Applications of Artificial Intelligence on Customer Experience and Service Quality of the Banking Sector

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[Abstract] The present article highlights the significance of what and how artificial intelligence (AI) and its applications enhance the customer experience by elevating the quality of the service delivered by the banking industry. A systematic study of the literature concerning the various emerging applications of artificial intelligence and its impact on the banking sector is presented in this research paper. A thorough review of the existing literature is systematically undertaken to discuss the applications of AI in banking. Artificial intelligence certainly enhances the banking experience of millions of customers and employees in the banking sector. AI facilitates various processes to reduce the employees' workload by furnishing credit score checking, system failure prediction, emergency alarm systems, fraud detection, phishing website detection, liquidity risk assessment, customer loyalty evaluation, and intelligence systems. On the other hand, customer experience is upgraded through diverse applications, namely, mobile banking, chatbots, and augmented reality.

[Keywords] banking sector, artificial intelligence, customer experience, service quality

Introduction

The banking sector has been undergoing keen competition (Javalgi et al., 1989; Joshi et al., 2010; Fu et al., 2014) because of the globalization of the world economy, which makes the banking environment unstable (Joshi et al., 2010) and fragile (Berger et al., 2008). There are various stages involved in the banking industry, from processing the customers' loan applications to ensuring safe banking transactions for customers until they maintain their services with the banks. Customers are looking for better service wherever they collaborate with the products and services; in other words, a better customer experience is the demand that the customers put forward. As the technology has evolved in the past decades, industries have embarked on using state-of-the-art technology, namely, artificial intelligence, whereby superior quality of service can be delivered to customers. The banking industry's importance and its influence on the country's development are discussed in section 2; how artificial intelligence and its different applications improve the processes involved in the banking industry will be discussed in section 3. The conclusion will occur in section 4.

Background Study

Banking and Economy

Banking is a kind of exceptional industry that deals with capital to multiply money regardless of risk (Ghodselahi & Amirmadhi, 2011). Banking institutions have a significant impact on the economy of a country (Park, 2012) and, also, the financial stability and sustainable development (Gutierrez et al., 2009) of a country. Thus, banks should scrutinize loan processing methods to segregate useful applications from the total number of applications. A well-established loan application process will help the banks discourage the sanction of loans to loss-generating projects that will lead to non-performing assets at a later point in time and will enhance the process of the loan allocation to the right projects. Approving loans to non-profitable projects will indicate a poor investment of resources, which affects the banks' performance and the economic growth of a country. Because providing loans is one of the banks' critical functions, failing in that core activity will severely affect the banks (Park, 2012).

Besides, banks have to lend the money to the borrowers to profit (Ince & Aktan, 2009) that will contribute to the growth of financial activities, economic development activities, and industrial activities

(Cetorelli & Gambera, 1999). At the same time, bank loan availability will drop significantly if the bank crisis happens, which leads to a reduction in loan supply offered by the bank (Hubber, 2018). In India, public sector banks possess more than three-fourth of total assets belonging to the entire banking sector. India's state bank has seventeen percent of the total commercial banking assets (Goldberg, 2009). Banking institutions can perform effectively in providing loans to individuals and firms as per their demand if the bank's market share is quite large. When banks charge high-interest rates, plan to achieve high margins, decide to decrease the loan supply, the economic growth and creation of jobs will be affected, and the unemployment rate will be increased (Feldmann, 2015). In addition, if the entry barrier is high in the banking industry, the initial expense will be higher. As a result, the high-interest rate will be charged to make a profit, and foreign banks will hesitate to come (Claessens & Laevan, 2005).

Gross domestic product (GDP) is a measurement of economic development, the monetary value of output (finished goods) of production of various industries within a country for a particular time (Atay & Apak, 2013). The GDP estimation is profoundly affected when the banking industry output is exaggerated (Oulton, 2013). Non-performing assets should be recovered to strengthen the banking industry in a stable manner (Tan & Floros, 2012), which will contribute to economic activities.

The International Presence of Banks
With the expansion across the globe, banks have a crucial role in stabilizing a country's economy during a crisis (Goldberg, 2009). Less competition in the banking industry will make it operate at a high cost and deliver poor quality of services, which reduces the need for outside finance and causes a decline in industrial growth (Claessens & Laevan, 2005). Because banks have international branches, financial systems are integrated across the globe. This international presence will make the transactions from one country to another country effortless and fill the gap that is not served by local banks, making the banks provide better customer service (Goldberg, 2009). Industries that depend on more outside financing will have faster growth rates due to the competitive nature of the bank and finance institutions (Claessens & Laevan, 2005). A banking institution is a significant source of funds for companies to gain external funds from which they can run the business smoothly (Campiglio, 2016).

Banking Crisis
When depositors withdraw money from the bank due to the perception that the bank is untrustworthy, the bank system will fail. Without deposits from customers, it is difficult for banks to run their business irrespective of whether the situation is normal or a crisis (Kunt et al., 2000). Depositors always look for the right functioning banks and higher interest rates to invest their money (Goldberg, 2009). During a crisis, the bank loan issue will reduce drastically, and bank assets will drop, paving the way for a reduction in output and investment growth. The crisis affects the growth of output volume in the year of crisis and the following year. After a few years of crisis, the growth of output can be recovered, but the recovery may not be possible for the banks' credit within that timeframe concerning growth. Bank loans to borrowers will be dropped significantly if a bank crisis happens, which leads to a reduction in loans supplied by a bank (Huber, 2018). The banking interest rate for deposits will be higher during the crisis and afterwards gain more deposits and maintain the existing deposits (Kunt et al., 2000). The inflation rate is inversely proportional to the country's output, and it is observed that both the inflation rate and output growth are correlated negatively (Haslag, 1995). Despite an increase in the interest rate, the interest rate should be higher than the inflation rate to lure customers into making deposits. However, there is no significant difference in interest rates before and after a crisis and no proof that banks have given a higher interest rate than the inflation rate (Kunt et al., 2000). Banks that have maintained liquidity, even after depositors withdraw their funds, will need help from the central bank and its authorities (Kunt et al., 2000).

Customer Experience and Service Quality
Customers are intrigued by availing themselves of newly launched products and services created by banks to quickly execute the banking operations (Laketa et al., 2015). Based on the quality of service delivered to the customers, the banks' success is determined, and the bank's differentiation from its competitors is

identified. Customer satisfaction, which decides the survival and the success of the organization in the competitive environment, is an essential indicator for evaluating the performance of the organization, especially retail banking, which is dependent on customer loyalty to run its business profitably by luring new customers and maintaining existing customers (Dahari et al., 2015). Despite the banks' more considerable efforts, most customers are not satisfied with banks' banking services. Due to the growing competition in the banking sector, banks have taken steps to enhance their service quality as per the customer demand and to intensify the service in a reliable way (Johnston, 1997).

Nowadays, businesses should segment their customers to deliver the best service to them as per their various needs, which helps to treat each customer effectively. Consumer behavior should be monitored to understand the consumers well (Samala & Satheesh, 2020) and serve them better. The customer relationship management methodology merges the marketing strategy with processes; functions performed within the company and network connections outside the company are developed to maintain the existing customers in the highly competitive market by ascertaining and understanding its needs. Banking institutions can efficaciously capitalize on customer relationship management to serve the customers better if they focus on four significant elements:

- preserving existing customers
- enticing new customers
- motivating customers to have profound collaboration with the bank and updating customers with the banks' new services (Laketa et al., 2015)

Additionally, the banking industry can gain more deposits from retail depositors if it treats them properly (Puri & Rocholl, 2008).

Banking Process and Technology
Banking services, namely, automated teller machines (ATM), internet banking, credit cards, and banking apps have been used by millions of customers every day, and, interestingly, the number keeps increasing (Sundarkumar & Ravi, 2015). This kind of service needs a huge workforce, incurs a high cost, and is time-consuming. Conventional banking needs many workers to perform tasks, such as receiving deposits, approving loans, and making money transfers, but this has been changed entirely by internet banking, which is smoother and faster with information technology (IT). Internet banking that revolutionizes the banking sector has a vital role in serving the individual customer better to maintain a long-term relationship through the dispensation of banking products through various channels, namely, ATMs, internet banking services, mobile banking, and others. The internet, which makes financial and banking services more competitive, has helped to have many e-banking products from ATMs to credit and debit cards. This e-banking, which loosens entry barriers, gives each customer access anywhere globally and saves time for customers and bank managers, who have changed manual and paperwork to paperless work with the help of technology and communication (Atay & Apak, 2013).

Scope of Artificial Intelligence and its Application in the Banking Industry

Credit Score
Banks should borrow money after critically evaluating credit scores to customers applying for loans (Eletter et al., 2010). The banking industry makes a profit, irrespective of the risk, because it controls and manages the risk. Among various risks, credit risk is one of the major risks, giving more attention to getting away from total system failure, since it is not easy to compensate (Ghodselahi & Amirmadhi, 2011). This classification discerns between a functional score that has a high probability not to default and a bad score that has a high chance of defaulting. Classification and regression tree models are made with a decision-tree algorithm, which is one of the artificial intelligence techniques used for classification problems. This technique gives better outcomes in evaluating credit scores than other techniques, namely, logistic regression and discriminant analysis (Ince & Aktan, 2009). Approving loans is a crucial decision for the bank's profit and marketing strategies; this is not easy when different lending approaches are followed by

competing banks and frequent changes occur in consumers' borrowing behavior. The loan application can be classified into two categories: positive credit risk and the applicants' negative credit risk. The positive credit risk indicates a high probability of applicants' failing to repay the loan.

In contrast, the negative credit risk shows a low probability of applicants' failing to repay the loan. The bank managers who are overwhelmed with customer data should make the right decision to approve the application with negative credit risk and deny the application with positive credit risk. Artificial intelligence has helped managers make better decisions (Eletter et al., 2010).

As mentioned earlier, classification is the technique used to classify the applicant's good credit and bad credit. This credit score is applicable for companies, municipalities, states, financial institutions, and so on. The value obtained from credit score processing is used by debt givers, bond buyers, and government officers. The risk involved is inversely proportional to the credit score value based on the various indicators, such as the applicant's economic condition, capital involved, collateral offered by the applicant, the applicant's capacity, and the applicant's behavior history (Ghodselahi & Amirmadhi, 2011). According to the relationship between the bank and company, the credit limit allocated for that company is decided along with various important factors, namely, the owner, the company, and the banks' activity if it is a big company. When it comes to small companies, the owner's activity plays a more important role in deciding the credit limit than other factors because a high chance of credit will be possible if the expert knowledge is shown by the owner in the business (Fernando et al., 2011).

The most commonly used models are logistic regression and linear discriminant analysis. The linear relationship of the two variables, which are not required for multivariate normality assumption and the latter, also has a drawback in assuming that the variables are linear. However, in reality, the variables are non-linear. Artificial intelligence techniques, such as decision trees, genetic algorithms, artificial neural networks, and support vector machines, give better results than traditional statistical methods. Three models, namely, the support vector machine, neural network, and decision tree, are used for classification along with the fuzzy C-Means clustering technique. However, hybrid approaches have been outperforming the above-mentioned specific methods concerning prediction accuracy (Ghodselahi & Amirmadhi, 2011). Predicting risk and making the right decision for the approval of credit will help avoid situations like bankruptcy and fraud activities (Moro et al., 2015).

Credit Card Fraudulent Activities

Fraudulent activities in credit card transactions are executed for various reasons, namely, improper deployment method to deal with tens and thousands of transactions and the wrong approach in classifying cost rates to the transaction of a different specified amount. Moreover, the data in which the model is performed are skewed, and the transformation of unlabeled data into labeled data is an unreasonable and prolonged-time-taking process, as well. K reverse nearest neighborhood is used to eliminate the outliers, considered noise labels, after applying stratified random sampling to deal with 20% of the unbalanced data present in the original dataset. To perform the dataset classification, a method that minimizes the dimensionality will be executed first, and then a support vector machine (SVM), a particular one-class support vector machine (OCSVM), is used. This OCSVM differs from SVM in training the dataset because the former uses only one class to train. Its performance is significantly better compared to the group method of data handling (GMDH) and probabilistic neural network (PNN) in the detection rate of fraudulent claims while using a hybrid under-sampling approach (Sundarkumar & Ravi, 2015).

Cloud Security

Many cloud computing-related projects are facing a severely high rate of failure due to security issues. There are five stages in modeling cloud computing: cloud deployment models, cloud risk management models, mobility and banking applications, and cloud service models. Besides, there are eight risk management sections in effective cloud computing: risk planning, risk analysis, risk identification, risk prioritization, risk evaluation, risk treatment, risk control, and risk communication and documentation. Levenberg-Marquardt based backpropagation is used in the data collected from the Cloud Delphi technique for assigning the probability of occurrence and building a network analysis. After building the network,

training of the data is performed, followed by the testing of the data. Finally, the prediction cloud security model is executed by an artificial neural network (ANN) (Elzamly et al., 2017).

Phishing Websites

Phishing websites allure people into disclosing their usernames and password, which will be used for various illegal transactions. The data mining algorithm, one of the artificial intelligence techniques, is used to detect those phishing websites. The prediction of these websites is also possible with associative and classification algorithms. The various estimations have been revealed that the cost per victim is continually increasing. Majorly, emails are used to lure the banking customers into falling into the trap, which is promoted by regularly sending spam emails to many people. The data mining technique will help get the required information pertinent to the user from the tons of data available. There are 27 major feature vectors, a conglomerate of different indicators, such as URL & domain identity, security and encryption, source code and Javascript, page style and content, web address bar, and the human social factor. Various approaches, namely, PART, PRISM, JRip, C4.5, MCAR, and CBA, are performed by Aburrous M et al. (2010a) to determine the best approach; MCAR outnumbered others in accuracy and speed among all other methods. The fuzzy data mining algorithm is used to identify phishing websites, particularly e-banking websites, automatically, but finding a critical feature to achieve this goal is not always easy with this technique (Aburrous M et al., 2010b).

Banking Failure

Banking failure will happen when the banks are not making a profit; this is due to various reasons: high competition in the market, emerging non-banking institutions, unexpected threats to loan portfolios, and financial distress. Big banks' failure is dangerous, as it will lead to a bulge in the whole financial system. In 1980, big banks failed to maintain security against non-performing loans, which is one reason for bank failure and system collapse (Boyd & Gertler, 1994). Predicting risk and making the right decision for credit approval will help avoid negative situations like bankruptcy and fraud (Mora et al., 2015).

Financial soundness indicators (FSI) are used to measure banks' financial vulnerabilities, which are classified into two leading indicators, such as the encouraging indicators and the corset indicators. It can be abridged by different criteria, such as capital adequacy, asset quality, management quality, earning ability, liquidity, and sensitivity. Three models, namely, discriminant, logit, and profit analyses, were introduced to reveal banking failures in advance by three years. "Adoptive Neuro-Fuzzy inference system (ANFIS)" is one of the techniques applied in finance, which is useful for predicting the failure of the events in the banking system (Messai & Gallali, 2015). Banks assist in the economic stability of a country and reinforce the country's financial system. Fuzzy logic and neural network techniques are the apparent techniques used to find the banks' efficiency and productivity (Sharma et al., 2013).

In addition to this, three models were executed to predict the currency crisis, and those models are logit regression, decision tree, and artificial neural network (ANN). The unpleasant situation can be estimated from the ratio of the non-performing loans to the total gross loans. The non-performing loans are the significant indicators of the probable financial crisis. ANN is performed with the main variables of a bank's distress: loan loss reserves of non-performing loans, return on equity average, and loan loss provision to gross loan ratio (Messai & Gallali, 2015). The neural network gives a better percentage in predicting the failure of banks according to Messai and Gallali (2015).

Alarm System

Artificial intelligence gives a better solution than a conventional emergency button alarming system in improving the banking system security from robberies in the banks and the ATMs. This system performs in three stages: artificial vision first takes a photo for image processing to get the features. An artificial neural network (ANN) classifies the event from the obtained pattern and gives the warning messages status. Based on the classification of the neural network, the output class is determined. If the output is 1, this means the alarm should be activated, and a warning message should be sent using GSM technology (Ortiz et al., 2016)

Mobile Banking
Mobile banking is famous nowadays; sixty-five members out of one-hundred member groups are using it, and most people use mobile payment. Most of the customers have positive opinions about online payment services, which attract the customer from the conventional card transaction and assist in enhancing banking services due to maximizing revenue generation. This transformation of user experience helps collect and analyze the user-generated data for delivering better service to each customer as per the patterns or insights extracted from that data (Dubey, 2019).

Mobile devices facilitate mobile banking services that customers prefer due to comfort and convenience, and they are, also, preferred by banking institutions to maintain good relations with them. However, ninety-one percent of participants who have attended a study conducted by KMPG recently responded that they did not use their mobile phones to do banking, not even once. The findings of the study clearly show that customers should be segmented per their preference. The segmented customers should be targeted to understand what makes them use mobile banking services and what kind of expectation they have in their perception. Along with convenient services provided in mobile devices, banks can also utilize the offered service to serve the customer better. This device that banks can use to deploy customer relationship management is operated for customers' purposes (Awasthi & Sangle, 2013). Recently, AI-enabled mobile banking (Payne et al., 2018) has gotten some customer attraction, which the banks can utilize to gain more customers

Customer Loyalty
The relationship between bankers and customers is paramount to keeping hold of existing customers and enhancing customer loyalty. The customer relationship will be healthy if the banking institutions fulfill the customers' needs and expectations, which change over the period. Customer loyalty can be improved if the customers are attracted by the excellent quality services provided at low prices. Customer loyalty can be predicted in the banking industry by using an artificial neural network already used by other industries for the same purpose. After collecting the data, essential variables should be taken from all the available variables using factor analysis, making the data ready for further modeling. In this prediction model, feed-forward backpropagation is used in the algorithm, along with the artificial neural network. K-fold cross-validation is used, where K subsets are obtained from the data's categorization during the dataset training. The algorithm's performance can be evaluated from the coefficient of efficiency and root mean square error after testing the dataset. The obtained result of predicting customer loyalty from the artificial neural network has proven that high accuracy is possible (Kishada et al., 2016).

Liquidity Risk Assessment
Banking institutions are prone to various technological and financial risks; these risks comprise the market, operational, and credit risk. Banks have to increase the profitability, which leads to more investment from the shareholders and ensures the liquidity position at any point in time. There should be an appropriate balance between the short-term risk of liquidity and the long-term risk of profitability. The depositors who invest their money for the short term in the bank will make frequent withdrawals, making the bank pay more attention to liquidity. However, there is an unwanted situation on both extremes of liquidity: high liquidity indicates reduced utilization of available resources, and low liquidity describes a wrong impression of the banks, which leads to low deposits and a drop in market share. In both cases, the bank is moving towards an unpleasant situation, such as bankruptcy.

Banks have a comprehensive database from which a liquidity risk alert system can be modeled with an artificial neural network, generic algorithm for evaluating the liquidity risk, and a Bayesian network for making predictions of the distribution liquidity risk. The measurement of a company's liquidity risk can be done by bifurcating into two elements: market-related features that consider recession, inference in the transaction system, and disarrangement in the markets (capital) and bank-related features that contemplate many factors such as credit risk and others. A system risk adjustment model for liquidity is a kind of probability measurement of liquidity risk by combining data from the market and balance sheet and the pricing method. The probability distribution is also used to find liquidity risk, but this requires big data to

get proper output (Tavana et al., 2018). Tavana et al. (2018) used an artificial neural network applied along with the genetic and Levenberg-Marquardt algorithm for identifying important feature vectors; the Bayesian network is preferred to assess the probability of occurrence of liquidity risk from the feature, as mentioned earlier vectors. This combination gives a better result, which is consistent after training the model correctly.

Intelligence and Augmented Reality
Various industries have started using the latest technology to enhance their business, which is an outstanding advantage for business operations. Augmented reality, which assists individuals by extending perception and easing communications, delivers virtual aid to alleviate the complex real-world problems by disclosing more details. From healthcare to games and media, many fields have already deployed augmented reality to optimize existing processes. Industries with high-cost operations and high-risk involvement can implement this application for business development (Heng, 2015). Augmented reality is also used by banking and finance institutions to understand and demonstrate customer performance and make the best recommendation to enhance customers' expenditure patterns (Dubey, 2019). On the other hand, intelligent systems are also installed for improving operations and reducing manual work. For example, JP Morgan has executed a contract intelligence system that reduces labor activity by 0.36 million hours (Dubey, 2019).

Chatbot
If there is an issue or inquiry related to banking institutions' products or services, customers have to contact the officers to get the problem solved. However, this process is kind of tedious, repetitive, and time-consuming. Due to advancements in AI-based banking technology, many industries have benefitted, and it is working well in businesses. Moreover, Watson, developed by IBM, is designed to answer the queries; this is done by applying machine learning algorithms and natural language processing (NLP), which helps to retrieve the information and represent the inbuilt domain knowledge. Implementing these bots is useful for serving customers better and is already done by most big growing banks (Singh et al., 2018).

Conclusion
Millions of customers undergo multiple transactions in a day as a routine. The data has been generated by the customers, which is stored and maintained as a big database. Moreover, there is a lot of manual work to perform to carry out most of the banking industry processes. Now, AI has made it easy for them to reduce manual labor from the employee and customer sides. This kind of sophisticated work has become a simple task, which has never been seen before due to the machine learning technique.

The banking sector has been improving its service quality by providing various practical tools to ensure safety and comfort. The technology keeps improving daily; it is better to incorporate those technologies into the business' different fields. State-of-the-art technology is mandatory in maintaining and enhancing security in the banking system, and other sections of the banking industry are ready to implement the latest technology. In this digital era, customers are also expecting their bank to be up to date. The technology upgradeability will uplift the service and security and improve the reputation of the bank. Nowadays, internet banking and mobile banking are attractive to customers due to their effectiveness and user-friendliness.

Many studies show that different models are launched to maximize the accuracy of the process, further improving the customer-banking relationship and creating a win-win situation for both. Due to the competition from the non-banking sectors, banks have to adapt the latest trending technologies used in the digital era to improve their service quality. Technology has a more positive effect on the banking industry. Artificial intelligence techniques should be utilized in the banking industry to make customer banking transactions smooth and spontaneous in the business. Fortunately, AI has been providing a plethora of applications to make the banks reach their fullest efficiency, paving the way for a new dimension in banking services.

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