

# Data Analytics for Customer Relationship Management: Improving Business Strategies

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**Abstract-** The primary objective of this paper is to present a holistic and usefully managerially oriented perspective on customer relationship management (CRM) as a kind of company strategy. The primary goals are as follows: to investigate the beginnings of CRM, its subsequent development and the changes that have taken place over the course of time, as well as to outline its future directions; to evaluate the many different definitions of CRM and select the one that most accurately captures the essence of CRM; to investigate the components of CRM; to develop a structure that guarantees CRM is approached in a strategic, balanced, and integrated manner; to define CRM strategy; and to locate CRM strategy within the who, what, where, when, why. The article offers recommendations for effective CRM strategy applications. This study article makes an attempt to analyse researches on Big Data Analytics, Data Mining methods, and Big Data Analytical Frameworks that may be employed in Customer Relationship Management. The purpose of this study is to present existing uses of Big Data in Customer Relationship Management, as well as their problems, limits, and potential future prospects in this sector by analysing the aforementioned research .

**Indexed Terms-** CRM, Business, Analytical

## I. INTRODUCTION

Big Data is an umbrella phrase that describes extremely large amounts of data that cannot be effectively managed with more traditional methods. This category of data is referred to as "Big Data." Big data analytics is the process of analysing and analysing vast amounts of data from a variety of sources, with the goal of discovering previously unknown patterns, trends, and diverse customer

preferences, among other things.[1] The name "big data analytics" refers to this process. If you work in the business world, having access to this information will offer you with a huge advantage over your competitors. Because of the growth of networking, the Internet, and computer technology, big data analytics has developed as a dominant movement in the world of business. [2] This may be directly attributed to the rise of the Internet. The patterns that are found via the use of Big Data Analytics may be put to use for a range of purposes, including the creation of fresh new goods as well as promotion for existing ones.[3] However, in order to handle large amounts of data, a number of different techniques and operating processes need to be put into place. The management of a company's interactions and relationships with its clients is what's meant when people talk about "customer relationship management." It is responsible for bringing in new consumers, maintaining relationships with existing customers, and creating stronger linkages among existing customers already in the market.[4] Customer Relationship Management makes use of a wide variety of approaches, such as data mining, in order to get information about customers and develop a knowledge of the preferences they have. This may be performed in a number of different ways. Data mining is one of these methodologies. Because of this, you should provide the customer with a greater degree of service.[5,6]

The management of a company's relationships with its clients is being assisted by a variety of software tools, which are already being employed by businesses. The development of internet and cellular technologies has led to a large rise in the flow of information relevant to consumers.[7,8] This increase in information flow has led to a major increase in the flow of information. In addition, a significant number of thriving companies are

considering the possibility of making use of such data in order to effectively manage the ties they have with their clients. The growth of big data analytics as a tool for managing client interactions is a significant development in the world of business.[9] This is largely attributable to the enormous quantities of information that are transmitted via networks and the internet.[10] The analysis of large amounts of data might be a useful tool for establishing what customers genuinely anticipate from companies and for projecting what their future requirements will be. As a consequence of this, doing analysis on vast volumes of data makes it possible for businesses to enhance the level of service they provide to consumers and better manage the connections they have with those customers. This research will look into how businesses may effectively maintain ties with their consumers by making effective use of big data analytics.[11]

## II. MAJOR RESEARCHES IN BIG DATA ANALYTICS FOR CUSTOMER RELATIONSHIP MANAGEMENT

The use of big data analytics in the business sector is the subject of a great number of research projects that are now being carried out. Romika Yadav, Monika, Tarun Kumar, and Garima are business students at Indira Ghandi University in India. They believe that the primary objective of any company should be to fulfil the prerequisites and criteria that have been outlined by the clientele. [12] They proposed a number of steps to be taken in order to establish how the management of the industry interacts with the clients of the business. As a result of the conclusions of this study, new legislation governing velocity, variety, privacy, and volume have been developed. This research requires a series of steps, which can be broken down into the following Big Data processes: descriptive analytics (which involves the use of statistical models and other methods to summarise and describe the data), diagnostic analytics (which involves identifying the background details related to the data), predictive analytics (which involves using the data to identify future patterns), and perspective analytics (which involves looking at the data from a variety of different perspectives). In order to provide assistance for the mobile service, S. Hemanth and Rajesh Rojanala have created a data mining model with three levels.[13] The purpose of this model is

to provide assistance to organisations in determining potential benefits for the most efficient management of customer relationships. The following are the actions that need to be taken: To get started, we are going to use K-means to cut down on the amount of really big data. The data are first arranged in K clusters, each of which is given a name that corresponds to the number of assumed means that were utilised in the first step of the K means approach, which is the grouping of the data. After then, a new mean is calculated for each cluster, and the procedure is repeated as many times as necessary until the result that is wanted is obtained. Second, generalising a number of different facts in order to uncover connected qualities by utilising a user-defined threshold in order to quantify the amount of information that has been lost in the process of generalisation. The third stage involves computing the information gain ratio in order to create decision trees for the purpose of accumulating and retrieving the data that is intended for use. In a decision tree, the non-leaf nodes represent the inputs or questions, the arcs indicate the characteristics or responses, and the leaf nodes reflect the final results together with the probability distributions. To put this another way: the non-leaf nodes represent the questions or inputs.[14]A customer relationship management system that makes use of a data mining approach such as this one will provide an enormous amount of value to whatever sector it is applied to. This is the last stage of the process. The relevance of this research comes in the fact that it suggests a three-step procedure for using big data on mobile platforms. This is a significant contribution to the field. However, the mobile sector served as the exclusive focus of this particular research endeavour. Customer segmentation, big data, and internet marketing analytics were originally three distinct areas of expertise. However, Dion Meijer, Marco Spruit, Georgia Fotaki, and Sjaak Brinkkemper merged these three areas into a single, cohesive structure in order to establish a new framework.[15]

This framework shows how marketing goals may be reached by utilising the right online marketing segmentation by making use of big data. Online marketing segmentation is the focus of this framework.[16] The process of designing this framework includes a number of phases, one of which is the definition of the primary objectives of internet marketing. This marks the beginning of the

procedure in its entirety. Utilising the data acquired from both online and offline sources, determine and describe the shifts that have taken place in the characteristics of the consumers and identify how these shifts have impacted the business. After that, classify many groups of customers into their respective categories. In the conclusion, methods from the Big Data movement are employed to carry out an analysis of customer segments, and the process of segmentation is detailed in agonising depth throughout the whole paper.[17] This research was essential because of the significant part that internet marketing plays not only in existing businesses but also in those that will exist in the future. This investigation was hindered by restrictions such as a restricted amount of time, an insufficient amount of data, and an absence of sufficient preceding investigations.[18] The development of management strategies for marketing was the topic of Lang Wang's explanation, which can be found here. During the course of his inquiry, he emphasised how he made use of all of the traditional, analytical, and digital Customer Relationship Management destinations.[19] The analytical management of customer relationships benefited greatly from the usage of large amounts of data. His research led him to conclude that one must not only have theoretical knowledge but also significant hands-on experience in order to be successful in the field of cross-channel interactions.[20] (a corporate strategy that is centred on the client; the integration of operations that span several companies in a suitable manner); (multichannel marketing, sales activities, and essential business services that are efficient and well-planned). Ricardo Chalmeta and Sergio Orenga-Rogla gave a presentation that provided an outline of the invention of an innovative method that may aid organisations in efficiently establishing a social customer relationship management system. This method was developed by Sergio Orenga-Rogla.[21]

The plan that was implemented takes into account aspects of social customer strategy, as well as a system for performance evaluation, processes, and a computerised system for managing connections with social customers. The strategy that is being recommended here is based on a method that was suggested by "Chalmeta," and that method is referred to as the "CRM IRIS." In order to demonstrate the reliability of the system that was

developed during the course of this investigation, it was implemented in a genuine commercial environment. This methodology makes use of a method known as social network analysis, which is categorised as a subset of big data analytics. The objective of this methodology is to conduct an analysis of social networks.[22,23] Graph theory is utilised in this method to first conduct a study of the connections that may be identified in social networks, and then those connections are diagrammed so that the findings can be presented. In these diagrams, people are displayed as nodes, and the arcs that reflect their relationships and interactions with one another connect the nodes.

Asma Sajid, Ramzan Talib, Jafar Raza Alam, and Muneeb Niaz offered an explanation of the tasks that big data serves in organisations, as well as the significance of big data and the advantages it brings to contemporary businesses. In addition, they discussed the significance of big data and the benefits it offers to modern businesses.[24] The authors state that the key objectives of using Big Data are, in order of importance, the reduction of costs, the reduction of time for business operations, the support in internal business activities and choices, and the development and implementation of new products that are based on Big Data. Some of the principal issues are dynamic provisioning, maintaining security and privacy, using large data in an unsuitable manner, sophisticated algorithm development, and data mining. They proposed a process that may be used to implement Big Data into the operations of a corporation.[25]

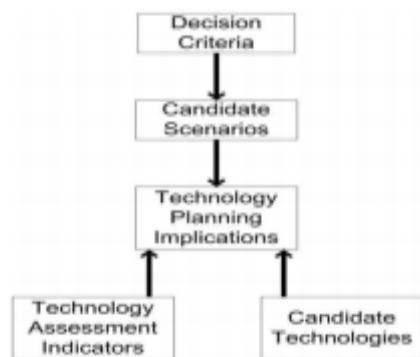


Fig. 1 Research methodology for the purpose of technological strategic planning [26]

These variables have the potential to be employed to great effect when it comes to the adoption of big data analytics for use in customer relationship management. Hui Jiang and Yuan Yuan Zhang, both

of whom are involved in the software industry, conceived up and carried out an approach to customer relationship management (CRM) that was predicated on multi-agent systems.[27,28] As part of the research, they looked at the features and requirements of a variety of Customer Relationship Management Systems that are employed by software companies. After that, they developed an appropriate framework by combining customer relationship management ideas with Multi-Agent technology. This allowed them to better serve their customers.

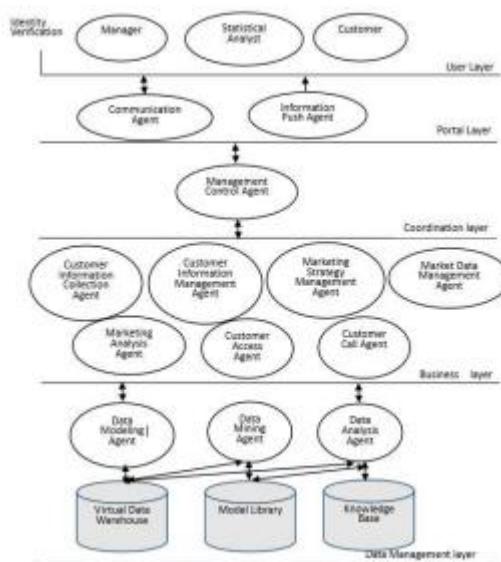


Fig. 2 Software based multi agent framework design [29]"

This framework is capable of undergoing further development and extension thanks to the utilisation of big data, which will, in the end, result in improved customer relationship management. Kang Li, Vinay Deolalikar, and Neeraj Pradhan talked about using open-source software for the purpose of enormous data collecting and mining pipelines for customer relationship management (CRM).[30,31] The authors of this study provide answers to queries regarding the processing and analysis of data, as well as the components that make up data and the amount of time spent on pipelines. Their proposed pipeline is essentially made up of two sections: the first is for the collecting of data and makes use of Hbase, Storm, and Kafka; the second is for the processing of data and makes use of MapReduce, Mahout, and Hadoop.

### III. RESEARCH METHOD

For the purpose of carrying out the empirical test of the postulated correlations among model variables, it was decided that a survey with both longitudinal and cross-sectional components would be the most appropriate technique (Glock, 1967).[30] The experiment was carried out in a realistic environment, with working decision makers who were expected to evaluate the actual situation in their respective businesses and marketplaces. The respondents' assessments of their own organization's business intelligence (BI) methods, as well as their rivals' BI approaches, as well as their thoughts regarding the business strategy and customer strategy of their own organisation were elicited through a series of questions. Table 1 contains a listing of the relevant items that were used to measure the study variables that were incorporated into the model.[32] When responding to the questionnaire, the respondents were asked to rate how much they agreed or disagreed with each of the statements based on a 5-point Likert scale with positive and negative endpoints .[33]

Table 1. Statistics for describing the factors involved in the research .[34]

Variables and items	Mean	Std. Dev.
<i>Organisation's business intelligence</i>		
BI1. My company uses BI tools for knowledge discovery.	3.37	1.26
BI2. Management of my organisation uses BI to leverage our information, business data, such as sales revenue by products and/or departments, or by associated costs and incomes.	3.42	1.15
BI3. My organisation's BI drives our business decision, improves our performance, and leads to innovation.	3.42	1.15
BI4. My company's management realises that BI is essential.	3.53	1.13
average	3.44	1.17
<i>Competitors business intelligence</i>		
EC1. My competitors jump ahead with analytical capability.	2.62	1.08
EC2. The choice of my competitors' analytical tools may affect my company's performance in the market.	2.81	1.10
EC3. My competitors' analytics are successful in financial terms.	2.79	1.07
EC4. My competitors use analytics to evaluate their efforts in terms of improvement of business objectives.	2.95	1.05
average	2.79	1.08
<i>Organisation's business strategy</i>		
BS1. My organisation's management chooses to pursue specific goals on the basis of organisational competitiveness.	3.25	1.14
BS2. Management of my company and shareholders are aligned with our goals.	3.50	1.12
BS3. Our organisational competitiveness is our new way of doing business.	3.20	1.02
BS4. The organisational competitiveness allows my company to have a strong financial performance, average revenue growth.	3.24	1.08
average	3.30	1.09
<i>Organisation's customer strategy</i>		
CS1. My company has the ability to initiate, expand, and maintain relationships with our customers.	3.53	1.30
CS2. My company's management optimises customer relationships through valuation.	3.44	1.20
CS3. My company manages customer relationships through "targeting" that will lead us to significant revenue growth.	3.39	1.14
CS4. My organisation uses early warning systems to detect changes in customers' behaviour that indicates service or retention issues.	3.13	1.13
average	3.37	1.19

- Independent and dependent variables

There were two factors that were not reliant on one another: the BI of the organisation and the BI of the rivals. They were judged based on the following criteria: the business intelligence (BI) of the organisation was examined with regard to its discovery, leverage, innovation, and essence. As can be seen in Table 1, it was operationalized using the following four items: BI1–BI4.[35,36] In a similar manner, the business intelligence (BI) of rivals was analysed with regard to their analytical skills, tools,

utilisation, and finances. The variable was evaluated based on the average rating score of the elements listed in Table 1, which were designated as EC1–EC4. Both the organization's business plan and its customer strategy were considered to be dependent variables in this study. The company's business strategy was evaluated based on how well it aligned with the organization's goals, how competitive it was, how innovative its approaches were, and how well it performed financially.[37] A rating score based on items BS1–BS4 was used to determine its value, and the results are presented in Table 1. The company's capacity to maintain healthy customer relationships, as well as its valuation, targeting, and ability to anticipate shifts in consumer behaviour, were included in the analysis of the customer strategy. In Table 1, the columns labelled CS1–CS4 represent the four different aspects of customer strategy that were measured.[38]

- Results

In Table 1, the study variables' means as well as their standard deviations are offered for examination. since a consequence of these findings, it appears that the amount of pressure exerted by rivals' BI techniques is not very high, since the mean score for each of these categories is lower than 3 (out of 5).[39] In contrast, the average ratings for an organization's business intelligence, customer strategy, and business strategy all exceed a score of three out of five. [40] These kinds of ratings imply that the corporation makes extensive use of its BI system and has an excellent business plan and customer strategy .

- Research model test

In this study, the research model was evaluated using the SEM analytical techniques that were proposed (Kline, 2011). Principal Component Analysis was the initial method of factor analysis that was carried out.[41]

Table 2. Summary results of factor analysis.[42]

Item	Rotated component matrix <sup>a</sup>			
	1	2	3	4
BI3	0.903	0.036	0.178	0.174
BI1	0.886	0.019	0.231	0.123
BI2	0.868	0.079	0.233	0.149
BI4	0.808	0.028	0.205	0.221
CS1	0.032	0.916	0.083	0.084
CS2	-0.029	0.847	0.201	0.230
CS3	0.084	0.845	0.206	0.237
CS4	0.069	0.777	0.331	0.212
BS2	0.271	0.228	0.834	0.265
BS1	0.272	0.203	0.818	0.256
BS3	0.258	0.258	0.754	0.339
BS4	0.325	0.396	0.573	0.158
EC3	0.142	0.337	0.236	0.755
EC4	0.282	0.242	0.259	0.732
EC1	0.341	0.165	0.471	0.627
EC2	0.236	0.248	0.531	0.588

Extraction Method: An examination based on principal components It took five iterations for the Rotation Method's Varimax with Kaiser Normalisation a Rotation to converge .

evaluating the measuring model in SPSS with the help of the Varimax rotation. The findings are detailed in Table 2, which may be seen below. Items with loadings of 0.50 or higher are acceptable, as this is the rule of thumb that is commonly advised.[43] It can be seen from the table that all of the elements, with the exception of EC2, loaded cleanly on their respective constructions.[44] The item analysis and greater loading value served as the basis for the decision that was made about the positioning of EC2. In addition to this, Cronbach's alpha, which is a composite reliability coefficient, was determined for each variable. These values ranged from 0.875 for business strategy to 0.911 for customer strategy, 0.917 for rivals' business intelligence, and 0.930 for the organization's business intelligence.[45]

According to Nunnally's research from 1978, the recommended cutoff point for a trustworthy construct is a value of 0.70. All of the determined Cronbach's alpha values in this investigation are higher than the cutoff of 0.7, demonstrating that the dependability is satisfactory. [46] Following that, the required route coefficients analysis was carried out in AMOS in order to test the structural model linkages.[47] Figure 2 provides a graphical representation of the findings obtained. The figure demonstrates that there is a sign change in each of the route coefficients (p less than 0:001). In addition, path values above 0.5 suggest "large" effects (Cohen, 1988) of both the organization's BI and the rivals' BI on the organization business strategy (0.533 and 0.531 respectively), in addition to a very

strong influence of the organization's business strategy on its customer strategy (0.881).[48] The figure also reveals a somewhat weak but statistically significant correlation cosecant between two independent variables ( $r$  equals 0.18;

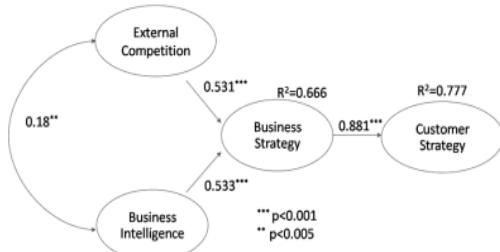


Fig. 2. Path coefficients that have been normalized for the model that was evaluated.[49]

Table 3. Summary of  $t$  indices for the tested model.[50]

Index	Method of estimation	Good fit indicators	Results
CMIN/DF	Difference between estimate and sample	Non-significant ratio CMIN//DF $\leq 3$	0.221
NFI	Normed fit index (Bentler-Bonett) compares chi square value of model to chi square value of independence model (variables uncorrelated)	$> 0.95$ and close to 1	0.999
CFI	Comparative fit index (CFI) (Bentler) compares fit of model with alternative models	$\geq 0.95$ and close to 1	1.000
RMSEA	Root mean square error of approximation measures discrepancy per degree of freedom	$< 0.05$ at least $< 0.100$	0.000

$p < 0.005$ ). Due to this conclusion, it would be prudent to do more research into the connection between the two factors. In the conclusion, a number of the recommended statistics were utilised in order to evaluate the global  $t$ -value of the model in relation to the data. Table 3 provides a summary of the outcomes obtained. The suggested model demonstrates evidence of a very excellent correspondence to the data across the board in terms of the CMIN/DF, NFI, CFI, and RMSEA. This is the case across all of the indices .

## CONCLUSION

The purpose of this article was to increase the present knowledge of the function that BI plays in CRM by conducting an empirical investigation of a few selected components and processes. The study model that was developed as a result of a previous literature assessment is completely supported by empirical findings. Two significant discoveries have been made as a result of this research. First, the research presents empirical evidence of a dual process of organisational CRM strategy formation.

This dual process involves the development of business strategy first, followed by the development of the organization's customer strategy. The research was conducted by a single researcher. Second, the research emphasises that major drivers to an organization's enhanced CRM strategy creation procedures include business intelligence (BI) projects that have been adopted by the organisation, as well as the pressure that the organisation feels from the methods taken by its rivals.

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