Knowledge Discovery in Databases (KDD) as Tools for Developing Customer Relationship Management as External Uncertain Environment: A Case Study with Reference to State Bank of India

Priyaranjan Dash1*, Sabyasachi Pattnaik2 and Biswaranjan Rath3

1Department of Statistics, Utkal University, Bhubaneswar - 751004, Odisha, India; prdashhsp@gmail.com
2Department of ICT, Fakir Mohan University, Vyasa Vihar, Balasore - 756019, Odisha, India; spattnaik40@yahoo.co.in
3Institute of Business and Computer Studies, Siksha ‘O’ Anusandhan University, Bhubaneswar - 751003, Odisha, India; brrath@yahoo.com

Abstract

In the modern competitive era, the financial institutions particularly public sector banks need to develop their service quality, to gain competitive advantage, based on the knowledge discovery from the old data bases by adopting new technologies to improve their service quality for retaining the existing customers as well as to increase the domain of new customers. But, the adoption of new technology in such financial institutions becomes a challenging task due to different internal, external as well as technological uncertainties faced at the primary stages. The present paper attempts to highlight the extent of improvement in service qualities and the CRM management basing on five dimensions namely tangibility, reliability, responsiveness, assurance and empathy on the basis of a primary survey of customers of State Bank of India treating them as external uncertainty factors. We have used frequency and percentages, Mann-Whitney-Willcox U Test and Kolmogorov-Smirnov Two Sample Test for this purpose and the results shows that the customers has the major role for external uncertainties and there was a considerable gain achieved in improving the customers values by the efficient gain in CRM technology using knowledge discovery. It can be improved considering the different internal and technological factors of uncertainty.

Keywords: Customer Relationship, Knowledge Discovery in Databases, Kolmogorov-Smirnov Two Sample Test, Management, Mann-Whitney-Willcox U Test Uncertain environment

1. Introduction

Customer Relationship Management (CRM) is a business strategy that can select and manage customers to optimize “long-term value”1. CRM can be defined also as “enterprise wide business strategy designed to optimize profitability revenue and customer satisfaction by organizing the enterprise around customer segments, fostering customer-satisfying behaviours and linking processes from customers through suppliers”2,3. CRM is an iterative process; the most significant aspect of the CRM process is the continuous learning of facts about customers in order to achieve the maximum profitability for their lifetime4. Therefore CRM is much...
important and also crucial for a financial institution to
gain the faith of the customers. In India, the State Bank
of India is the largest public sector bank having highest
number of customers. For them it is a very difficult
task to effectively address and handle their customers’
behaviour and attitudes so that they can satisfy them
and, as a result, retain them.

In\textsuperscript{5} pointed that an effective CRM results the
improvement of information technologies and IT
companies which in turn will take advantage of the fast
growth of the CRM market requirements\textsuperscript{5,6}. The present
paper emphasizes Suresh’s definition\textsuperscript{7}:

Customer Relationship Management is a process by
which a company optimizes and manipulates customer
information to increase loyalty and retain them over their
lifetimes.

The primary goals of CRM are to:

\begin{itemize}
  \item Build strong relationships with target customers.
  \item Get closer to target customers at each contact channel.
  \item Optimize a company’s share of the customers finance.
\end{itemize}

The CRM cycle model has four major components
that are intended to collect summarize data related to
customers, in order to identify customer’s behaviour\textsuperscript{4}. In
addition, author in\textsuperscript{4} identifies the model as a consequence
process, converting customer information into customer
relationship through use of learning and action from
the information. Business, banks, and government
agencies apply the model to establish and manage long-
term, resource manageable and profitable customer
relationships\textsuperscript{4,8}. He further stated that CRM starts by
gathering knowledge about the customers and results in
high impact interaction with the customers. Swift\textsuperscript{4} divides
his model into four stages (Figure 1):

\begin{itemize}
  \item Knowledge discovery.
  \item Market planning.
  \item Customer interaction.
  \item Analysis and Refinement.
\end{itemize}

2. Knowledge Discovery in
Databases (KDD)

Knowledge Discovery in Databases (KDD) is the
process of exploring useful knowledge from a large data
base using data mining algorithm with specifications
of measures and thresholds. In recent times with a
high level of technological developments, artificial
intelligence techniques are used to solve the purpose.
The ultimate goal is to extract high-level knowledge
from low-level data\textsuperscript{8}. The Figure 2 outlines the overall
KDD process.

3. The Purpose of KDD in CRM in
the Banking Sector

KDD began to be used in the banking domain from
1990. Many changes forced banks to use new techniques.
These changes were the result of the emergence of new
competitors and high demand from customers for more
convenient channels such as ATMs, telephone banking,
internet banking and online transactions. In turn, CRM
have four stages that provide competitive advantages to
the banking sector as follows:

\begin{itemize}
  \item Organizationally, CRM is a strategic focus on the
customers behaviour, and the customers connection
between them.
\end{itemize}

\begin{figure}[h]
\centering
\includegraphics[scale=0.5]{Figure1.png}
\caption{CRM cycle model (Source: Adapted from Swift, 2001\textsuperscript{4}).}
\end{figure}
Technologically, CRM is dependent on DM to predict the customers' behaviour in the future.

In business processes, CRM mainly uses target customers' data to improve efficiency and effectiveness in marketing opportunities.

CRM is a commitment to drive customer satisfaction and investors' satisfaction at the same time.

Furthermore, the banking sector uses data mining techniques to increase their understanding of customer behaviour. Sequentially, this deep understanding of customer behaviour permits banks to determine marketing campaigns more accurately and support campaigns to be more related to the customer's needs\textsuperscript{10,11}. It help the decision-makers in the banking sector to apply the appropriate strategies that can help them to retain customers and increase campaign response rates, which, in turn, increases Return on Investment (ROI)\textsuperscript{10}.

4. Uncertainty Environment

In the early stages of a new technology adoption process, there is often uncertainty concerning the dynamics of price, technical change, or profitability and this may have considerable influence on the adoption process\textsuperscript{12}. These uncertainties deter firms that are averse to risk from adopting a new technology. However, as time proceeds, uncertainty reduces as a result of learning from experience, and thus the number of adopters/users increases. Figure 3 represents a customized model taking into account our case study “SBI”. The adopted model demonstrates how customers and increase campaign response rates, which, in turn, increases Return on Investment (ROI)\textsuperscript{10}.

**Figure 2.** An outline of the steps of the KDD process.

**Figure 3.** Conceptual framework (Factors of uncertainty).
internal and technology factors influence the business, particularly customer satisfaction, customer loyalty and retention in the banking sector along with considering the external factors.

In the absence of empirical studies to assist in the selection of the most significant factors for the new technology adoption process in uncertain environments, all relevant factors have been identified and grouped together into three broad categories of internal, external and technological factors that influence this process in State Bank of India.

5. External Factors

There is a number of uncertain external factors affecting the banking sector in India namely: Customer satisfaction, governmental policies, competition, the cultural and educational environment, as depicted in Figure 4.

5.1 Customer Satisfaction

Generally the adoption and use of new technologies for improving customer service and satisfaction has recently attracted much attention13–16. Most of the research, however, is based on the service providers perspective. More research is needed to investigate the impact of the adoption process of a new technology on customer perceptions of service quality. One of the most cited contributions of IT-based service enhancement is convenience16–20. Adoption and use of a new technology can affect customers perceptions of service quality either positively or negatively21.

In the banking industry, author22 indicates that service quality in banking implies consistently anticipating and satisfying the needs and expectations of customers. Comparing service quality in a manufacturing firm, in23 state: “The problem of evaluating service quality is more difficult and complex than product quality due to the intangible nature of services”.

Generally, service quality in banking plays a significant role as it is directly linked to customer satisfaction and profitability. The relationship between service quality, customer satisfaction and profitability has been examined in some empirical studies24–27. The results of all these studies indicate the existence of a positive relationship between all three elements.

There has been a number of empirical studies dealing with service quality in the banking industry in general and the application of SERVQUAL instrument in commercial banks28–33.

In India, one of the empirical studies conducted by State Bank of India on delivery channels for retail banking products, focusing on measuring levels of customer satisfaction in banks with in-person bank branches and their possible switch to alternative delivery channels, or a complete shift to different competitors, indicated high levels of dissatisfaction due to the bank’s lack of awareness of customer needs. The study showed low levels of loyalty,
where 62% of customers surveyed stated their willingness to change banks if offered more convenient banking alternatives.

Responsive service was found to be a major driver in satisfaction, followed by a 24-hour feature of accessibility. Our study used the SERVQUAL instrument to measure service quality two times: First time was in early adoption process stages of a new technology to evaluate the customers’ satisfactions in the State Bank of India in 2010/2011 and the second time was in most recently adoption process to evaluate the current customers’ satisfactions in the State Bank of India in 2013/2014.

In 2010/2011, to evaluate the customers’ satisfactions in the State bank of India, a customer questionnaire has been prepared to analyse the current level of services that are offered by the State Bank of India. The customer questionnaire observes the current situation at that time from the State Bank customers’ aspect. The customer questionnaire measured the attitude and behaviour of customers towards the bank. The data on customer variables stems from a customer survey. Customer survey questions were extracted from the study in relating to Bank’s service as:

- **Tangibles**: Measuring the appearance of physical facilities, equipment, personnel and communication materials.
- **Reliability**: Measuring the ability to perform the promised service reliably, precisely, dependably and accurately.
- **Responsiveness**: Measuring the willingness to help customers and provide punctual and prompt service.
- **Assurance**: Measuring the knowledge and courtesy of employees and their ability to motivate/convey trust and confidence.
- **Empathy**: Measuring provision of caring, personalized attention that the bank provides to its customers.

In the customer survey questionnaire is distributed to 1200 customers of State Bank of India across different state head quarters through mail and the mail address were collected purposively through different known respondents. Out of these respondents, 730 respondents give their response within specified time. Service quality as perceived by customers was measured by means of 5 dimensions, that is, tangibles (4 items on satisfaction with facilities and information provision, and appearance of personnel), reliability (6 items on satisfaction with staffs knowledge and the ability to perform the work), responsiveness (4 items on satisfaction with staff that are willing to help promptly), assurance (4 items on satisfaction with staff being courteous and trustworthy), empathy (5 items on satisfaction with being treated friendly and getting attention by staff of the bank).

Customer satisfaction was measured as a summary psychological state attribute, by asking the respondent on a 5-point rating scale if the customer is satisfied with the service of the bank. Each question was scored on a scale from 1 to 5 where a 1-rating indicated strong disagreement and a 5-rating indicated strong agreement.

Customer loyalty was settled based on in-depth interviews with those managers of the bank under investigation. Table 1 and Table 2 illustrate the customers views of the bank based on the survey of the five dimensions of SERVQUAL measurements.

### Table 1. Customers’ views of the bank

| Measures Items | Measure | No | Sometimes | Yes |
|----------------|---------|----|-----------|-----|
| Tangibles Freq. % | 28 | 3.8 | 434 | 59.4 | 269 | 36.8 |
| Reliability Freq. % | 37 | 5.1 | 342 | 46.9 | 351 | 48.0 |
| Responsiveness Freq. % | 9 | 1.2 | 327 | 44.8 | 394 | 54.0 |
| Assurance Freq. % | 0 | 0 | 310 | 42.5 | 420 | 57.5 |
| Empathy Freq. % | 15 | 2.0 | 249 | 34.1 | 466 | 63.9 |

To conclude, the findings confirm that service quality perceived by customers has a direct, significant effect on the customers’ satisfaction. Based on the factor analysis, the results indicate that the five dimensions of the original service quality defined by are comprised in two dimensions. The first dimension can be summarized as IT provision and the second dimension refers to the employee service performance that focuses on service attitude, such as willingness to respond, being courteous and friendly from the view point of the customers. The initial interaction between customers and front office desk employees has a great influence on how customers evaluate the service quality because customers start to form their opinions and expectation of the service delivery experience from that moment on.
5.2 Governmental Policies and Regulations in India

Banks operating in most of the countries must contend with heavy regulations, rules enforced by Federal and State agencies to govern their operations, service offerings, and the manner in which they grow and expand their facilities to better serve the public. A banker works within the financial system to provide loans, accept deposits, and provide other services to their customers. They must do so within a climate of extensive regulation, designed primarily to protect the public interests and nation's broad economic goal. So, different laws of banking were framed by the Government, which are based on a contractual analysis of the relationship between the bank and customer defined as any entity for which the bank agrees to conduct an account. The law implies rights and obligations into this relationship in terms of providing certain services to the customers.

Currently in most jurisdictions commercial banks are regulated by government entities and require a special bank license to operate. Usually the definition of the business of banking for the purposes of regulation is extended to include acceptance of deposits, even if they are not repayable to the customer's order—although money lending, by itself, is generally not included in the definition.

Unlike most other regulated industries, the regulator is typically also a participant in the market, i.e., a government-owned (central) bank. Central banks also typically have a monopoly on the business of issuing banknotes. However, in some countries this is not the case. In UK, for example, the Financial Services Authority licenses banks, and some commercial banks (such as the Bank of Scotland) issue their own banknotes in addition to those issued by the Bank of England, the UK government's central bank.

Some types of financial institutions, such as building societies and credit unions, may be partly or wholly exempted from bank license requirements, and therefore regulated under separate rules. The requirements for the issue of a bank license vary between jurisdictions but typically include:

- Minimum capital.
- Minimum capital ratio.
- ‘Fit and Proper’ requirements for the bank's controllers, owners, directors, and/or senior officers.
- Approval of the bank's business plan as being sufficiently prudent and plausible.

5.3 Competition

The liberalized policies of RBI and Government of India relating to Indian Banking have set the stage for a competitive banking. In the past competitive advantages have been determined by size, branch, distribution capability, artificial barriers to entry etc., which helped old players in maintaining a prominent position in the industry despite their inefficiencies. The direction of the new policy is to establish a level playing field. The creation of term money market, changes in credit delivery mechanism, flexibility in credit assessment process, diversification of sources of money etc., will change the factors that determine the survival, growth and profitability in the Indian Banking.

The areas in which the competition in the industry is either prevalent or is likely to emerge:

- Price based competition.
- Product based competition.
- Quality of service based competition.
- Market segment based competition.
- Technology based competition.
5.4 Characteristics of Competition

- Large number of users and providers of banking services and none of them able to influence the price, demand or supply in a significant manner. Free flow of information about industry, its products, range of services, pricing etc. In other words, a situation of near perfect competition.
- Competition is demand driven now rather than supply driven which used to be there till few years ago. There has to be innovations, differentiation and value addition.
- Competition will be based more on skills or core competencies than on products.
- Competition will have to be based on long term strategies and not short term goals.
- Competition is not only internal i.e., with the banking system but it is intra financial system.

The factors on which competitive advantages will be determined are:

- Strategic focus: Majority of banks will have to develop mix of products and business based on relative strengths and competence rather than historical reasons. Every product may it be deposit or credit or retail lending or corporate banking, must pay for itself in terms of return on investment rather than exist to promote or subsidize other business.
- Adaptability: Size alone is not sufficient and adaptability to new products, processes, technology, markets and customer needs will be more crucial.
- Cost competitiveness: Competitive pressure would lead to declining margins. Lower cost operators will have obvious advantage. Lean and mean organizations are the likely winners.
- Productivity: Cost efficiency would be supported by the ability to work smartly and capability to handle volumes and changing processes efficiently will be very crucial.
- Technology: Adopting, assimilating and implementing appropriate technology will significantly influence competitive strengths. Technology affects cost, productivity and people. The necessity and utility of the branch net works will have to be seen in the context of power and reach of technology.
- People: The quality of people will often support an organisation in an environment where differentiation based on product, pricing and delivery methods will be negligible.
- Risk management: The ability to grow and expand would depend on quality of risk, which will determine access to funds as well as the freedom to price products competitively.
- Attitudinal changes: Perhaps the more important than all the other factors is the requirement of flexible mind-set to understand, appreciate and anticipate the changes in the market place. A large part of the banking industry has for long been conditioned to think in a directed manner in an environment where innovation was virtually prohibited.

5.5 Competitive Strengths of Banks

PSBs: Bank network, market coverage, product differentiation, technology absorption, knowledge of local environment, expertise in niche segment (weakness are poor HRD policies, delayed decision making, poor risk management systems).

Old Private Banks: Knowledge of local environment, personalized service, speedy decisions, reasonable branch network, technology absorption (weakness - poor risk management systems, poor product innovations).

Foreign and new private banks: Automation and technology, product innovation, strong risk management system, speedy decision making, personalised service, progressive HRD policies, expertise in niche market (weakness - branch network and poor coverage).

Measuring competition in State Bank of India requires getting three kinds of data relating to the type of competition and the degree of this competition. This is necessary to obtain a clear image of competition factors that must be carefully scrutinized, which in turn enable bank to adopt proper new technology to contend with local and global markets. Accordingly, respondents were asked about the kind of competition in their bank: Local, international or both.

Besides, the respondents were asked about the factors that can help the bank to increase the competitive advantage by implementing KDD to improve CRM from two different point views of: The CRM department and the IT department.

The findings show that the bank face both local and international competition and have indicated
that the degree of competition to a great extent is big, which is fully consistent with our expectations that the competition has a critical role in adoption process forced the bank to going steps forwarded in the adoption process to take the competition advantages. Further, the findings illustrate that the CRM and IT staffs thought that the important factors to increase the bank competition and achieve the competitive advantage in the market are following:

- New technologies.
- Technical support of the customers.
- Customer/client satisfaction and loyalty.
- Pricing policy and cost level of services.
- Differentiation and quality of services.
- Price/quality relationship.
- Market research and bank image.
- Flexibility (time-service customizations).

5.6 Culture and the Educational Environment

It has been observed that the cultural diversity, norms, and beliefs could have major implications on the success of online banking in a society. The attitudes towards the use of technology should be optimally introduced and managed in the market place in order to prevent the community resisting the use of the technology, especially since the platform for implementation is related to a sensitive issue in the banking sector. The reaction should focus on issues of the adoption, diffusion, and adaptation of the technology into a specific environment.

The reaction is also related to different issues arising out of transformation from traditional to digitalized economy and the implications of how this will impact the volume of business growth and development.

India participates along with other developing countries in many of the challenges of building an Information Society. In order to bridge the digital divide, developing countries must overcome barriers that hamper the use and availability of new communication and information technology and their applications. For instance, cultural barriers in India may exist and cause people to reject the acceptance of e-commerce as a means of conducting business36. Shopping in India is a social activity, and personal, face-to-face contact with sellers is an important aspect of the shopping experience. People in any country are prone to distrust what businesses do with personal and credit card information; this is a universal e-commerce issue, while, in India where there may be grounds for such distrust, it could become a serious obstacle to the growth of e-commerce. Lack of developed legal and regulatory systems might also inhibit the development of e-commerce in developing countries37. As technological limitations, language barriers, and strict regulations become less of a problem, Arab countries have an opportunity to reap the rewards established by western countries on the information highway and interact with the global economy and its huge markets via cyberspace. In India, efforts to develop ICT are government-led, in close partnership with the business community and civil society.

A number of differences have been identified between western and Indian cultures, but there is also a number of mutual common problems. The following cultural factors inhibit the adoption process of benefits and opportunities associated with a new technology, such as the internet or virtual reality36-37.

5.6.1 Trusting New Technology

Although it is gradually subsiding with increasing education, advertising and information distribution, the lack of trust in electronic equipment, data and items continues to be a worldwide deterrent towards the internet and in particular, e-commerce. Countries such as India often cash, not plastic-based, lacks the skills and equipment required to create secure internet sites. Thus, such countries lag behind in the issue of trust, which is still a strong deterrent in making payments over the internet. It is thought that the younger generations are content with internet purchasing but are restrained by the government and banks that remain wary of the technology restricting public access to these services.

5.6.2 Technological Limitations

As a new technology is released and large corporations utilize up-to-the-minute software and hardware, many people are left behind and are trapped with old or inefficient machines incapable of running the new software. A computer is still a major purchase for most people who cannot then afford to upgrade or change machines every six months. This is especially the case in India where the average wage does not permit most of the bank customer to buy and maintain appropriate computer hardware and software. A comparative survey of computer science students highlighted that over half
the British respondents owned an I5 or I7 computer, while most of the Indian students did not own a machine, and on average they only had access to Pentium III or IV machines.

5.6.3 Conflict with Change
Conflict with change/resistance to change is one of the largest drawbacks in any attempt to bring about technological development. Decision-makers are used to doing business in a certain way and they do not want to change. Our common saying: “Our system is working, so why change it?” is the common attitude, which represents a significant hurdle in itself.

5.6.4 Generation Gap
Many, if not most, middle or top managers in India do not use e-mail or e-commerce for the simple reason that they were not raised in the information age. Information technology is not a part of their daily routine, and this fact coupled with their reluctance to invest in new technology and their failure to perceive the added value, leads to a lack of business-orientated technology.

This has led to a serious lack of e-commerce sites, but this situation will gradually change, as middle-aged managers, currently in potential management positions rise to top-level management in the next decade. They should be convinced of the benefits of IT and be technologically adept.

5.6.5 Organizational Culture
One of the key factors that may influence an organizations adoption process is its organizational culture and traditions. The field of organizational behavior is rich in theoretical literature on business culture\textsuperscript{38}. Author in\textsuperscript{39} define organizational culture as the pattern of shared values and beliefs that help individuals understand organizational functioning; thus providing norms for behaviour in the organization. Two key dimensions were used to classify organizational culture: The continuum from organic to mechanistic processes and the relative emphasis on internal maintenance versus external positioning\textsuperscript{38}.

Based on the previous discussion about the external uncertainty factors in the banking sector in India in general and in particular in SBI (customer satisfaction, governmental policies and regulations, competition, and culture and the educational environment); the Indian business environment is considered a labile environment especially within its application to transfer to free market like most developing countries in the Arab world and Africa. These external factors should be taken into account when implementing a new policy or strategy for developing the bank business environment. Furthermore, the effect of these factors should be studied carefully when applying any new or innovative technology for improving the Indian business environment because all of these factors may have a double-sided effect, positive or negative, on the implementation of any new technology according to earlier studies and our case descriptions that recognized these effects as mentioned above. However, this might need more separately focuses in future researches.

6. Conclusion
In this paper the detailed set-up of the study was described based on the basic research approach and the results from relevant studies as well as our synthesis model for factors of external uncertainty. The description comprised a short preface to the study design and methods. Relevant to our case background, the description is followed by: 1. KDD notion, significance and leading model. 2. CRM definitions, significance and dominant cycle model, and 3. Different external uncertainty factors like laws of Customers perception, laws of banking and competitive strengths of banks. Therefore, the argument began with factors of external uncertainty and their influence on the adoption process of a new technology. To achieve the desired benefits from such debate, each factor mentioned above has been explained from three basic views. These views are: 1. the empirical description of the factor in the banking industry. 2. The way to measure it in the banking sector in India, and 3. The way to measure it specifically in State Bank of India. Alternatively, our main interest lies in the relationship between the process of adopting new technology and its impact on business value in situations with a highly external uncertain environment. This relation is likely affected by internal and technological variables also but are not covered in the study. These variables were partially shown in fixed/stable environments and can, therefore, be excluded from further analysis in uncertain environments. The rationale behind the choice of conceptual and operational variables was explained and the measures of such variables were defined.
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