

The Impact of Knowledge Management and Data Mining on CRM in the Service Industry



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Abstract The marketing trend in the service sector is changing at a rapid pace due to fierce competition and ever-growing innovation in the field of information technology. The marketing approach has transformed from product-centric concept to customer-centric concept. Adopting customer-centric strategy has become the essential component of business philosophy especially in the service sector, where customers are treated like guests. The whole concept of business performance is based on the philosophy of hospitality. Efforts are on satisfying individual needs of the customer and thus creating personal relationship by offering customised service. Customer relationship management (CRM) has replaced the traditional concept of marketing. Successful implementation of CRM program requires effective database management system to facilitate acquiring and maintaining customer information and thus applying this information to extend customised service based on individual needs thereby, supporting customer satisfaction and retention. Hence, it is evident that technology-based CRM has become essential for the survival and growth of business organisation mainly, the hotel sector and maintaining effective CRM strategy has its origin in knowledge management and data mining technique.

Keywords Customer relationship management · Relationship marketing
Knowledge management · Data mining

1 Introduction

Creating and maintaining relationship with the customers has become the most essential tool of marketing and goal of business. A strong relationship with customer brings intimacy which results in customer retention which is cost-effective

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than attracting new customer. In case of service industry, customer relationship management (CRM) is a crucial factor to improve its performance. The economic environment over past few years is dynamically changed and it continues to be due to advent of innovative technology connecting people around the world making the world a global village. Customers are now a day more knowledgeable than ever before. The development has led the organisation to change their way of interaction with the customer. The firms are forced to understand their customers and their changing needs to survive in the market as loyalty of customer cannot be guaranteed. For a successful business organisation, one has to be proactive in anticipating the desire of their potential customer and respond suitably. A successful enterprise places their customer first and at centre while devising their marketing strategy as any change in customer behaviour can lead unpredictable profitability and result in marketing failure.

Since 1980, relationship marketing has taken the centre stage and has become the fundamental concept of business marketing. It is imperative for all business organisations especially the service sector to adopt the philosophy of CRM to be competitive and gain an edge over the competitors. CRM is technology-driven concept of identifying, attracting, managing and retaining potential customer. In many research studies, it has been concluded that CRM has positive impact on customer satisfaction and customer retention.

In recent years, information technology has played a great role and influenced change in the behaviour of consumer, organisation and industries worldwide. The market is transformed from labour intensive to technology intensive. Growth and productivity increase is no longer only dependent on human resource only, but technology is playing significant role for it.

Service industry is not untouched with recent development and change in technology, with bigger role of IT, it has enabled the system more sharing and interactive. This has facilitated the hospitality industry to improve performance and productivity through better CRM with the application of technology.

The contribution of knowledge management and data mining is exceptional for effectiveness of CRM in customer satisfaction and success of service sector. It is significant in many ways as it helps in cost reduction by customer retention, growth in revenue generation and improvement and management of better quality relationship.

Service sectors accumulate huge quantity of data in the process of business and information gathered can be processed quickly and accurately by data mining and knowledge acquired can be helpful in decision-making for customer satisfaction. Most of the service organisations have already applied data mining technology to create database. This database management system facilitates in knowing the taste and preference, likes and dislikes and other personal attributes of customer which support in rendering customised service on individual basis.

1.1 Customer Relationship Management

CRM is a concept that facilitates organisation to deliver service on individual basis, i.e. customised service. Customised service is possible when there is frequent interaction and in the process, valuable information is accumulated regarding the customer. Swift [1] defined CRM as *'Enterprise approach to understanding and influencing customer behaviour through meaningful communications in order to improve customer acquisition, customer retention, customer loyalty, and customer profitability'* [1].

CRM is a strategy facilitating an organisation to provide customised service to each individual customer leading to intimacy development that fosters personal relationship. The personalised service creates a sense of belongingness as the customer is cared for and hence creates a new business opportunity based on taste and preferences, likes and dislikes and profile of the customer through effective interaction [2]. CRM integrates human resource, business processes and technology to meet the expectation of the customer efficiently and improving business and customer relationship. It is more of a customer-centric business approach and all the activities of the organisations are aimed at achieving customer satisfaction. It is convenient and costs less to sell to retained customer than to a new customer who has encountered for the first time. Organisations are now devising strategies to achieve customer satisfaction and customer retention by adopting customer focused service oriented practices.

It is a concept of business strategy, philosophy or culture of managing customer for long-term customer value and organisational profitability. CRM is the integration of strategies and process backed by software in view of achieving competitive edge and customer loyalty. It is process to learn and understand more about the customer.

The goal of CRM is to achieve customer satisfaction by providing customised service, organisation profitability by customer retention, increase performance and productivity standard by collecting feedback and suggestion and hence improvement in service quality, cost reduction and savings and achieve competitive edge in the market.

Schierholz et al. [3] advocate CRM as an instrument used to understand customer relationships is an investment that improves competitive position in the market by increasing customer loyalty. Their study concluded positive and significant association between CRM with customer loyalty [3].

Altran [4] came with a conclusion that enterprise with effective CRM supported by effective technology maintains their customer database in a better way suffer less in economic crisis [4].

CRM can be classified into three components: operational, collaborative, and analytical CRM [5].

Operational CRM is a CRM component that improves the effectiveness of regular every day customers operations. The process is automated concerned with frequent interaction and communication with customer. This is the first stage of data

generation integrating all the intercoordinated with all the functional areas. Here, the organisation on requirements of customer fulfils them.

Collaborative CRM is a communication point that occupies the central role of linking business establishment with their customers, stake holders and others who have share in management and operational functions. It allows all the stake holders to share and disseminate information. This component provides efficiency in operation and creates opportunities to improve service process leading to customer satisfaction. This component helps in creating relationship.

Analytical CRM focusses on the analysis of collected data by analytical tool which supports formulating strategy and making decisions related to identification, attraction and retention of customers. The data collected are processed to make it more meaningful and interpreted to prepare reports. This component enables to maintain customer relationship by analysing customer's behavioural pattern. Analysing data facilitates prediction of future trends of customer accurately.

According to Swift [1], Parvatiyar and Sheth [6] and Kracklauer et al. [7], the four dimensions of CRM are customer identification, customer attraction, customer retention and customer development. The four dimensions enable complete in-depth understanding of customers helping in optimising customer value to the organisation.

The following are some of the studies related to CRM on customer satisfaction and loyalty:

Haridasan and Venkatesh [8] investigated the impact of CRM on customer loyalty. The study was conducted on seven mobile service provider company Chennai, Tamil Nadu on 490 mobile users. It was concluded that the impact of CRM was positively correlated with customer loyalty [8].

Yao and Khong [9] made investigation about CRM effectiveness on customer satisfaction in the banking sector of Taiwan. The study was conducted on 31 general managers of 42 commercial banks. In their research findings, it was revealed that CRM implementation is positively associated with customer satisfaction; and there is significant linkage among IT capability, interaction rate management and recovery management with customer satisfaction [9].

Khaligh et al. [10] investigated the effect of CRM on customer retention and loyalty in the telecom industry of Iran. He surveyed 200 consumers of telecom services and found that the structure of the strategy should be flexible specially and the policies of price benefit the telecom firms and increase the customer loyalty [10].

The effectiveness of CRM on customer satisfaction and retention and ultimately performance of service sector can only be achieved if it is well integrated and supported by effective IT software system across the establishment covering various operational and functional departments and sub-departments. The integration of various sections will enable to gain real-time information to meet the expectation of customer through knowledge management and data mining technology.

2 Knowledge Management and Data Mining

2.1 Knowledge Management CRM

Knowledge management and data mining process technology is an essential significant component of CRM. CRM is a technology-driven strategy, and the soul of this concept lies in the process of knowledge management and data mining to achieve success in CRM effectiveness. In the present scenario, the service sector integrates knowledge management aspect with CRM as the knowledge which is gathered in the form of data from customer plays a significant role in the success of CRM. Knowledge is an internal dimension of CRM collected from the customer and is about the customer and applied for the satisfaction for the customer. The knowledge gained by service provider through various channels, touch points by means of interaction is applied for designing and developing strategies in the service delivery process. Service sector is making use of this information (Knowledge) to offer better quality services to its clients, understand the importance and advantage of knowledge management. Yichen and Chienshihen [11] in their his work titled 'having knowledge in creation of method for CRM' stated that customer knowledge and their knowledge management are key factors that have impact on organisations performance [11]. Knowledge management involves collecting and gathering information, storing the knowledge information, distribution of knowledge and extracting benefits from the knowledge by designing service based on the knowledge. The role of knowledge management has become important in the context of present customer-centric marketing environment [12]. Knowledge management is the management of organisations information and knowledge which supports consistent decision-making ability of the managers. Integrating knowledge with CRM data facilitates customer-centric decision-making. CRM can be effective if it is integrated with knowledge management system to enable management to evaluate their performance based on customer satisfaction and profitability [12, 13]. Therefore, it is evident that knowledge management contributes significantly in CRM, which the service sector can use it to build and maintain relationship with the customer that can enable to gain competitive edge in the market [14]. Successful and effective CRM can be identified if customer information can be realised into customer knowledge. Knowledge management supports business organisations in establishing better CRM and it contributes positively in its performance [14]. The importance building customer relationship is most essential for service sector and hence, knowledge management can help significantly to gain competitive advantage to such sector. Various studies have been conducted by scholars to establish positive relationship between knowledge management and customer satisfaction.

3 Data Mining

The recent development in information technology over the past few years has made unprecedented change in the style of functioning of the business organisation especially in the service sector where the core concept of business philosophy is to provide hospitality service to the customer which needs long and continued relationship. The IT has penetrated almost every organisation. The massive application of IT has enabled the provision of database management where huge amount of data is stored. The effective utilisation of database needs a systematic method of collecting, storing and analysing data.

In a general sense data mining is the process of searching valuable information from large volumes of data. It is the exploration and analysis of large quantity of data using computational technology to discover meaning pattern and rules.

The hospitality industry is customer service oriented organisation that collects and gathers large amount of data from property management system (PMS), central reservation systems (CRS), guest loyalty program databases and point of sale (POS) leads to data mining application which play significant role in the industry. The volume of data created through Internet and web site are difficult to be handled and therefore, the need for data warehousing and data mining system arises for hospitality industry. Data mining technology in service establishments converts customer information into valuable customised service process decisions to improve long-term relationship and profit and it is an effective and efficient technology for a service firm to transform customer information into customised and dynamic marketing decisions to improve long-term profit. A data mining technique also reveals new pattern of purchasing and customer behaviour.

Data mining helps in constructing models of customer behaviour by use of statistics and appropriate data mining technique. It helps to identify potential market segment for potential customer through analysis of various factors that predicts similar buying behaviour. Hence, it can be applied for attracting potential and profitable customer.

Data mining provides opportunity to database marketers to come closer to their customers by inputs related to customer's need, likes and dislikes, taste and preferences. The only condition is that the necessary data input should exist in the database system. It can be used to identify possible customers who have intention of switching over and necessary action may be taken to retain them. It can be applied for more revenue generation by upselling by identifying customers' needs and desires and offering service as per desire. It can be also used to meet the changing needs of customer by offering additional services.

Various studies have also been conducted by scholars to establish relationship between data mining, knowledge management and CRM, which is summarised in Table 1.

Table 1 Review of previous literatures

Year	Authors	Title	Journal	Findings
2016	Uma [15]	Social CRM: A Survey on Various Techniques for Text Analysis in Social Media	International Journal of Computer Science and Mobile Computing	Social media platforms are source of huge amount of valuable information expressed by opinions and thoughts that can be captured and analysed for attracting and retaining existing customer. Sentimental analysis and natural language processing along with other techniques can be very effective in data mining for texts available on the platform of social media
2016	Abdavi et al. [16]	The impact of knowledge management factors on improving the performance of success of Sports customer relationship management	Journal of Novel Applied Sciences	The research was conducted in six metropolitan cities of hotels of Iran which have sports service sector. Positive correlation was found between the components of KM and success of CRM
2016	Jeyashree [17]	An analysis of CRM through data analysis	International Journal of Advance Research in Computer Science and Management Studies	Analysing various customer retention techniques to enhance customer relationships through data mining. Helps to understand buying pattern and classify customers
2016	Nair et al. [18]	Improving Customer Relationship Management Using Data Mining	International Journal of Scientific & Engineering Research	The paper develops a model for Hotel Management System to maintain records of the requirement of the guests, suggests automated system for all the services provided by the hotel and email-based communication system to retain the customers

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Table 1 (continued)

Year	Authors	Title	Journal	Findings
2016	Sharma and Sharma [19]	A Study on Data Mining on Algorithms for Tourism Industry	International Journal of Latest Trends in Engineering and Technology	The paper presents an overview of different data mining algorithms used for tourism industry. It explains the application of algorithm for various aspects of business operations
2015	Femina and Sudheep [20]	An Efficient CRM Data Mining Framework for the Prediction of Customer Behaviour	Procedia Computer Science.	Proposed a data mining CRM framework using two models for predicting customer behaviour for the banking sector. Multilayer perception neural network (MLPNN) has better accuracy than Naive Bayes (NB). The data collected is for general client's behaviour, classification of gender is significant as their behaviour differs
2015	Tama [21]	Data Mining for Predicting Customer Satisfaction in Fast Food Restaurant	Journal of Theoretical and Applied Information Technology	Data mining concept based on decision tree and neural network was applied to find out the determinants having impact on customer satisfaction. Staff behaviour, cleanliness of restaurant and food presentation were found to be the significant predictor of customer satisfaction
2015	Kumar [22]	Increasing the Efficiency of CRM Process Using Data Mining Practices	International Journal of Advance Research in Computer Science Management Studies	The paper investigates to improve the efficiency of CRM suitable software and technology related to data mining should be selected. Integration of CRM and data mining will respond promptly to customer's

(continued)

Table 1 (continued)

Year	Authors	Title	Journal	Findings
				requirement and improve service quality
2014	Maheswari et al. [23]	Role of Data Mining in CRM	International Journal of Engineering Research	The paper designs a mining model and explains the merits of Chi Square Automatic Interaction Detection (CHAID) method for classification as compared to Classification and Regression Trees (CART)
2013	Anand et al. [24]	Customer Relationship Management using Adaptive Resonance Theory	International Journal of Computer Application	Adaptive Resonance Theory (ART) can be used for the classification of customer and can handle large volume of customer data leading to understanding and needs of customer
2013	Yadav et al. [25]	Knowledge Management in CRM Using Data Mining Technique	International Journal of Scientific & Engineering Research	Application of various data mining techniques (algorithm) like clustering, classification, association, prediction and correlation to enterprise database to enhance CRM through knowledge management. Requirement of Knowledge management for different sector of business is different
2013	Sadath [26]	Data Mining in E-Commerce: A CRM Platform	International Journal of Computer Applications	The paper examines a three-tier architecture integrating data mining in Internet platform and model of value assessment. A close integration between e-commerce and data mining will

(continued)

Table 1 (continued)

Year	Authors	Title	Journal	Findings
				be the best method to improve strategy, prediction and decision-making for better relationship
2009	Ngai et al. [27]	Application of data mining techniques in customer relationship management: A literature review and classification	Expert Systems with Applications	The paper examines 87 articles concerned with CRM and Data mining. Majority of the paper described neural network for classification, clustering and prediction followed by decision tree and association tools. The classification model is the most commonly used method for forecasting the future behavioural pattern of the customer. The research was conducted between 2000 and 2006 and only seven online databases were used

4 Data Mining and Analytical CRM

Data mining techniques of analysing customer data are getting more popularity in analytical CRM. Application of data mining to facilitate CRM analytical dimension is becoming an emerging trend [27]. This technique can be applied to achieve competitive advantage to acquire customer and maximise customer value by analysing and understanding customer characteristics and behaviour. Association, classification, clustering, forecasting, regression, sequence discovery and visualisation cover the main data mining techniques.

Association explains the relationships between attributes stored in a database. Classification is used to mapping a data item into a predefined class of category [28, 29]. Clustering is process of mapping a data item into a categorical class or clusters determined from the data, i.e. putting group of customers into one group with similar attributes of purchasing behaviour [28, 30].

Forecasting anticipates the future value of return from the pattern of customer attributes based on records. Predictor is the key element of forecasting analysis [30].

Regression facilitates real value prediction variable [28, 31]. Sequence discovery helps in explaining and identifying relationships between items for due course of time [28, 31, 32].

Visualisation is presenting data of complex nature in combination with other data mining model to provide better understanding of identified relationship [33, 34].

The identification of appropriate data mining techniques to interpret useful information from a large volume of customer databases is the important stage in data mining process.

The research work conducted by Swift [1], Parvatiyar and Sheth [35] and Kracklauer et al. [7]. Ngai et al. [27] proposed that for customer identification, classification and clustering techniques are the most preferred; to attract customers, classification technique is preferable; to retain customers, association and classification are frequently preferred; about Concerning customers' development, association technique is preferred. Usually, combination of more than one data mining techniques is used frequently to support CRM analytical dimension [27].

Following are some of the findings concluded by some of the research scholar on the subject CRM and data mining technology in service sector.

Danubianu et al. [36] in his research work titled 'improving CRM in hotel industry by data mining techniques' concluded that data mining technique can be useful in predicting behaviour of the guest and helpful in taking marketing decision in identifying and contacting customer, deciding to whom to offer incentive and kind of relationship to be maintained [36].

Camilovic [37] in his study on 'Data Mining and CRM in Telecommunications' concluded that telecommunication industry is highly competitive, and they receive massive amount of data. Customers are their assets and to retain customers competitive advantage must be achieved [37]. To serve the purpose, the telecom industry must apply data mining technology to understand the behaviour of customer and frequently interact with the customer to identify their needs and desire and satisfy them by advanced and flexible service. Data mining technology can support them to achieve these objectives by enabling customer segmentation and churn prediction. Data mining can be proved to be an effective tool for developing CRM strategy facilitating telecommunications enterprise to keep their customers happy.

Kim et al. [38] investigated on 'Data Mining Applications in Hospitality Industry' and concluded that using data mining technique was helpful in identify profitable customer, create more loyal customer and maximise profit in case of both restaurants and hotels [38].

Liao et al. [39] in his study on 'Mining customer knowledge for tourism new product development and CRM' on Phoenix Tours International, in Taiwan concluded that data mining helps in new product designing to meet the changing needs of customer in tourism sector and supports in attracting and retaining customer by improving CRM. Mining technique contributes significantly by developing innovative tour package by segmenting customers purchase behaviour and pattern.

It helps in identifying the factors and variables influencing the choice of customer demand [39].

Wang and Wu [40] in his study investigated about CRM of agricultural bank of China by applying data mining technique. The sample included 53,872 customers, classified into three types. The test sample was 51,749 customers. The study collected data about the basic information of the bank customer and details of transaction between customer and the bank. It was found that the implementation of data mining technology into the bank's CRM achieved CRM target with high quality, and service quality was improved effectively, assigned by the bank to target customers and minimise the cost of operation of the bank [40].

Lin [41] in his work in the research paper 'A Technique for Enhancing Customer Relationships in the Service Industry' 'application of data mining in CRM in Taiwan's hotel industry', 50 hotels were invited for study, the directors of 33 hotel agreed to participate and they confirmed that they are aware of data mining and using it. The data mining technique is aligned with needs of the hotel industry. According to them data mining was very helpful in managing strong and long-term relationship with the customers. The study concluded that this technique is useful in understanding the behaviour pattern of the customer through better and effective interaction with the customers [41]. To achieve competitive advantage in CRM, data mining is must for hospitality industry.

Jenabi and Mirroshandel et al. [42] study on 'Using Data Mining Techniques for Improving Customer Relationship Management CRM', the data are collected from 2011 to 2014 in from automotive industry in Saipa Yadak, Iran. The data set consisted of 126 maintenance features. After pre-processing, data set was left with 2849 records and 23 features for data mining. The study concluded that data mining technique helps in obtaining accurate information about potential customer. It also suggests that data mining is useful in knowing the characteristics and the needs of customer so as satisfy customer and make them loyal and achieve more profit [42].

Tama [21] in his research study in fast food restaurants in Palembang, Indonesia applied data mining for predicting customer satisfaction in fast food restaurant. 400 respondents were surveyed by offering questionnaires with ten input variables such as taste, serving, dessert, restaurant environment, washing basin, waiting time, staff behaviour, menu pricing, discount and store location. Finally, 340 samples were selected for analysis. He concluded that the basic customer service attributes like staff behaviour, restaurant's cleanliness, and food presentation were significant predictor in assessing customer satisfaction with more accuracy.

Nair et al. [18] in her study on 'Improving CRM Using Data Mining' in a Hotel Management System concluded that by using data mining technique customised service is improved and it effectively supports decision activity, thereby, improving CRM.

Chen et al. [43] in his study titled 'Data Mining Application in CRM of Credit Card Business', data were collected from credit card customer about their transaction record from 2003 to 2004 from banks. The number of purchase data collected was 10,304,500 and 1,146,200 for the year 2003 and 2004 respectively and finally, 1,063,000 were used as dataset for each year in the study. The study

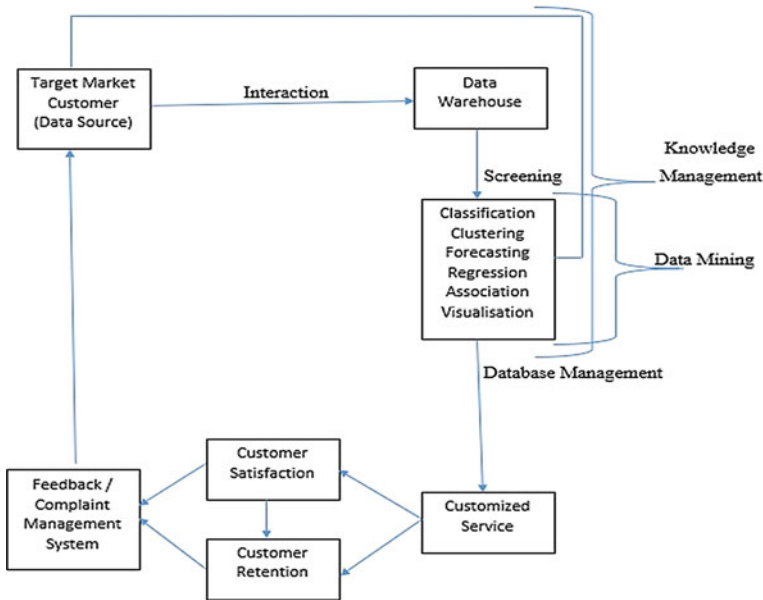


Fig. 1 Proposed framework for knowledge management—data mining based CRM cycle

concluded that data mining technique was useful in identifying the needs of customer and change in marketing strategy was required. 80% of customers have little contribution in bank’s profit and only 3.3% customers were highly profitable and loyal to the bank. So, data mining technique is useful helping management to take corrective marketing actions to improve business performance [43].

XI and Chen [44] in their his study ‘Application of Data Mining Technology in CRM System of Commercial Banks’, they he concluded that data mining is used to analyse the huge data effectively in the CRM system of commercial banks. Data mining technique transforms information into knowledge, and hence benefits the bank for better decision-making [44].

Complaints or feedback plays a very important role in CRM for service industry. It creates opportunities for service provider to further improve their service. It ensures that a success or failure of data mining technique applied is communicated to the service provider. Immediate action based on feedback strengthens the trust of customer leading to customer satisfaction and hence ensuring customer retention.

Based on above review of literatures, a proposed framework for knowledge management and data mining leading to effective CRM is given in Fig. 1.

5 Suggestion and Conclusion

The world market has moved from product-centric approach to customer-centric approach. This has facilitated relationship marketing and hence, the growth in CRM has remarkably occupied the centre stage of marketing philosophy. The interaction and communication with the support of advanced IT technology enabled the organisation to have in-depth view of their customer like taste and preference, likes and dislikes, purchasing behaviour and pattern. Organisations can take advantage of this opportunity and offer customised service to the customer. The customised service creates strong and continued relationship with the customer for a long time that supports retention and loyalty.

The CRM concept is more desirable for service sector where the complete concept of business and marketing is based on hospitality. Customer satisfaction is treated as mission and vision of the service sector. CRM becomes more effective when it is technologically backed by knowledge management and data mining. The information collected through various touch points is transformed into knowledge through data mining. The knowledge creation by the process of data mining is valuable for the management to take marketing decisions aligned with customer needs. Data mining helps in identifying potential customer and various attributes associated with customer like behaviour and pattern of purchasing and their changing needs. It facilitates making appropriate marketing decision on one-to-one individual basis. From the above literature study, it is concluded that knowledge management and data mining play a significant role in improving quality of service, increasing effectiveness of CRM, improving customer satisfaction and retention of customer. Smaller and medium size service sector should also introduce data mining technology to compete and get competitive advantage in the market.

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