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Time Series Analysis: A Study on the Pharmaceutical Industry in Indi

Vaishnavi D¹ & Lakshmi J V N²

^{1&2}Department of Management, Sunstone, Bangalore

Abstract—Time series analysis is a method that helps one to understand how various variables change with time. It helps one to take various important decisions in various aspects. One such important decisions involve the decision relating to investments. This study assists investors regarding the confusion in deciding which companies from the pharmaceutical industry to invest in. It also advises the investors on taking long and short positions. The companies chosen for the study are Dr Reddy's, Cipla, Lupin, Sun Pharma and Divis Lab. The data collected include the opening price, closing price, volume of trade, day's high and day's low for each of the above-mentioned companies for the last three years. The data was collected from the National Stock Exchange. The analysis includes the calculation of cumulative log returns and rolling statistics represented in the form of graphs. The study advises investors to hold long positions for Cipla and Sun Pharma and short positions for Lupin and Divis labs. It suggests intraday trading for the shares of Dr Reddy. As the study was limited to Pharmaceutical Industry, It opens the scope for study in other industries.

Keywords: Finance, Pharma, Decision, Stock prediction, Time Series Analysis

INTRODUCTION

Time has been the greatest factor in all the types of analysis one could think of. The value of financial securities, investments and money has always been dependent on time. Data recording is been taking place for a very long period and time has been the most crucial aspect of the same. Therefore, by default, time series data becomes the important data type in finance.

Time series analysis is the method of studying the data related to a particular sequence/series. In other words, it is a study of data related to a particular collection of figures and numbers recorded at regular intervals. For example, the stock prices at a particular stock exchange; financial statements belonging to a particular industry for a period of 5 years etc.

A time series study helps us to identify how various variables change with time. It typically shows how a particular variable adjusts itself with time and helps us to predict future trends based on the historical behaviour of the variable.

Organisations and Researchers mainly use time series analysis to predict/forecast the future trend, make investment-related investments, alter the organisation structure, and track its risk and progress over time, for a better understanding of the variables, segment and classify data as per the nature. Time series analysis is also used in descriptive and intervention analysis.

Stock market analysis is a time series analysis that involves the evaluation of a particular stock, industry, or the market itself using various tools to predict the investment potential and to analyse future growth and behaviour. The popular types of stock market analysis are fundamental analysis and technical analysis.

Fundamental analysis helps us forecast stock prices using the company's financial activities/ financial statements such as the Balance sheet, Income statement, and Cash Flow Statement. It also involves the use of various ratio analyses which help draw relationships between various variables. Ratios like liquidity ratio and solvency ratio can be used.

Technical analysis is a practice that uses historical stock prices to predict future data. It refers to using stock prices, charts, trends, and statistical indicators. It is also based on historical values. Technical analysis is affected by various market factors. It is mostly based on the opening and closing prices and the corresponding technical charts. This Study uses technical analysis to study the pharmaceutical industry.

This study focuses on analysing the trend of the top companies in the pharmaceutical industry. The objective of the study is to analyse and bring out the future trend in the industry and to study the investment opportunity in the industry.

LITERATURE REVIEW:

| Sl no | Year | Title | Author(s) | Problem(s) | Purpose | Algorithms | Evaluations | Summary |
|-------|------|---|--|--|---|--|---|--|
| 1. | 2019 | Stock Market Analysis: A Review and Taxonomy of Prediction Techniques | Dev Shah, Haruna Isah and Farhana Zulkarnaen, School of Computing, Queen's University, Kingston, ON K7L 2N8, Canada; dshah@cs.queensu.ca (D.S.); farhana@cs.queensu.ca | A review and Taxonomy of the stock market prediction techniques. | To discuss technical, fundamental, short- and long-term approaches used for stock analysis. To present some challenges and research opportunities in this field. | Based on secondary data. Based on the literature review. | This paper discusses the various prediction techniques of Stock market prediction. It presents a detailed literature study of the state-of-the-art algorithms and methods that are commonly applied to stock market prediction. It also discusses some of the never-ending challenges in this domain that require more attention and provides opportunities for future development and research | The paper brings out the challenges involved in predicting the market and stock prices. It says predicting stock prices has been one of the greatest challenges ever. The article defines and throws light on the two main techniques of stock market analysis, Fundamental Analysis and Technical analysis. It elaborates on statistical, pattern recognition, machine learning and sentimental analysis. The methodology followed was a literature survey. It also includes a discussion based on the most suitable technique that can be used for predicting the market. It finally concludes that a hybrid or a combination of the techniques could be more suitable to predict the stock prices and it also establishes the gap for further research in the same. |
| 2. | 2019 | Python for Finance, Chapter 8 | Yves Hilpisch | Financial Time Series | To discuss the method of analysis of time series data using various tools of analysis using Python. | Based on secondary data. Analysis of High-frequency data using various statistical tools. | This article deals with financial time series, probably the most important data type in the financial field. It concludes that pandas are a powerful package for dealing with such data sets, allowing for efficient data analyses and easy visualizations. pandas are also helpful in reading such data sets from different sources as well as in exporting the data sets to different technical file formats effectively. | The article explains the importance of time series data and the use of Python and pandas in the analysis of time series data. It provides step by step explanation of analysing time series data, using various statistical techniques with the help of pandas and Python. The steps of analysis include identifying financial data, data import, summary statistics, understanding the changes in data over time, resampling if necessary, rolling statistics, technical and correlation analysis, regression and finally dealing with high-frequency data. It concludes that pandas are a powerful package for dealing with such data sets, allowing for efficient data analyses and easy visualizations. |

RESEARCH METHODOLOGY

The study is based on secondary data. It consists of data from the top companies in the pharmaceutical Industries. The samples include- Cipla, Dr Reddy, Sun Pharma, Divis Lab and Lupin. The data set consisted of the opening price, closing price, volume of trade, day's high and day's low for each of the above-mentioned companies for the last three years.

ANALYSIS REPORT

Considering the five companies for analyzing the financial times series data. The analysis is categorized into the following sections as shown below:

A financial Analysis

The companies involved in the following study are:

Data columns (total 5 columns):

Column Non-Null Count Dtype

```

0 cipla 497 non-null float64
1 divislab 497 non-null float64
2 drreddy 497 non-null float64
3 lupin 497 non-null float64
4 sunpharma 497 non-null float64
    
```

To visualize the complete informational index by means of various subplots the accompanying picture is utilized

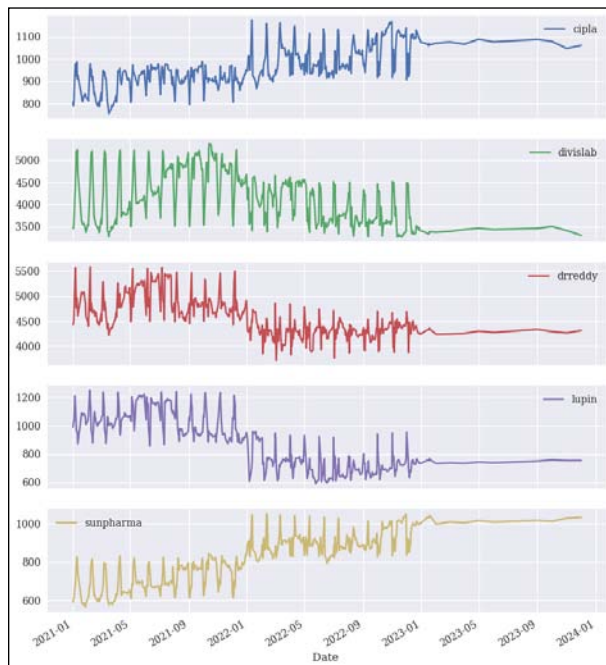


Figure 1: Showing index by means of subplots

Summary statistics are given below:

| | cipla | divislab | drreddy | lupin | sunpharma |
|-------|---------|----------|---------|---------|-----------|
| count | 497.00 | 497.00 | 497.00 | 497.00 | 497.00 |
| mean | 963.30 | 4106.65 | 4570.21 | 870.43 | 817.87 |
| std | 87.95 | 577.13 | 387.92 | 183.42 | 125.54 |
| min | 755.15 | 3265.95 | 3718.85 | 590.25 | 564.35 |
| 25% | 910.60 | 3587.65 | 4302.80 | 714.45 | 703.00 |
| 50% | 950.50 | 4061.45 | 4481.00 | 881.75 | 829.25 |
| 75% | 1025.65 | 4530.40 | 4792.35 | 1018.35 | 905.90 |
| max | 1173.40 | 5372.15 | 5575.70 | 1247.25 | 1051.95 |

Figure 2: summary statistics

Pct change () is visualized using a bar plot as shown below.

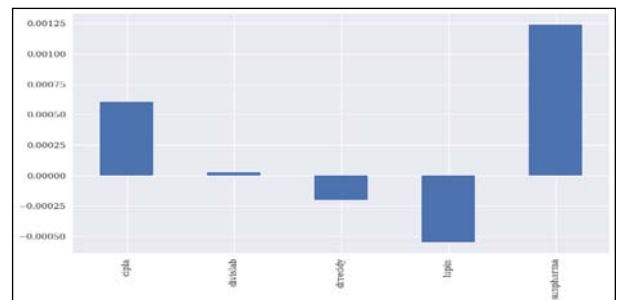


Figure 3: Showing Pct Change

Insights from the bar plot: There is an increase in the mean percentage change for Cipla, Divislab and Sunpharma shares. But there is a decrease in the mean percentage change of Drreddy and Lupin shares.

Cumulative log-returns of the financial time series data are shown below for all the shares:

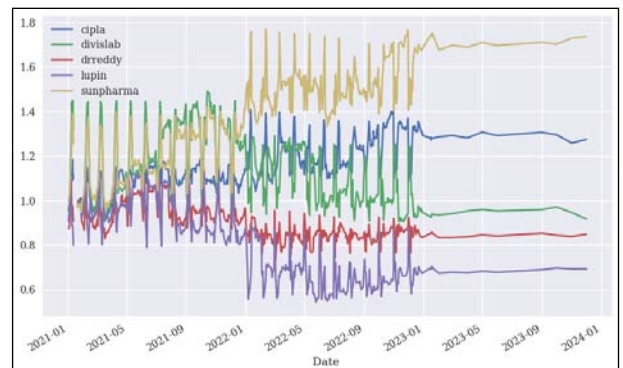


Figure 4: showing Cumulative log returns

Insights from the log time series data: Cumulative log returns over time are shown in Fig _____. On 20-01-2021 Cipla's share cumulative log return is 0.98

and later on 19-01-2023, the share price increased to 1.28. On 20-01-2021 Divislab share cumulative log return is 0.999; later on 19-01-2023 the share price decreased to 0.94. On 20-01-2021 Dr Reddy's share cumulative log return is 0.994; later on 19-01-2023, the share price decreased to 0.853. On 20-01-2021 Lupin's share cumulative log return is 0.981; later 19-01-2023, the share price decreased to 0.698. On 20-01-2021 Sunpharma's share cumulative log return is 0.98; later on 19-01-2023, the share price increased to 1.75.

By resampling the data by monthly time intervals cumulative log returns are computed and the plot is shown below:

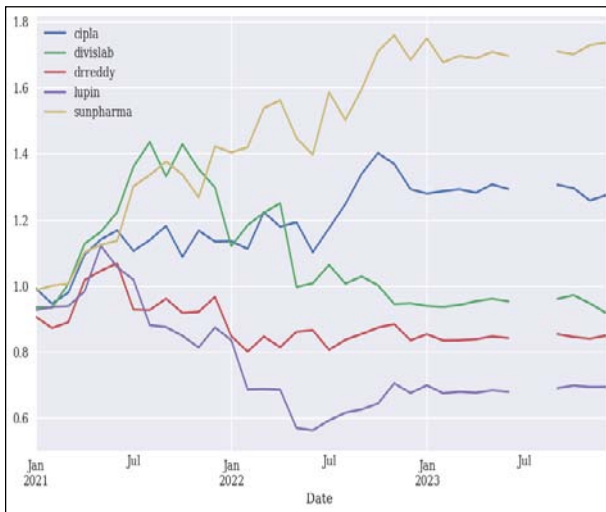


Figure 5: Showing cumulative log returns based on monthly time intervals

Insights from the log time series data: Cumulative log returns over time are shown in fig 5. On 31-01-2021 Cipla's share cumulative log return is 0.99; later on 31-12-2023, the share price increased to 1.27. On 31-01-2021, Divislab's cumulative log return is 0.93; later on 31-12-2023, the share price decreased to 0.92. On 31-01-2021 Drreddy's share cumulative log return is 0.90; later on 31-12-2023, the share price decreased to 0.85. On 31-01-2021 Lupin's share cumulative log return is 0.93; later on 31-12-2023, the share price decreased to 0.69. On 31-01-2021 Sunpharma's share cumulative log return is 0.99; later on 31-12-2023, the share price increased to 1.74.

Rolling Statistics

Minimum, Mean and Maximum statistic parameters are Plotted showing rolling statistics for the final 200 data rows for 5 shares are given below.



Figure 6: Rolling statistics for cipla

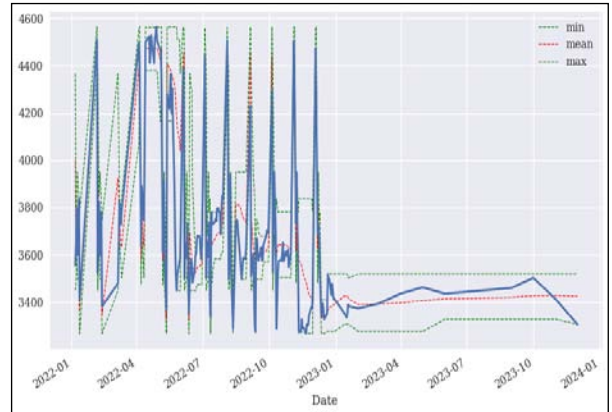


Figure 7: Rolling statistics for DivisLab



Figure 8: Rolling statistics for Dr Reddy's

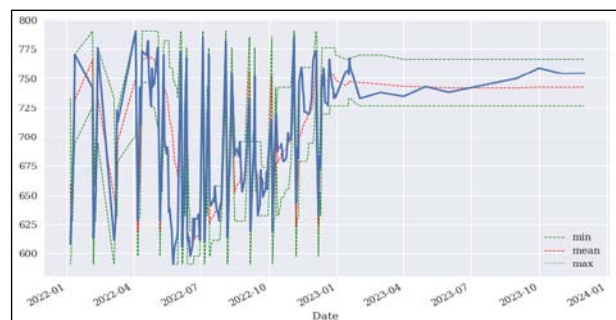


Figure 9: Rolling statistics for Lupin



Figure 10: Rolling Statistics for Sun Pharma

A traditional trading strategy for technical analysis is computed using two simple moving averages (SMAs) for all 5 Medi shares. The idea is that the trader should go long on a stock (or financial instrument in general) when the shorter-term SMA is above the longer-term SMA and should go short when the opposite holds true. Short-term SMA is for the window = 42 and Long term SMA is for the window = 252. Visualizes a long position by a value of 1 and a short position by a value of -1. The change in the position is triggered (visually) by a crossover of the two lines representing the SMA time series:

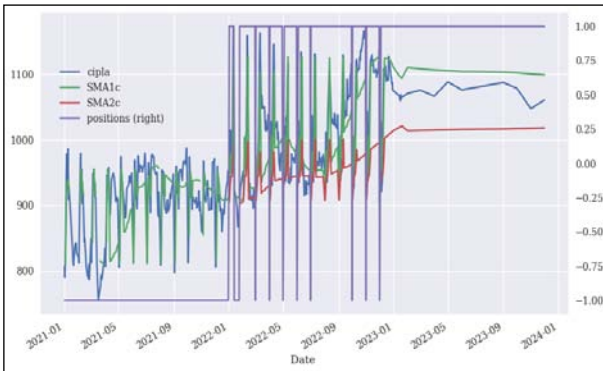


Figure 11: SMA Cipla

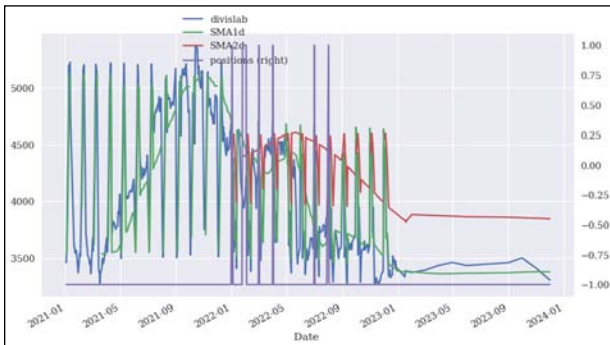


Figure 12: SMA Divislab

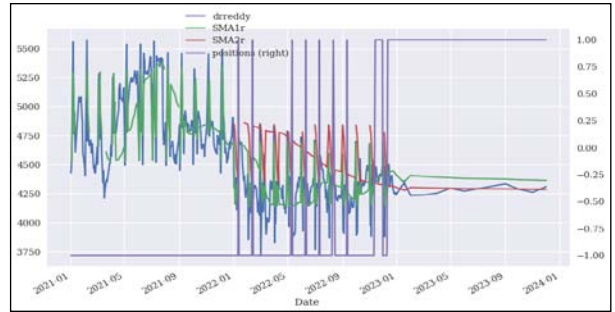


Figure 13: SMA Dr Reddy's

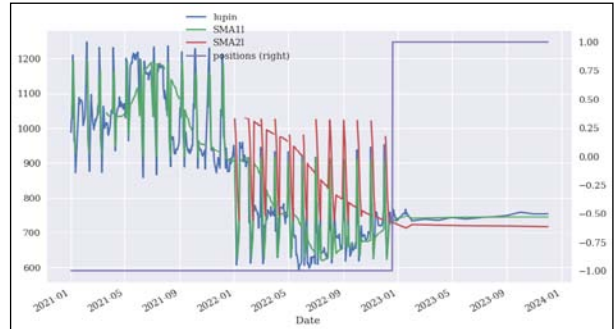


Figure 14: SMA Lupin

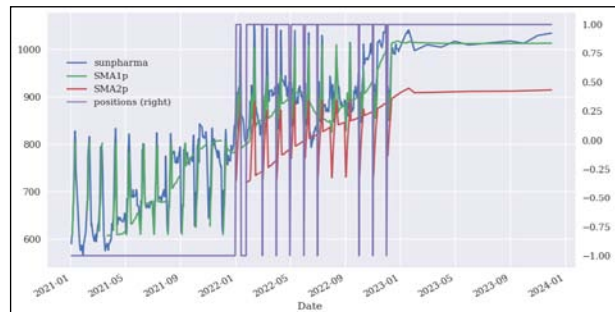


Figure 15: SMA Sunpharma

CONCLUSION

From the above analysis we can observe that Share prices of Cipla and Sun pharma are showing an upward trend in the market which indicates it can sustain the market fluctuations and maintain an upward trend in the market. Therefore, the investors are advised to take long positions with respect to these shares. On the other hand, Lupin and Divis Labs are showing bearish traits as there is a downward trend observed. With respect to these shares, the investors are advised to go short in the market or reconsider the investment. However, Dr Reddy's is taking a neutral and sustainable stand, where there are possibilities for the share to move up and down frequently. Intra-day users can take advantage of this scenario and make the best of it.

Here the study focused only on the companies from the pharmaceutical industry. Therefore, it widens the scope for further research in other industries.

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Artificial Intelligence & Machine Learning Models for Credit Scoring and Risk Management

Himanshu Singh, Keerti, Dr. Sapna Arora

School of Management Studies, IILM University, Gurugram, Haryana

Abstract—Credit risk management is an essential aspect of financial management for lenders and borrowers alike. This paper provides an overview of credit risk management, including its measurement and mitigation. The measurement of credit risk involves the use of proprietary risk rating tools and requires qualitative and quantitative techniques to rate the risk of business borrowers. Credit risk can be mitigated through credit structuring techniques, sensitivity analysis, and portfolio-level controls. Basel I, Basel II, and Basel III are rules made by the Basel Committee on Banking Supervision to ensure banks have enough money to cover any losses they might have. The traditional 5C model, the FICO scoring, VantageScore, decision trees, logistic regression, and neural networks are among the many of the credit scoring models addressed in the paper. Credit scores are calculated and risks are monitored using statistical models, credit scoring software, risk assessment tools, data visualization tools, and credit bureau reports. The combination of these analysis tools helps lenders and financial institutions identify patterns and trends, assess borrower creditworthiness, and mitigate credit risk. This paper highlights the importance of effective credit risk management in ensuring the financial stability of lenders and borrowers.

Keywords – Credit Scoring, Financial Risk, Artificial Intelligence (AI), Machine Learning (ML), Algorithm, Models.

INTRODUCTION

Lenders use credit scoring as a tool to assess borrowers' creditworthiness. The term "credit" is used to describe a sum of money that a financial institution lends to a customer and that must be repaid, with interest, over time (Hand and Henley 2007). Based on information from your credit reports, a credit score predicts your credit behaviour, such as how likely you are to repay a loan on time. To assess a borrower's likelihood of timely debt repayment, numerous elements are

examined, including credit history, payment history, income, and other financial data. Risk management is the procedure for identifying, evaluating, and minimizing any hazards connected to lending. In doing so, it is necessary to consider both the risks involved in lending to a specific borrower or group of borrowers as well as the larger economic and market risks that might have an effect on a lender's portfolio.

As one of the primary instruments used in the risk management process, credit scoring and risk management are closely related. By assessing a borrower's creditworthiness, lenders can more accurately gauge the risks involved in lending to that borrower and decide whether and under what conditions to give credit. For lenders to reduce their vulnerability to possible losses and keep a healthy loan portfolio, effective risk management is essential.

The use of quantitative modeling techniques in finance has become increasingly important in recent years, particularly in the wake of the 2008 financial crisis. However, it is important for financial institutions to be transparent about the assumptions and limitations of their models, in order to avoid false comfort about their accuracy. In addition, the rise of AI and machine learning methods in the industry has led to concerns about the lack of transparency and the "black box" effect of these techniques. Despite the potential benefits of AI in reducing model risk and improving predictive power, the lack of explainability remains a practical and ethical issue. The World Economic Forum has called for the development of minimum criteria for governance and control of AI in the banking and insurance sectors, including reliability of algorithms, models' explainability, and interactions between humans and intelligent algorithms. Overall, understanding and explaining the output of machine learning is becoming a top priority for banks and regulators in order to ensure transparency and reliability in financial modeling.

Therefore, traditional financial service companies and banks have begun to understand the importance of user experiences to build customer loyalty and improve their market share; thus, some of them have started acquiring or cooperating with fin-tech firms. The trend of using artificial intelligence and machine learning techniques by Fin-Tech firms has helped reshape customer relations, like customer contact, from traditional face-to-face contact to interactive contact using web systems where no human intervention is involved. Indeed, there are more use cases of artificial intelligence and machine learning in finance than ever before, from detecting client risk profiles or solvency to providing warning signals to traders about position risk in financial markets, and more.

LITERATURE REVIEW

Financial Technology industry funding has already reached new highs globally in 2018, with an increase of nearly 12 times from 2010 to 2018. In 2018, venture funding for African fintech startups increased by 51%, reaching \$195 million, according to a report from Disrupt Africa (KPMG 2018). AI and ML have also increased efficiency and reduced the cost of labor in the financial industry. Automation of production processes has enabled companies to increase

their total output, and the use of robots has eliminated the need for breaks and refreshment, unlike human capital (He et al. 2018). For credit scoring, a crucial financial activity, both statistical and Artificial Intelligence (AI) algorithms have been investigated. Recent research indicates that integrating many classifiers, or ensemble learning, may have a superior performance, while there is no consensus on which is preferable (Wang et al. 2010). AI is transforming the financial services industry by generating and utilizing insights from data, leading to new business models and reshaping competitive environments. It enhances efficiency, reduces biases and errors, and improves management information. As algorithms and data volume increase, regulation becomes integral to managing risks and instilling trust in consumers. The future of machine learning in the banking and financial industry is well recognised, and it is expected that the field of risk management will also seek to apply machine learning techniques to enhance their capabilities (Leo, Sharma, and Maddulety 2019). The experimental results and statistical tests from (Marqués, García, and Sánchez 2012) show that the decision tree constitutes the best

solution for most ensemble methods. Over the years, despite the innovations in the financial services sector credit risk still remains the most prominent reason for bank failure. For this reason, “more than 80% of the bank’s balance sheet commonly relates to this aspect of risk management”. The ultimate objective of credit risk management is to intensify the risk-adjusted rate of return by controlling and standardizing credit risk exposure (Oino 2016). Banks earn revenue through their primary lending business, and it is important for them to prioritize managing credit risk as it directly impacts their profitability. The Basel Committee on Banking Supervision (2001) defines credit risk as the probability of incurring losses, either in full or in part, due to risky loans. Banking companies also assess their business activities undertaken to know their profitability performance. CAMEL (Capital Adequacy, Asset Quality, Management, Earning and Liquidity) analysis is used by the banks to analyse financial performance. Banks adopt CAMEL model analysis to assess various kinds of risks and manage them effectively. Financial ratios have been long practiced by the researchers to evaluate the bank’s financial performance. Banks use CAMEL ratings for examining their financial health and performance (Rostami 2015). In consumer credit risk modeling, a variety of prediction tasks occur. As per Basel II Capital accord, it is necessary for banks and other financial institutions to estimate: i) probability of default (PD); ii) exposure at default (EAD); and, iii) loss given default (LGD) (Trivedi 2020). (Bandyopadhyay 2006) concluded that by using „Z’ score model banks and investors in emerging markets like India can get early warning signals about the firm’s solvency status and reassess the magnitude of default premium they require on low grade securities.

DIFFERENT PERSPECTIVES OF CREDIT SCORING AND RISK MANAGEMENT

Credit risk management involves two main categories: measurement and mitigation.

Measurement:

Credit risk is measured by lenders using proprietary risk rating tools that vary by firm or jurisdiction. For personal lending, creditors assess the borrower’s financial situation, including assets, liabilities, income, and credit history. Commercial lending is more complex and requires qualitative and quantitative techniques to rate the risk of business borrowers.

Mitigation:

Credit risk can be mitigated through credit structuring techniques such as collateral security, loan-to-value ratios, loan covenants, and amortization periods. Sensitivity analysis is also performed by changing variables in the proposed credit structure to assess the impact on credit risk. Additionally, portfolio-level controls such as monitoring credit types and risk scores of borrowers can be employed by financial institutions and non-bank lenders to mitigate credit risk.

(Oino 2016) In 2002, the Reserve Bank of India (RBI) released a directive on credit risk management, which was in line with international regulations. The implementation of Basel I was crucial in strengthening the financial system by addressing issues such as weak incentives and inadequate risk management practices. In light of this, Basel II was introduced to assess banks' inherent risk exposure and ability to adapt to financial innovations like securitization.

Basel I, Basel II, and Basel III are rules made by a group called the Basel Committee on Banking Supervision to make sure that banks have enough money to cover any losses they might have.

- **Basel I**, which was created in 1988 and required banks to have enough money to cover at least 8% of the risks they take on.
- **Basel II**, introduced in 2004, made the rules more complex and required banks to have enough money to cover all the different types of risks they face.
- **Basel III**, which was introduced in 2010, made the rules even stricter and required banks to have even more money set aside to cover risks. The goal was to make the banking system more stable and able to handle any big problems that might come up.

Credit Scoring Models: Most statistical credit scoring models employed today follow a similar pattern, combining quantifiable financial indicators of a company's performance with a small number of additional variables intended to capture qualitative aspects of the credit evaluation process.

Traditional model: The 5C model is a method used to evaluate the risk and creditworthiness of potential borrowers. It considers five main factors, referred to as the 5 C's: character, capacity, capital, collateral, and conditions (Treece and Tarver 2021).

→ Character refers to the borrower's reputation and credit history

- Capacity evaluates their ability to repay the loan.
- Capital refers to the borrower's financial resources
- Collateral considers any assets that can be used as security for the loan.
- Conditions evaluate the overall economic and industry climate that could affect the borrower's ability to repay the loan. Together, these factors are used to determine a borrower's creditworthiness and risk level.

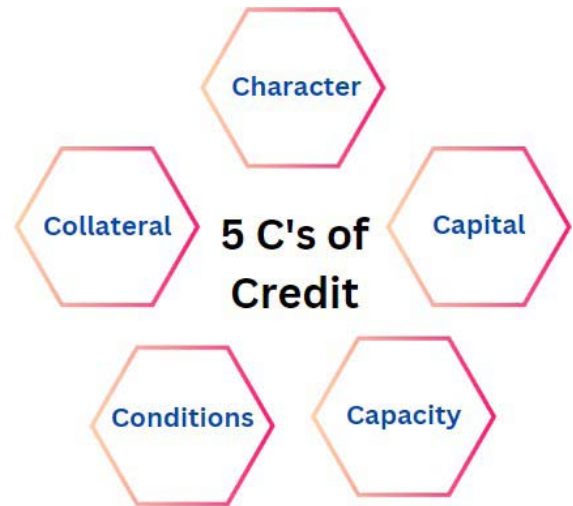


Fig. 1
5 C's of the credit scoring system

Although the 5C's model is a helpful framework for assessing a borrower's creditworthiness and risk, it is not a credit scoring model on its own. Nowadays, more complex credit scoring models that incorporate a greater range of data and variables have become more prevalent and are widely used by lenders and financial institutions. These models have largely replaced the 5C's model, but some lenders may still utilize certain elements of it, particularly when evaluating larger or more complicated loans. Advances in technology and the collection and analysis of data have led to the increased sophistication and prevalence of credit-scoring models in recent years.

- **The FICO Score** (FDIC, 2007) is a credit scoring model developed by the Fair Isaac Corporation and widely used to evaluate creditworthiness. It considers several factors such as payment history, credit utilization, credit history length, credit types used, and recent credit inquiries.
- **Vantage Score**, on the other hand, is a credit scoring model developed by Equifax, Experian, and

TransUnion. It uses machine learning algorithms to analyze a wide range of data, including payment history, credit utilization, credit age and mix, and recent credit behaviour. (FDIC, 2007)

- *Decision Trees* are a type of machine learning algorithm that evaluates creditworthiness based on factors such as income, employment status, credit history, and loan purpose, using a tree-like model.
- *Logistic Regression* is a statistical modeling technique that is often used for credit scoring. It identifies the relationship between factors such as income, credit history, loan amount, and the likelihood of default or delinquency.
- *Neural Networks* are another type of machine learning algorithm that analyzes large amounts of data using a complex network of nodes and connections to identify patterns and trends that can be used to predict credit risk.

Factors that do impact your FICO Score fall into one of the following five categories. (Black 2022)

- Payment History: 35%
- Amounts Owed: 30%
- Length of Credit History: 15%
- New Credit: 10%
- Credit Mix: 10%

EXPLORING THE TECHNOLOGIES WHICH ARE HELPFUL IN CREDIT SCORING AND RISK MANAGEMENT

The calculation of credit scores and risk management involves the utilization of various analytical tools, including statistical models, credit scoring software, risk assessment tools, data visualization tools, and credit bureau reports.

- Statistical models like logistic regression, decision trees, and neural networks are commonly employed to develop credit scoring models that predict the probability of a borrower defaulting on a loan or credit card.
- Credit scoring software, such as FICO score open access, Zoot, ScoreNet, etc., automates the credit scoring and risk management process by utilizing diverse data sources to calculate credit scores and assess risk.

- Risk assessment tools, such as Value at Risk (VaR) and Monte Carlo simulations, aid in identifying and evaluating risks in a borrower's financial profile, estimating potential losses in a portfolio or investment based on specific risk levels.
- Data visualization tools, such as Tableau, Power BI, and QlikView, facilitate the analysis and presentation of complex data in visual formats, allowing for the identification of patterns and trends in borrower data.
- Credit bureau reports collect and maintain data on borrowers' credit histories, such as payment records, credit utilization rates, and account balances, providing lenders and other institutions with vital information to assess a borrower's creditworthiness and manage risk.

Overall, a combination of these analysis tools is used to evaluate a borrower's creditworthiness and manage risk, with the specific tools used depending on the lender or institution and the data available.

Artificial intelligence (AI) and machine learning (ML) have transformed the financial industry in several ways. AI and ML have provided businesses with the ability to process large amounts of data, analyze market trends, and make informed decisions. One of the major breakthroughs in AI has been natural language processing and vision recognition, which has enabled companies to automate production processes and provide highly accurate computations and reports automatically.

AI and ML have been instrumental in helping businesses gain a competitive edge through cost reduction and increased efficiency. AI software can quickly analyze web data and provide feedback. Machine learning has also found applications in fintech, such as personalized investment plans, fraud detection, and risk management. Machine learning is the mathematical aspect of AI that enables machines to learn and improve from data without explicit programming. Data scientists manually identify and test data, and human decision-making guides the application of the information provided.

Machine learning is a growing field that utilizes data, computers, and algorithms to learn and make predictions. There are two main types of machine learning:

- **Supervised:** In supervised learning, input data is used to predict a well-defined output.

- **Unsupervised:** In unsupervised learning, the goal is to extract useful information or trends from input data.

A newer type of machine learning called **reinforcement learning** combines elements of both. Supervised learning is further divided into two categories:

- **Regression**, which involves predicting quantitative variables. In credit scoring, historical data is used with regression algorithms to establish a relationship between input features (e.g. credit history, income, employment status) and the likelihood of loan default. The regression model uses this relationship to predict the probability of future loan default.
- **Classification**, which involves predicting qualitative variables with class values. In Credit scoring, classification means predicting whether a customer is likely to default on a loan or not based on their financial history, credit score, and other relevant features.

Examples of classification problems include credit risk assessment and predicting churn or attrition rate. Understanding the different types of machine learning can aid in selecting the appropriate algorithm for a given problem, as machine learning is a powerful tool for data analysis and prediction.

In credit scoring, banks use credit scores to assess a customer's creditworthiness based on numerical scores. However, some banks still rely on outdated statistical models, which may not be as accurate or adaptable. Regression algorithms have been commonly used due to their interpretability, but the limitations of using a single model like logistic regression are becoming apparent with the emergence of new machine learning algorithms.

MACHINE LEARNING ALGORITHMS USED FOR CREDIT RISK MANAGEMENT

Logistic Regression:

A classification algorithm used to predict the probability of a binary outcome. Commonly used in credit risk modeling to predict loan default likelihood based on credit history and financial data. (Tyagi 2022)

Decision Tree:

A tree-like model used for classification and regression. It splits the dataset based on significant features to

determine the outcome. Commonly used in marketing to identify target audience based on demographic data. (Trivedi 2020)

Linear Discriminant Analysis (LDA):

A statistical model for classification with multiple classes. Reduces dimensionality of dataset to maximize separation between classes. Commonly used in image classification. (Tyagi 2022)

Quadratic Discriminant Analysis (QDA):

Similar to LDA, but allows for non-linear decision boundaries. Captures complex relationships between features and classes. Commonly used in medical research for disease diagnosis based on patient data. (Trivedi, 2020)

Random Forest (RF):

Creates multiple decision trees in the forest, and the prediction for an unseen sample is obtained by averaging the predictions from all the trained individual decision trees on that sample. By creating multiple estimators, the influence of over-fitting is reduced. (Trivedi 2020)

Neural Network (NN):

It is a mathematical model of how the brain functions. It receives external information in the first layer, and neurons in the input layer send signals to the hidden layer. By adding more hidden layers, the number of layers can increase. NNs have been used in many financial prediction studies since the 1990s and have higher accuracy than conventional statistical techniques like LDA, QDA, logistic regression, etc. (Tyagi 2022)

Random Forest is an ensemble learning algorithm that combines multiple decision trees to make predictions. Each decision tree is trained on a random subset of the training data and a random subset of features. The final prediction is made by aggregating the predictions of all the decision trees. Random Forest is a highly scalable algorithm and can handle large datasets with high dimensionality. It is also robust to noisy data and missing values.

On the other hand, **Neural Networks** are a set of algorithms that are modeled after the structure of the human brain. They consist of an input layer, one or more hidden layers, and an output layer. Each layer contains a set of neurons that perform a specific

function. Neural Networks are highly flexible and can learn complex patterns in the data. They are widely used for image recognition, natural language processing, and speech recognition.

Compared to Random Forest, Neural Networks can handle more complex data structures and can learn more complex relationships between the features and the target variable. However, they require a lot of computational resources and can be difficult to train. In addition, Neural Networks are more prone to over fitting, which can lead to poor generalization performance on new data.

ISSUES AND CHALLENGES

Credit risk assessments are critical for banks to avoid losses. Adopting AI and ML models can help banks improve risk management and credit value chain. These technologies enable efficient analysis of large data sets, dynamic risk profile adjustments, and improved accuracy over time through machine learning. These models can also present only the final insights, reducing the need for manual data analysis and minimizing human expertise requirements. Starting from the initial underwriting process to risk measurement and analysis, until deciding on the final maximum exposure. Some of the key use cases that would be addressed are:



Fig. 2
Credit Risk assessment processes

Assessing Risk for Individual Customers

Traditional analytical models may not accurately predict loan defaults due to the over- representation of non-defaulters in the data. Machine learning models like Artificial Neural Networks can address this by creating diverse datasets that reflect the actual distribution of good and bad customers. This allows for more accurate predictions of default likelihood, helping banks make better lending decisions.

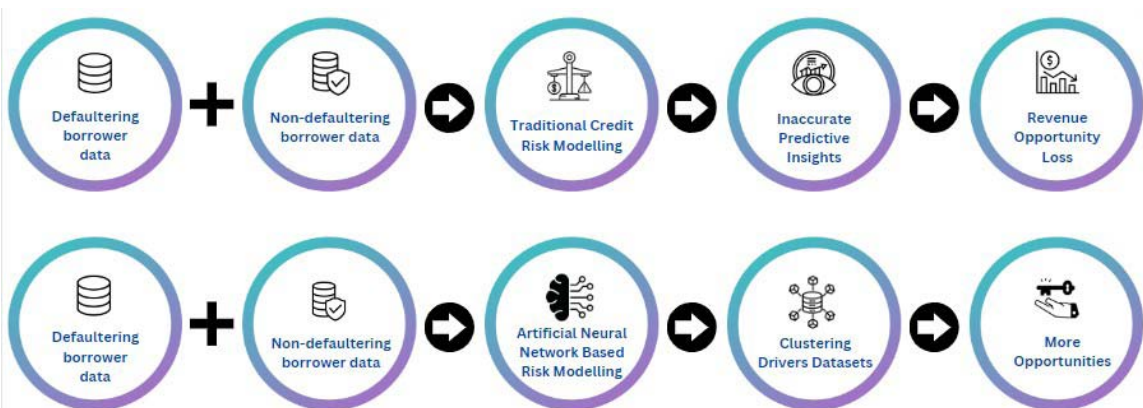


Fig. 3
How machine learning models lead to better revenue opportunities

Machine learning techniques, such as AI and ML, can reshape credit risk analysis by providing advantages over conventional statistical models. ML models can adapt and learn from data,

rather than relying on predefined instructions, which makes them more flexible and accurate. The ML model continuously analyzes new data to extract insights and generate predictions on fresh datasets, leading to a cyclical process that improves the accuracy of credit analysis over time.

CONCLUSION

The fintech industry has witnessed tremendous growth in recent years, largely due to increased funding and advancements in AI and ML technologies. The use of these technologies has revolutionized credit scoring, leading to increased efficiency and reduced costs. However, there is no one-size-fits-all approach, and traditional credit scoring models still coexist with AI and ML approaches. As these technologies continue to evolve, regulatory considerations and managing risks will be critical. Future research should focus on examining the impact of variables on credit scoring, exploring more advanced statistical models, and reducing the black box nature of AI and ML models to enhance reliability. Overall, the future of AI and ML in banking and finance is promising, but it will require further research and innovation to advance credit risk management practices in the industry.

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Criminal Behaviour against women in Haryana: An Analysis through Machine Learning Algorithm

Alka Rawat, Romika Yadav

National Institute of Fashion Technology, Kangra

Abstract—Being one of the worst sex ration in India, a deep rooted believe in honor killing and KHAP panchayat system, Haryana crime against women ranges from eve teasing to domestic violence rape to murder. The absence of data on crime against women behavior trends act as a hurdle to curb the climbing crime rates in the said area. The present paper is an approach to model the past crime behaviour for future crime prediction. The study considered major crime events from Haryana state and used a time series analysis approach to predict future crime trends. The analysis results obtained on 'R' tool for the past few years are found inconformity with that of real time trends, which envisage the success of our model proposed in this paper.

Keywords: Haryana, crime location, criminal, crime prediction, clustering

INTRODUCTION

Crime is an offence against society. This unwanted anti- social behaviour is punishable under law. It not only affects the individual rather terrifically affects the people of the whole country. The law and prosecution agencies, enshrined with the duty of mitigating the crime, adopt various measures to control the crimes in their realm. The crime events can be controlled effectively if the areas more prone to such events could be identified in advance. This quest for crime predictions makes the issue more challenging and fetches the interest of the research community on equal footing with that of security and law enforcement agencies.

The prevalence of criminal acts targeting women in Haryana is a concerning issue with serious implications for public safety and gender equality. By utilizing a machine learning algorithm, this study seeks to provide insights into the dynamics of criminal behavior against women in the region. The algorithm employed in this research employs data mining techniques to identify hidden patterns, trends, and relationships within the

collected data, enabling a comprehensive analysis of factors contributing to criminal acts.

This clustering approach model is based on a crime dataset of the last few years obtained from National Crime Records Bureau (NCRB) for major cities in Haryana and predicts the possibility of such an event in the next year. Since the crime dataset has features resembling.

Big Data. We have used the ``R'' tool to carry out analytical study. The following subsections of this paper describe the important terms and rationale behind this research.

REVIEW OF LITERATURE

Traditional approaches to studying criminal behaviour against women have relied on qualitative methods, such as surveys, interviews, and case studies. However, the advancements in machine learning algorithms offer new opportunities to extract valuable insights from large-scale datasets, enabling a more objective and systematic analysis. Machine learning algorithms can effectively identify hidden patterns, correlations, and predictive models from diverse data sources, including crime records, socio-economic indicators, and demographic information.

This research paper aims to leverage machine learning algorithms to analyse criminal behaviour against women in Haryana. By utilising a large and diverse dataset, this study aims to identify key risk factors, temporal and spatial patterns, and potential predictors of criminal behaviour. The findings will contribute to a deeper understanding of the underlying dynamics of these crimes and assist in developing targeted interventions and preventive strategies. Overall, this research endeavours to shed light on the complex nature of criminal behaviour against women in Haryana and provide evidence-based insights for policymakers, law enforcement agencies, and social organisations to combat this alarming issue effectively.

Criminal behaviour against women in Haryana is a significant social issue that demands extensive research to understand its causes, patterns, and implications for the well-being of women. In this qualitative study, Singh (2021) delves into the socio-cultural factors contributing to gender-based violence in Haryana. Through interviews and focus group discussions, the author explores prevailing patriarchal norms, dowry-related issues, and the impact of rapid urbanisation on women's safety. The study underscores the need for addressing deep-rooted cultural norms to effectively combat criminal behaviour against women in Haryana.

This study investigates the role of police responsiveness in addressing crimes against women in Haryana. Using survey data and statistical analysis, Gupta and Kumar examine the perceptions of women regarding the effectiveness of police interventions. The study highlights the importance of an efficient and gender-sensitive law enforcement system to combat criminal behaviour against women effectively Gupta and Kumar (2018). Singh and Gupta (2022) conducted a qualitative study exploring the socio-psychological factors influencing criminal behaviour against women in Haryana. Through in-depth interviews and thematic analysis, the authors identified various factors such as patriarchal norms, economic disparities, and socialisation processes that contribute to the perpetration of crimes against women. The study underscores the need for comprehensive interventions targeting these underlying factors. This study investigated the impact of criminal behaviour against women

on their mental health in Haryana. Through surveys and qualitative interviews, Kaur and Dhillon (2021) explored the psychological consequences of crimes such as sexual assault and domestic violence. The findings revealed significant emotional distress, trauma symptoms, and long-term psychological consequences for the victims. The study highlights the urgent need for support services and mental health interventions for women affected by such crimes.

Through a comprehensive analysis of relevant legislation and case studies, the authors evaluated the effectiveness of existing laws in addressing such behaviour. The study revealed gaps in implementation, low conviction rates, and the need for legal reforms to ensure more robust protection and justice for women examined by Sharma and Verma (2019). The study by Sharma, Gupta, and Singh (2020)

utilised machine learning techniques to analyse crime patterns in Haryana, focusing on crimes against women. Employing clustering algorithms, the authors identified spatial patterns and association rules, providing insights into high-risk areas and the modus operandi of criminals involved in offences against women. Kaur and Bansal (2019) employed machine learning algorithms, including logistic regression and random forest, to predict domestic violence incidents against women in Haryana. Their research highlighted significant predictors of domestic violence and developed a predictive model to aid in early identification and intervention. In the study by Malik and Bala (2018), machine learning algorithms such as decision trees and support vector machines were employed to analyse crimes against women in Haryana. The research examined socio-economic and demographic factors associated with different types of offences, contributing to a better understanding of crime patterns.

The studies exhibit the efficacy of machine learning algorithms in analysing criminal behaviour against women in Haryana. And provide insights into patterns, risk factors, and predictive models that can aid in developing preventive measures. Further research is needed to address the unique socio-cultural context of Haryana and refine these approaches. Malik and Chaudhary (2019) employ quantitative methods to analyse crimes against women in Haryana. By examining official crime data, the authors identify the prevalence rates and trends of various offences, including sexual assault, domestic violence, and dowry-related crimes. The study highlights the need for comprehensive measures to address the alarming rise in criminal behaviour against women in the state. The studies have demonstrated the effectiveness of machine learning techniques in identifying patterns, predicting incidents, and understanding the underlying factors contributing to crimes against women. Further research is required to develop targeted prevention strategies and evaluate the effectiveness of interventions aimed at reducing criminal behaviour against women in Haryana.

DATA ANALYSIS AND INTERPRETATION

The main objective of this research paper is to determine the crucial features or characteristics that are contributing to higher levels of criminal patterns

of crime against women in the State of Haryana.. The model is developed on various issues mentioned below:

- Predict the crime rate based on criminal characteristics.
- Provide recommendations to security organisations and crime fighting institutions for better planning for crime prevention.

The data collected in this paper are taken from the National Crime Records Bureau of India. The technique of Clustering commonly used in the data paradigm for grouping of objects or data based upon some common instinct. Based on the dataset collected in which past year data is applied using time series analysis and a predicted data is generated.

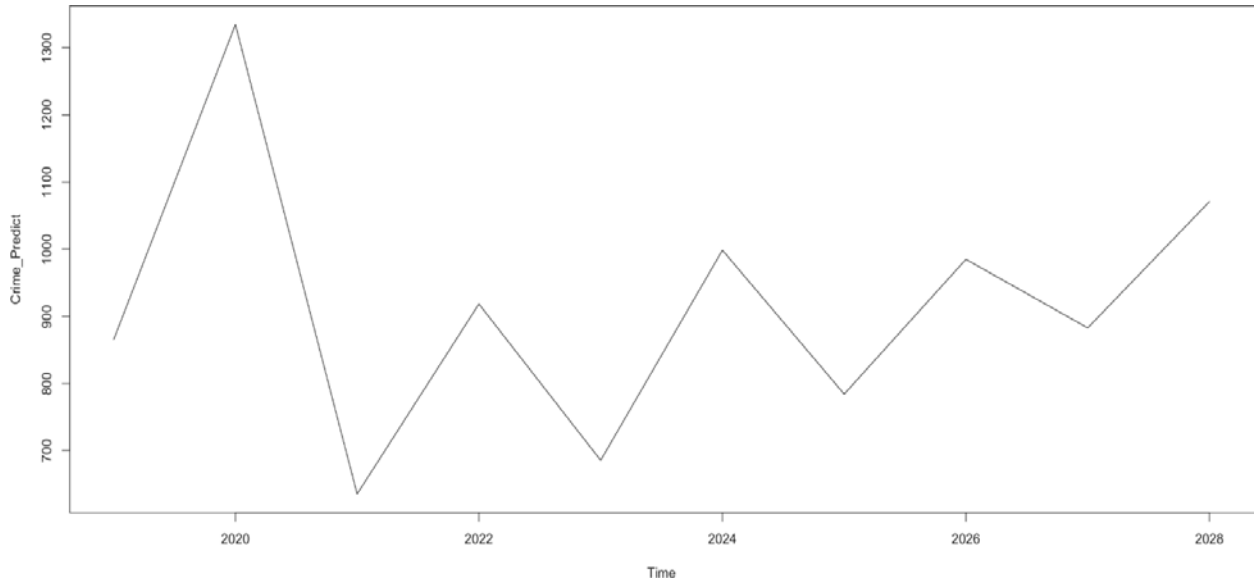


Figure 1: Haryana State Crime Prediction

In figure 1 it is showing the predicted crime in numbers from the year 2020 to the next till 2028. Crime data is taken from the state of haryana against the women. In order to keep the above rate of crime against women, it is stated that many NGO and women police are helping the women to raise their voice against the crime.

CONCLUSION

This paper concluded that the attributes of Criminal behaviour against women is a pervasive issue in various parts of the world, including the Indian state of Haryana. Haryana has witnessed an alarming increase in crimes against women, including sexual assault, domestic violence, dowry-related offenses, and gender-based discrimination. These offences not only have severe consequences for the victims but also undermine societal progress and gender equality. Therefore, it is crucial to comprehensively analyse the patterns and factors contributing to criminal behaviour against women in Haryana to inform evidence-based interventions and policies.

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Factors Affecting the Adoption of Cloud Based Accounting: A Case Study in Bhubaneswar

Sweeta Agrawal¹ Dr. Jayashree Jethy²

¹Research Scholar, Department of Commerce, Rama Devi Women's University Bhubaneswar, Odisha

E-mail id: swetaagrawal1845@gmail.com

²Assistant Professor, Department of Commerce, Rama Devi Women's University Bhubaneswar, Odisha

E-mail id: Jayashreejethy@rdwu.ac.in

Abstract—Cloud based accounting is a revolutionary innovation due to which the accounting and finance sectors has undergone major transformations. The lack of awareness and understanding of internet-based accounting is one of the major issues in India. This paper tries to focus on the challenges faced during the acceptance of cloud based accounting. In this research both primary and secondary data has been used. The primary data is gathered via an online survey, and the questioner were created using Google forms. The secondary data is collected from various research articles and journals. The data was examined using the statistical software SPSS. Cronbach's Alpha was used to assess the question's reliability. The conceptual model used in this paper consists of 6 factors which were identified by integrating TOE, IDT and UTAUT models. The results showed that all these factors positively and significantly affected the acceptance of cloud based accounting.

Keywords: Cloud based accounting, Unified Theory of Acceptance and Use of Technology (UTAUT), Innovation Diffusion Theory (IDT), Technology-Organization-Environment (TOE) JEL CODE – C,L,M,O,Q

INTRODUCTION

The advancement of technology in recent years has brought many positive effects to people's lives. Governments around the world have invested in innovation to step into the future. Cloud based accounting is one of such innovations. It can increase accounting efficiency by simplifying the financial management and providing real-time insight into the data. With the development of cloud computing technology in the middle of the 2000s, the idea of cloud-based accounting began to gain popularity. Businesses started to manage their accounts more

effectively and efficiently, thanks to cloud-based accounting systems provided by companies like Xero, QuickBooks Online, and FreshBooks (Achar, 2018). Many organizations are rapidly moving towards cloud-based accounting as a reliable, adaptable, and secure option for their accounting requirements. Businesses can access their financial information and accounting tools using cloud-based accounting softwares, enabling increased mobility and engagement. Xero, which was established in 2006 in New Zealand, was one of the first pioneers of cloud-based accounting (Liew, 2022). It was one of the first business organizations to provide an accounting software solution for small and medium-sized companies.

The transition of accounting into a cloud-based system is caused by several factors such as technological advancements, alterations in company procedures, and the demand for improved efficiency and collaboration (Carlsson et al, 2022). Most of companies used desktop-based accounting software's that were installed on individual PCs until cloud-based accounting became popular. In the traditional accounting system information sharing was one of the major challenges as financial information could not be easily shared or accessed remotely and was only accessible from a particular computer. This hindered cooperation and made it challenging for businesses to collaborate effectively. However, Businesses started to understand the benefits associated with online financial data storage as cloud-based technologies developed (Dimitriu and Matei, 2014). Now, Companies are able to access their financial data using cloud-based accounting software from any place that has accessibility to the internet, providing greater collaboration and real-time access to financial data. The demand for better efficiency is another factor influencing the transition of accounting to cloud-based systems. Many of the

manual accounting procedures, such data input and validation are automated by cloud-based accounting software, reducing effort and time while managing financial data. This enables companies to concentrate on various other aspects of their operations, such as expansion and improvement. The requirement for remote access to financial information has increased as more number of business organizations have adopted remote work practices or expanded

Cloud accounting” basically denotes an software of accounting which can be used from any location with an Internet connection(Rashi and Chaturvedi,2019).It is a wholly original paradigm in that customers use the required resources (i.e. hardware and software systems) over the internet rather than being required to own them.

It is not necessary to possess a server or install software on PCs to engage in the practice. Remote servers and the applications are offered by a cloud computing company that sells accounting services. Online access to manage and maintain the client company’s financial records is available for a fee. The purpose of accounting softwares is similar to the accounting software installed on the company’s (client’s) computer, but it operates on a different company’s computer. The data provided by the client is stored on the cloud. Some of the popular cloud accounting software’s is zero, zoho books, SAP, clear books.

LITERATURE REVIEW

Cloud computing is no longer just a fancy term for technology. It is currently a buzzword that is prevalent in many areas of the economy and is therefore relevant to experts in finance and accounting (Ali and Thakur,2017).Due to the increasing complexity of the corporate environment, the fierce competition on international platforms, and the expanding expectations for worldwide accounting standards and practices, accountants are confronting new problems which can be solved using cloud based accounting (Efosa and Oseikhuemhen,2022).It is important to develop a positive attitude regarding CBA in the mind of users. They should be assured about the ease of use so that they can be motivated. Encouraging accountants to use cloud accounting in their job will help them have a beneficial impact on companies.(Zebua And Widuri, 2023)

According to some surveys, security concerns, the need for continuous support, a lack of knowledge

are some of the marjor issues related to cloud-based accounting software.Although CBA is advanced accounting solution, businesses are still hesitant to use it mostly because of worries about cost and unfamiliarity. The key variables impacting the adoption of cloud accounting include organizational willingness, support from management, relative advantage and the alignment of cloud accounting with present practices and corporate culture. cloud accounting providers can use software to decide on investments decisions, address client demands, and create marketing strategies which are appealing to both current and potential clients and foster loyalty (Rawashdeh and Rawashdeh,2023).To reduce the conflicts relating to cloud based accounting users have to understand the value of organizational competency and support form top management (Eldalabeeh et.al, 2021) many firms are still not aware about the use of cloud based accounting systems. Service providers can use promotional seminars and workshops to increase awareness (Saad et.al,2022). More emphasis should be given on user-friendly interfaces so that users who have little technological expertise and experience can also use these systems with ease.(Lufti,2022). Cloud accounting can benefit SMEs by achieving higher business performance with reduced cost. It also improves the information flow in addition to enhanced management. Decision-making within organizations can become more effective as a result of improved information accessibility (Kariyawasam, 2019).

In addition to the benefits, cloud-based accounting has disadvantages as well. It depends on internet connectivity, uses up the resources in cloud since more information is stored there, and also affects the functionality of cloud - based accounting software’s. Additionally, even though consumers are able to easily register and subscribe, they feel that they need training even though the subscription fee does not cover the cost of this. Regarding the potential risks associated with cloud implementation, clients should think about them before deciding on internet accounting. These risks include leaks of firm’s confidential business statements, data loss, cyber threat, and revisions to programmer services that permit the company to increase payments for maintaining its database (Marsintauli et.al,2021). For an accountant to be effective and maintain its credibility in the rapidly evolving business environment, they must be knowledgeable about the recent economic and technical developments along with continuous training.

Authorities and service providers in the accounting industry should offer necessary assistance in this regard (Rotimi et.al, 2023).

RESEARCH GAP

From the literature review, it is very clear that there were very few researches on cloud based accounting. The researches based on the identification of factors influencing the adoption of cloud accounting are scarce. Moreover there is no research conducted on the adoption and implementation of cloud based accounting in Odisha. This paper has made an attempt to understand the challenges faced during the adaptation of CBA in Odisha.

RESEARCH OBJECTIVES

- To determine the extent to which CA firms in Odisha are aware of and using cloud-based accounting.
- To examine the factors influencing the adoption of cloud based accounting.
- To identify the threats faced by business organizations during the adoption and implementation of cloud based accounting.

MODELS

INNOVATION DIFFUSION THEORY (IDT)

This concept that explains how new innovations are embraced and spread within a population or social system is the Innovation Diffusion Theory (IDT). It has since been used in a variety of technology adoption contexts, including the adoption of fresh information technologies in businesses. According to the IDT, a number of elements affect how quickly new technologies are adopted, including the characteristic of it. Some of these factors are time taken for an innovation to diffuse, social context, characteristics of the innovation and channel used to spread the information (Sastararujil et.al ,2022). Innovations are more likely to be adopted when they are put into a social setting where there is a high level of trust or acceptance among individuals. The perceived complexity of the technology and the perceived benefits it offers over current technologies can affect its adoptability. The IDT model provides a helpful way to comprehend the acceptance and dissemination of emerging technologies, and it can assist businesses

in developing plans for fostering the dissemination of cloud based accounting.

UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

This model tries to analyse, how organizations accept and use modern technology. UTAUT model outlines four critical variables that affect how well new technologies are adopted and used. They are Performance expectancy, effort expectancy, facilitating condition and social influence (Eldalabeeh et.al,2021). The extent to which a person or organization thinks utilizing new technology will enable them to carry out their activities more productively or effectively will affect its acceptance. If the resources and assistance needed to use the new technology effectively are readily available then it will speed up its adoptability. The UTAUT model also takes into account potential moderators, such as age, gender, and expertise, which may have an impact on how the four critical variables.

TECHNOLOGY, ORGANIZATION, AND ENVIRONMENT MODEL

The acronym “TOE” stands for “Technology, Organization, and Environment,” which is a schema for strategy formulation that’s used to examine exterior influences that impact on an effectiveness and competitiveness of an organization (Zebua and Widuri, 2023). This framework takes into account how technology, organizational structure and macro environment affects the organization’s performance. Technology factor consists of the instruments, tools, and infrastructure that an organization uses to accomplish their goals whereas organization includes the management style of a company along with its culture and structure. Environment refers to all the macro factors that are uncontrollable in nature such as political, social, economic factors (Saad et. Al, 2022). Thus, The TOE model assists firms in making sound strategic choices by adapting the shifts in demand in the competitive environment by taking each of these elements into account.

INTEGRATING 3 MODELS

For the purpose of this research Unified Theory of Acceptance and Use of Technology (UTAUT), Innovation Diffusion Theory (IDT), and the Technology-Organization- Environment (TOE) model is combined

to create an extensive research framework for recognizing the variables that affect the adoption as well as utilization of technology in organizations. In this model the technological, organizational, and environmental factors that affect technology adoption is based on the Technology-Organization-Environment (TOE) model. The Unified Theory of Acceptance and Use of Technology (UTAUT), discusses the individual-level variables like performance expectations, effort expectations, social impact, and facilitating conditions that affects technology adoption and its usage. The Innovation Diffusion Theory (IDT) sheds light on the variables such as relative advantage and social influence that affect the diffusion of innovation. The term “technological factors” (TOE) refers to the features of the technology itself, including the degree of complexity, compatibility with current systems, and relative edge over competing solutions(Zebua and Widuri,2023).

Overall, this study model can aid practitioners and researchers in comprehending the complex variables that can affect the adoption and use of technology in workplaces and in creating successful implementation strategies.

HYPOTHESIS DEVELOPMENT

- **Performance expectancy** – The term “performance expectancy” describes how much a person expects that utilizing a specific technology will increase their level of productivity or their ability to perform better at their jobs. It is based on how useful and helpful the technology is in helping them accomplish their objectives (Zuiderwijk et.al, 2015). The UTAUT model states that Performance Expectancy is affected by a number of variables, including the user’s prior experience with related technologies, their perceptions of the technology’s usability, the level of support offered for the technology, and the user’s own belief in their capacity to use the technology successfully.

H1: Performance expectancy significantly impacts the acceptance of CBA

- **Effort expectancy**- Effort Expectancy significantly affects the user’s intention to utilise and actual use of the technology. The user’s opinion of the technology’s usability and the amount of effort required to learn and utilize it is reflected in the effort expectancy metric (Eldalabeeh et.al,2021).

It is influenced by elements like the user’s prior exposure to related technologies, level of complexity, the user’s technical proficiency, and the degree of instruction and assistance offered for the technology. Performance Expectancy and Effort Expectancy are closely related because people are more likely to find a technology worthwhile and useful if they also find it simple to use. In order to forecast user acceptance and uptake of new technology, both constructs are crucial.

H2: Effort expectancy significantly impacts the acceptance of CBA

- **Facilitating condition** - The user’s assessment of the external elements, such as the availability of technical assistance, training, and resources, as well as the technology’s compatibility with their work environment and current systems, is reflected in the facilitating conditions(Brown et.al,2010). Users are more likely to accept and use technology effectively if they believe that the resources and help they need to do so are readily available. The possibility that users will adopt new technologies and use them successfully can be enhanced by offering the required resources and assistance.

H3: Facilitating condition significantly impacts the acceptance of CBA

- **Social influence**- The term “social influence” refers to how other individuals may affect a person’s attitudes and views regarding the use and acceptance of technology. It is based on how the user perceives the demands and opinions of powerful others, as well as how much pressure they experience to live up to these demands (Penney et.al,2021). Social influence can significantly affect an individual’s intent to use technology. If users believe that his superiors support and expect them to utilize a technology, they are more likely to accept and use it. Social Influence tells us about influence that other people may have on a person’s attitudes and beliefs towards the adoption and use of a technology.

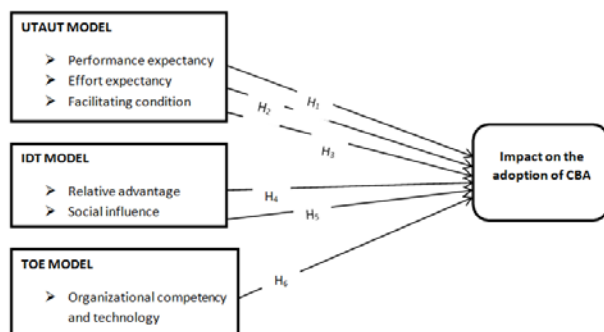
H4: Social influence significantly impacts the acceptance of CBA

- **Relative advantage**- The user’s assessment of the advantages and benefits of adopting and employing the innovation in comparison to the pre-existing methods of doing things shows up in relative advantage(Saad et.al ,2022). It is based on

elements like the functionality, efficiency, efficacy, and compatibility of the innovation with current systems. Relative advantage is also connected to concepts like flexibility and complexity. Users may perceive an innovation's relative advantage more favorably, for instance, if it is simple to use and compatible with current systems. It captures how users perceive the benefits of adopting and utilizing an invention in comparison to the alternatives already available.

- H5: Relative advantage significantly impacts the acceptance of CBA
- **Organizational Competency and technology** - One of the main concepts in the Technology-Organization-Environment (TOE) paradigm is organizational competency and technology (Rawashdeh and Rawashdeh, 2023). It describes the extent to which an organization has the skills, resources, and competencies needed to successfully implement and utilize a new technology. In other words, organizational competency and technology represents an organization's capacity to successfully integrate and utilize new technology by utilizing its current resources, such as expertise and infrastructure. A company may be better able to adopt and use new innovation if it has a strong technological context and a track record of effective technology adoption

H6: Organizational Competency and technology significantly impacts the acceptance of CBA



Proposed Research model

RESEARCH METHODOLOGY

For of this research both primary and secondary data has been used. Primary data has been collected using convenience sampling. A structured questioner was prepared and circulated among CA firms in Odisha to understand their perspective on the awareness and

acceptance of CBA. The questioners were distributed online through emails. The questionnaire was divided into two parts. The first part was related to the demographic profile/ personal details of the respondents and the second part was based on the variables that were identified from TOE, IDT and UTAUT models. The Secondary data was collected through various articles and research papers. Six factors were considered for measuring the influence of cloud based accounting. The constructs performance expectancy, Effort expectancy and Facilitating condition were adopted from UTAUT model. Relative advantage and Social influence were derived from IDT model. Organizational competency and technology was adopted from TOE model.

Data and Sampl

As evidenced from agcsodisha.nic.in the estimated number of CA firms in Odisha is found to be 458. In this study the sample sized is selected for an estimated population of 458 with a confidence level of 95% and 10% margin of error , the sample size was calculated using the following formula:

$$\text{Sample size} = \frac{z^2 \times p(1-p)}{e^2} \div \left[1 + \left(\frac{z^2 \times p(1-p)}{e^2 N} \right) \right]$$

$$\approx 80$$

Form the above formula we receive a minimum sample size of 80 respondents. There were a total of 130 responses received from which 100 were considered for data analysis as others were incomplete.

Scale

The Likert scale used in this questionnaire ranges from 1 to 5, where 1 indicates "not at all" or "very unsupportive" or "strongly disagree" and 5 indicates "very much" or "very supportive" or "strongly agree"

RESULTS AND ANALYSIS

Reliability of a Scale

The data analysis is done using SPSS. The internal consistency or reliability of a scale or questionnaire is measured by Cronbach's alpha. It is used to assess how well a set of items or questions used to measure a construct or variable are consistent with one another. Higher values of Cronbach's alpha indicate greater internal consistency or reliability. A number of 0.7 or greater is usually considered as satisfactory.

Table-1: Reliability Statistics

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|------------------|--|------------|
| .866 | .881 | 16 |

As from the table the overall coefficient of Cronbach's alpha is found to be 0.881 which is greater than 0.7, therefore the internal consistency or reliability of a scale or questionnaire is considered to be relatively high.

Table-2: Awareness of CBA

| | Frequency | Percentage |
|------------------|-----------|------------|
| Aware about CBA | 76 | 76% |
| Not aware of CBA | 24 | 24% |

Out of 100 respondents, 76 % of the respondents were aware about the term 'cloud based accounting' whereas 24 % of the respondents still lack knowledge about cloud based accounting which shows that there is a need to increase awareness of CBA among accountants.

Regression Analysis

Regression analysis is used to look at the relationship between a dependent variable and one or more independent variables. The variable thought to have an impact on the dependent variable are known as the independent variable and the variable that we are attempting to explain or predict by considering the independent variables is known as the dependent variable. This model calculates the effect of the independent variables on the dependent variable while controlling for other factors that might also influence the result and establishes the magnitude and direction of the relationship between the independent variables and the dependent variable.

In this study non-adoption of CBA is considered as Dependent variable whereas performance expectancy, Effort expectancy, Facilitating condition, Organizational competency and technology, Relative advantage and, Social influence are taken as independent variables.

Table-3: Variables Entered/Removed^a

| Model | Variables Entered | Variables Removed | Method |
|-------|--|-------------------|--------|
| 1 | Facilitating_condition, Effort_expectancy, Relative_advantage, Organisational_competency_technology, Social_influence, Performance_expectancy ^b | | Enter |

^a Dependent Variable: Adoption

^b All requested variables entered.

Table -3 shows that performance expectancy, Effort expectancy, Facilitating condition, Organizational competency and technology, Relative advantage and, Social influence are taken as independent variables are the independent variable and adoption of CBA is considered as dependent variable for which regression is calculated.

Multiple Regression Analysis

A multiple regression analysis was conducted to examine the relation between the dependent variable and independent variable. The dependent variable, adoption was regressed on performance expectancy, Effort expectancy, Facilitating condition, Organizational competency and technology, Relative advantage and, Social.

Table-4: Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .923 ^a | .852 | .704 | .708 |

a. Predictors: (Constant), Facilitating_condition, Effort_expectancy, Relative_advantage, Organisational_competency_technology, Social_influence, Performance_expectancy

The model summary table demonstrates a high correlation between the dependent variable, adoption and the independent variables: performance expectancy, Facilitating condition, Organizational competency and technology, Effort expectancy, Relative advantage and, Social influence. The value of R square shows that 85.2 % of the variance in the adoption of CBA can be explained by the explanatory variables used in this study. The result is supported by the value of Adjusted R Square as 70.4% which suggests that the research model has a good fit.

Table-5: ANOVA^a

| Model | Sum of Squares | Df | Mean Square | F | Sig. |
|------------|----------------|----|-------------|-------|-------------------|
| Regression | 17.301 | 6 | 2.884 | 5.755 | .026 ^b |
| 1 Residual | 3.006 | 6 | .501 | | |
| Total | 20.308 | 12 | | | |

^a Dependent Variable: Adoption

^b Predictors: (Constant), Facilitating_condition, Effort_expectancy, Relative_advantage, Organisational_competency_technology, Social_influence, Performance_expectancy

Table 5 shows the ANOVA results of the multiple regression analysis. It indicates that the multiple regression analysis conducted for this study is Significant as the probability value is 0.026^b which is less than 0.05.

Linear Regression Analysis

For this research linear regression analysis was conducted using SPSS among the dependent variable (adoption) and independent variables (performance expectancy, Effort expectancy, Facilitating condition, Organizational competency and technology, Relative advantage and, Social influence)

Table -6: Coefficients^a

| Model | B | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|-------|-------------------------|-----------------------------|------|---------------------------|--------|------|
| | | Std. Error | Beta | | | |
| | (Constant) | .506 | .194 | .959 | 2.615 | .024 |
| 1 | Performance_ expectancy | .872 | .078 | | 11.225 | .000 |

a. Dependent Variable: Adoption

Table no. 6 shows that there is a significant relationship between adoption and Performance expectancy as indicated by the p-value which is less than 0.05. It indicates that Performance expectancy is a significant predictor of adoption of CBA. - value from the coefficient tables indicates that the positive effect between adoption and Performance expectancy is 11.225. It also implies that a change in Performance expectancy will account for a change in the acceptance of cloud based accounting by 0.872%. Therefore the alternative hypothesis "Performance expectancy significantly impacts the acceptance of CBA" is accepted.

Table-7: Coefficients^a

| Model | B | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|-------|--------------------|-----------------------------|------|---------------------------|--------|------|
| | | Std. Error | Beta | | | |
| | (Constant) | .294 | .119 | .983 | 2.468 | .031 |
| 1 | Effort_ expectancy | .900 | .051 | | 17.527 | .000 |

a. Dependent Variable: Adoption

Table no. 7 that there is a significant relationship between adoption and Effort expectancy as indicated by the p-value which is less than 0.05. It indicates that Effort expectancy is an important predictor of adoption of CBA. The T- value from the coefficient tables indicates that the positive

effect between adoption and Effort expectancy is 17.527. It also implies that a change in Effort expectancy will account for a change in the acceptance of cloud based accounting by 0.900%. Therefore the alternative hypothesis "Effort expectancy significantly impacts the acceptance of CBA" is accepted.

Table-8: Coefficients^a

| Model | B | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|-------|-------------------------|-----------------------------|------|---------------------------|--------|------|
| | | Std. Error | Beta | | | |
| | (Constant) | .311 | .116 | .983 | 2.676 | .022 |
| 1 | Facilitating_ condition | .895 | .050 | | 17.891 | .000 |

a. Dependent Variable: Adoption

Table no. 8 that there is a significant relationship between adoption and facilitating condition as indicated by the p-value which is less than 0.05. It indicates that facilitating condition is an important predictor of adoption of CBA. the T- value from the coefficient tables indicates that the positive effect between adoption and Effort expectancy is 17.891. It also implies that a change in facilitating condition will account for a change in the acceptance of cloud based accounting by 0.895%. Therefore the alternative hypothesis "facilitating condition significantly impacts the acceptance of CBA" is accepted.

Table-9: Coefficients^a

| Model | B | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|-------|---------------------|-----------------------------|------|---------------------------|--------|------|
| | | Std. Error | Beta | | | |
| | (Constant) | .295 | .128 | .981 | 2.302 | .042 |
| 1 | Relative_ advantage | .915 | .055 | | 16.598 | .000 |

a. Dependent Variable: Adoption

Table no. 9 that there is a significant relationship between adoption and relative advantage as indicated by the p-value which is less than 0.05. It shows that relative advantage is an important predictor of adoption of CBA. The T- value from the coefficient tables indicates that the positive effect between adoption and relative advantage is 16.598. It also implies that a change in relative advantage will account for a change in the acceptance of cloud based accounting by 0.915%. Therefore the alternative hypothesis "

relative advantage significantly impacts the acceptance of CBA” is accepted.

Table -10: Coefficients^a

| Model B | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. | |
|------------|-----------------------------|------|---------------------------|------|--------|------|
| | Std. Error | Beta | | | | |
| 1 | (Constant) | .311 | .120 | .982 | 2.592 | .025 |
| | Socia_influence | .903 | .052 | | 17.461 | .000 |

a. Dependent Variable: Adoption

From the above table it is clear that there is a significant relationship between adoption and Social influence as indicated by the p-value which is less than 0.05. It indicates that Social influence is an important predictor of adoption of CBA. The T- value from the coefficient tables indicates that the positive effect between adoption and relative advantage is 17.461. It also implies that a change in Social influence will account for a change in the adoption of cloud based accounting by 0.903%. Therefore the alternative hypothesis” Social influence significantly impacts the acceptance of CBA” is accepted.

HYPOTHESIS TESTING RESULTS

| Hypothesis | Regression weights | P-value (<0.05) | T- value | Hypothesis supported |
|------------|--|-----------------|----------|----------------------|
| H1 | Performance expectancy significantly impacts the acceptance of CBA | .000 | 11.225 | Yes |
| H2 | Effort expectancy significantly impacts the acceptance of CBA | .000 | 17.527 | Yes |
| H3 | Facilitating conditions significantly impacts the acceptance of CBA | .000 | 17.891 | Yes |
| H4 | Social influence significantly impacts the acceptance of CBA | .000 | 16.598 | Yes |
| H5 | Relative advantage significantly impacts the acceptance of CBA | .000 | 17.461 | Yes |
| H6 | Organizational Competency and technology significantly impacts the acceptance of CBA | .000 | 13.147 | Yes |

CONCLUSION

The transition of accounting into a cloud-based system is caused by several factors such as technological advancements, alterations in company procedures, and the demand for improved efficiency and collaboration. Many firms in India are still using traditional accounting techniques. The intention to accept cloud based accounting in India is still in infant stage. To improve the effectiveness of cloud based accounting in India it is very important to resolve a number of issues. Lack of knowledge is one of the major issues that can hinder the adoption of CBA. In this study; we investigated the variables affecting the adoption of cloud accounting

Table -11: Coefficients^a

| Model B | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. | |
|------------|---------------------------------------|------|---------------------------|------|--------|------|
| | Std. Error | Beta | | | | |
| 1 | (Constant) | .462 | .166 | .970 | 2.784 | .018 |
| | Organisational competency_ technology | .904 | .069 | | 13.147 | .000 |

a. Dependent Variable: Adoption

Table no. 11 shows that there is a significant relationship between adoption and organizational competency technology as indicated by the p-value which is less than 0.05. It indicates that organizational competency technology is an important predictor of adoption of CBA. The T- value from the coefficient tables indicates that the positive effect between adoption and organizational competency technology is 13.147. It also implies that a change in organizational competency technology will account for a change in the acceptance of cloud based accounting by 0.904%. therefore, the alternative hypothesis “Organizational Competency and technology significantly impacts the acceptance of CBA ”is accepted.

in Odisha using TOE, IDT and UTAUT MODEL. The findings from this study reveals that all the six variables have a significant impact on the acceptance and adoption of CBA. Despite all of the challenges faced by cloud based accounting, it is impossible to ignore its advantages and if used properly, it can be a game-changer in the field of accounting.

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The Booming Trend of Digital Learning in India

Shreya Uppal¹ & Dr. Anamika Rana²

¹Student, BBA Department, Maharaja Surajmal Institute
Email :uppalshreya1@gmail.com

²Associate Praofessor, Maharaja Surajmal Institute
Email:anamikarana@msijanakpuri.com

Abstract—Nowadays our life is governed a lot by “trends”. Trends are patterns that bring change in one or more segments of the population. Trends are there for a short period, they come and go. Megatrends are the trends that impact the whole population and stay forever. The biggest example of a megatrend is the print revolution and technology.

Technology has impacted every domain. One such domain is education. The coming up of technology in the education sector gave birth to digital learning. Now the old traditional classroom system has completely been changed to a modern one. Blackboards have been replaced with smartboards. Now teaching is no longer restricted to textbooks rather teachers to make teaching more interesting have started to use presentations. Students no longer have to write notes, they can simply get PDFs of the notes from their teachers on smartphones. Learning is now not restricted to just classrooms. At the time of the pandemic covid-19, digital learning played a vital role. Students were able to take their classes in online mode with the help of various applications like Google Meet, Zoom, etc. The main purpose of this research article is to analyze digital learning as a concept. The article will help in understanding the pros and cons associated with digital learning.

INTRODUCTION

Education is the basic right of every individual. A good education system gives a broader mindset that it helps us to gain a better perspective. It's good to see how knowledge is being delivered in different ways. The education system has completely been revolutionized. It's phenomenal to see how education is being delivered through digital ways. Digital education has given birth to remote learning. During the pandemic, it was technology that made sure that education don't stop. Nobody ever thought that they will be able to take

lectures from their couch. The Internet is a prerequisite for digital learning. Sound internet has to be there for digital learning to take place smoothly. Digital learning has helped many people as well to make their careers in the field of the education system. Youtube is one such platform that has helped many people for the same. There are various youtube channels like Khan Academy, Physics Wallah, BYJUs, and many more. They provide free access to lectures to students and make learning fun and interesting. Gone are the days when students were taught in the same old monotonous ways through textbooks by teachers. Presentations, audio, and video clippings are the new normal through which students are taught. This has even helped in avoiding rote learning as these innovative ways have helped students to understand every concept well. Any kind of knowledge can be gained with the help of the web. It won't be wrong to say that knowledge is just one click away. It is good to see how the pandemic has changed learning to learning. The pandemic has helped developing countries like India to come one step closer to digitization. Digitalization has helped individuals to fulfill their thirst of knowledge.

LITERATURE REVIEW

Baregama S. and Dr. Arora R. [2021] in their article titled “Analysis of digital tools of learning” concluded that digital tools are a boon to society and their benefits can be obtained by anyone in society. They are a boon to the teachers and the students as they can save themselves from repetitive classes and this can save a lot of time.

A. Gunasekaran, Ronald D. Mc Niel, and Dennis Shaul [2002] concluded in their research themed “E-learning: Research and Applications” that digital learning is cost-effective and its main advantages are its flexibility, its convenience to users, its wide reach, its easy accessibility, its consistency, and its repeatability.

Dr. Aggarwal R.K. [2021] concluded in his research titled “Digital education in India: scope and challenges” that e-learning is not only an innovative way of learning but also a holistic way of teaching and learning. As per the environment, digitalization of education is undoubtedly the need of the hour and youth should maintain a balance by not being too much dependent on electronic media therefore, they should be prevented from behavioral and physical imbalances.

Jha A.K. and Singh A.P. [2020] concluded in their research titled “Digital Education in India: Challenges and their Solutions” that Indian education is accelerating in the last 10 years and the government has also taken various steps in the last 10 years establishing of NPTEL in different states.

Lynn G.D., Rosati P., Conway E., and Curran D. [2020] concluded in their research titled “Digital Education” that digital learning has become the central pillar of govt. education and training strategies worldwide but its benefits have still not reached to the most vulnerable in the society.

AIM OF THE RESEARCH

- a) To understand the concept of digital learning
- b) To analyze the advantages and disadvantages of digital learning
- c) To know the future of digital learning in India

COMPONENTS OF DIGITAL LEARNING

1. Internet

Primary and the most basic requirement of digital learning is the internet. A good and sound internet connection is necessary for digital learning to take place smoothly without interruptions.

2. Computers, laptops, and smartphones

Computers, laptops, and smartphones are the basic and minimal requirements for digital learning. During the pandemic, we saw companies coming up with laptops that were specially designed for students or had features that could provide smooth digital learning to the students.

3. Cameras

Cameras are important for digital learning. Without cameras, it is impossible for learning to take place. Cameras can help in providing a classroom type of atmosphere. Cameras can be

inbuilt or it can be a webcam. Cameras act as an interface between students and teachers during online classes.

4. Whiteboards and interactive whiteboards tool

The term whiteboard is not new to us anymore. The old traditional blackboards have been replaced with these smartboards. These boards have inbuilt tools like pens and stylus and so they are quickly becoming the symbol of high-tech learning.

5. Audio and video tools

The audio and video tools comprise of headsets, microphones, speakers, and cameras. Often they are present within your laptops and computers that is they are inbuilt, however, one can buy an external one to increase the standard of video calling.

6. LCD projectors

Whiteboards have made it possible to use LCD projectors in the classroom. Lcd projectors have helped in keeping students engaged in interactive class sessions.

SIGNIFICANCE OF DIGITAL LEARNING

1. Facilitates collaboration

Digital learning helps students to collaborate and learn in a shared environment. With the help of audio and video tools, they can easily share their thoughts and can learn how to be more expressive which will help them in their future also.

2. 24/7 access to resources

Online teaching can help in recording lectures so that students can access them whenever required. Repeated listening to lectures can also help them to understand concepts well. Also, material shared in the form of pdfs on digital platforms {google classroom} stays there always which means students can access them anytime they require.

3. Personalised learning

Digital learning allows teachers to give personalized lessons to students. Teachers can provide lectures tailored according to the needs of the students. Students can also learn according to their own pace. Digital learning is not based upon the idea of “one size fits all” rather it understands the needs of every individual and caters to them.

4. **Development of new learning strategies**

Digital learning has encouraged the development of new learning strategies. Gamification, micro-learning, and other teaching methods are some of the strategies that are increasingly becoming popular in this way of teaching.

5. **Students' progress tracking**

Digital learning can allow teachers to progress the performance of students. Technology can easily help in maintaining and tracking records of students related to their marks, attendance, etc. This can also help in identifying areas where students are lacking. Therefore personalized lessons based on their lacking can be prepared and can be given to them to improve their performance.

6. **Improved communication**

Digital learning can help students improve their communication. Students can easily ask questions, give feedback, and can also engage in projects with their peers which was earlier a little difficult. In the traditional classroom system, everybody is physically present and therefore many students hesitate to ask doubts as they fear getting judged by their peers. Digital learning to some extent has helped students in overcoming these hesitations.

7. **Increased accountability**

Digital learning has made students accountable as well for their performance as students can now easily track what they are studying and how they are studying.

LIMITATIONS OF DIGITAL LEARNING

1. **Can lead to social isolation**

E-learning can lead to social isolation as students don't get to see their classmates and teachers in physical form that is face to face, therefore, social interaction is very less which can ultimately lead to social isolation.

2. **Use of unethical ways**

E-learning includes assessment just like traditional classroom systems, however, there are no teachers to check whether everything has been done with honesty or not. They can cheat in their regular assignments by copying everything from the web as information is just one click away for students.

Moreover, during the test as well, it has become very easy for students to cheat and pass.

3. **Focus more on theory**

One of the major drawbacks of digital learning is that it focuses more on theory rather than practical part. Students are bound to watch videos, listen to podcasts and most of the time have their eyes glued on presentation slides. The practical part is missing that is there is no hand on experience.

4. **Lack of accessibility**

One of the major prerequisites of digital learning is that it lacks accessibility. Only those people who have internet in their areas have access to digital learning. There are a lot of areas that lack internet accessibility. During the pandemic, the education of children in rural areas was highly disrupted as rural areas lacked internet accessibility.

5. **Language barrier**

There are a lot of courses available online. But one problem is that most of these courses are in English. In a country like India, most people prefer Hindi rather than English as the illiteracy rate is high. Therefore, the language barrier is one of the major drawbacks of digital learning.

SITES THAT OFFER DIGITAL LEARNING

1. **COURSERA**

It is a free learning site that offers free courses from all the well-known universities. The site contains pre-recorded lectures that students can watch at their convenience.

2. **UDEMY**

Udemy is a library of courses that you can use to increase the skills that you can use to increase your knowledge in business, design, marketing, etc.

3. **EDX**

Edx is considered one of the best online course providers. You can refer to edx for various courses like computer science, data science, engineering, etc.

4. **LINKEDIN LEARNING**

Linkedin learning is an online course provider where you are taught by experts. You have access to 15000 courses that too in 7 languages for free.

5. KHAN ACADEMY

Khan Academy is a study website that offers in-depth knowledge of various subjects. Khan Academy is very helpful in delivering personalized learning experiences to students.

6. ACADEMIC EARTH

Academic Earth is a top online learning site that provides various certified courses to students. The courses are designed in a way that suits your professional and personal goals.

There are various other sites than those stated above like:-

- Skillshare
- Udacity
- Memrise
- MIT OpenCourseWare
- Open Culture
- Connections academy
- Stanford online
- Open Yale courses

And many more.

FUTURE OF DIGITAL LEARNING IN INDIA

India has come a long way when it comes to digital or online learning. Well, it will not be wrong to say that the pandemic was a game changer because it was during the pandemic that we shifted from traditional learning to digital learning. It has been quite a journey for India to usher into the era of e learning-learning believed that India has not yet experienced the growth curve in digital learning. To make digital learning a success, it is important to merge it with the trade national classroom system. This means customizing e-learning strategies for every learner across the country. Well if we talk about the growth of digital learning in India, it is believed that the current online learner base is expected to grow at 44% CAGR. According to a report, India's digital learning market is the second largest in the world after the US. It is believed that digital learning has a bright future in India. Digital learning is not only needed to serve the large student base across the country but it is needed to cater to the obstacles of traditional classroom teaching. A lot of private schools have started to curate online lesson plans for students. Not only this, many ed tech platforms have

been introduced that offer certified professional courses to brush up the skills of the students. E-learning will bring a dynamic change not only in the landscape of education but in the business environment as well.

CONCLUSION

Nobody can deny the fact that digital learning is the need of the hour. Even the government is trying its level best to implement digital learning by introducing websites like NPTEL that offer free courses. Digital learning is surely beneficial as it comes with a lot of advantages. However, we can't deny the fact that its benefits have still not been reaped by every section of society. The basic pre-requisite of digital learning is the internet. Internet is not available in many rural areas, therefore, people in rural areas don't have access to digital learning. Moreover, most e-learning takes place in English, so it will not be wrong to say that language is a big obstacle for people who don't know English. Therefore, digital learning implementation still requires a lot of effort. There is still a long way to go to make sure that e-learning benefits have been accessed and enjoyed by all.

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Genetic Algorithm for Load Balancing in Cloud Computing

Arun Gupta¹ & Dr. Anoop Sharma¹

¹Department of Computer Applications, Singhania University in Pachari Bari, Jhunjhunu (Raj.), India
(arun.gupta@gmail.com, sharmaanoop001@gmail.com)

Abstract—Cloud computing (CC) is a structural layout where virtual computers are involved and connected to the cloud service provider (CSP). The virtual computers establish a connection with CSP on the users' behalf. VMs are overloaded by the uncertainty. The load may be caused by the CPU, memory, or network. In the preceding work, the genetic algorithm was used to migrate virtual machines (VMs). When a virtual machine is moved, the low-latency genetic algorithm shows a high-latency network. In this study, the evolutionary algorithm is used to migrate virtual machines. In this work, the suggested algorithm is utilized in MATLAB. The findings achieved are contrasted with those of an earlier algorithm.

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Keywords: Cloud Computing, Virtual Machine Migration, Genetic Algorithm, Load Balancing

1. INTRODUCTION

CC environment provides users the appearance that they have unrestricted computational control. Depending on their individual demands, users can increase or decrease their asset utilization, including their use of energy, but they are unaware of how this control was acquired. When cloud computing is used in computer technology, the consumer is not concerned with the method of calculation and how effectively it operates. It is believed that the cloud itself is an entirely virtualized environment [3]. The infrastructure for data measurement processing and application development can be viewed as a framework unto itself, alongside the database. It offers robust and simple computing facilities; technological advancements like cloud grids and clusters each tend to continue offering access

to a significant amount of computing power from a fully virtualized infrastructure by easily consolidating requirements and ensuring a single overarching framework. Additionally, utility computing services are offered through cloud technology. A commercial strategy for providing computing resources in response to consumer requests is described by the term “on-demand computing” [4]. Based on how much service is used, customers pay service providers. All members of the public have access to traditional public services, specifically water, electricity, and gas.

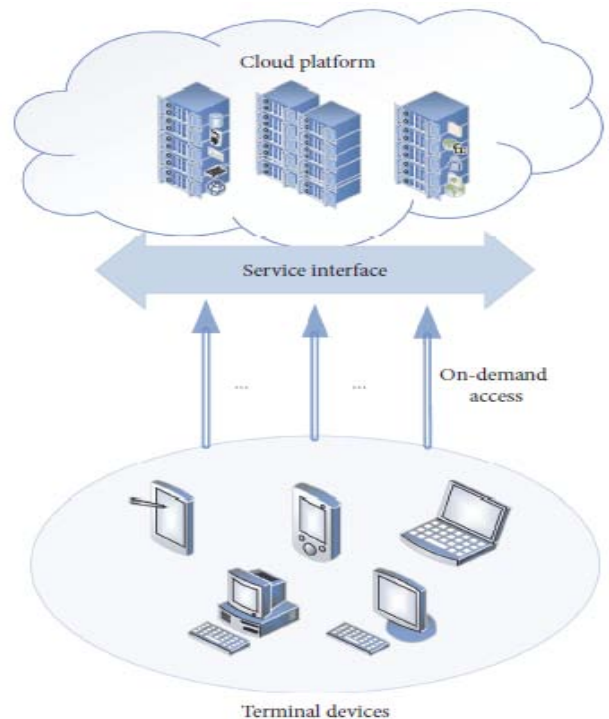


Figure : The structure of cloud computing

Cloud computing's main goal is to support widespread, suitable, and OD network access for computing resources, which can be configured easily, including storage, networks, platforms, and services in shared pools. It is feasible to give and release resources fast and with little managing effort or SP interface [5]. CC framework is depicted in Figure 1. Due to its

pay-as-you-go pricing model, which enables service providers to profit from the cost of renting resources in the cloud without investing in infrastructure, cloud computing does not require a large upfront investment. Resources are managed and leased in a flexible manner. According to the demands of the users, it is possible to release the resources in the cloud. In order to relieve strain on centre load and energy consumption and cut expenses, service providers can proactively release idle resources in the cloud when service demand is low. The data resources obtained by a cloud data centre can be gathered and analysed by the infrastructure providers. Data analysis is used by service providers to identify prospective business trends and control the growth in demand for their services, which is the foundation for them to expand their service footprint and scale. Through devices like mobile phones, PCs, and PDAs, cloud services are easily available over the Internet [6]. A contemporary paradigm for offering computing services that satisfy the changing needs of information technology is cloud computing. Because it can greatly cut expenses and offer support for the management of information technology systems without any issues, it is believed to be of tremendous benefit to consumers and companies. Over the past few years, it has shown to be beneficial in practically every area of industry, including financial trading, e-commerce, academia, and many others. Cloud computing also lowers the absolute risk for capital investments made by IT organizations. Companies that provide cloud services can better manage cloud resources and help with controlling and coordinating revenue and income [7]. The ease of use of computing resources and software, as well as the usage of minimal IT infrastructure, are valued by researchers. The way that data processing services operate can be drastically altered by the cloud. Cloud-based data processing technologies are becoming commonplace in the market area. However, remote data processing is often overseen by a remote provider (CSPs). The list highlights a number of advantages of traditional computer systems, including their unlimited data storage capacity, great performance, and low cost, to name just a few. However, people are worried about losing personal information in contrast. Similar to cloud computing, users are provided with resources in the form of tools and services; they can select the ones that best suit their needs. In cloud environments, users cannot track the origins of their data, where it has been collected from, who has accessed it, or how it has been altered.

1.1. LOAD BALANCING IN CLOUD COMPUTING

A fundamental problem with distributed frameworks and cloud computing paradigms is load balancing. The load balancing process involves dividing workloads among a collection of reliable infrastructure servers. Inconvenient computing involvements, like QoS, and SLA breaches, untrustworthy data processing, and lack of sensitivity, may result from the workloads given without the use of load balancing solutions. It is essential to use load balancing techniques in cloud computing models due to the rise of high-tech computing systems [8]. Infrastructure as a Service is the cornerstone of CC architecture. The cloud data centre makes the implementation of several physical hosts to provide customer services. As the residual resources of each physical host are changing at rapid rate, the impossible process is of implementing the task to the physical host having an enormous amount of resources every time. Instead, let the tasks that users request be arrayed on a physical host that is chosen at random each time [9]. In case the volume of resources requested for the work are found above to the quantity of resources left over on the chosen physical host, the physical host is unable to manage the task. The deployed task will be regarded as failing in this case. The time required to complete a task will be comparably long if the resources requested for the task have similarity with the rest of the resources of the physical host that is chosen for task execution. Because of the unbalanced computational outcomes that occur when a cloud data centre receives successive work requests, users cannot be served in a timely and efficient manner [10]. Due to a variety of factors, the cloud center's data load can become so unbalanced that it is unable to provide users with effective external services. In fact, cloud computing data centres normally guarantee the service performance by allocating jobs in accordance with the respective hosts' maximum load demands. Because of this, the vast majority of physical hosts are largely inactive, wasting CPU resources.

2. LITERATURE REVIEW

B. B. Wang, et al (2020) suggested a method called QuickN to assist in searching the nearest neighbour on the encrypted data on unreliable clouds [11]. Moreover, an optimized algorithm was implemented on the peak of an enhanced search algorithm to save the communicating overheads of a client and no information was leaked during this process. H. Zhu, et

al (2020) discussed that FL (Federated Learning) was utilized for preventing the leakage of secret information [12]. A MOEA (multi-objective evolutionary algorithm) was put forward to optimize the structure of the NN (neural network) of FL with the objective of mitigating the communicating costs and ER (error rates). The DNN (deep neural network) was made more effective on the basis of a scalable method.

Z. L. Jiang, et al (2021) analysed that an ML (machine learning) technique known as FL was utilized for preserving the privacy so that the algorithms were trained on the distributed datasets [13]. A secure NN (neural network) was put forward in (Federated Learning) and the multiple keys were created. Moreover, this approach made the deployment of a DTE (double-trapdoor encryption) technique. The fundamental intend of clients was that EL algorithms were uploaded to the primary CS. Thereafter, the subsequent server was employed to decrypt the initial one. For this, one trapdoor is utilized. T. Kong, et al (2020) recommended a MTD (moving target defence) system called ConfigRand which was able for preventing the information outflows which the shared kernel caused in the CBC [14]. MTD concept was assisted in formulating a framework to generate, distribute and exploit the deceiving system configurations. An innovative technique was put forward for creating these configurations and quantifying their heterogeneity. Z. Wu, et al (2019) investigated a Boolean formula as a set of DFAs and an innovative method adopted for operating an encrypted DFA [15]. The cloud was useful to process these automatons. Three kinds of queries called: conjunctive, disjunctive, and Boolean helped in making the system more efficient, adaptively secure, and mitigating the leakage.

B. H. K. Chen, et al (2018) established a novel CypherDB method that was implemented subsequent to encrypt the complete subcontracted database and execute the queries across this data [16]. The joint data paths were employed to optimize the computing effectiveness. The accessing of database and executing the query led to avoid the information leakage. S. Gao, et al (2020) presented a new CP (ciphertext-policy) known as TrustAccess having reliability and system used to control the attribute hiding access in accordance with blockchain [17]. The system was accessed reliably using this method and its applicability was proved to preserve the safety of policy and attribute. An OHP-CP-ABE (optimized hidden policy ciphertext-policy-

ABE) was presented to secure the policy and fulfil the requirements of vast universe access.

S. V. Usov, et al (2019) introduced a TaC-RBAC (Task-Controlled Role-Based Access Control) algorithm based on the restricted guidelines to authorize the limit role and perform the activation legacy. The notion of few privileged user was implemented and the redundancy of user permissions was alleviated [18]. The least number of tasks were executed using the potential of person. The major task was to determine whether multiple roles or a single role activated the least privilege theory or not in a session. The generalized RBAC (Role-Based Access Control) focused on organizing a hierarchy and granting the permissions by higher-level roles. Moreover, TC instructions were considered to perform the permission heritage and the role activation in this algorithm such that it was not possible to allocate the tasks for senior roles to junior roles; it was not essential to allocate the permissions from senior to junior roles; and considering any session at which the allocation was not done, the activation of role was not done.

Y. Wang, et al (2018) presented two rules in which initial emphasized on restricting the association among the task role. The so-called “priority junior roles rule,” were executed to determine the capability of a junior position for carrying out a duty, the senior role cannot be allocated [19]. The second rule was utilized to restrict the relation of approval with task for limiting the permissions. Thirdly, only a customer was allowed a function to allocate the job to that role. The appropriateness of the RBAC (Role-Based Access Control) algorithm was proved for organizational systems for handling the information and users via the same entity. In case of controlling the data by a third party, RBAC’s access control resolutions were ineffective to fulfil the demands due to the files management after encrypting the third party to client’s data privacy.

Likewise, the limitation of RBAC systems was the knowledge of security administrators earlier regarding all potential user agreements and functions. An access provide was utilized to restrict the little versatility as a consumer. R. Ghazal, et al (2020) analysed that the complex task was to change an access privilege of user with no change of its assigned roles [20]. Moreover, this approach focused on maintaining and assisting the users in connecting the roles and other ties among privileges and responsibilities in every solution to control the access. K. Soni, et al (2019) presented a technique

and conduct its computation. The results exhibited that the allocation of those functions was required for enforcing the (Role-Based Access Control) system, and there was no change in accessing the privileges without any change in the roles for protecting the records of unreliable entities [21].

K. Lee, et al (2020) suggested an IBE (Identity-based Encryption) method. This method was utilized to encrypt the data at which the redundant information for recognizing the user was comprised in customer profile [22]. A sender was responsible for encrypting data. For this, the key of the Recipient user was implemented, and the private key generator (PKG) was the trusted party to generate a corresponding personal key to decrypt the data. A public master key was granted by PKGs, and any key was allowed to compute the key for matching that identity with its public master key. The effectiveness of the suggested method was proved due to the known identities of user to an encrypted which was capable of decrypt the data earlier. Likewise, no intender user was required for granting its public key to perform the encryption after extracting the identity from the public key.

Z. -Y. Liu, et al (2021) established a HIBE system which was a modified form of an IBE (Identity-based Encryption) for decentralizing the process to create PK (private keys). This system was planned on the basis of diverse PKGs (private key generators) arranged in a hierarchical structure [23]. The PKG root at the next hierarchical phase led to create only a private key. Moreover, a PKG was not only assisted in generating a secret key for the entities stated. This system allowed series ID to define a user as well as tuple of IDs are executed for comprising the predecessor IDs in the order. To illustrate, a user placed below to the root in the order was described by integrating the strings ID1, ID2, and ID3. Moreover, the established system implemented to publish a cryptographic signature at one level and affect the private keys at the next level.

RESEARCH METHODOLOGY

In this study, an algorithm known as BFO is employed to address issues with node failure in CC. An algorithmic solution is proposed that contains several nodes. A candidate node is selected from amongst all motes based on the failure rate and the smallest possible execution time. In this case, the master node is used to fix the threshold value. This threshold value takes into account two variables. As participant nodes, the

master node selects nodes with an execution time that is as short as possible and a comparable failure rate. Unlike the threshold value, node N1's value is lesser. As a result, the selection of such kind of mote is done as a participant mote. Node N2 contains a lower and a greater parameter. Node N3 is chosen as the participant node because it contains a value equal to the threshold. N4 is not selected as a participant node due to its value which is found greater. The candidate node begins to function after being chosen. Many tasks are started in this scenario. Once the task is finished, one node switches to another location. As a result, task failure happens. A novel methodology is suggested to address the problem of failure brought on by node mobility. A fresh parametric quality called master node time is included in the new algorithmic method. Master node time, that aids in collaborating a node, is the actual time that connects the end customers. The formulas provided for determining the master node time are as follows:

1. $E\text{-cost} = \text{maximum execution time} + \text{Time taken by the master node (master node time)}$
After that we will calculate profit of each node.
2. $\text{Profit of each node} = E\text{-cost} + \text{Failure node of each node}$
3. $\text{Weight of each node} = \text{No. of tasks} + \text{maximum execution time/Profit}$

PSEUDO CODE OF PROPOSED SYSTEM

Begin

Input: Virtual machine

Output: Task migration

Define Number of Tasks as Tk

Threshold value of failure rate as FR

Threshold value of execution time as ER

Repeat while virtual machine is selected for the Task (Tk)

If (FR of machine i > FR of machine i+1)

If (ER of machine i > ER of machine i+1)

Select i+1 as best machine

End if

End if

End of while

If (virtual i get overloaded=true)

Calculate weight ()

If (weigh of i > weigh of i+1)

Select machine i for migration

Else

Select execute weight algorithm
End if

End

3. RESULT AND DISCUSSION

The new approach is implemented in this work using MATLAB as a simulation tool because real-world scenarios would be highly difficult without it. The introduced algorithm is compared with the existing ones with regard to power utilization and execution time. The simulation settings utilised in the presented work are displayed in Table 1.

Table 1: Simulation Parameters

| | |
|------------------------|------|
| Number of VM | 10 |
| Number of cloudlets | 60 |
| Host Memory | 2 GB |
| Processor | Xeon |
| Number of Data centers | 5 |

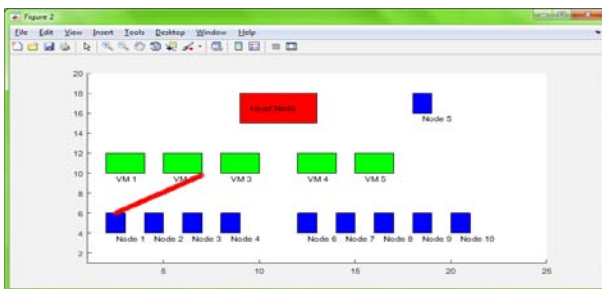


Figure 1: Virtual Machine Migration

Figure 1 illustrates how the best virtual machine is chosen as the one to which the task will be transferred for execution.

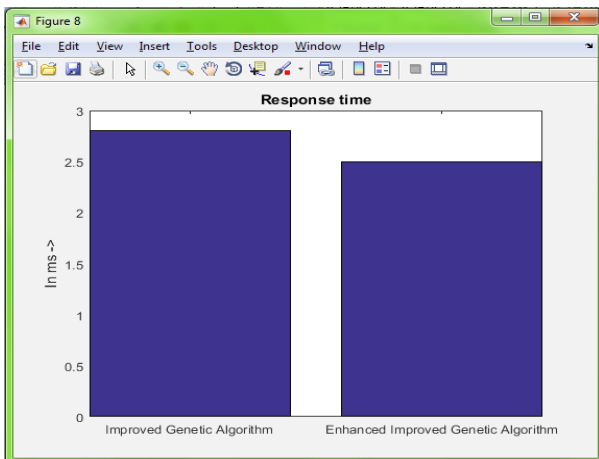


Figure 2 Comparison graph of Response Time

In order to perform comparison of the improved Genetic Algorithm and the new enhanced improved GA, Fig. 2 shows a reaction time-based comparison

between both. The new algorithm is better since it responds faster than its predecessor.

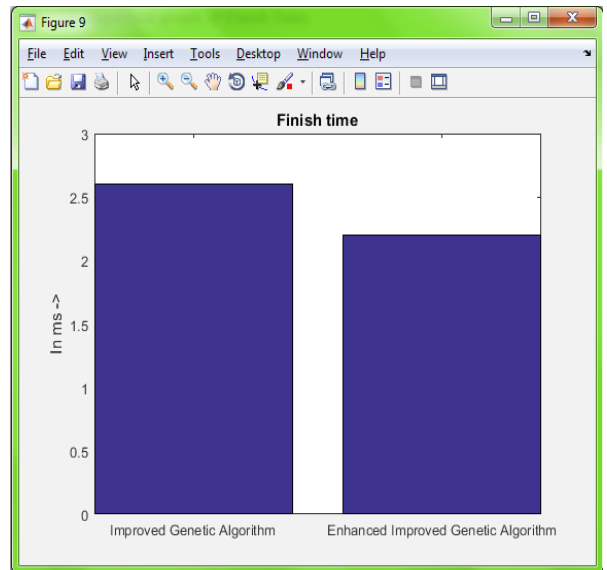


Figure 3 Comparison graph of Finish Time

In order to compare the performances of the existing algorithm with the new enhanced Genetic Algorithm, Fig. 3 shows a finish time-based comparison between the two algorithms. The new algorithm is better because it completes in less time than its predecessor.

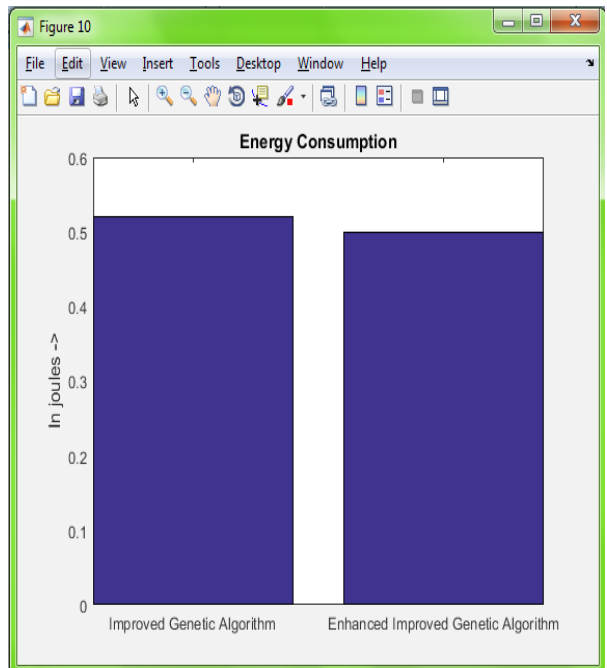


Figure 4: Graph of Energy Consumption Comparison

The Fig. 4 demonstrates the comparison of the introduced GA with the existing algorithm concerning

energy consumption. Because it uses less energy than its predecessor, the new algorithm is superior.

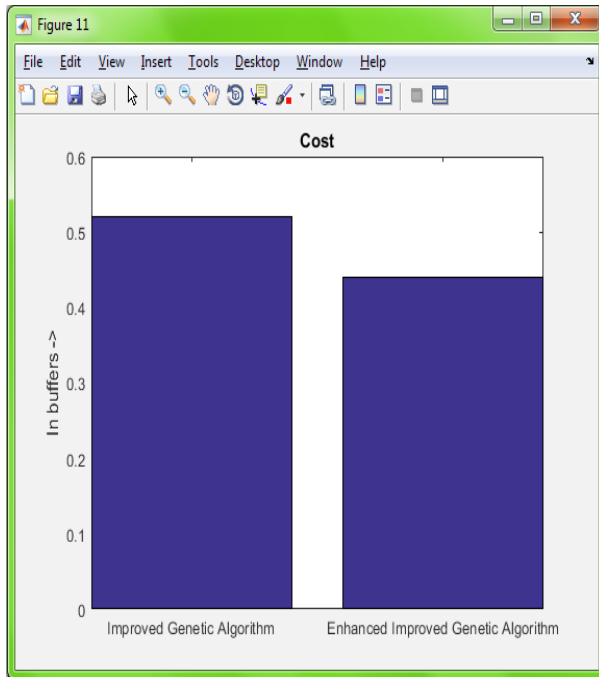


Figure 5 Comparison graph of Cost

To analyse the performance of both of these algorithms, Fig. 5 represents the comparison of the introduced GA with the existing algorithm concerning cost. The new algorithm is better since it costs less than its predecessor.

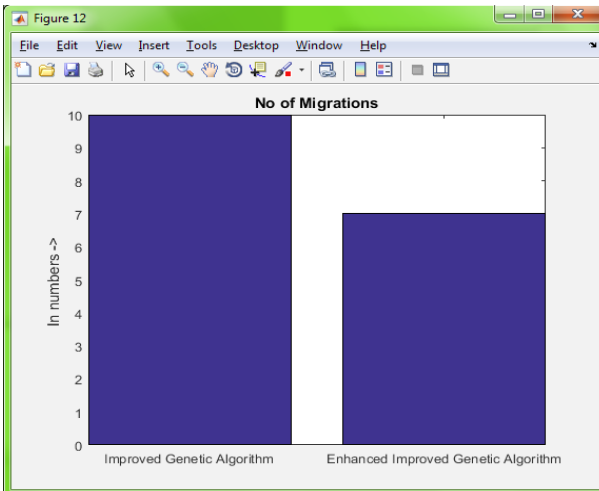


Figure 6: Comparison graph of No of Migrations

On the basis of the number of migrations, Fig. 6 contrasts better GA with new enhanced improved GA. The new algorithm outperforms its predecessor with fewer migrations.

4. CONCLUSION AND FUTURE WORK

The terms “dynamic” and “static” refer to two main groups of load balancing techniques. The choice about load shifting is not made depending on the state of the algorithm’s static type scheme at the time. Here, knowledge of the system’s resources and applications is necessary. This study aims to find a solution to the load balancing problem that cloud architectures are now experiencing. Due to load balancing, latency in the systems may rise. The work done in the past has applied GA for VM migration. This study demonstrates the high level of genetic algorithm complexity. As a result, virtual machine migration takes longer. The goal of this research project is to migrate virtual machines using an enhanced genetic method. The newer algorithm is implemented in MATLAB, and numerous metrics are produced to assess the effectiveness of the introduced algorithmic approach. The outcomes demonstrate that the new algorithm is superior to the current algorithmic technique. By offering a new security technique that uses machine learning models to separate cloud virtual channel attacks and can be compared to other models to demonstrate its validity, the research can be expanded.

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D-29, Institutional Area, Janakpuri, New Delhi- 110058

Telephone: 011-2855051, 28525882, Telefax: 28520239

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