. Value to the Bank is defined as being the economic value to the bank as sales, profits and growth rates. Value for Customers refers to the perceived value of the customer, which is the enhancement of financial value, brand trust, customer relationships and customer satisfaction. The improvement of the quality of services and products provided is a direct experience of this value.

- **Enhancing Customer Equity with NLP:** The banks take advantage of NLP to position their brand strategically and customize customer interactions, which enhances marketing behaviors. With the help of NLP-based insights, banks are able to increase CLV, and this results in increased profitability and a better relationship with customers in the long term. Besides, NLP-based insights should be used to optimize dynamic pricing strategies by banks [24]. An ability to predict customer behavior and price structuring along the customer expectations would help the banks to increase the profitability of each customer and the overall customer base equity.
- **Driving Value for the Bank with NLP:** Banks are advised to use NLP to support product innovation, maximize revenues, and reduce costs to improve financial success. The analysis of customer feedback through NLP can be used to influence product design by banks as well as make sure that new products offered by the bank are highly correlated with customer requirements. Not only is this the key to successful product launches, but it also helps in long-term revenue growth.
- **Creating Value for Customers with NLP:** Banks are encouraged to use NLP to improve the accessibility, inclusiveness, and quality of the banking services by delivering customized experiences as per the needs of the individuals. NLP-based and personalized investment advice can assist customers in making a smart financial investment that is in line with their risk profiles and financial objectives. Also, sentiment analysis and a multi-criteria decision-making combination make sure that the product suggestions are meaningful and important to a particular customer.

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D. Customer Engagement Strategies Through Analytics

The AI analytics allow banks to predict consumer behavior, divide the audience, and develop active retention campaigns. With personalization, segmentation and the use of churn prediction models, the financial institutions are able to detect the at-risk customers, provide the relevant offers in time and increase the engagement. Recommender systems and machine learning convert raw behavioral data into actionable insights so that banks can prevent attrition, improve satisfaction, and develop long-term loyalty in a competitive online environment.

E. Personalization and Recommendation Systems

Artificial intelligence can be applied in digital banking to create hyper-personalized experiences where each interaction is based on the individual behavior, preferences, and goals of a customer [25]. Deep learning and machine learning algorithms examine the history of transactions, lifestyle and engagement trends to form dynamic profiles that progress with time. The collaborative and content-based filtering are some of the techniques employed by recommender systems to recommend the appropriate financial products, including savings plans, investment options or credit offers at the most required time [26]. These systems can be perfectly combined with real-time analytics and sentiment analysis to ensure that each suggestion does not appear to be dated. This experience is also enhanced through natural language processing that occurs during customer interaction through the application of chatbots and digital assistants and the personal response to them [27][28]. This combination of behavioural analytics and recommendations provided by AI helps banks gain trust, build strong emotional bonds, and achieve a loyal customer relationship in a more competitive digital world.

F. Customer Segmentation and Targeting Models

Customer segmentation and targeting are critical areas of knowledge that every bank should understand in order to develop effective and profitable marketing strategies. This is the result of an analysis of the transactional data and the demographic data, which would enable the financial institutions to categorize the customers into different groups that have common behaviors, preferences, or needs. Recency, Frequency, and Monetary (RFM) segmentation with K-Means clustering techniques help the banks to set up the most loyal and valuable customers [29]. Such hybrid models aid in assisting the banks to identify the customer segments most likely to embrace online banking or react to certain campaigns. It enables the banks to target clients with high value by determining Customer Lifetime Value (CLV) and prioritizing the clusters in terms of client value. The segmentation based on information enables personalized communication, improved retention strategy and customized marketing strategies to maximize the engagement and profitability.

G. Predicting Customer Churn and Retention Strategies

Customer churn is the new critical challenge that banks located in the modern competitive environment of financial affairs must comprehend and anticipate. The fact that since the customers close their accounts or stop using banking services, customers also affect the reputation and trust of the bank in a negative way also contributes to the loss of revenue [30]. Banks can detect characteristics of an imminent turnover through the analysis of such factors as credit score, the level of activity, balance and tenure. In addition, a combination of predictive analytics and visualization systems, such as the RShiny application, can be used to monitor and make decisions in real-time. These insights enable the banks to develop individualized retention strategies, including individualized offers and personalized communication, which guarantee customer satisfaction, low churn rates and long-term loyalty and enhance operational efficiency.

V. LITERATURE REVIEW

Digital banking, AI, big data, and sustainability-driven CRM strategies are being used more extensively in the literature, where they play a role in attracting customers but leave them vulnerable to analytical, personalization, and data integration shortcomings.

Bakwuye, Dokai-Okonkwo and Odor (2025) used a quantitative research design, with the data collected via the administration of structured questionnaires to 300 bank customers and employees. The results showed that mobile banking, e-banking, and USSD banking, as well as the AI-based customer service, had a significant effect on CRM, with e-banking the most pronounced one. Mobile and USSD banking were also very important in terms of enhancing

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accessibility and financial inclusion. Although AI-based customer service was a part of CRM, it did not have such a firm effect as other digital banking channels. The research justifies why banks should invest in effective, safe, and convenient digital banking systems in order to improve on customer service. Additionally, the regulation policies need to encourage financial literacy, cybersecurity, and digital banking innovation [31].

Pavlović et al. (2025), The significance of CRM system implementation in the banking market is analyzed in the paper through the prism of personalization of services, improvement and user experience optimization of communication. One of the particular focuses is on the inclusion of digital technologies that can help banks know the needs of the clients better and develop individual offers. The outcome of the research shows that the adoption of CRM helps considerably enhance customer satisfaction, which is directly translated into customer loyalty and long-term value of the bank. The paper gives strategy implementation criteria of CRM as a competitive advantage in the dynamic banking market [32].

Shirpak and Beyzavi (2024) study attempts to fill the gap between theory and practice in sustainable banking. Qualitative research design was adopted and semi-structured interviews were conducted on twelve customers of a big Swedish bank. These interviews were very rich and detailed in terms of the customer perceptions, attitudes and behaviors towards the sustainability in banking. The key discoveries are that the customers are more concerned about sustainability when deciding on their banking preferences, and they want banks to embrace and encourage sustainable practices. Customer loyalty and engagement are greatly improved with effective communication through CRM systems of the sustainability initiatives [33].

Kadam, Anawade and Sharma (2024) study examines how AI can be used in banking CRM, such as personalized customer service, automating processes, predictive analytics, and fraud detection. Chatbots and virtual assistants have been integrated to make customer support and response time much faster. Furthermore, banks may proactively provide individualised solutions, spot patterns, and anticipate client wants with the use of analytics driven by AI. Data privacy, ethical concerns, and the lack of trained personnel are just a few of the obstacles that must be overcome before AI can realize its vast potential [34].

Iraqi, Benhiba and Idrissi (2023) Embracing data-driven change, where decision-making is grounded in facts and data, is becoming increasingly important for enterprises as digital transformation takes center stage. Investment banks can use the insights on the target culture, patterns that could be implemented, and phases that should be followed to map out their data-driven transformation journey in this article. In order to guarantee the maximum levels of performance, the article also covers the beginning of data architecture work, its drivers, obstacles, and hazards [35].

Kristiana et al. (2023) present a hurdle to data-driven business adoption, since data ownership and processing/use capabilities are essential for ensuring data is used to generate value for the company. Banks can benefit from data governance in terms of the processes and strategies that aid in data management and security. In order to fix the mentioned problems, offer a big data architecture that uses a multi-tiered strategy for massive data structures. By implementing this design, the banking industry finds it easier to gain valuable insights from big data while still protecting its customers' personal information [36].

Table II summarizes each study's focus, contributions, and limitations, revealing insufficient exploration of CRM analytics frameworks, limited empirical evidence, and gaps in customer behavior prediction, data governance, and integrated engagement strategies in banking

Table 2: COMPARATIVE ANALYSIS OF DATA-DRIVEN CRM ANALYTICS APPROACHES IN BANKING AND BUSINESS CONTEXTS

Reference	Focus Area	Key Findings	Challenges	Key Contribution	Limitations / Gap
Bakwuye, Dokai-Okonkwo & Odor (2025)	Impact of digital banking channels (e-banking, mobile banking, USSD, AI customer	Digital channels significantly enhance CRM; e-banking has the strongest influence; mobile and USSD banking	Need for secure platforms; financial literacy gaps; cybersecurity concerns	Demonstrates comparative impact of various digital channels on CRM; supports strategic	Focuses mainly on usage impact—does not deeply explore CRM analytics or customer behavior modeling; AI impact

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	service) on CRM	improve accessibility and inclusion; AI customer service contributes but less strongly		investment in digital banking technologies	underexplored; lacks granular data-driven CRM metrics
Pavlović et al. (2025)	CRM system implementation for personalization, communication, and user experience	Effective CRM implementation boosts customer satisfaction and loyalty through personalized services and improved communication	Integrating advanced digital technologies into CRM; ensuring seamless personalization	Provides strategic guidelines for effective CRM implementation in banking	Does not analyze the role of CRM analytics or big data; lacks empirical data on digital engagement strategies; limited exploration of predictive CRM capabilities
Shirpak & Beyzavi (2024)	Sustainable banking perceptions and CRM communication of sustainability initiatives	Customers value sustainability and expect banks to communicate initiatives clearly; CRM can enhance loyalty when sustainability is emphasized	Geographic boundaries; aligning CRM communication with real practices; small sample size	Connects sustainability orientation with CRM communication strategies	Limited to one bank and region; focuses on sustainability rather than data-driven CRM analytics; lacks quantitative CRM performance measures
Kadam, Anawade & Sharma (2024)	Role of AI in banking CRM, including chatbots, automation, predictive analytics, and fraud detection	AI improves personalized service, support speed, trend identification, and prediction of customer needs	Data privacy, ethics, lack of skilled professionals, integration complexity	Highlights the transformative potential of AI-driven CRM and predictive analytics in Indian banking	Does not provide empirical evidence or CRM analytics models; limited focus on customer engagement outcomes; lacks comparative analysis with traditional CRM
Iraqi, Benhiba & Idrissi (2023)	Data-driven transformation in investment banking	Data-driven decision-making improves performance; guidance on culture, patterns, architecture, drivers, and risks	Data architecture challenges, change management, risk mitigation	Offers a roadmap for data-driven transformation and architecture planning	Focused on investment banking; not directly tied to CRM analytics; lacks customer-centric engagement strategies
Kristiana et al. (2023)	Big data analytics implementation and data governance in banking	Big data architecture and governance help extract business value; highlights key challenges to big data optimization	Data governance, accessibility, security issues; multi-tier architecture complexity	Proposes a big data architecture to enable business value insights generation	Does not explicitly link big data architecture to CRM analytics; lacks discussion on how data supports customer

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					engagement; no empirical evaluation

VI. CONCLUSION AND FUTURE WORK

CRM analytics further application has been such an inseparable aspect of contemporary banking as it enables the banking institutions to turn the customer service balance in favor of proactive interactions, which occur on the basis of intelligence. Banks will understand customer behaviour, preferences, and needs more through big data, AI, machine learning, and natural language processing. The change will assist to hyper hyper-personalized interaction, predictive retention and real-time decision making, which will ultimately result to customer satisfaction, customer loyalty and profitability. The included advanced analytics are used in major operations, including credit risk management, fraud detection, and targeted marketing, and informational action that can be taken to facilitate strategic planning. Recent studies emphasize the utility of digital banking platforms, artificial intelligence-based customer service, and sustainable banking as contributors to CRM success. Still, there are loopholes in holistic CRM analytics models, which are empirically evaluated, and predictive intelligence is intertwined with customer-centric engagement models. Future research should focus on the development of comprehensive, scalable and interoperable CRM analytics frameworks using multi-source data that address the challenge of data privacy and governance and redistribution of resources to the maximum to provide individual customer experience. Furthermore, the long-term impacts of AI-driven CRM on the customer lifetime value and organization can be analyzed and delivered as practical recommendations that can be applied in the future to help the financial institutions stay abreast in the fast-changing digital landscape.

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