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# RESEARCH BULLETIN

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

*Statutory Body under an Act of Parliament*

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## Vision Statement

**The Institute of Cost Accountants of India would be the preferred source of resources and professionals for the financial leadership of enterprises globally.**

## Mission Statement

**The CMA professionals would ethically drive enterprises globally by creating value to stakeholders in the socio-economic context through competencies drawn from the integration of strategy, management and accounting.**

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**CMA Ashwin G. Dalwadi**
President
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12 Sudder Street, Kolkata - 700016

# Foreword

'Digitalisation' and 'Sustainability' are the two megatrends that the organizations have to deal in the forthcoming years in order to maintain its growth and sustainability. In the Union Budget 2023, digitisation has been the key focus area. The government's vision for the Indian economy is to create a technology-driven and knowledge-based economy leveraging digital tools and platforms.

The government's focus on AI is aimed at encouraging the growth of the technology and ensuring that it benefits the country. The government has put a strong emphasis on the development of artificial intelligence (AI), Machine Learning and Internet of things. Further, to promote financial inclusion, introduction of a new digital payment system and the expansion of digital financial services to rural areas has been done. The goal is to tap into the potential for new business models and job opportunities that 5G technology can bring.

The Government has launched the e-Courts Integrated Mission Mode Project in the country for computerization of District and subordinate courts with the objective to modernise the delivery of judicial services and provide a more streamlined and accessible system for citizens. Digilocker, the government's digital certificate repository will be made available to the fintech sector to provide a boost for fintech startups. The expansion of Digilocker services to the fintech sector will provide new opportunities for businesses and improve access to important certificates and records. Therefore, the digital economy in India is growing at a robust speed and will bring new opportunities for businesses and individuals of the nation as well as the global community at large.

It gives me an immense pleasure to present before you Research Bulletin Vol.49, No. I, April, 2023 issue. This publication brings you in-depth research insights on a wide range of topics on contemporary issues well-written by researchers, academicians and professionals.

Wish you all a happy reading and hope you would find it to be an extremely beneficial tool to enrich your knowledge base.

**CMA Ashwin G Dalwadi**
President
The Institute of Cost Accountants of India

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# Chairman's Communique

The government's roadmap to make India a $5 trillion economy comprises measures like focussing on inclusive growth, promoting digital economy, fintech, technology-enabled development, energy transition and climate action and relying on a virtuous cycle of investment and growth. The path-breaking reforms including Goods and Services Tax (GST), Insolvency and Bankruptcy Code (IBC), a significant reduction in the corporate tax rate, the Make in India and Start-up India strategies and Production Linked Incentive Schemes, among others, have been implemented to achieve the target.

The Government has also focused on a capex-led growth strategy to support economic growth and attract investment from the private sector, increasing its capital investment outlay substantially during the last three years.

The Union Budget 2023-24 has taken further steps to sustain the high growth of India's economy. These include a substantial increase in capital investment outlay for the third year in a row by 33 per cent to ₹10 lakh crore. Direct capital investment by the Centre is also complemented by Grants-in-Aid to States for the creation of capital assets. The 'Effective Capital Expenditure' of the Centre was accordingly budgeted at ₹13.7 lakh crore for 2023-24. This strong push given by the government is also expected to crowd in private investment and propel economic growth.

I feel privileged to place before you the present volume of Research Bulletin, Vol.49, No. I. Our Research Bulletin mainly highlights on pragmatic research articles and has a much wider reader base consisting of academicians, researchers, industry professionals and practitioners.

This issue comprises of articles on contemporary economic issues - Accounting, Auditing, Digital Transformation, Financial Inclusion, Marketing Strategies of Telecom Operators, Banking, Cryptocurrency, SDGs, etc.

The readers are invited to tender their valuable feedback towards enrichment of Research Bulletin.

**CMA (Dr.) K. Ch. A V S N Murthy**
Chairman, Journal & Publications Committee
The Institute of Cost Accountants of India

# Editor's Note

Greetings!!!
Dear Readers,
It is with great pleasure that we present the latest volume of the *Research Bulletin - Volume 49, Issue 1, dated April 2023*. This edition delves into a diverse array of socio-economic issues, aiming to stimulate thought, foster understanding, and encourage conscious decision-making.
In the pages that follow, we embark on a journey through pivotal aspects of our rapidly evolving world. Our primary mission is to draw attention to issues spanning the environmental, social, economic and market domains. By doing so, we seek to empower our society with knowledge, enabling us all to navigate our ever-changing surroundings with wisdom.
Here's a glimpse of the thought-provoking articles featured in this issue:

- ***3As of Business: Accounting, Auditing and Artificial Intelligence:*** This article explores how Artificial Intelligence has left an indelible mark on the accounting and auditing field, underlining the importance for professionals to embrace these transformative technologies.
- ***Analysis of Tariff Rate and its Trade Growth of Developed and Developing Countries*****:** Using a wealth of secondary data, this piece sheds light on the intricate relationship between tariff rates and trade growth in developed and developing nations, offering valuable insights for future tariff rate planning.
- ***An Empirical Analysis of IPOs and Its Determinants:*** **An Indian Perspective:** This in-depth analysis employs the ARDL model to understand the impact of various macroeconomic factors on IPO performance, revealing the significance of GDP per capita and stock market returns.
- ***Critical Review of Digital Transformation in BHEL vs. L&T:*** We compare and contrast the digital transformation efforts of two major corporations, BHEL and L&T, showcasing how determination, speed and scale in digital improvements are paramount to success in the dynamic field of energy and smart infrastructure.
- ***Impact of Artificial Intelligence on E-Commerce Customers*****:** This article examines the role of Artificial Intelligence in the e-commerce industry, providing an informative foundation for understanding its advantages.
- ***Financial Inclusion through Digitalisation in Indian Economy:*** We emphasize the pivotal role of Aadhaar in advancing financial inclusion and offer recommendations to

policymakers advocating for its accelerated implementation.

- ***Influence of Marketing Strategies of Telecom Operators on Customers' Buying Decisions:*** Delving into the strategies of mobile telecom operators, this piece scrutinizes their influence on customer choices, be it related to location or choice of operators.
- ***Performance Evaluation of State Bank of India Before and After the Merger*****:** An insightful evaluation of the State Bank of India's performance, before and after a significant merger, leveraging deposit mobilization and employee productivity metrics.
- ***Role of a CMA as Social Auditor for attaining SDG Goals (With reference to the latest ICAI-SAS):*** We explore the emergence of social auditing roles and their alignment with global sustainable goals, emphasizing the vital role they play in creating a lasting impact.
- ***Technical Analysis, Trading Opportunity, and Random Walk Hypothesis - A Review:*** Despite its age, this article demonstrates the enduring efficacy of technical analysis in making investment decisions, rooted in well-established assumptions.
- ***Testing the Random Walk Hypothesis in the Cryptocurrency Market*****: After Declaration of Global Pandemic:** A pioneering study that reveals most cryptocurrencies do not conform to the random walk hypothesis, suggesting market inefficiency and opportunities for arbitrage strategies.

We extend our heartfelt gratitude to all the contributors and reviewers who have enriched this issue with their invaluable insights and knowledge. We eagerly anticipate your feedback on the articles and the overall development of the Research Bulletin. Please share your thoughts with us at research.bulletin@icmai.in.

As we embrace the season of festivities, we wish you a joyful and vibrant celebration. May this Navratri bring blessings, remove your sufferings and bestow upon you a happy and healthy life.

Warm regards,

**CMA (Dr.) Debaprosanna Nandy**
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# Journal & Publications Committee for the Year 2023-24

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# Contents

# 3As OF BUSINESS: ACCOUNTING, AUDITING AND ARTIFICIAL INTELLIGENCE

*Pinky Mistri*
*Rajendra Mistri*

***Abstract***

*Accounting and auditing is a highly complex and tedious task. Artificial Intelligence has crept into the field of accounting and auditing. The introduction of Artificial Intelligence has greatly impacted the accounting and auditing domain, but the basic nature and objective of the Account and Audit remain unchanged. Artificial Intelligence (AI) makes human-like rational decisions based on data provided using cognitive intelligence. The paper studies the impact of Artificial Intelligence in the accounting and auditing domain. The paper also evaluates the latest AI tools developed by Big4 companies, mainly for accounting and auditing. AI has a significant impact on Accounting and Audit profession. The need of the hour is for accounting and audit professionals to equip themselves with these emerging technologies.*

***Keywords:***

*Artificial Intelligence, Accounting, Auditing, Tech Companies*

## Introduction

Technology is changing the face of business. Technology is an integral part of every industry in today's digital world. Corporations are taking leverage of emerging technologies. Accounting firms and Audit firms are professional service providers. Accounting is a systematic arrangement of information so that it displays meaningful information. According to ICAI, "Audit is a systematic and independent examination of data, statement, records, operations and performance of an enterprise for stated purpose". Accounting and auditing involve many structured, unstructured and semi-structured decision-making (Baldwin et al., 2006). There is a significant amount of risk involved in such decision-making. Performing accounting and auditing task requires good education, training, knowledge, experience and expertise. Traditional Accounting and Auditing practices are unsuitable for new business models. Automation has already enabled firms with the increased efficient performance of routine tasks. Automation enabled Accountants and Auditors to spend more time analyzing and decision-making. Artificial Intelligence has now entered the accounting and auditing domain. AI is capable of performing routine tasks efficiently and also capable of analyzing and decision-making. Artificial intelligence can be helpful in various areas like preparing and assessing financial reports, identifying high-risk transactions, etc.

John McCarthy was among the first to coin Artificial Intelligence (AI). According to him, it is "the science and the engineering of making intelligent machines". AI learns and adjusts according to inputted fields; it helps in decision-making using computational logic like the human brain. AI possesses the capabilities of a computer to learn from its experience and stimulate human intelligence in decision-making. AI can perform tasks like observing and thinking, learning from past experience, problem-solving and decision-making, adapting to changing environments, and acting rationally and independently. AI is used commonly and is part of everyday life search engines (like Google and Microsoft), recommendations in an application (like Netflix, Facebook and Youtube), creative tools (like ChatGTP and AI art), self-navigating cars (like Tesla, Waymo), understanding human speech (Alexa, Siri and Google Assistant), and gaming app (like AlphaGo and Deep Blue).

## Artificial Intelligence Global revenue

The global revenue generated from Artificial intelligence is valued at USD 10.1 billion and is expected to expand, valuing USD 126 billion.

**Table 1: Revenue from the artificial intelligence (AI) software market worldwide (in billion USD)**

| Year | Market revenue in USD billion |
|---|---|
| 2018 | 10.1 |
| 2019 | 14.69 |
| 2020 | 22.59 |
| 2021 | 34.87 |
| 2022 | 51.27 |
| 2023 | 70.94 |
| 2024 | 94.41 |
| 2025 | 126 |

Source: https://www.statista.com/statistics/607716/worldwide-artificial-intelligence-market-revenues/

## Objective of the study

- To study the impact of Artificial Intelligence on accounting and auditing domain.

## Review of Literature

Baldwin, et al., (2006) argues that AI can be applied to auditing and accounting domains and particularly be fruitful in auditing and assurance functions. Zemánková (2019) analyzed the trends, opportunities and emerging threats of AI. The study provided an overview of AI technologies popularly used in audit and accounting, like genetic algorithms, fuzzy systems, neural networks, and hybrid systems. The study found that AI can perform crucial function like risk assessment. Lee and Tajudeen (2020) found that organizations derive benefits like increased productivity, improved efficiency, improved customer service, flexible working style, process governance, and manpower saving by using AI-based accounting software. Seethamraju and Hecimovic (2022) conducted an exploratory study and identified technological, organizational, and environmental (TOE) factors influencing the adoption of AI. The study raises concern over the lack of control in AI 'black-box' and suggested that AI adoption requires a rethink of audit practice. Overall, the papers suggested that AI can improve audit quality when entities overcome challenges to fully realize the potential of AI in auditing. Munoko et. al, (2020) highlights the benefits

of AI in auditing and advisory function like quick data analysis, time-saving, accuracy, in-depth analysis and better client service. The study investigates the ethical implications of using AI in auditing, including issues related to privacy, bias, and accountability. The study also focused on policy and governance relating to emerging technology. Hasan (2022) also highlights the benefits of AI in accounting and auditing, such as efficiency, accuracy and productivity. However, the papers also underlined challenges, like wealth inequality, the risk of unemployment of traditional jobs, and unskilled workforce. There are several challenges faced by enterprises in adoption of AI in auditing and accounting. Shi (2019) laid down the challenges arising due to adopting AI in accounting like the increased vulnerability of accounting information and rise of unemployment of accountants. Raji et al. (2020) addressed the governance and accountability concerns in implementation of AI. The study propounded a framework for algorithmic auditing that addresses the accountability gap. Gotthardt et al. (2020) highlighted challenges like communication, management, control systems, etc., that need to be addressed for the successful implementation of AI in accounting and auditing. Almufadda and Almezeini (2022) discusses that challenges faced by enterprises during decision-making to the use of proper countermeasures to ensure proper implementation of AI applications.

## Research Methodology

The study conducted is descriptive in nature, and the source of data is secondary in nature, collected from various sources like journals, books, websites, newspapers and magazines.

## Application of AI in the Accounting and Auditing Profession

AI makes human-like rational decisions based on data provided using cognitive intelligence. Many businesses have already adopted sophisticated technologies. AI better equips audit and account professionals in the digital transformation age. Understanding the core of accounting and auditing is essential to integrate Artificial Intelligence (AI) concisely. There is significant pressure on the accountants and auditors due to the tremendous workload. Companies are producing more data than ever before (Gepp et al., 2018). Professionals must deal with huge datasets with too many adjustments and comply with national and international rules. Auditors have to meet the compliance and assurance need of the stakeholders.

AI can perform traditional accounting functions like the generation of Invoices, Computation of data, Consolidation and Reconciliation of Accounts, preparation of Reports, and critical tasks like the prediction of bankruptcy. With AI, tasks like entering the financial record, memorizing rules and checking data accuracy will reduce pressure on Accountants. Voluminous financial statements can be created and processed efficiently and effectively. Auditing and accounting can be performed efficiently in a short duration and in real-time. A large volume of tasks can be done quickly, and this helps the accountants and auditors to focus on critical areas. Decision-supporting tools like AI models provide valuable real-time accounting and auditing insight. AI can detect outliers and account for fluctuations. Accountants and auditors can use AI models to optimize predictive models. AI algorithms are used in accounting and auditing to optimize predictive models. These algorithms will process hundreds and millions of data from transactions in milliseconds. AI also can provide independent third-party opinions. From pre-audit work to preparing audit reports, there are multiple stages of Auditing where AI can be integrated.AI can perform services like accounting and auditing on 100% of data which is not feasible for humans.AI-enabled auditing can be carried out on a population or in increased samples, or through in-depth sample analysis. Corporates maintain huge volumes of documents. AI can help by identifying patterns and anomalies. This allows auditors to provide a holistic view and better assurance to the stakeholders. AI can perform risk assessment in auditing. AI can help auditors perform repetitive and redundant tasks quickly and conduct in-depth analyses. This facilitates auditors to concentrate on critical areas or the areas of greater risk.AI works on complex tasks that involve either deep thought or expertise.AI can help auditors recognize emergencies in real-time. AI can also reveal fraudulent transactions. Accounting professionals, by using AI, can provide predictive services to their clients like bankruptcy prediction, cash flow prediction, Budget forecasting etc. Along with the capability of performing digital task AI can as well perform physical task like inventory management. AI adoption results in improved accounts and audit outcomes. Accounts and Audit firms also invest in emerging technologies at par with corporates. Big Audit firms like PwC, Deloitte, KPMG and EY have adopted AI.

There are many reports which paint a negative picture of AI in the field of Accounting and Auditing. Many believe that AI can be a threat to white-collar employees and will displace accounting and auditing professionals. Many believe that AI is not going to replace humans but rather help these professionals to function efficiently (Agarwal, et al., 2019)

## Artificial Intelligence categorization

AI can be further categorized into the following:

| AI Categories | Description |
|---|---|
| Expert System | As the name suggests, Expert System bears expert knowledge and simulates reasoning in decision-making. Expert System is a sub-set of a knowledge system. Expert System is widely used in accounting. Expert System is built with if-then rules. In accounting, Expert Systems can be applied in inventory control, cost and variance analysis, diagnosis of management control systems etc. Auditing can use Expert systems can be used in audit planning, obtaining evidence, assessment of audit risk, audit opinion decisions and preparation of audit reports. |
| Cloud Computing | It is an AI-based tool that provides the computing facilities like data storage, data management, servers, databases, software and other services. It is an on-demand facility provided by a cloud computing service provider to its clients over the Internet. Cloud computing can be of three types where Infrastructure, Platform and Software is provided for service.- IaaS, PaaS and SaaS. |
| Continuous Auditing | Continuous auditing is a meticulous collection of electronic audit evidence collected in real-time required to form an opinion on the true and fair view of financial statements. |
| Decision Support System | Decision Support System is an interactive, adaptable and versatile decision-making AI. It helps in making decisions in a non-structured management process. Combining Decision Support system and Expert System can replace humans in decision-making. |
| Neural Networks | Neural Network has multiple layers and networks like the human brain having a network of neurons. These layers are termed 'Deep Learning". It is an architectural model of the human brain. It can be used to cater to more advanced problems like information processing, Audit risk assessment, forecasting accounting models, bankruptcy prediction, etc. |
| Machine Learning | Machine learning uses data and algorithms that enable machines to perform tasks conventionally performed by humans. It detects patterns in data and analyses those patterns. In Machine Learning, the computer learns to think and act and solve real world problem with minimal human intervention. |
| Natural Language Processing (NLP) | AI model Natural Language Processing focuses on communication between humans and computers. It works on Human language understanding and processing. It can be applied in areas like recording unstructured text information, extraction of valuable input from unstructured text information and on-demand retrieval of documents systematically. It can help enterprises to automate accounting. By applying Natural Language Understanding and Natural learning generation key information regarding market sentiments, emerging trends and revenue source recognition can be done. |
| Fuzzy Logic | Fuzzy logic is an algorithm resembling reasoning like human thinking. The fuzzy variable can be between the variable ranging from 0-1. A concept like 'partial truth' and 'degree of truth' is considered that ranges from false and true. Fuzzy logic can be applied in areas like fraud detection, materiality decision, etc. |

| | |
|---|---|
| Genetic Algorithm | Genetic algorithms are a suitable approach towards solving the problems of Account and Transaction Classification. |
| Robotic Process Automation (RPA) | RPA is logic-driven robots that follow pre-programmed rules and work with primarily structured data. RPA replaces repeatable human work. RPA is software that can be used to automate established business processes by running other application software. RPA differs from AI in that it is process-driven, while AI is data-driven. Data preparation for audits, file organization, data integration from different files, basic audit tests in Excel, data copying and pasting, and manual annotations are all use cases of RPA (Zhang, 2019). |
| Hybrid Systems | All the audit tasks are not the same, i.e. some involve quantitative analysis, some involve qualitative judgment, and some may involve both. |
| Process Mining | This technology automates the processes using meta-data; it extracts knowledge from event logs. The technology can be used to identify anomalies and outliers. |
| FAAS | FAAS stands for firm-wide, fully-automated, self-aware and self-improving accounting system. FAAS is a multi-dimensional deep-learning network. FAAS can process both structured and unstructured data as per the regulations and generates reports in a proper format for its audience (Lehner et al., 2020) |

Source: Author's Compilation from various existing studies

**Changing Accounting and Auditing Landscape**

Accounting and audit firms have partnered with Tech companies. KPMG has partnered with Tech Companies like IBM's Watson AI to develop an Audit tool kit. KPMG is also working with Tech companies McLaren applied technology and using their predictive technology that will be capable of examining financial statement risk (Kokina and Davenport, 2017). KPMG is also working towards developing AI tool, which will be developing a leasing portfolio. AI is being used to analyze investment agreements by big companies like KMPG. AI can also be used in the visual inspection of assets; companies use technologies like AI drones to count inventories. PWC innovation in AI, namely PWC's technology gl.ai, is capable of analyzing accounting journals and preparing reports. EY is using big data analysis for processing its client's big volume datasets. Deloitte has partnered with Tech Company like Kira Systems that facilitate to documentation and review of financial statements. AI technology also helps in framing an extraction of the relevant clause of a legal contract.


Source: Authors own illustration

In another picture, it can be noticed that Audit firms like PwC, Deloitte, KPMG and EY are facing completion from tech companies as the tech companies are already assisting companies in accounting and auditing services. Modern technology like AI will not be just be limited to big firm, small firm will also adopt AI (Lee and Tajudeen 2020). Audit firms are also facing challenges from small tech companies or software developers who are selling AI-based software that assists firms in accounting and auditing.

**Conclusion**

AI has slowly entered every walk of human life and it is painting a rosy picture for the future. The objective of the paper was to study the impact of Artificial Intelligence on accounting and auditing domain. The global revenue of AI software market has shown an upward trend as in year 2018 it was USD 10.1 billion which soared to a value of USD 51.27 billion in year 2022. The study found that accounting and auditing is going through a paradigm shift with the introduction of Artificial Intelligence. The study discussed the impact of AI in the accounting and auditing fields. The study highlighted different categories of AI. Many are of the opinion that AI cannot totally replace humans as human insight and expertise are required to understand the application of AI and interpret the outcome of AI, like analytical reports, patterns, anomalies, etc. The accounting and audit professionals must equip themselves with these emerging technologies. Accounting and audit firms have partnered with Tech companies. People are very optimistic about the role of Artificial intelligence in future. The full potential of AI is yet to be explored, but one thing is certain are that AI is going to have a huge impact on these professions.

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# ANALYSIS OF TARIFF RATE AND ITS TRADE GROWTH OF DEVELOPED AND DEVELOPING COUNTRIES

*Deepana. P*
*U.Vani*

***Abstract***

*The nation will engage in international commerce to progress toward positive economic growth. In the existing situation, the nations could not function independently to meet the needs of the general public and businesses. To advance along a sustainable route, the nation needs to keep track of its trade in each sector along with global commerce. If developing countries wish to preserve sustainable economic growth, they think about addressing their trade imbalance. Imposing tariff rates to regulate imports would make it feasible. To participate in international commerce, the nation imposes barriers to shield its native industry from foreign competitors. To safeguard domestic marketers and customers, barriers should be established on both imports and exports. Tariff barriers or trade restrictions will lead domestic businesses to compete with foreign ones that might be able to provide a quality and innovative product. Using secondary data, this article provides an outline of the tariff rate growth of the developed countries and developing countries that support its trade growth in recent decades. It also provides the outline that there exists a relationship between the tariff rate and the trade growth of the countries. This will help to promote future planning of the tariff rate in emerging nations, to compete with established countries in the coming decades.*

***Keywords:***

*Trade, Tariff rate, Trade Growth*

## Introduction

Each nation in the world has distinctive natural resources, distinctive manufacturing capabilities, and distinctive technical support. Uniqueness and efficient resource utilization in a clearly defined manner can serve as the foundation for economic progress. The countries engage in international commerce in order to benefit from unique goods and services. Trade conducted outside of one's own country's borders is referred to as global trade. The current situation cannot resist global trade because of the distinctiveness of the global components. Global commerce now entails meeting the daily needs of everyday individuals and commercial organizations. The effect of international commerce was that nations incorporated one another to meet their needs. Every country aspires to advance in the direction of positive trade, thus everyone planned for high exports followed by low imports to generate foreign currency. Every country aspires to advance in the direction of positive trade, thus everyone planned for high exports followed by low imports to generate foreign currency. The earning of foreign currency and reserves can be used to quantify a country's economic growth. World bank (2002, table 1) data show that both China and India enjoyed historically unpredicted average annual rates of growth of GDP of around 10% and 6% respectively, as the two countries engaged in opening their economies to foreign trade and investment over 1980-2000. Integration undoubtedly played a significant influence, even while the result cannot be totally attributed to "Globalisation" because both nations simultaneously participated in internal economic reforms that increased the importance of markets and the private sector in the economy.

(Cashin, 2002)[1] mentioned that global trade frequently enables nations to get foreign currency, which may support them in maintaining economic equilibrium and generate more foreign currency, nations rely on basic products and commodities that are produced at a lower rate globally and that other nations cannot ignore. (Jeffrey Sachs, 2005)[2] directed the United Nations millennium project and the report of the project was submitted to the UN Secretary-General on Jan 17, 2005, recommends that high-income countries can open their markets to developing country exports through the Doha trade round and help least developed countries to raise their export competitiveness through investments in critical trade–related infrastructure, including electricity, roads, and ports. (Winters et

1 (Cashin, 2002)

2 (Jeffrey Sachs, 2005)

al,2004)[3] states that several mechanisms through which globalization could be expected to contribute to poverty reduction but in practice, it has mixed effects due to domestic policy distortions, continued industrial country protectionism, and limited labor market integration across countries.

**Barriers**

Global commerce cannot be avoided, but one can limit a nation's imports to avoid a negative trade balance and a negative balance of payments. Through the outsourcing of some service activities by industrialized nations, globalization directly affects the demand for educated labor in developing nations. To facilitate the smooth functioning of global commerce and sustainable growth, countries cooperate through the World Trade Organization (WTO) and other economic integration. By structuring the barriers, it is feasible to reduce imports into a certain nation. One of those barriers is Tariff barrier which is imposed to restrict the free flow of trade into a country either in the tax form or else in some other terms. Tariff constraints are those relating to how taxes are implemented. Tariff and non-tariff barriers are two main categories into which barriers can be divided. Barriers may be tariff or non-tariff, but they must only be of a certain minimum magnitude. Tariff barriers resemble tax rates that are set according to the amount of the commodities, their worth in money, or a compound charge. Tariff barriers can be fixed based on the demand in the market for both imports and exports. Typically, nations impose import trade to protect home manufacturers from international competition and adopt export trade to safeguard domestic consumers from resource shortages.

(McCormick, 2001)[4] explains in detail the examination of communication and the movement of individuals across vast distances. While silk continued to enter northwest Europe, the imports of exotic remedies and novel pharmaceuticals from Arab pharmacology took the place of the imports of spices. "To pay for these imports," McCormick states, Europe produced a rather narrow range of high-value, low-bulk goods. Some textiles, perhaps, and some tin seem plausible if barely documented. According to (Drelichman and Voth 2008)[5], the ensuing struggles between the crown and the Cortes weak ended domestic institutions and this had unfortunate consequences for Spanish economic growth. (Jeremy

3 (Winters et al,2004)

4 (McCormick 2001)

5 (Drelichman and Voth 2008)

Caddel 2014)[6] make the point that AD/CVD politics in the US are better understood as a struggle between opposing domestic interests than a bureaucracy that has been captured and is paying rent to protectionist activities.

**WTO**

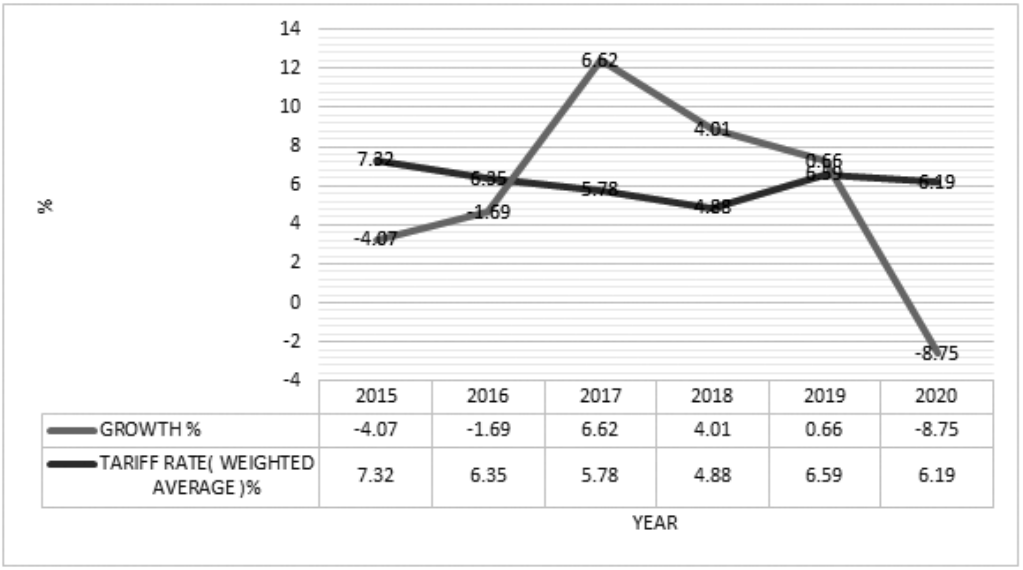
WTO members enacted more trade-facilitating (376) than trade-restrictive (214) measures on products during the WTO report review period (mid-October 2021 to mid-October 2022), with the average number of trade-facilitating measures per month reaching its highest level since 2012. While most constraints were on the export side, most liberalization took place on the import side. For the 1st time since the beginning of the monitoring exercise in 2009, the number of export restrictions outpaced that of import restrictions. A USD 278.0 billion estimate was made for the trade coverage of the trade-facilitating measures. According to a recent WTO study, the number of import restrictions in force also increased, and by mid-October 2022, more than 9% of all imports worldwide will still be subject to import restrictions that were put in place since 2009 and are still in effect. The WTO secretariat reported that as of mid-October 2022, 79.2% of the trade restrictions related to COVID-19 had been lifted, leaving 27 export restrictions and 14 import restrictions in place. Although the number of pandemic-related trade restrictions still in place has decreased, their trade coverage, at USD 134.6 billion, has remained significant.

**Objectives**

- To examine the average tariff rate and its trade growth of developing countries and developed countries

6 (Jeremy caddel 2014)

**Chart No.1**
**India's Tariff rates & Growth (Developing Country)**



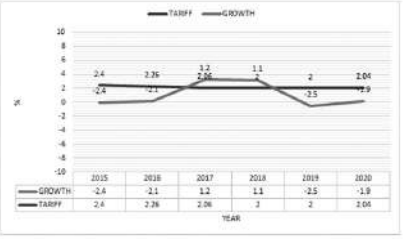

Source: World bank

**Interpretation**

From the above data, it is evident that in the year 2017, the growth of the developing country India is raised by 6.62 % against the weighted average tariff rate of 5.78%, 4.01% of growth against the tariff rate of 4.88% in the year 2018, 0.66 % growth against 6.59 % of tariff rate in 2019, -1.69% of growth against tariff rate 6.35% in the year 2016, -4.07% of growth against tariff rate 7.32% in 2015 and -8.75% of growth against tariff rate 6.19% in 2020.

**Most (6.62%) of growth in India is carried out by the year 2017 against the weighted average tariff rate of 5.78%.**

**Chart No.2**
**Indonesia's Tariff rates & Growth (Developing Country)**




| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| GROWTH | -2.4 | -2.1 | 1.2 | 1.1 | -2.5 | -1.9 |
| TARIFF | 2.4 | 2.26 | 2.06 | 2 | 2 | 2.04 |

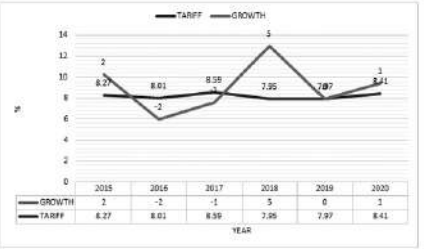
Source: World bank

**Interpretation**

From the above data, it is evident that in the year 2017, the growth of the developing country Indonesia is 1.2% of growth against the tariff rate of 2.06 % ,1.1% of growth against the tariff rate of 2% in the year 2018, -2.5 % of the growth against the tariff rate of 2 in the year of 2019, -2.4% of growth against the tariff rate of 2.4% in the year of 2015, -2.1% of the growth against tariff rate of 2.26% in the year of 2016.

**Most (1.2%) of growth in Indonesia is carried out by the year 2017 against the weighted average tariff rate of 2.06%.**

**Chart No: 3**
**Brazil's Tariff rates & Growth ( Developing Country)**




| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| GROWTH | 2 | -2 | -1 | 5 | 0 | 1 |
| TARIFF | 8.27 | 8.01 | 8.59 | 7.95 | 7.97 | 8.41 |

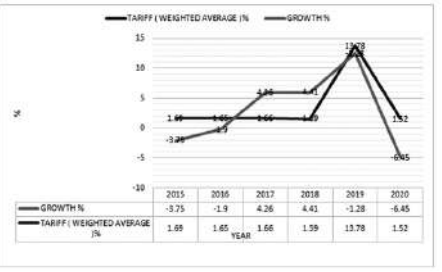
Source: World bank

**Interpretation**

From the above data, it is evident that in the year 2018, the growth of the developing country Brazil is raised by 5% against the weighted average tariff rate of 7.95% , 2 % of growth against the tariff rate of 8.27% in the year of 2015, 1% of growth against the tariff rate of 8.41%, -1% of growth against tariff rate 8.59% in 2017, -2% of growth against tariff rate of 8.01% in 2016.

**Most (5%) of growth in Brazil is carried out by the year 2017 against the weighted average tariff rate of 7.95%.**

**Chart No.4**
**U.S Tariff rates & Growth (Developed Country)**




| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| GROWTH % | -3.75 | -1.9 | 4.26 | 4.41 | -1.28 | -6.45 |
| TARIFF ( WEIGHTED AVERAGE )% | 1.69 | 1.65 | 1.66 | 1.59 | 13.78 | 1.52 |

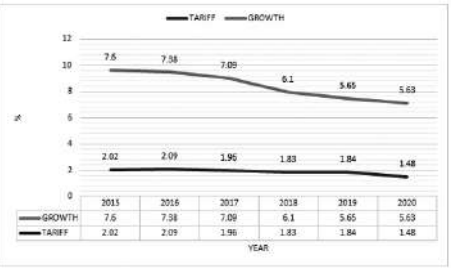
Source: World bank

**Interpretation**

From the above data, it is evident that in the year 2018, the growth of the developed country U.S is raised by 4.41 % against the weighted average tariff rate of 1.59%, 4.26% of growth against the tariff rate of 1.66 % in the year 2017, -1.28 % growth against 13.78 % of tariff rate in 2019, -1.9% of growth against tariff rate 1.65% in the year 2016, -3.75% of growth against tariff rate 1.69% in 2015 and -6.45% of growth against tariff rate 1.52% in 2020.

**Most (4.41%) of growth in the U.S. is carried out by the year 2018 against the weighted average tariff rate of 1.59%.**

**Chart No.5**
**Germany's Tariff rates & Growth (Developed Country)**



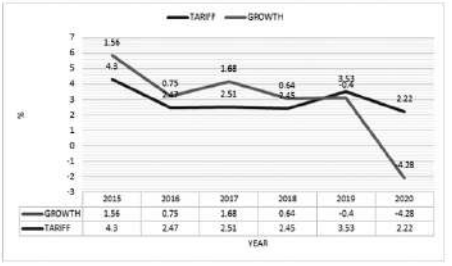

Source: World bank

**Interpretation**

From the above data, it is evident that in the year 2015, the growth of the Germany is raised by 7.6% against the tariff rate of 2.02% , 7.38% of growth against the tariff rate of 2.09% in the year 2016, 7.09% of growth rate against the tariff rate of 1.96% in the year 2017, 6.1% of growth against the tariff rate of 1.83% in the year 2018, 5.65% of growth rate against the tariff rate of 1.84% in the year 2019, 5.63% of growth against the tariff rate of 1.48% in the year 2020.

**Most (7.6%) of growth in the Germany, is carried out by the year 2015 against the weighted average tariff rate of 2.02%.**

**Chart No.6**
**Japan's Tariff rates & Growth (Developed Country)**




Source: World bank

**Interpretation**

From the above data, it is evident that in the year 2017, the growth of Japan is raised by 1.68% against the tariff rate of 2.51%, 1.56% of growth rate against the tariff rate of 4.3% in the year 2015, 0.75% of the growth against the tariff rate of 2.47% in the year of 2016, 0.64% of growth against the tariff rate of 2.45 in the year of 2018, -0.4% of growth against the tariff trade of 3.53% in the year of 2019, -4.28% of the growth against the tariff rate of 2.22% in the year 2020.

**Most (1.68%) of growth in the Japan, is carried out by the year 2017 against the weighted average tariff rate of 2.51%.**

**Findings**

For the analysis of the trade and tariff rate of the developing countries, India, Indonesia, Brazil and for developed countries U.S, Germany, Japan has been chosen to identify how the growth of the country is dependent on the tariff growth of that particular country.

**Developing Countries**

From developing countries, it is identified that the relationship between the growth and the tariff rate is exist. The developing countries suffer lot when they impose high tariff rate and has the growth when they reduce the tariff rate.

- Most (6.62%) of growth in India is carried out by the year 2017 against the weighted average tariff rate of 5.78%.
- Most (1.2%) of growth in Indonesia is carried out by the year 2017 against the weighted average tariff rate of 2.06%.
- Most (5%) of growth in Brazil is carried out by the year 2018 against the weighted average tariff rate of 7.95%.

**Developed Countries**

From developed countries, it is identified that the relationship between the growth and the tariff rate is exist but not significant as much as developing countries. The developed countries slightly react when they impose high tariff rate while comparing to developing countries.

- Most (4.41%) of growth in the U.S. is carried out by the year 2018 against the weighted average tariff rate of 1.59%.
- Most (7.6%) of growth in the Germany, is carried out by the year 2015 against the weighted average tariff rate of 2.02%.
- Most (1.68%) of growth in the Japan, is carried out by the year 2017 against the weighted average tariff rate of 2.51%.

**Suggestion**

The results of this study demonstrate that when developing nations apply the highest tariff rates, their economies suffer significantly. A higher tariff rate will have an impact on the country's import and export commerce, which would be detrimental to the expansion of the economy. The nation cannot impose more restrictions instead, it should focus more on the production of its gross domestic product and the incentives it offers to its exporting as well as domestic markets. To establish a foundation for sustainable economic growth, developing nations must focus more on domestic manufacturing and the resources used by the manufacturing sector. Even industrialized nations experience challenges with economic growth when they impose the highest tariff rates in comparison to prior years. Yet, emerging countries impose high tariff rates in comparison to industrialized ones, which restricts their ability to expand economically. This is because, in comparison to developed countries, developing countries will advance toward new technologies by investing more in research and development. So, developing countries cannot resist adopting new technology advancements that might help them improve upon their existing situation. Instead of levying tariffs on all products and services, emerging nations might do so on those that are unavailable inside their borders and on technologies that can enable them to expand more quickly than they are now. Low tariff rates may be imposed by the government on goods and services that are not accessible on the domestic market, while high tariff rates may be imposed. The cost of the product in emerging countries will be the main factor in consumers picking goods from other countries. The nation can prevent the economic downturn in the forthcoming years by focusing on this. Trade agreements and regional cooperation between nations may support one another's growth in both positive economic growth and currency values. Without international commerce, it is now impossible to avoid a monopoly in an industry.

## Conclusion

Integrating new innovations that are not yet available locally will enable everyone to benefit from global trade, and making optimal use of the resources already in place will pave the road for long-term economic progress in the nation. The preceding finding demonstrates that there is a connection between the tariff rate and national growth. Hence, the countries should set their tariff rates so as not to interfere with the expansion of their own markets and commerce. In order to boost member growth, the World Trade Organization now places more emphasis on trade facilitation than on trade prohibitions. The members of the WTO can benefit from access to new innovative items as well as exporting their homegrown goods to create a sustainable pathway by focusing more on trade facilitation.

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# AN EMPIRICAL ANALYSIS OF IPOs AND ITS DETERMINANTS: AN INDIAN PERSPECTIVE

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*Manowar Hussain*
*Sourav Chakraborty*

**Abstract**

*The strategy of going public is pertinent to the growth and development of a country's overall economy. Macroeconomic variables play a decisive role in the going public decisions of entrant firms. The present paper is an attempt to explore the performance of the IPOs in the Indian context for the period 2012 to 2022 in an aggregative sense. Here the issue size of IPOs is considered as a proxy of its performance while the number of IPOs launched in a particular year is the measure of the extent of equity financing that the unlisted firms rely on. The paper uses the ARDL model to examine the macroeconomic factors on which the IPO's performance depends. It turns out that GDP per capita and returns from stock markets have a positive influence while treasury bills rate has some negative impact on the performance of IPOs. On the other hand, GDP Per capita has a significant positive relationship with the number of IPOs.*

***Keywords***

*ARDL Bound Cointegration Test, Granger Causality, Initial Public Offerings (IPOs), Issue Size, Number of IPOs.*

## Section 1: Introduction

In the Capital Market, a company can raise capital for its further expansion through two financial instruments in the primary market namely Equity Capital and Debt Capital. The new entrants often suffer from capital inadequacy that acts as an impediment to the expansion and diversification of their business operations. So, in order to tackle this situation, the entrants are left with two options: First, taking recourse to debt finance from banks or other financial institutions. However, such debt finance is constrained by the low rating, lack of marketability and reputations, etc. of a typical new entrant firm. Secondly, the possibility of raising funds through equity finance. Among the various equity financing instruments, Initial Public Offering (IPO) is one of the probable ways through which an unlisted company can raise capital by fulfilling the requirements of the Securities and Exchange Commission (SEC). The new entrants can dilute their equity ownership in the primary market by issuing IPOs. IPO is the process of public offering where the ownership of the private companies is transferred to the general public in a new stock issuance for the first time. It is also known as New Issue Market. Issuance of IPO creates new capital inflow in the economy which in turn stimulates economic growth through expanding the investment opportunities and thereby helping the new entrants to carry out their business activities without incurring debt liabilities.

The performance of IPOs is likely to determine the growth and prosperity of the concerned company and in general the growth prospect of the overall economy. But this performance might get affected by several macroeconomic factors of a country in both the short and long run. Against this significant role that IPOs play in overall economic development, this paper is a modest attempt to examine the performance of IPOs in India over the period 2012 to 2022. To be more specific, the performance of IPOs in the Indian context is examined at the aggregative level and any firm-specific analysis of IPO is beyond the scope of this present paper. Conventional theories and casual empirical observation suggest that the performance of IPOs, both in the short and long run, depends on some key macroeconomic variables. The purpose and motivation behind the paper are to empirically establish the short-run and long-run relationship between those macroeconomic variables and the performance of IPOs in an aggregative sense. By doing so, the paper adds value to the literature in terms of addressing the influence of the key macroeconomic factors on the going public decision.

The paper is organized as follows: Section 2 deals with a brief literature review relating

to IPOs, enabling us to identify the research gaps and pinpoint our research agenda. Data sources and methodology are discussed in Section 3. Section 4 focuses on the results and discussions while Section 5 concludes the paper.

**Section 2: Brief Review of Literature**

A limited number of works have included the analysis of the relationship between macroeconomic variables and the activities of IPOs.

A study was conducted by **Chang (2009)** on the impact of macroeconomic variables on the number of IPOs in China. The results point towards a significant positive impact of industrial production on the total number of IPOs launched and a significant negative relationship between interest rates and the number of IPOs. A similar result was reported by **Ameer (2012)** for the Malaysian market where the findings suggest negative relations between interest rates and the number of IPOs while a positive relationship with the business cycle, namely industrial production. In addition, the result points out the existence of "hot" and "cold" IPO regimes depends on the changes in the interest rates.

The work of **Meluzin and Zinecker (2014)** focussed on micro and macro aspects of going public mainly in the Czech Republic and Poland markets where their finding suggests number of IPOs possess a positively significant relationship with the GDP growth rate and industrial production growth rates, whereas, the study did not find any significant association between the interest rate and number of IPOs in Poland economy.

**Tran & Jeon (2011)** conducted a study on the US economy for the period 1970 to 2005 to examine the relationship between macroeconomic variables and IPOs activities. The study not only points towards an excellent impact of macroeconomic variables on the number of IPOs but also shows why any changes in macroeconomic variables influence the net cash flows of the companies. The empirical finding suggests a positive relationship between S&P500 index and IPOs activities where S&P500 Index is considered as proxy measure of stock market performance. The estimated results imply a significant impact of the Fed funds rate and the 10-year US Treasury bond (TBs) yield on number of IPOs proceeds. A prevailing high-interest rate in the US economy results in lower discount-adjusted cash flows which lead to a low value for the companies which in turn decreases IPOs activities. Similar work of **Angelini and Foglia's (2018)** paper focuses on analyzing the short and long-run equilibrium relationship between the external factors and the IPOs for the UK market over the period of 1996 to 2016. Applying Johansen Cointegration

Test, they observed a long-run equilibrium relationship among the variables. The result from Granger Causality Test shows a significant causal relationship between variables and points out that volatility, industrial production, and interest rate Granger cause with the number of IPOs. On the other hand, the stock market return has no influence on the number of IPOs. Thus, they concluded that the 'firms interested in going public in the UK should pay more attention to the macroeconomic variables causing the number of IPOs.' In contrast, the study of **Mustafa Esin (2022)** reveals that stock market returns have a significantly positive effect on the volume of public offerings.

**Rees (1997)** showed that for the UK market over the period from 1972 to 1994, the number of IPOs is positively and significantly correlated with the business cycle indicator and the number of IPOs and their total value exhibits a positive and significant association with the stock market return which is supported by the study of **Priti Gera (2019)** in Indian context. In addition, the later study reported the existence of a long-run negative relationship between Bank Rates and the number of IPOs in the Indian Capital Market.

Another research work in the Indian context was studied by **Rani and Kaurman (2017)**. The paper examines the relationship between financial market conditions, total economic activity and IPO activity where a quarterly time-series data was chosen for the period from 2004 to 2016. The empirical findings of Co-integration tests report that interest rate has cointegration, but does not have a causal relationship with the number of IPO issues, as well as with the size of IPO whereas GDP showed a significant causal relation with issue size, but an insignificant one with the number of IPO issue. Finally, it is concluded that only GDP has a Granger-causal relation with the issue size of IPO.

**Gleason, Johnston, and Madura (2008)** concluded that especially in the technological sector, "for the companies going public with a high level of volatility", the risk of IPOs gets enhanced.

The study of **Amorium et.al (2021)** explores the impact of macroeconomic factors on IPOs in the Brazilian stock market considering the period from 2007 to 2018. The empirical results indicate that economic activity and uncertainty have long-run effects on both the proceeds and the number of IPOs, while interest rate has a long-run relationship with only IPO proceeds. In addition, the causality test highlights the fact that uncertainty precedes the IPO proceeds, more precisely, the reduction of uncertainty levels can foster IPOs in the Brazilian stock market. It is also evident that IPOs tend to vary in the opposite direction to the economic cycle.

**Dayaratne Wijethunga's (2015)** paper examines the long-run dynamic relationship between macroeconomic variables and Initial Public Offering (IPO) activities in the emerging economy of Sri Lanka for the period 1989 to 2014. Interestingly, this study captures the turmoil period of the Sri Lankan economy as well as considers the peaceful environment after the civil war. The findings of the cointegration test suggest the existence of a long-run relationship among macroeconomic variables with total and average proceeds of IPO. While the Granger causality test results in an insignificant causality between macroeconomic variables and IPO activities.

According to **Bhullar and Bhatnagar (2014),** Initial Public Offering (IPO) acts as new blood in the nerves of entrant firms. This paper exhibits a comparative analysis of the one-year and six-month performance of IPOs launched by companies belonging to various sectors of India over the period 2007 to 2012. The analysis highlights that there are several factors that have an impact on IPO performance on a short-run basis.

The above survey of existing literature helped us to pinpoint the following research gaps:

- The above studies considered very few macroeconomic and financial variables that affect the number of IPOs and the performance of IPOs. But many other probable explanatory variables (namely, GDP Per Capita, Consumer Price Index, Exchange Rate, etc.) might affect the activities of IPOs.
- There is hardly any literature that considered the Issue Size of IPOs as a proxy measure of IPOs' performance.
- The existing literature on IPOs is mainly from the perspective of advanced economies. Very few studies exist in the Indian context.

Accordingly, the objectives of the study can be posited as follows:

1. To examine the effect of selected key macroeconomic variables on the performance of IPOs in both the short and long run. Here the issue size is taken as a proxy measure of IPOs' performance.
2. To analyze the effect of these macroeconomic variables on the number of IPOs launched in the Indian context.

## Section 3: Data Source and Methodology

The study considers the number of IPOs and issue size (in Crore rupees) of the IPOs as the board indicator of preference for IPOs and its performance respectively. The key macroeconomic variables that are identified to have some influence on IPOs are Consumer

Price Index (CPI), Exchange Rate, GDP Per Capita, Stock Index Return (SIR), and 91-day Treasury Bill Monthly Market Interest Rate (TBs).

The data on the Number of IPOs and Issue Size has been extracted from the website of the National Stock Exchange whereas we have considered S&P BSE SENSEX monthly data as the Stock Index Return which has been collected from the Bombay Stock Exchange. The GDP Per Capita (US$) data has been extracted from the website of Macrotrends Data. The data on CPI and TBs have been collected from St. Louis Database and for the exchange rate, the data has been gathered from the RBI website and St. Louis Database.

We have considered Number of IPOs, Issue Size as response variables on a monthly frequency basis where,

- Number of IPOs is considered as the reflection of a conducive business environment and is used as the indicator of the company's preference for equity capital, and
- Issue Size is considered as the proxy measure of the performance of IPOs during the study period. Following Ritter's specification (1984) the small-size IPOs are excluded and we have only considered the IPOs with an Issue Size of more than Rs.1000Cr.

Whereas explanatory macroeconomic variables are posited below:

- Inflation rate is reflected by Consumer Price Index (CPI) (2015=100). When the economy suffers from inflation, it hampers the saving status of the investors thereby adversely affecting the demand for purchasing of financial assets including IPOs.
- 91-day Treasury Bill Monthly Market Interest Rate (TBs) rate is used as the proxy of return from the risk-free assets. If there is a rise in the rate of return from risk-free assets than the investors will tend to invest more in risk-free assets thereby discouraging the activities of IPOs.
- A bullish stock market return fuels IPO activities which is the reason behind the consideration of Stock Index Return (SIR) as one of the macroeconomic determinants and it has been calculated as the difference between the present and previous monthly closing returns of S&P BSE SENSEX.
- GDP Per Capita has a major impact on IPO activities. An increase in the GDP Per capita leads to an increase in the investors' purchasing power, thereby encouraging the investor's demand for financial assets.
- The role of the Exchange Rate is pertinent to the IPO activities as with the devaluation of home currency, the value of remittances inflow increases which can

be effectively used for investing in IPOs.

*Methodologies:*

Prior to examining the short-run and long-run relationship between the macroeconomic variables and IPO-specific variables, we conduct Unit Root Test (Dickey and Fuller, 1981) to check the order of integration of the variables. As the variables are found to be integrated of different order, the study uses the Autoregressive Distributed Lag (ARDL) approach developed by Pesaran and Smith (1998) and Pesaran et al. (2001). Additionally, the ARDL approach possesses another advantage of estimating short-run and long-run parameters simultaneously and an error correction model is used to integrate the short-run adjustment and long-run equilibrium without losing any long-run information (Jalil and Mahmud, 2009). To determine the optimal lag order, Var Lag Order Selection Criterion has been performed. Bound Cointegration Test is used to investigate the presence of the long-run cointegration among the variables of interest which was developed by Pesaran et al. (2001). In Bound Cointegration Test, the calculated F-statistics values is compared with two sets of tabulated critical values developed by Pesaran et al. (2001) where one set assumes all the series follow I(0) process and that of another set follows I(1)process. If the computed F-statistics value exceeds the upper bound of the critical values, the null hypothesis of no cointegration is rejected irrespective of the integrated order of the series indicating the existence of a long-run relationship between the variables, whereas if it is below the lower bounds value, then irrespective of integrated order the null hypothesis is accepted and lastly, if calculated F-statistic falls between the two levels of the bounds, the cointegration test becomes inconclusive.

After establishing the long-run relationship among the variables, an error correction model is estimated, indicating the speed of adjustment to attain equilibrium in the long run after having any shock in the short run.

Stability Test and Diagnostic Tests are applied to ensure the goodness of fit of the applied ARDL model which includes Cumulative Sum of Recursive Residuals (CUSUM), Cumulative Sum of Square of Recursive Residuals (CUSUMQ) tests, the Breusch-Godfrey Serial Correlation LM Test and the Heteroscedasticity Test of Breusch-Pagan-Godfrey.

Finally, the Granger Causality Test is used to determine the causality relationships among the variables and the direction of their causal relationship.

**Section 4: Results and Discussion**

Before applying the time-series econometric methodologies to our dataset, we carried out a detailed descriptive statistical analysis. The summary of descriptive statistics is shown in Table 1.

*Table 1: Descriptive Statistics*

| | Variables | | | | | | |
|---|---|---|---|---|---|---|---|
| | **CPI** | **Exchange Rate** | **GDP Per Capita** | **Issue Size** | **No. of IPOs** | **Stock Index Return** | **TBs** |
| **Mean** | 117.8270 | 69.65613 | 164.6998 | 1475.332 | 5.549451 | 385.4947 | 0.969890 |
| **Median** | 115.5244 | 69.48952 | 166.5216 | 842.5500 | 4.000000 | 331.7600 | 0.510000 |
| **Maximum** | 145.6808 | 82.29150 | 190.1656 | 9228.000 | 21.00000 | 4965.550 | 4.150000 |
| **Minimum** | 82.24418 | 54.40462 | 120.3235 | 15.00000 | 1.000000 | -8828.800 | 0.020000 |
| **Standard Deviation** | 15.44773 | 5.583674 | 19.65396 | 1714.719 | 4.475275 | 1905.891 | 0.982281 |
| **Skewness** | -0.001110 | -0.250032 | -0.451208 | 1.941513 | 1.053519 | -0.850479 | 0.908200 |
| **Kurtosis** | 2.233638 | 3.311670 | 2.511217 | 7.321170 | 3.752738 | 7.947298 | 3.090739 |
| | | | | | | | |
| **Jarque-Bera** | 2.226904 | 1.316479 | 3.993628 | 127.9703 | 18.98192 | 103.7742 | 12.54110 |
| **Probability** | 0.328423 | 0.517762 | 0.135767 | 0.000000 | 0.000076 | 0.000000 | 0.001891 |
| | | | | | | | |
| **Sum** | 10722.26 | 6338.708 | 14987.68 | 134255.2 | 505.0000 | 35080.02 | 88.26000 |
| **Sum of Square Deviation** | 21476.90 | 2805.968 | 34765.02 | 2.65E+08 | 1802.527 | 3.27E+08 | 86.83890 |
| | | | | | | | |
| **Observation** | 91 | 91 | 91 | 91 | 91 | 91 | 91 |

*Source: Authors' own calculation using Eviews 12*

During the study period (2012 – 2022), the average Issue size (in Cr.) of aggregative IPOs is 1475.33 and the average number of IPOs is 5.54. It is observed that the standard deviation of Issue Size and the Stock Index Return are very high among all other variables. The

skewness of Issue Size and Number of IPOs are positively skewed having a significantly right tail. Again, both the number of IPOs and Issue Size are Leptokurtic indicating a high peaked curve. Exchange Rate is normally distributed given by the Jarque-Bera Probability value being greater than 0.5 and the rest of the variables are not normally distributed.

***Unit Root Test:***

The study is mainly concerned with the impact of macroeconomic variables on the Number of IPOs and the performance of IPOs and examines whether any long-run relationship exists between the variables.

Prior to the application of ARDL model, it is necessary to conduct Unit Root Test to ensure none of the variables follows I(2) process as in the presence of I(2) or higher order the calculated value of F-statistics does not remain valid for higher order (Sezgin and Yildirn 2003, Ouattara 2004).

*Table 2: Unit Root Test using ADF Test*

| | Trend and Intercept | |
|---|---|---|
| **Variables** | **Level Value I (0)** | **1st Difference Value I (1)** |
| CPI | 3.8416 | 9.242*** |
| Exchange Rate | 3.1000 | 8.803*** |
| GDP Per Capita | 2.6909 | 9.683*** |
| Stock Index Return | 9.459*** | 10.0611 |
| 91 – days T – Bills Interest Rate | 0.8295 | 5.100*** |
| Issue Size | 7.133*** | 9.9475 |
| Number of IPOs | 3.3177 | 4.231*** |

**** indicates the rejection of null hypothesis of ADF test at 1%, 5%, and 10%*
*Source: Authors' own calculation using Eviews 12*

Table 2 primarily reports the stationarity of the variables using the Augmented Dickey-Fuller Test at the trend and intercept. The result shows the Stock Index Return and Issue size are stationary at the level [I(0)] while the series of CPI, GDP Per Capita, TBs, Exchange Rate, Number of IPOs are stationary at first difference[I(1)].

Our study has been decomposed into two sections: the first section considers the Issue

Size as the response variable, whereas the second section deals with the analysis when the Number of IPOs is chosen as the explained variable. And in both cases, the independent variables remain the same.

***Part I: Issue Size chosen as the Response Variable***

To begin with, we conducted Var Lag Order Selection Criterion to select the optimum lag orders of Issue Size which is depicted in the following table.

*Table 3: Var Lag Order Selection*

| Lag | LogL | LR | FPE | AIC | SIC | HQ |
|---|---|---|---|---|---|---|
| **0** | -1700.327 | NA | 2.90e+10 | 41.1163 | 41.2911 | 41.18656 |
| **1** | -1201.623 | 913.2895 | 417466.8 | 29.9668 | 31.1908* | 30.45854* |
| **2** | -1156.613 | 75.9205 | 340455.9* | 29.74970* | 32.0228 | 30.66292 |

** Indicates the lag order selected by each criterion*

It has been observed from the table that the optimal lag length is one as specified by the criterions SIC and HQ while the criterions FPE and AIC suggest the optimal lag length to be two. For all practical purposes, we consider the optimal lag length to be one.

*Table 4: Result from Bound Test*

| ***Dependent Variable: Issue Size of IPOs with an optimum one-period lag*** | | | | |
|---|---|---|---|---|
| ***Significance Level*** | ***F-Statistics*** | ***I(0)*** | ***I(1)*** | ***Decision*** |
| ***1%*** | 5.5793 | *3.06* | *4.15* | ***Cointegration*** |

*Source: Authors' own calculation using Eviews 12*

After conducting ADF and ensuring that none of the series is I(2), to investigate the existence of cointegration between the variables the Bound test has been conducted. The calculated F-statistics is 5.5793 where the critical value ranges are I(0)= 3.06 and I(1)=4.15 at 1% level of significance. From comparing the computed value of F-statistics with critical values, the null hypothesis gets rejected indicating the existence of cointegration between Issue Size of IPO and macroeconomics variables.

The estimation of the long-run coefficient of the selected ARDL Model (2,2,0,2,3,0) using SIC and HQ is depicted below.

*Table 5: Long-run estimates results*

| **Dependent Variable = Issue Size** | | |
|---|---|---|
| **Regressors** | **Coefficients** | **t-value** |
| Intercept | -1.0476 | -0.7363 |
| Issue Size(-1) | -0.9703 | -5.8651 |
| GDP Per Capita | 0.0187 | 2.3524** |
| Stock Index Return(-1) | 0.0001 | 1.8074**** |
| TBs | -0.1459 | -2.3189** |
| D(Issue Size) | -0.2195 | -2.0230*** |
| D(CPI(-1)) | -0.1055 | -2.5323** |
| D(GDP Per Capita(-1)) | -0.0331 | -2.5969** |
| D(Stock Index Return(-1)) | -0.0001 | -2.6241** |
| D(Stock Index Return(-2)) | -6.16E-05 | -2.2762*** |
| | | |
| **Diagnostic Test** | **Test Statistics** | **P – value** |
| Serial Correlation LM Test | 0.0778 | 0.7810 |
| Heteroscedasticity Test | 0.8953 | 0.5671 |

***, *** and **** indicates 2.5%, 5% and 10% level of significance respectively.*
*D is the difference operator; Source: Authors' own calculation using Eviews 12*

The results from ARDL long-run estimates are reported as follows.
Issue Size possesses a significant positive relation with GDP Per Capita and one period lagged Stock Index Return in the long run. This result is amenable to easy economic interpretation- as the GDP Per Capita increases, the investors' income increases, thereby encouraging the investors to invest more in equity assets. In the case of Stock Index Return, the value of the coefficient is very negligible implying its impact is not so noticeable. While TBs' coefficient is significant with negative relation which can be intuitively explained as - an increase in the rate of the risk-free asset, here TBs returns, the investment in the risky assets tends to fall. The result of the diagnostic test statistics supports the result of the ARDL model.
Now we will estimate the error correction term to measure the speed of adjustment leading to the convergence of equilibrium in the long run.

*Table 6: Error correction model estimates*

| Regressors | Coefficient | t – values | p-value |
|---|---|---|---|
| D(CPI) | -0.0340 | -0.9344 | 0.3532 |
| D(GDP Per Capita) | 0.0006 | 0.0648 | 0.9485 |
| D(SIR) | -1.48E-05 | -0.7083 | 0.4810 |
| ECT(-1) | -0.9703 | -6.5011 | 0.0000 |
| | | | |
| R-squared | 0.6946 | Mean dependent variable | 0.0113 |
| Adjusted R-squared | 0.6637 | S.D. of dependent variable | 0.7191 |
| S.E. of Regression | 0.4170 | AIC | 1.1852 |
| Sum squared residual | 13.7377 | SC | 1.4385 |
| Log-likelihood | -43.1502 | HQ | 1.2873 |
| Durbin-Watson Statistics | 1.9481 | | |

*Source: Authors' own calculation using Eviews 12*

The coefficient of the error correction term is statistically significant with an expected negative sign within the usual range of 0 and 1. More precisely, the speed of adjustment is given by -0.97 at 1% significance level, that is, any disequilibrium would get corrected by 97% in each period to restore the long-run equilibrium relation.

Finally, the stability of the model has been checked by applying CUSUM and CUSUMSQ tests.

Figure 1 and 2 indicates that the result is within the critical bounds of 5% significance level implying that the model is well-defined and robust and also the estimated coefficient of the model is stable.

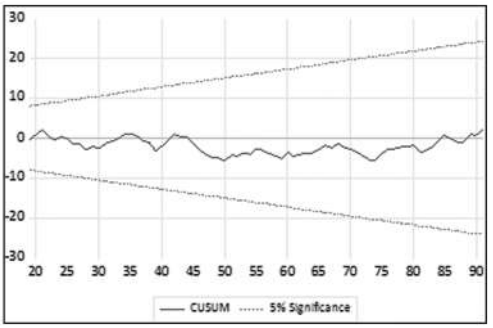


***Figure 1: CUSUM Test***

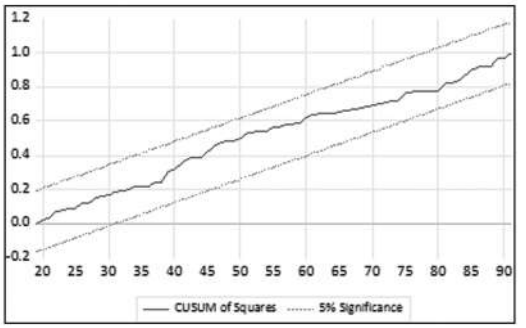


***Figure 2: CUSUM SQUARE Test***

*Source: Authors' own calculation using Eviews 12*

### *Granger Causality Test*

The last analysis of this section focuses on testing the Granger Causality relation among the variables having a long-run relationship.

*Table 7: Pair-wise Granger Causality Test*

| ***Lag Length: 1 period*** | | |
|---|---|---|
| ***Null Hypothesis*** | ***F statistic*** | ***Probability*** |
| Issue Size does not Granger Cause GDP Per Capita | 0.0054 | 0.9413 |
| GDP Per Capita does not Granger Cause Issue Size | **8.9106** | **0.0037** |

*Source: Authors' own calculation using Eviews 12*

The result obtained from the pair-wise Granger Causality Test shows that there is a unidirectional causality running from GDP Per Capita to Issue Size when Issue Size is considered as the response variable. The result can be intuitively explained as GDP Per Capita gets enhanced, investors' purchasing power gets increased thereby encouraging the investors to purchase equity assets.

***Part II: Number of IPOs as the Response Variable***

Here the Number of IPOs is the response variable and we conduct the Var Lag Order Selection Criteria in order to find out the optimum lag length which is tabulated below.

*Table 8: Var Lag Order Selection*

| Lag | LogL | LR | FPE | AIC | SIC | HQ |
|---|---|---|---|---|---|---|
| **0** | -1877.885 | NA | 2.90e+12 | 45.3948 | 45.5696 | 45.4650 |
| **1** | -1366.020 | 937.3921 | 21929269 | 33.9281 | 35.1521* | 34.41992* |
| **2** | -1327.205 | 65.46982 | 20763544* | 33.86037 | 36.13350 | 3477359 |

** Indicates the lag order selected by each criterion*

The result of VAR Lag Order Selection Criteria reports that the optimum lag length of our data is 1 (one) which is specified by the criterions SIC and HQ.

***Bound Cointegration Test***

Now since our variables are integrated in different order, we proceed forward to test the ARDL Bound Cointegration Test.

*Table 9: Result from Bound Test*

| ***Dependent Variable: Number of IPOs with optimum 1-period lag*** | | | | |
|---|---|---|---|---|
| ***Significance Level*** | ***F-Statistics*** | ***I(0)*** | ***I(1)*** | ***Decision*** |
| ***1%*** | 4.5565 | *3.06* | *4.15* | ***Cointegration*** |

*Source: Authors' own calculation using Eviews 12*

Comparing the calculated value of F-statistics with critical values at different levels of significance, the null hypothesis of no cointegration gets rejected, pointing towards the existence of cointegration between the variables when the Number of IPOs is considered as the response variable.

The coefficient of the long-run estimates of the selected ARDL model (1,0,0,4,2,2) is depicted in the following table:

*Table 10: Long-run estimates results*

| ***Dependent Variable = Number of IPOs*** | | |
|---|---|---|
| **Regressors** | **Coefficients** | **t-value** |
| Intercept | 1.7085 | 0.1604 |
| NIPO(-1) | -0.6065 | -5.4889* |
| GDP Per Capita | 0.1503 | 2.2530*** |
| D(GDP Per Capita(-3)) | -0.2777 | -2.9185* |
| D(Stock Index Return(-1)) | -0.0004 | -1.8541**** |
| D(TBs(-1)) | 5.4970 | 2.1007*** |
| | | |
| **Diagnostic Test** | **Test Statistics** | **P – value** |
| Serial Correlation LM Test | 5.1452 | 0.0264 |
| Heteroscedasticity Test | 0.9531 | 0.5084 |

**,**, *** and **** indicates 1%,2.5%, 5% and 10% level of significance respectively. D is the difference operator; Source: Authors' own calculation using Eviews 12*

The results from the ARDL Bound Cointegration Test report that with an optimum lag length of one period, the number of IPOs has a long-run positive correlation between GDP Per Capita and lagged Number of IPOs and these results are in conformity with Meluzin and Zinecker (2014). Intuitively, this result suggests that as there is an occurrence of gradual enhancement in GDP Per Capita, it brings more money into the hands of investors which in turn encourages the new entrant firms to rely more on equity financing. Whereas the number of IPOs launched in the previous period has a significant impact on accelerating the expected number of IPOs to be launched in the upcoming future period.

The diagnostic test of the selected ARDL model (1,0,0,4,2,2) suggests that there is the absence of heteroscedasticity in our dataset but it suffers from serial correlation. The expected future number of IPOs is guided by the previous period's number of IPOs which indicates the existence of a correlation in the number of IPOs launched over the time series.

We then proceed to estimate the Error Correction Model in order to attain long-run equilibrium even if there occur any short-run shocks.

***Table 11: Error correction model estimates***

| Regressors | Coefficient | t – values | p-value |
|---|---|---|---|
| D(GDP Per Capita) | -0.0385 | -0.4732 | 0.6374 |
| D(SIR) | -0.0001 | -0.9304 | 0.3553 |
| D(TBs) | -0.6149 | -0.2643 | 0.7923 |
| ECT(-1) | -0.6065 | -5.8782 | 0.000 |
| | | | |
| R-squared | 0.4628 | Mean dependent variable | 0.1494 |
| Adjusted R-squared | 0.4077 | S.D. of dependent variable | 4.2468 |
| S.E. of Regression | 3.2682 | AIC | 5.3040 |
| Sum squared residual | 833.1640 | SC | 5.5591 |
| Log-likelihood | -221.7282 | HQ | 5.406814 |
| Durbin-Watson Statistics | 2.1623 | | |

*Source: Authors' own calculation using Eviews 12*

The coefficient of the error correction term is statistically significant at 1% significance level with the usual negative sign within the reference range of 0 to 1. More concisely, the speed of adjustment is -0.60 indicating any error gets corrected by 60% in each period to bring back the system to the long-run equilibrium.

### *CUSUM AND CUSUM SQUARE*

Finally, to test the stability of the model we have conducted CUSUM and CUSUMSQ tests.

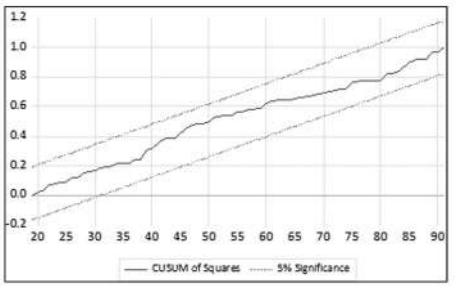


***Figure 3: CUSUM Test***

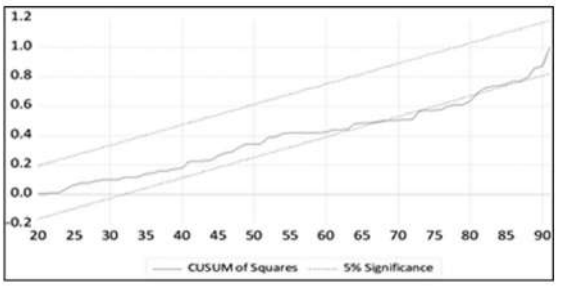


***Figure 4: CUSUM SQUARE Test***

*Source: Authors' own calculation using Eviews 12*

The result of CUSUM is depicted in Figure 3 which ensures the robustness and stability of our model and the observed result lies within the critical bound at a 5% significance level whereas Figure 4 reports the result of CUSUMSQ where the observed result partially intersect the critical bound which indicates there is a possibility of inherent structural break within the study period. Upon close observation with casual empiricism, it suggests that this structural break is because of the pandemic, related to Covid-19.

***Granger Causality Test***

Lastly, we go for Granger Causality Test in order to determine the causality relationships among the variables.

*Table 12: Pair-wise Granger Causality Test*

| **Lag Length: 1 period** | | |
|---|---|---|
| **Null Hypothesis** | **F statistic** | **Probability** |
| Number of IPOs does not Granger Cause GDP Per Capita | 0.2354 | 0.6288 |
| GDP Per Capita does not Granger Cause Number of IPOs | **4.95455** | **0.0286** |

*Source: Authors' own calculation using Eviews 12*

The result obtained from the pair-wise Granger Causality Test point towards the existence of a unidirectional causality relation between GDP Per Capita and the Number of IPOs when the Number of IPOs is chosen as the response variable.

***Section 5: Conclusion***

The present paper is an attempt to examine the determinants of IPOs in India. Our study investigates the linkage between the activities of IPOs and selected macroeconomic variables in the Indian context during the period 2012 - 2022.

Our analysis has been decomposed into two parts where the first part focuses on the Issue Size as the proxy of the performance of IPOs and the second part concentrates on the number of IPOs as the measure of the extent of equity financing that the unlisted firms rely on.

In both cases, the ARDL Bound Cointegration result reveals the existence of a long-

run positive correlation with GDP Per Capita. Intuitively this result is amenable to easy explanation- the enhancement of GDP per capita leads to a rise in the per capita income thereby resulting in an increase in the purchase of IPOs as assets. Issue size has a positive long run relationship with one period-lagged return on the Stock Index and a significantly negative long-run relationship with TBs. The probable reasons behind the observed result are as follows: the increase in the TBs rate indicates that investors can invest in a risk-free asset rather than investing in risky assets. When the number of IPOs is chosen the response variable, we observe a positive significant relationship between the lagged Number of IPOs and the current Number of IPOs which acts as a signal for the unlisted existing firms to rely on equity finance to raise funds from the market.

The Error Correction term is observed to be statistically significant with a negative sign for both cases. Furthermore, the diagnostic tests along with the stability test ensure the robustness and stability of the results of the ARDL model. In addition, the Granger causality test indicates unidirectional causality from GDP Per Capita to Issue Size and Number of IPOs.

Our study shows a close linkage between GDP per capita, Stock Index return and TB rates and IPO activities. Hence the macroeconomic fundamentals, specifically those identified above, might influence the activities of IPOs and this can act as a guide for the firms intending to float IPOs in the nearby future. Besides this, creating a favourable economic environment can attract and encourage investors to invest more in the capital market.

As a prospect for future research work, investigation regarding the possibility of a structural break in the time series data can be explored. Another area of value addition would be the performance evaluation of the firm-specific IPOs.

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# CRITICAL REVIEW OF DIGITAL TRANSFORMATION IN BHEL VS. L&T

*Padmanabhan Satyes Kumar*

***Abstract***

*Digitization of business adopted in the last few years and its varied applications in functions and processes of big corporate managing dispersed projects and resources, has been both a challenge as well as a technical advantage for time and resource optimization in projects.*

*Review of the impact of the digital transformation implemented in BHEL vs. L&T, correlated with their overall financial performance, shows a vast difference between the two in the same period partly due to the depth of the digital improvements implemented in L&T which has unfortunately been delayed and ineffective in BHEL till date.*

**The most crucial inference** *of this critical study seems to be that* **the Determination, Speed and Scale** *of DT, clearly visible in L&T and missing in BHEL, holds the key for success of the whole drive and likely to radically impacts the overall business success especially in emerging arena of energy and smart infra.*

***Keywords:***

*Digital Transformation, BHEL, L&T, Financial Performance*

A) **Theme of the Research Study:**

BHEL has seen significant downturn in its business in the last few years, while, over the same period, L&T has seen significant growth in similar sector. Incidentally this is the period in which the importance of DT has significantly enhanced both in business applications as well as under the emerging business opportunities.

***Hence this research study aims to critically analyze the relative performance of these two giants of the E&C segment particularly with reference to the impact of their DT in the results of over last 10 years in the backdrop of the specific significance of DT in the E&C segment.***

B) **Research Methodology:**

The Research study is based on the published Annual Reports and other articles gathered from the web on the status and progress of DT in the select companies against the backdrop of the recent international articles on the relevance of the concept of DT in the E&C sector.

C) **Some Recent Literature on DT in Construction Sector:**

1) **Rethinking Construction through DT (Ref#1)**

Construction is one of the largest sector where DT is still not optimized but it is hoped that in the coming few years DT may be adopted in a big way as it is noted that the applications of DT in the E&C segment is inevitable for more efficient, productive and safe operations at both the headquarters as well as at the field levels ultimately leading to immense cost and time savings.

**Benefits:**

- **Increased productivity**: by optimizing planning, designing, management of the building process.
- **Increased safety and risk mitigation: through** laser scanners or laser distance meters etc.
- **High-quality Construction:** human errors can be reduced through better modeling and monitoring.

- **Improved collaboration:** provide a shared data environment for Supply chain partners.

Challenges:

- **Lack of alignment:** many small and medium-sized partners imply alignment and cost issues.
- **Unique projects:** require standalone design making DT unviable to tailor-fit such projects.
- **Poor data management:** The construction sector poor record hindering smooth DT in them.
- **Worker training problem:** skilled aging workforce generally resist new tech like DT.

**Key DT Tools Useful for Construction**

a) **Big Data**- to identify patterns/possibilities of risk for safety provisioning and increased efficiency.
b) **Artificial Intelligence (AI)**-better project designing & automation task for increased productivity.
c) **Machine Learning (ML)** useful for monitoring and identifying critical issues.
d) **Internet of Things (IoT)**- enables smart machinery to notify their maintenance and stock levels.
e) **IoT enabled smart devises** can be used for reducing waste and reducing carbon footprint.
f) **Geo Location** – useful to identify dangerous areas and accordingly devise worker safety.
g) **Building Information Modeling (BIM)** enables virtual modeling and real time review of project.
h) **Augmented Reality (AR) and Virtual Reality (VR)** can enable fast and accurate simulation.
i) **Cloud Technology** enables to store operational data and improves Supply chain integration.

2) **Decoding DT in Construction (Ref#2)**

A large construction company, after spending 5 years and large amount on DT experiments, called it off after dozens of failed efforts such as 5D BIM and a few successes in the pilot phase which could not be applied on required scale, apart from staff resentment, delayed project and higher cost dictated the decision.

However, similar experience has been avoided by some E&C companies where DT was successful due to:

- Focus on fixing pain points, not installing IT solutions.
- Implement digital use cases that promote collaboration.
- Re-skill and restructure engineering teams.
- Adjust project baselines to capture value.
- Connect projects to unlock impact across the enterprise.

Thus for right DT the executives and managers must start with a clear definition of how digital will create value for the business and regularly monitor the impact as DT can result in productivity gains of 14-15% percent and cost reductions of 4-6%.

3) **Embracing DT in Construction (Ref #3)**

a) **Useful Digital Tools :**

- **Drones & UAVs**- to survey land, aerial photography, remote mapping etc.
- **3D Printing** -3D printing techniques to construct components as it may lead to 20% cost savings.
- **Sensor Networks** - quickly detect unsafe conditions and alert workers particularly at hazardous work sites.
- **Material Forecasting** -useful for large companies that have numerous projects linked to common souring.
- **Improved Tracking Capabilities** -to track and accurately predict delivery times for time & cost reduction.
- **Mobile Devices** – provide staff at remote project with real-time updates and information from top level.

b) **Risks of lower DT:**

- **Higher Construction Costs** - due to waste, and slower supply chains and inefficiency.

- **Poor Quality Talent**–next generation of skilled workforce may be inclined to opt for better DT companies.
- **Customer Confidence** – lost by Supply chain, scheduling, and project delays due to lower DT.
- **Environmental Compliance** – DT will play pivotal role in making construction more ESG compliant.

**D1) Detailed Study**

This segment is based on latest Annual Report of BHEL & L&T:

**1) 10 Yr Financial Trend of BHEL** (Ref#4)

| Fin Year | Revenue | Direct Cost | Gross Margin | Indirect Cost | PBT | GM% | PBT% |
|---|---|---|---|---|---|---|---|
| 2012-13 | 48425 | 37545 | 10880 | 1447 | 9433 | 22.47% | 19.48% |
| 2013-14 | 39109 | 32405 | 6704 | 1691 | 5013 | 17.14% | 12.82% |
| 2014-15 | 30242 | 26577 | 3665 | 1525 | 2140 | 12.12% | 7.08% |
| 2015-16 | 25630 | 25185 | 445 | 1921 | (1476) | 1.74% | (5.76%) |
| 2016-17 | 28599 | 26739 | 1860 | 1232 | 628 | 6.50% | 2.20% |
| 2017-18 | 28813 | 24962 | 3851 | 2266 | 1585 | 13.36% | 5.50% |
| 2018-19 | 30423 | 26520 | 3903 | 1855 | 2048 | 12.83% | 6.73% |
| 2019-20 | 21459 | 21894 | (436) | 227 | (663) | (2.03%) | (3.08%) |
| 2020-21 | 17308 | 19042 | (1734) | 1878 | (3612) | (10.02%) | (20.87%) |
| 2021-22 | 21211 | 22080 | (869) | (1307) | 438 | (4.10%) | 2.06% |

**Inferences: a)** ***FY 21-22 Operating Revenue down almost 60% vsFY12-13.***

b) ***Gross margin eroded from 22% in 2012-13 to minus 4% in FY 21-22.***

c) ***Excluding Provisions in FY21-22, the profitability remains negative, as in last previous two FYs***

***Note: Indirect cost shown above is made up of Depreciation, Finance cost, Provisions, Exchange Rate Variations netted off with non operating income.***

**2) Generation and distribution of Value Added of BHEL:**

| Particulars | **FY 21-22** | **FY 20-21** |
|---|---|---|
| Revenue( incl. GST) | 23123 | 18688 |
| Other Revenue | 1426 | 1383 |
| **Total Revenue (A)** | **24549** | **20071** |
| Material & Direct cost | 14794 | 11871 |
| Power & Fuel | 415 | 319 |
| Net Other Exp/(Income) | (253) | 2882 |
| Total Variable Cost(B) | 14956 | 15072 |
| **Value Added (A-B)** | **9593** | **4999** |
| | (39%) | (25%) |
| **Distribution of Value Added:** | | |
| Employee Cost | 5517 | 5372 |
| Depreciation+ Finance Cost | 669 | 846 |
| Exchequer (IT+GST+ Def Tax) | 2997 | 1498 |
| Net Profit/ (Loss) to Equity | 410 | (2717) |
| **Total Value Distributed** | **9593** | **4999** |

***Inference:a) Despite 39% value added in FY 21-22 the paltry 2% Net Profit reflects the high fixed cost.***

b) ***In FY 20-21 the 25% value added was not even sufficient to cover the Employee cost.***

c) ***For sustained future company need to cross breakeven minimum 30000 (Rev) with 25% VA.***

***3)*** **CMD Report (FY 21-22 of BHEL): Salient abstracts (***see linked inference E1 etc. in section E***)**

**-*Total O*rder booked (Rs** 24000 crore) includes single largest order for Rs 12000 crore of one nuclear project (E1)

**-Maiden order** for flexible operation of thermal power plant for future grid stabilization in the energy-mix. (E2)

-**Maiden order** for propulsion electrics of 'Vande Bharat Express' (Train-sets) (E3)
-**BHEL now the largest EPC player** for floating plants in lakes, ponds, canals and reservoirs, etc. (E4)
-**Crude prices and the European war** highlighted the importance of energy security with cleaner coal (E5)
-**Strategic Plan 2022-27 focuses** on turning around traditional business while intensifying diversification (E6)
-**Indigenously developed methanol plant under** National Coal Gasification Mission by the year 2030. (E7)
-**Indigenous development of various spares/ components for defense sector** is another green sign for BHEL. (E8)
-**Emerging opportunities like EV chargers and hydrogen** value chain induced building partnerships. (E9)
-**Many equipment has been successfully indigenized** and orders have been received in the Oil & Gas. (E10)

**Main concern of the company:**

FY21-22 addition of 5GW (fossil plants) and 15 GW (RE source) reflect major swift to green energy. Significantly muted orders in last 5 years especially for thermal (8.3 GW vs. expected 46 GW) resulted in underutilization of BHEL's manufacturing capacity resulting in loss of substantial revenue and margin despite winning nearly 75% of the thermal market in this period. (E11)

4) **L&T Ten Year Financial Trend ( Ref#5)**

| *Fin Yr* | *Revenue* | *Cost* | *PBDIT* | *PAT* | *PBDIT%* | *PAT%* |
|---|---|---|---|---|---|---|
| 2012-13 | 52196 | 46723 | 5473 | 4169 | 10.60% | 8.50% |
| 2013-14 | 57164 | 50497 | 6667 | 4905 | 11.78% | 9.71% |
| 2014-15 | 57558 | 51070 | 6488 | 4699 | 11.38% | 8.70% |
| 2015-16 | 63813 | 57984 | 5829 | 4454 | 9.23% | 7.91% |
| 2016-17 | 66301 | 59820 | 6481 | 4560 | 9.86% | 8.30% |
| 2017-18 | 74612 | 66911 | 7701 | 4861 | 10.34% | 7.23% |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2018-19 | 82287 | 74634 | 7653 | 5466 | 9.30% | 9.10% |
| 2019-20 | 82384 | 75546 | 6838 | 5414 | 8.30% | 8.11% |
| 2020-21 | 87255 | 78946 | 8309 | 5966 | 9.52% | 13.52% |
| 2021-22 | 101000 | 91945 | 9055 | 7612 | 8.97% | 7.80% |

**Inference: a)** ***Revenue has almost doubled over last 10 years showing a sustained growth.***

***b) Profit margin though under pressure in last few years has been steady around 10%.***

***c) Extraordinary income in FY 20-21 resulted in PAT at 13.52% otherwise at 8% level consistently.***

5) **Value Added and Distributed of L&T**

| Particulars | **FY 21-22** | **FY 20-21** |
|---|---|---|
| **Total Revenue (A)** | **106171** | **92709** |
| Mat. ,construction & Op.Exp (B) | 84121 | 72150 |
| **Value Added (A-B)** | **22050** | **20559** |
| | (21%) | (22%) |
| **Distribution of Value Added:** | | |
| Employee Cost | 7391 | 6388 |
| Finance Cost+ Dividend | 4845 | 4910 |
| Exchequer (IT+GST+ Def Tax) | 5437 | 5343 |
| Social Stakeholders (CSR Exp) | 132 | 157 |
| Net Profit/ (Loss) to Equity | 4245 | 3761 |
| **Total Value Distributed** | **22050** | **20559** |

**Inference:** ***a) Despite a just around 20% Value Added, the bottom-line is good because of low BEP.***

***b) 17% hike in cost and 16% hike in employee cost has impacted the net profit but it is still very healthy.***

***c) L&T seems to be steadily earning well above the BEP of 80000 crore @ 20% value added baseline.***

6) **Chairman's Letter in FY 21-22 Annual Report of L&T:**
-Despite challenged posed by oil, supply chain, and US rate, **structural reforms in India** well for L&T. (E12)
-**Capex-driven infrastructure** in India, the GCC economy & the Africa expected to remain buoyant. (E13)
-**The closing Order Book- Rs 357,595 crore** registering a growth of 9% during the FY.(E14)
**-Strategic 5yr Plan 'Lakshya 2026'-targetting FY25-26-Rev Rs2.7lakh crore and RoE 18%** (E15)

***MD's Report :*** additionally highlights Green Hydrogen and Circular Economy using the 6R (reduce, reuse, recycle, repair, refurbish and rethink),solar, water, green hydrogen, constitutes >30% of group turnover. (E16)

7) **Management Discussion & Analysis:**
**Strategic Plan 'Lakshya',** targets to achieve value accretive growth through a multipronged approach such as emerging technological trends for services, value engineering and digitalization initiatives etc. (E17)
**Apart from global megatrends ( Urbanization, Climate Change, Mobility, Societal Change) L&T business are focused on initiatives on DT like** Big Data, AI/ML, AR/VR, 5G, Cloud, Cyber security; Industry 4.0 etc. ( E18)
**Portfolio Strategy:** aims to de-risk the revenue, improve profitability with growth through**:**

i) **Supplementing the standalone** offerings with global partnership**.**
ii) **Geographically** India, Middle East, Africa, ASEAN for EPC Projects, US &Europe for IT services.
iii) **Complementing the mature** businesses with growth stage businesses.
iv) **Balancing cyclical EPC business through Services** to optimize technical resources. **(**E19**)**

**Risk Management:** comprehensive ERM framework for identification, assessment, treatment and reporting of risks consisting of following four tiers**: a) Operating Business (as risk owners); (b) Dedicated Corporate Teams ( as risk monitors); (c)**

**Apex Committee ( suggesting strategic risk mitigation plans) ; and (d) Board Risk Management Committee ( Risk governance oversight body).**

**Project Risk Management -** consisting of (a) Country clearance process; (b) Pre-bid risk reviews; (c) Execution risk reviews; and (d) Close out reviews (key learning for future bids).

The top enterprise-wide risks, **namely Energy Transition, Inequitable Terms of Trade, Execution Risks, Cyber Security and Climate Risks and their mitigation measures** are also detailed in the Annual Report. (E20)

**Innovative solutions:** beyond defensive risk management -**L&T Sufin –A B2B E-Commerce online platform** launched to provide seamless interactions of SME/MSME buyers and sellers for a win-win situation. (E21)

**Construction Process Improvements (*especially through DT*):**

**New digital tools** like Procurement Tracker, Material Wastage Control Solution, and Workforce Management;

**LMNOP Raksha** -to monitor remote working areas works, a mobile application enabling better EHS.

**Collaboration with startups** for efficient and remote operation of plants aiming for cost and EPC excellence

**Advanced Value Eng. & Technology Services(AdVENT)**-Leveraging the expertise in Hydrocarbon industry.

**AdVENT** also focusses on technology backed chemical industries to **reducing dependence on imports**.

**Advanced Work Packs** Project Management, Smart SCM, value engineering etc.

**Drone-based progress** monitoring and survey, product quality surveillance, augmented reality etc. (E22)

**Power Sector*:*** Exploring into various aspects such as Life-cycle Management of STG, efficiency improvement of existing plants, co-firing of Biomass, waste to energy etc. for cleaner environment. (E23)

**L&T Technology Serv.(LTTS)-offers Life cycle consultancy, design, development, and testing services like*:***

-Software and digital engineering, embedded systems, engineering analytics and plant engineering etc.

-Innovation and cutting-edge work -autonomous welding robot, smartest campus, block chaining real estate etc.
-Solar project connectivity through drones.
-Unveiled eVOLTTS, a first-of-its-kind EV technology demonstrator platform.
-Focusing on delivering state-of-the-art telematics and connectivity solutions, cutting-edge infotainment systems etc.
-Helping drive private 5G network rollouts for global organizations to achieve seamless connectivity etc. (E24)

**Integrated Report for All Stakeholders**

**Also describes** concerted efforts made towards achieving resource efficiency and de-carbonizing businesses, improving performance across ESG parameters. This Report (IR) includes financial and nonfinancial performance and is aligned to the International Integrated Reporting Council. The Report includes the employee profile as under:
Permanent Employees: 52,155; **Engineers (BTech/MTech/Diploma): 37,966**; Workforce (Contract Employees): 200,062; Employees covered under leadership development programs: 310 (E25)

**Value creation in HR** Anchored to Dynamic Business Needs, Learning &Development offerings are strongly aligned to the needs of the business over 3 major archetypes – Business, Technical and Project Leadership, focused on Strong Learning Ecosystem – People, Processes, Infrastructure: Technical Training, Project Management, Leadership and Behavioral Training, **Digital Learning (ATL Next) etc**. (E26)

**D2- Some Web Articles on DT in L&T and BHEL**

1) **Resolve on Digital Transformation in L&T (Ref#6)**
L&T CEO says that since 2014-15, the emerging technologies were creating new processes, new business models and entirely new businesses as DT was sweeping the business world as noted by L&T **through its IT subsidiary**.
L&T saw the opportunity as twofold-f**irstly, to transform its own operations to get better**. Secondly, to ***look at DT as a new business opportunity and acted swiftly with determination, speed, and scale on both***. (E27)
***In early 2016, L&T started the mammoth exercise at speed and scale. In less than 3 years,***

***every possible technology like IoT, Cloud, Mobility, Drones, BIM, etc. implemented without much time wasted on trials***.

***Today, there are over a 50 of DT tools utilized at projects connecting over 11,000 construction equipments have to provide real-time visibility*** enabling improvements in productivity and utilization of these machines, better maintenance and uptime, better fuel efficiency for savings in costs apart from improving every process relating to safety, quality, activity completion and materials tracking and monitoring . Geospatial technologies using drones, Lidar, 3D scanning, Photogrammetry, have transformed accuracy and information to make L&T competitive. (E28)

2) **L&T leads the Digital Transformation of HR function (Ref#7)**

HR function at the EPC, Hi-tech manufacturing and Services is leading the digital transformation with:

a) The entire bouquet of recruitment is digital-from the Job request creation up to on boarding of candidates;
b) With the thrust on digitalization, there has been a considerable reduction in time taken to complete various tasks leading to more productivity and reduction in the attrition from 6.49% in 18-19 to 4.30% in 20-21.
c) Campus recruitment is 100% virtual -remote proctoring, interviews, offer letters and on-boarding, reducing TAT (Turn-Around Time) by 60%.
d) L&T today has at least 23 businesses. To align with business requirements, the Human Resources team transformed itself by adopting a host of digital solutions including AI, ML, Deep-Learning & NLP.

The company is also moving to micro learning through the byte-sized rapid learning platform. Various platforms are being used wherever possible to reduce the manual interaction & improve productivity and supplemented with a 7 step development process for creating a leadership pipeline for succession planning.

3) **Technology Hubs & Partnership (Ref#8)**

A strategic mix of in-house R&D and the expertise of its JV partners for innovation, design and development.

**Technology Hubs** carry out process design and simulation, fluid dynamics, mechanical design, failure analysis etc.

a) **Engineering Development and Research Centers (EDRC):** multi-disciplinary teams of engineers work on sophisticated software and hardware offering value-added integrated engineering services to clients across projects covering piping & instrumentation diagrams, sizing & selection of equipment, etc.

b) **Technology Innovation Centre (TIC)** based on system apps, IOT devices, CCTV's, Multi-Protocol Label Switching etc. smartly connects and monitors campus to provide real-time data driven solutions. As an integrated control centre, it incorporates systems on Smart Lighting, Surveillance, Environmental Sensors etc.

c) **L&T Research & Construction Testing Centre:** conduct quality tests on all types of construction materials and specialized in concrete technology, structural engineering, geotechnical engineering, industrial wastewater, sophisticated instrumentation, NDT of special structures, foundation structures for solar projects etc.

d) **Tunneling Excellence Academy (TEA):** to develop in-house capabilities and skills to design, construct, operate and manage the construction of underground structures in the areas of railways, roads, hydro and smart projects aims to improve capabilities and efficiencies in operating Tunnel Boring Machines.

e) **BIM Academy**- provides world class training to employees in BIM for optimum digital transformation as BIM application enables virtual integration of all aspects of construction from concept to end applications even before the actual start of construction thus apt for complex buildings such as Airports, Sport Stadiums etc.

f) **Heavy Engineering– Product Development and Process Technology Centre (PDPT)** a dedicated DSIR approved R&D Centre for technology development, primarily for Process Plant and Nuclear Plant equipment businesses. It also caters to strategic businesses like marine & aerospace and cutting edge technologies.

g) **Hydrocarbon Engineering and Technology Centres:** provide technical support for the comprehensive EPC services integrating in-house strength in design & engineering, fabrication, modularization and construction to

provide solutions that are construction-friendly, and meeting world standards in quality and safety.

h) **AdVENT (Advanced Value Engineering & Technology)** an incubator vertical established to foster new business lines and technologies, to make L&T Hydrocarbon Engineering (LTHE) future ready added with new dimensions like Green Energy, Modular Solutions, Cutting-Edge Hydrocarbon Technologies etc.

i) **Defense & Aerospace – Technology**: At L&T Heavy Engineering, the Product & Technology Development Center (PTDC) is a dedicated group that develops and engineers highly advanced strategic systems and sculpt state-of-the-art products & systems for the Defense & Aerospace sector.

**Technology Alliances: Its collaborations with world leaders in following JVs:**

**a)** **L&T MHPS:** Mitsubishi Hitachi Power Systems (MHPS), Japan has over five decades of experience in manufacturing supercritical boilers and turbine-generators and is a global leader with a world market share of 28% for large turbine generators with Technology transfer agreement for upto 1000 MW sets.

**b)** **L&T Sargent & Lundy:** S&L provides complete consulting, engineering and project development services for all types of fossil fuel power generation. The JV has a team of experienced engineers who deploy advanced technology to engineer customized solutions for power projects around the world. (E29)

**4) BHEL consolidating systems for efficiency/ cost- ED-Corporate Digital Transformation (Ref#9)**

BHEL reorganized Corporate IT as CDT (Corporate Digital Transformation) to focus on business side of technology. The IT function in BHEL is based on three pillars-infrastructure & services, systems applications development, and information security now appended with –**digital strategy and governance**.

Despite the limitation posed by federal set up, BHEL was the 1st PSU to implement Reverse Auction, a digital mode purchase function apart from consolidation of dispersed internet gateways and implementing video conferencing on a big scale which has saved cost and money.

On the ERP front also units have different platforms and effort to migrate to a common set up called One BHEL is underway for quite some years now delayed albeit by slow response on its tenders.

**Present focus :** on mobility, virtualization and IoT projects from all the units for remote monitoring, solar power plants, energy management system, RFID based material tracking, GPRS based logistics, etc.(E30)

5) **Present Status of CDT Tenders in BHEL (Ref#10)**

a) Under a Tender floated in 2021 (last date of response as 21/6/2021) by CDT, the scope of work is:

"***BHEL intends to implement centralized data warehouse, business intelligence and advanced analytics solution by integrating data from multiple heterogeneous sources across BHEL to support analytical reporting, structured and/or need based queries processing and decision making***".

b) Under another Tender floated in 2020 (last date of response being 10th Dec 20) the EOI was for:

"***This EoI calls interested parties who are willing to be consultant for SAP-ERP Assessment and Review for some BHEL applied since 2004 to verify if the deployed SAP systems are fully and optimally deployed for managing the current business processes etc***" (E31)

6) **Federal IT setup in L&T**: (Ref#11)

IT operates on a federated structure with Corporate IT as the apex IT organization and CIO council that is represented by all business CIOs.

Strategic investments have been done in the areas of cyber security in FY 21-22 to ensure that uniform sets of policies, processes and technologies are implemented across the organization for evolving threat landscape. Multiple generational changes have been done to ensure that IT is able to respond to the future needs of the business. L&T also working with public cloud vendors selectively to move workloads wherever found economically viable.

**DT permeates across L&T wherein IT is working very closely with the businesses and stands ready to deliver to business relevant and state-of-the-art solutions for competitive future**. (E32)

**7) L&T's Emerging Business in DT**: **(Ref#12)**

**Prolific experience as a leading systems integrator (MSI) gained through development of Safe & Smart Cities, digital connectivity, integrating IoT Devices, Data Centers and Defense communication projects etc. More than 700 professional are dedicated for DT in the following segments of new business:**

**a) Safe & Smart Infrastructure – Safe Cities, Smart Cities, Public Safety, Critical Infra Security etc.**

**b) Communication & Telecom– Network Design, Engineering & Rollouts, Network Migration & Up-gradation, Next-Gen Data Centers, Private Cloud, Cyber Security etc.**

**c) Military Communication – Satcom and Ground stations, Radio communication System (HF VHF & UHF), Tactical Communication Systems, Software Defined Radios, Electronic Warfare Systems etc.**

**To leverage DT in core domains and tap future growth avenues, the following are now functional:**

i) **L&T EduTech Technology** - World-class education is now available online . Hybrid / blended learning is here to stay. With rich experience in technology L&T intends to bridge the industry –academia gap through EduTech.

ii) **L&T Sufin** a B2B e-commerce platform making inroads into all business segments, e-commerce is slated to grow exponentially and brings choice and convenience in a single and completely reliable package for inter actions amongst all the partners in win-win situation.

E) **Inferences/ Suggestions (linked to observations under Part D1 and D2)**

***E1) Profile of Orders reflects poorly on the mainstay thermal and emerging solar business.***

***E2) which may prove to be risky for spares business in future.***

***E3) Still its overall share of metro and rail sector seems insignificant.***
***E4) this needs to be further optimized with cost viability for commercial success.***
***E5) should have been supplemented with BHEL's efforts on commercialization of cleaner use of coal.***
***E6) unlike L&T's Lakshay 2026, the strategic plan 2022-27 of BHEL lacks quantified targets.***
***E7) such success needs to be made commercially viable.***
***E8) however the high tech capacity of BHEL will be critical for company as well as for India.***
***E9) learning from slower reaction to similar emerging solar segment in past should not be forgotten.***
***E10) this is good opportunity to promote domestic supply chains under Vocal for Local.***
***E11) BHEL desperately awaits revival of the Thermal energy market instead of adopting greener energy.***
***E12) Aligning of company with emerging opportunities reflect on the company's strategic adaptability.***
***E13) Macros for the company seems to be highly positive on domestic as well as world fronts.***
***E14) Very healthy compared to the present turnover thereby reflecting sustained market share.***
***E15) the plan reflects objective oriented targets to scale up business on expected strategic lines.***
***E16) Reflect the excellent commitment/ preparedness to align with green energy.***
***E17) Comprehensive plan aligned to long term sustained growth targets in near future.***
***E18) Reflects excellent focus and alignment to emerging and future opportunities.***
***E19) Reflects well directed strategies for sustained growth focused on high value business.***
***E20) architecture of Risk Management as also the monitoring reflects a high quality of management.***
***E21) shows how the DT is effectively utilized for stakeholder's benefit.***
***E22) Multitude of construction related area where the company has implemented DT for success.***

***E23) L&T focus on life cycle opportunities (spares & services) in thermal is learning for BHEL.***

***E24) while BHEL was still planning to tap the emerging business, L&T made clear headways through LTTS.***

***E25) This HR mix is qualitatively better compared to just 35% technical staff in total HR in BHEL.***

***E26) this is one of the critical aspects of DT as digitally skilled HR is the key asset for the success of DT.***

***E27) the crux of DT so successfully achieved in L&T (but lacking in BHEL) is Intent, Scale and Speed.***

***E28) early vision of 2014-15 and readiness by 2016 resulted in timely success of DT achieved in L&T.***

***E29) This segment gives a wide indication why L&T is such a well managed and best E&C companies.***

***E30) Compared to L&T, the process of DT in BHEL is relatively much slower and sketchy.***

***E31) BHEL seems to be very slow in their DT as reflected in the status of the CDT tenders by 2021.***

***E32) Federal setup in both companies inevitable due to size and locations yet L&T seems to be well knit IT setup.***

***E33) DT (tool as well as emerging opportunity) seems well factored by L&T but missed by BHEL.***

F) **Concluding Remarks:**

***As clearly visible from the observations and inference of this study, basically the reasons, for consistent good financial performance of L&T in the same E&C sector and in the same period (2012 to 2021), seems to be timeline and quality of strategic management implementation as compared to the lack of them in BHEL over the same period.***

***While L&T has implemented timely diversification beyond the conventional thermal energy segment and established well into emerging markets like greener energy and smart infrastructure, BHEL seems to be slow in diversification as well***

***as lacking in scale of commercial advantage and seems to be desperately waiting for the coal based plant's market to revive in the last few years.***

***The quality of professional management and timely preparedness for changing macro-economic global scenario better has been the core differential which sets L&T far apart from the pathetic performance of similar E&C giant like BHEL.***

***This is all the more apparent in the quality and scale of the DT being applied in these two companies. The details compiled under this study reflect the difference of the degree of their digital adaptation both for improvement as well as for emerging business which made L&T to successfully en-cash both the utilization of these tools and business opportunities while BHEL still remains in the planning and Tendering stage.***

***While L&T seems to have gone much ahead with the scale, speed and determination in their definitive digital transformation plans BHEL seems to be much slower and indefinite in their trials and tenders.***

***It is sincerely noted, that unless BHEL makes a quick time-bound and focused effort to utilize relevant objective oriented DT tools both for improving the productivity of their traditional business as well as to significantly plan its diversification into the emerging business, especially under green energy and smart infrastructure segment based on significant DT architecture, it may find its long run business sustainability at a greater risk.***

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## Abbreviations used

- BHEL- Bharat Heavy Electricals Limited; L&T- Larson & Toubro Limited; DT- Digital Transformation;
- EPC- Engineering Procurement & Construction; E&C- Engineering & Construction;
- GOI-Government of India; GCC- Gulf Cooperation Council, ASEAN-Association of South East Asian Nations;
- AI/ML-Artificial Intelligence/Machine Learning; AR/VR- Augmented Reality vs. Virtual Reality;
- IoT- Internet of Things; UAVs- Unmanned Aerial Vehicles;
- ERM- Enterprise Risk Management; B2B- Business to Business; QHSE- Quality Health Safety Environment;
- SCM- Supply Chain Management; STG- Steam Turbine & Generator;
- NLP-Natural Language Processing;
- BIM- Building Information Modeling; EV- Electrical Vehicles; ESG- Environment Social & Governance;
- NDT-Non Destructive Test; FEED- Front End Engineering Design;
- DSIR-Department of Scientific & Industrial Research; EOI- Expression of Interest

# IMPACT OF ARTIFICIAL INTELLIGENCE ON E-COMMERCE CUSTOMERS

*Madhu Agnihotri*
*Tushar Jain*

***Abstract***

*Artificial intelligence is rising in popularity as information and communication technology advance. In today's e-commerce market, businesses' primary goal is to persuade consumers to buy particular goods and brands. It might seem like a move in the right direction to use artificial intelligence as a cutting-edge tool in the e-commerce industry. The study focuses on describing the fundamentals of artificial intelligence and e-commerce as well as their advantages. On the basis of the studies that are now accessible, the objective is also to assess the significance of artificial intelligence and its application in the context of e-commerce.*

*Many E-Commerce firms today employ artificial intelligence to better understand their customers and meet their expectations. Machine learning, the most popular subset of AI technology, can make sense of all the data that online stores collect and use it to provide insights that improve customer experience, streamline internal business operations, and combat fraud.*

***Keywords:***

*Artificial Intelligence, e-Commerce, Chatbots, Customers*

**Introduction:**

Artificial intelligence is not a new concept for anyone today. It has used everywhere these days, whether in your house or in outer space. Anyone can see self-driving vehicles, AI-based domestic and industrial robots, Alexa/Google Assistant/Siri, satellite navigation systems and road mapping tools, facial recognizers, intelligent speech assistants, chatbots, virtual assistants, and other AI-based technologies. Though artificial intelligence appears to span a wide area nowadays, people tend to use it in their various sectors and areas, and it is getting significant attention in industries such as e-commerce, finance, healthcare, robotics, marketing, agriculture, banking, and finance, among others.

With the help of intelligent algorithms, rapid, repetitive processing of vast amounts of data, and AI, software is able to spontaneously learn from patterns or other qualities in the data. It helps software and machines become more intelligent, enabling them to think and behave like people. Artificial intelligence (AI) technology is widely used by businesses to improve customer satisfaction, increase revenue, and decrease operating costs. Future marketing efforts must embrace artificial intelligence and develop it.

Every day, businesses employ artificial intelligence (AI) technologies to improve internal workflow, cut costs, speed up turnaround, and boost output. Teams who already provide AI software are expanding their businesses at a quick rate as a result of the unparalleled velocity of technological change.

The study focuses on the impact of artificial intelligence on the e-commerce customers in the e-commerce ecosystems. It also focuses on the impact of artificial intelligence on business and various kinds of artificial intelligence techniques that are utilized by companies in the industry today.

**Literature review**

In recent years, there has been a lot of interest in the effect that artificial intelligence (AI) will have on customers of online stores. By providing personalized customer experiences, improving customer service, and streamlining the purchasing process, AI has the potential to transform the e-commerce industry. In this literature review, we'll look at some of the studies on how AI affects e-commerce customers: -

- 2021
    - "The Impact of Artificial Intelligence on Customer Experience: Evidence

from the Retail Industry" by Wael Kortam and Kevin Kam Fung Soh (2021) (Soh, 2021) -

- This study examines the impact of AI on customer experience in the retail industry and shows that AI-based personalization leads to higher customer satisfaction and loyalty.

- 2020
  - "Artificial intelligence and customer experience in e-commerce: A review and agenda for future research" by Yan Liu, Lingling Zhang, and Xi Zhang (2020) - (Yan Liu, 2020)
  - This review paper provides an overview of the impact of AI on customer experience in e-commerce and identifies key areas for future research.
- 2020
  - "The Role of Chatbots in Customer Experience Management: A Case Study of E-commerce" by Suhaib Aslam and Tariq Rahim Soomro (2020) - (Soomro, 2020)
  - This study investigates the impact of chatbots on customer experience in e-commerce and shows that chatbots can significantly improve customer satisfaction and reduce response time.
- 2020
  - "Artificial Intelligence in E-commerce: A Comprehensive Review" by Yujia Huang and Tingting Huang (2020) - (Huang, 2020)
  - This review paper provides a comprehensive overview of the use of AI in e-commerce, including customer experience, marketing, supply chain management, and fraud detection.
- 2019
  - "The Impact of Artificial Intelligence on E-commerce: A Systematic Review and Research Agenda" by Kai Hu, Huibin Du, and Jun Zhu (2019) - (Kai Hu, 2019)
  - This systematic review examines the impact of AI on e-commerce and proposes a research agenda for future studies in this area.

Personalized recommendations are one area where AI is being used in e-commerce. By investigating client information, computer-based intelligence calculations can recommend items that are probably going to bear some significance with a specific client.

Personalized recommendations were found to increase sales and customer satisfaction in a 2018 study by Zhang and colleagues. (Min Liu, 2021) However, the study also revealed that customers may be concerned about the safety of their personal information and their privacy.

Chatbots are another area where AI is being used in e-commerce. Chatbots can answer questions from customers in real time and offer customer service round-the-clock. 64% of customers would rather use chatbots for customer service than more conventional methods like email or phone calls, according to a Statista (2021) study. However, the study also revealed that customers may become dissatisfied if the chatbot does not respond to their inquiries.

Additionally, AI is being used to enhance the purchasing procedure. For instance, AI can predict when customers are likely to make a purchase based on their behavior and offer discounts or promotions at the right time. Personalized promotions based on AI analysis, according to a study by Chen and colleagues (2020), increased sales and customer satisfaction.

However, the application of AI to e-commerce may also have some potential drawbacks. The possibility of bias in AI algorithms is one cause for concern. It is possible for the algorithms to make recommendations or decisions that reinforce existing biases if they were trained on biased data. The possibility that artificial intelligence (AI) will eventually succeed human workers in customer service positions, resulting in job losses, is yet another cause for concern.

In conclusion, AI has the potential to revolutionize the e-commerce sector by streamlining the purchasing process, enhancing customer service, and providing personalized customer experiences. Concerns about privacy, bias, and job losses are just some of the potential drawbacks of using AI in e-commerce. To fully comprehend how AI will affect e-commerce customers and to devise strategies to mitigate any adverse effects, additional research is required.

**Objectives:**

- To understand the applications of Artificial Intelligence in E-commerce industry.
- To study the impact of artificial intelligence on e-commerce customers.

**Research Methodology:**

The study is aimed to provide a clear understanding of how Artificial Intelligence is diversifying in the e-commerce industry. The research is done only in the context of recognized E-commerce entities and their customer base to provide a clear understanding on the applications, constraints, and future scope of Artificial Intelligence in E-commerce industry.

The research used Primary data which was collected from the designed questionnaire to administer the various facts and figures about the AI feature and it also shows the perception of the customer. The Questionnaire consisted of various areas of applications of AI in e-commerce.

**Research gap:**

There are numerous studies on AI that describe its workings, advantages and disadvantages, specifications, and different areas of specialty. Consumer awareness and preference are the subject of a fairly small number of studies. Many studies have concentrated on the AI applications for devices, but e-commerce has received very little research attention.

Consumer perceptions of AI technology in relation to e-commerce have not been the subject of any research studies. The consumer's perspective of artificial intelligence was examined in this study.

The research is aimed to answer the following questions: -

1. What is the impact of Artificial intelligence on E-commerce customers?
2. What are the different challenges in the use of AI technologies in e-commerce for customers?

**Scope of Study:**

The goal of the study is to clearly explain how Artificial Intelligence is expanding in the e-commerce sector. In order to give a comprehensive knowledge of the uses, limitations, and future potential of artificial intelligence in the e-commerce industry, the research is only conducted in the context of recognized e-commerce organizations and their client base.

Applications of Artificial intelligence in E-commerce

Artificial intelligence has got its' applications in many areas such as E-Commerce, Education, Healthcare, Finance, Marketing, Lifestyle, Navigation, Robotics, Agriculture, Banking, Automobile, social media, Travel, Transport etc.

E-commerce is one of the sectors today that utilizes artificial intelligence to its fullest potential by amassing a sizable customer base, attempting to comprehend customer wants, conducting real-time research, developing the best possible solutions, and performing a variety of other tasks. There are various types of artificial intelligence. Artificial intelligence in software includes speech and facial recognition systems, picture analysis tools, search engines, and so-called virtual assistants. Robots, self-driving automobiles, and drones are examples of material objects with artificial intelligence integrated in. (Europal, 2020)

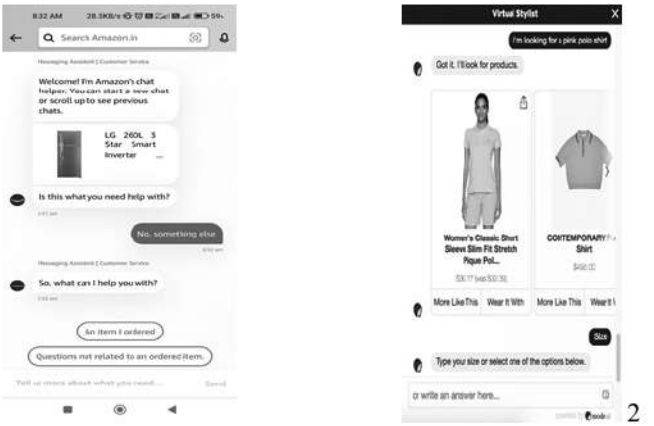

Pie-chart showing Awareness of E-commerce among respondents.

Chatbots:

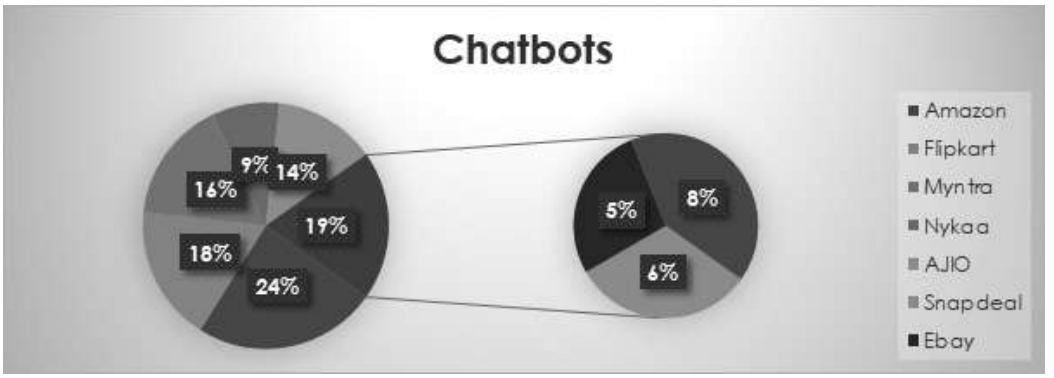
[1]The finest part of online purchasing is that ecommerce companies provide their clients with support and assistance around-the-clock. All of this has been made feasible via chatbots. Online merchants can use an eCommerce chatbot, an AI-powered Intelligent Virtual Assistant, to interact with clients at every stage of their shopping journey. ECommerce chatbots are the ideal technology for enabling "conversational commerce," or the

1 Image Source: - https://www.haptik.ai/hubfs/Knowledge%20Center%20Pages/KC%20-%20Ecommerce%20Chatbot/what-is-ecommerce-chatbot.png

use of conversational interfaces (such as online messaging, chatbots, voice assistants, etc.) to give customers a better buying experience. (eCommerce Chatbots, 2020)




Images showing chatbot feature of Amazon and Myntra.



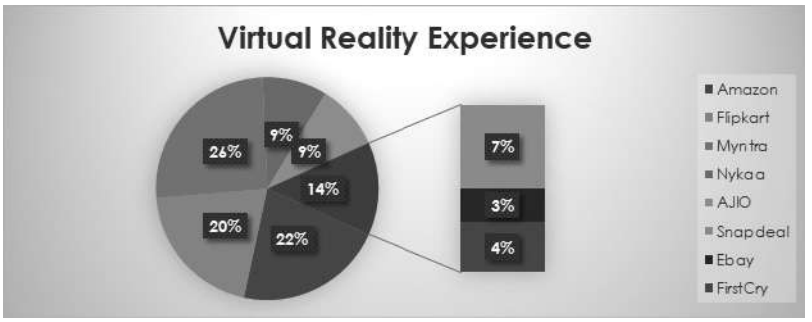

Pie-chart showing percentage of Respondents who have experienced "Chatbots" feature.

Virtual Reality Experience

In order to bring in a completely new era for the sector, VR enables ecommerce to bring the physical buying experience online. Online buyers can interact with and try

2 Image Source: - https://content.altexsoft.com/media/2018/06/Screenshot-at-Jun-13-21-45-56.png.webp

on merchandise with friends in virtual settings. They have access to details including a product's weight, texture, shape, and fit. Virtual reality (VR) makes online-sold goods more palpable, thereby lowering the knowledge gaps between a customer and a product that so frequently cause customers to cancel transactions.

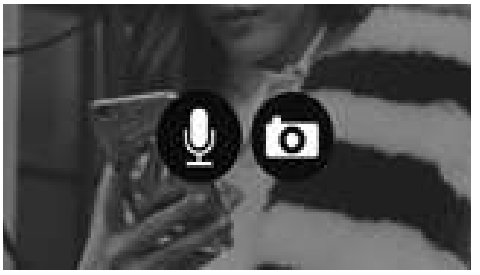



Pie-chart showing percentage of Respondents who have experienced "Virtual Reality Experience" feature.

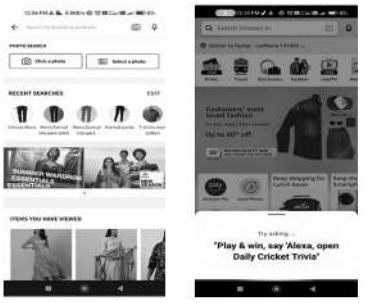
3 Image Source: - https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.threekit.com%2Fblog%2F6-brands-using-augmented-reality-in-ecommerce&psig=AOvVaw10JsLF-8mGRa5oUVtbVU0Iw&ust=1679293890640000&source=images&cd=vfe&ved=0CBAQj-RxqFwoTCMDkw7Gv5_0CFQAAAAAdAAAAABAE

4 Image source: - https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.forbes.com%2Fsites%2Fbernardmarr%2F2021%2F09%2F13%2F10-best-examples-of-augmented-and-virtual-reality-in-retail%2F&psig=AOvVaw22t3-7eF5Ad-7cCtV-jGOTb&ust=1680952868284000&source=images&cd=vfe&ved=0CBEQjRxqF-woTCNjSs8fTl_4CFQAAAAAdAAAAABAE

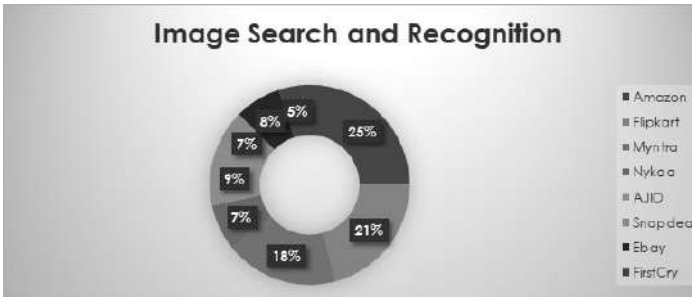
Visual and Voice Search:



[5] Visual and audio searches on websites can be implemented using artificial intelligence. Image and sound processing algorithms are the foundation of visual and aural searches. Consumers can search for a product using an image or voice instead of keying in keywords. A potential customer conducts a visual search by entering an image or photo rather than text. The user uploads an image, copies a piece of text, or both, and the search engine recognizes it and displays it in the search results.

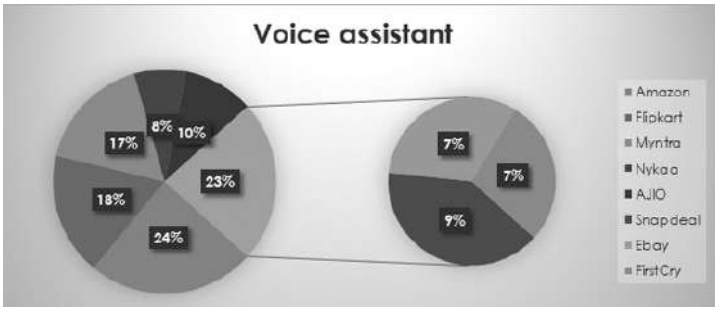



Images showing Visual search feature of Myntra and Voice search feature of Amazon.




Pie-chart showing percentage of Respondents who have experienced "Image Search and Recognition" feature.

5 Image Source: - https://blog.wideeyes.ai/2018/05/28/voice-search-or-visual-search/



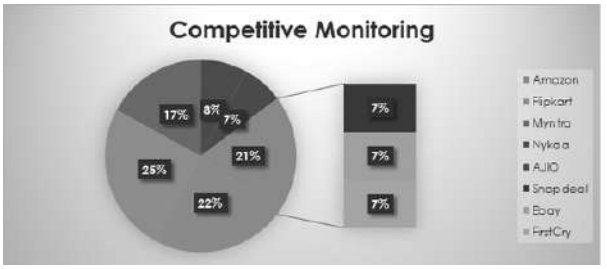

Pie-chart showing percentage of Respondents who have experienced "Voice assistant" feature.

Competitive Monitoring

For any e-business to gain a clear understanding of how other companies are operating in similar circumstances, on the same market, and with the same clientele, competition monitoring has become crucial. But, it's critical to consider references from any pricing changes as well as other elements when determining whether competitors want to increase the potential of our own brand. Understanding the customer relationship is essential when studying the competition for a brand or online store. After all, it is because of their purchases that these folks allow you to survive. This perspective is influenced by how each product is presented as well as interactions with customers and potential customers.


Images showing Competitive Monitoring feature of Amazon

6 Image source: - https://netnut.io/wp-content/uploads/2021/01/Scraping-eCommerce-Web-sites-for-Competitive-Intelligence.jpg




Pie-chart showing percentage of Respondents who have experienced "Competitive Monitoring" feature.

Inventory Management

Any business's foundation is effective inventory management. Both the front end and the back end of your activities are served by it. It is a crucial component of the supply chain on the back end, frequently serving as the go-between for your suppliers and customers. For instance, it ensures that your front-end quantities are exact so that you do not lose clients as a result of inaccurate information. This allows users to see out-of-stock, out-of-stock, overstocked, and missing items more clearly. In this situation, artificial intelligence is used to reduce the risk of both overstocking and understocking inventory by using technological solutions such as precise analysis and correlation of demand insights, detection and response to dynamic demand for a particular product, and consideration of location-specific demand.

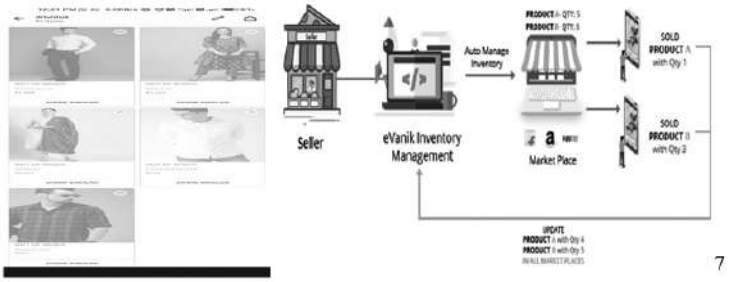



Image showing Inventory Management System of Myntra

7 Image source: -https://www.evanik.com/wp-content/uploads/2019/02/inventory-management.png


Pie-chart showing percentage of Respondents who have experienced "Inventory Management" feature

Personalized shopping experience

[8] Online merchants employ the practice of e-commerce personalization to give visitors to their e-commerce sites unique interactions and experiences. This is achieved through a variety of techniques, including content delivery, suggested readings, visitor history, demographics, and many more. A tailored purchasing experience is now more crucial than ever in our increasingly digital society.


Customers' overall purchasing experience is enhanced with a personalized shopping experience that makes them feel valued and special. Consumers who feel valued remain loyal, which increases conversion rates for your online store. Customization promotes brand loyalty and exposure.


Pie-chart showing percentage of Respondents who have experienced "Personalized Shopping"

8 Image Source: - https://www.scnsoft.com/blog-pictures/ecommerce/ecommerce-personalization.png

Data Analysis and Interpretation

Demographic Profile

| Particulars | Count | Percentage (%) |
|---|---|---|
| 18-25 | 45 | 73.77% |
| Own business/self-employed | 2C | 3.28% |
| PG | 1 | 1.64% |
| UG | 1 | 1.64% |
| Private sector | 1 | 1.64% |
| Professional course | 1 | 1.64% |
| Public sector | 2 | 3.28% |
| Below UG | 1 | 1.64% |
| UG | 1 | 1.64% |
| Student | 40 | 65.57% |
| Below UG | 7 | 11.48% |
| Diploma | 2 | 3.28% |
| PG | 2 | 3.28% |
| Professional course | 2 | 3.28% |
| UG | 27 | 44.26% |
| 25-40 | 7 | 11.48% |
| House wife | 1 | 1.64% |
| PG | 1 | 1.64% |
| Own business/self-employed | 3 | 4.92% |
| PG | 2 | 3.28% |
| Professional course | 1 | 1.64% |
| Private sector | 3 | 4.92% |
| Diploma | 1 | 1.64% |
| Professional course | 2 | 3.28% |
| Above 40 | 8 | 13.11% |
| Own business/self-employed | 5 | 8.20% |
| PG | 3 | 4.92% |

| | | |
|---|---|---|
| Professional course | 1 | 1.64% |
| UG | 1 | 1.64% |
| Private sector | 3 | 4.92% |
| Below UG | 1 | 1.64% |
| UG | 2 | 3.28% |
| Below 18 | 1 | 1.64% |
| Student | 1 | 1.64% |
| Professional course | 1 | 1.64% |
| | | 0.00% |
| **Grand Total** | **61** | **100.00%** |

Interpretation:

According to the table, out of 61 respondents overall, 74% were between the ages of 18 and 25, 45% were between the ages of 25 and 40, and 11.48% were between the ages of 35 and 45. All other respondents were over 40, with the exception of 1 who was under the age of 18.

Of all respondents, 14% were undergraduates, 52% were undergrads, 14% were postgrads, 14% were enrolled in professional programmes, and the remaining 6% were enrolled in diploma programmes. 67% of respondents were students, 11% were employed in the private sector, 3% were engaged in the public sector, and 16% were self-employed.

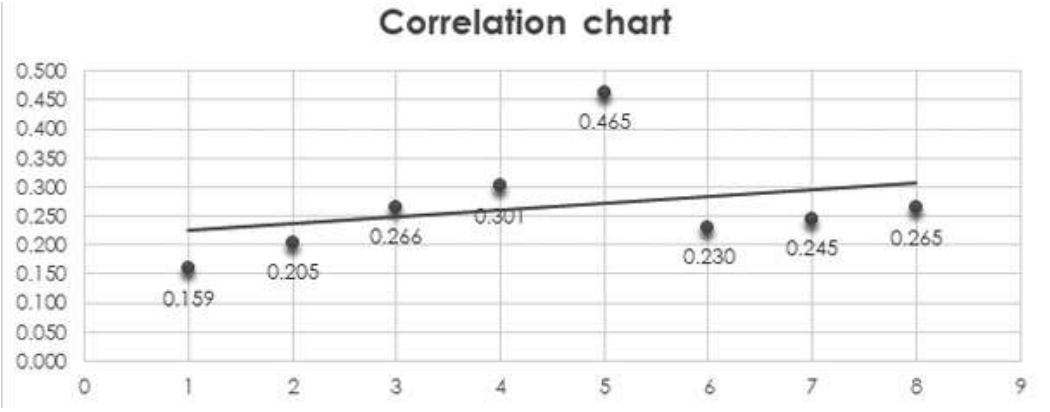
Correlation

Variable1- Have you experienced Artificial Intelligence while using following E-commerce platforms?

Variable2- Will you use these E-commerce platforms even if the above features are not provided?

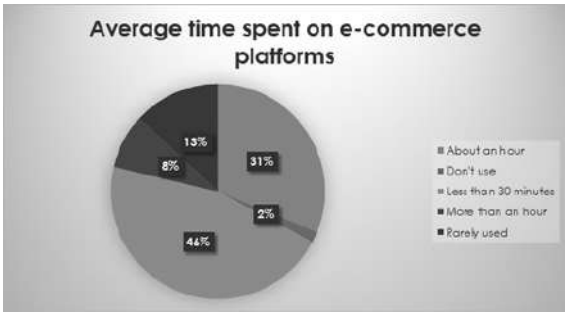
| E-commerce platform | Correlation Coefficient | Interpretation |
|---|---|---|
| Amazon | 0.159 | Weak and Positive |
| Flipkart | 0.205 | Weak and Positive |
| Myntra | 0.266 | Weak and Positive |

| | | |
|---|---|---|
| Nykaa | 0.301 | Moderate and Positive |
| AJIO | 0.465 | Moderate and Positive |
| Snapdeal | 0.230 | Weak and Positive |
| eBay | 0.245 | Weak and Positive |
| FirstCry | 0.265 | Weak and Positive |




Data showing Average time spent on e-commerce platforms by respondents

| Average time spent on e-commerce platforms | Percentage |
|---|---|
| About an hour | 31.15% |
| Less than 30 minutes | 45.90% |
| More than an hour | 8.20% |
| Rarely used | 13.11% |
| Not used | 1.64% |
| Grand Total | 100.00% |




PIE- CHART SHOWING PERCENTAGE OF AVERAGE TIME SPENT ON E-OMMERCE PLATFORMS BY RESPONDENTS

Table showing respondents who have linked social account/banking account and faced a situation of data theft

| | Linked | Not linked | Data theft |
|---|---|---|---|
| Social Account | 55 | 6 | 12 |
| Bank Account | 54 | 7 | 9 |

Findings:

The e-commerce industry is a data-driven one, meaning that every aspect and action is controlled by the data. Data is always the most crucial component, whether it comes from the provider or the customer. In the e-commerce environment, artificial intelligence systems are built on data, are powered by data, and produce their own data.

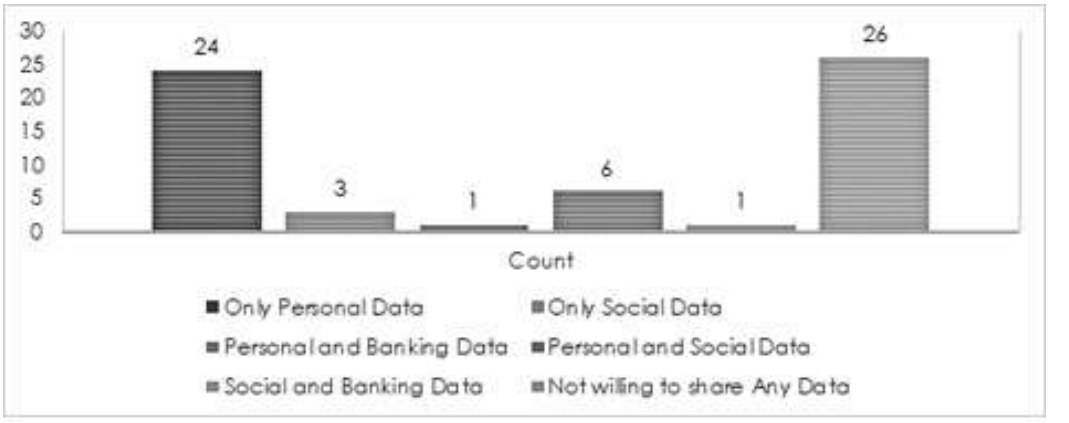
We can see from the table above that nearly ninety percent of respondents have linked their social media accounts. This is because many e-commerce platforms require sign-in, which is typically done through a social media platform. Banking interlinking is done for convenience even though the main goal is to create a purchase profile along with a person's social media behavior pattern and in the current scenario of credit scoring as well (Flipkart Post-pay and Amazon Pay-Later services).

According to the table above, 20% of the population under study has been the victim of data theft that was either directly or indirectly connected to an e-commerce application. Although though this interlinking gives the consumer a better and far more customized

experience, it also leaves them open to data theft and unauthorized use of critical information. Such data theft exposes the systems to deadly vulnerability.

Data showing Number of respondents willing to share data to Artificial Intelligence in E-Commerce platforms

| Particulars | Count |
|---|---|
| Only Personal Data | 24 |
| Only Social Data | 3 |
| Personal and Banking Data | 1 |
| Personal and Social Data | 6 |
| Social and Banking Data | 1 |
| Not willing to share Any Data | 26 |
| Grand Total | 61 |




Data Interpretation:

We can see from the above table that a sizeable portion of the population, or roughly 26 people, are not at all ready to share their social data, banking data, or confidential information. We can see from the answers that after condensing, a significant portion of

respondents restrict their risk by not giving such data inputs. As a result of their reliance on data, artificial intelligence (AI) systems have been heavily criticized for having weaknesses in the e-commerce industry. This makes them both a reliable alternative and a potential source of security breaches that could result in cybercrime. To fully grasp this, it is crucial to understand that data theft does not simply involve taking data from its source and deleting it; rather, a cybercrime entails multiple levels of these attacks that might circumvent the security mechanism and ultimately lead to the collapse of the structure. This poses a significant risk, especially when the data that is preserved has monetary and social value and can be modified and moulded maliciously. These cybercrimes primarily demotivate customers from granting full access to their information, and in many cases, customers are limiting the volume and quality of their shared data using either self-measures or third-party control tools.

## Future Scope and Recommendation

As the study only discovered the perception factors of the Ecommerce customers about AI, it may serve as a foundation for future research. Future scholars can expand their study into the risks, difficulties, or disadvantages that users may encounter. The study can also be expanded to include the internal operational processes or the data used by the specialists.

The way e-commerce businesses acquire and retain customers will be significantly affected by AI. A lot of new jobs in data science, machine learning, and engineering will be created by the AI revolution in e-commerce. E-commerce based on AI will also generate IT jobs for software and system developers. However, in the coming years, there may be a demand for skills and unemployment as a result of the new inventions. Not only should people be aware of AI, but they should also be able to use and build it, as well as develop the many capabilities of human intelligence.

## Conclusion

India is the nation with the fastest-growing e-commerce sector, where many new technologies and innovations are used. The potential for AI to expand in many different directions is greater. People are using and becoming more and more conscious of AI technology today. The research emphasizes the areas of applications of artificial intelligence in e-commerce.

The findings of the study indicate that there is more room for AI technology to advance in different industries. Since AI has been developing, many new innovations in numerous fields are now possible. AI has the potential to spark a new transformation and pave the way for machine learning and new data sciences.

With the advent of Generative AI tools, managing social media has become 10x easier and can be completely automated. The e-commerce industry is at the forefront of adopting machine learning and artificial intelligence. Entrepreneurs apply modern solutions to improve their operations and boost their visibility in the digital platform. This will leverage to promote brand awareness and attract more customers offering more value to their customers by providing their desired products and delivering them on time through reliable means. AI can also enable e-commerce businesses to gain a competitive advantage by incorporating better and increasing customer loyalty.

By learning from these successful implementations, SMEs can harness the power of AI to improve their own e-commerce platforms and better serve their customers by offering them more relevant and engaging shopping experiences.

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# FINANCIAL INCLUSION THROUGH DIGITALISATION IN INDIAN ECONOMY

*Shalini Devi*

***Abstract***

*This research paper aims to examine the impact of digital advancements on financial inclusion in India. Digital technologies, such as mobile banking, fintech solutions, and digital payment systems, have the potential to revolutionize financial services and expand access to underserved rural population. The research highlights the significance of Aadhaar boosting financial inclusion in the economy. Based on the observations made in the study, recommendations for the policymakers are also made to speed up the financial inclusion in the country.*

***Keywords:***

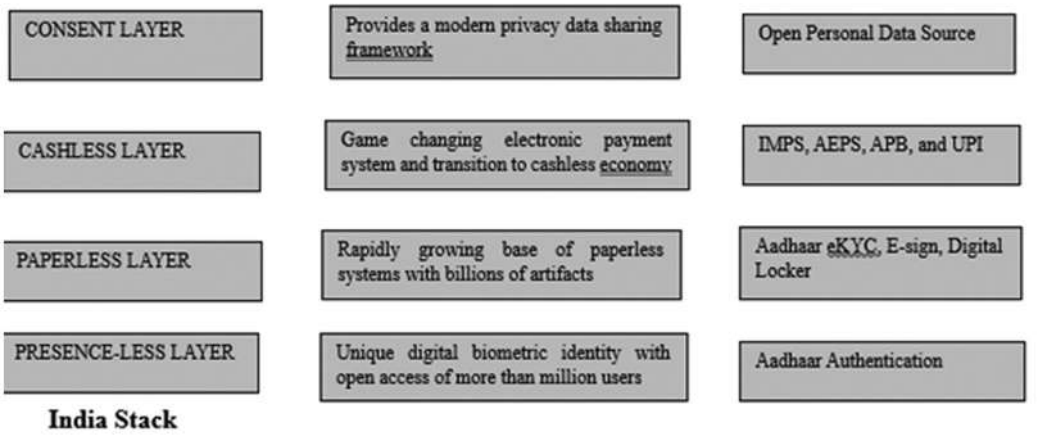
*Digital Innovations, Microfinance, Financial Inclusion, Digital Payment System, Fintech*

## 1. Introduction

The rise of digital financial inclusion has proven to be a significant disruptor, especially benefiting marginalized low-income households and small businesses that earlier had no access or limited access to financial services. Financial inclusion entails ensuring that both individuals and enterprises can readily access cost-effective financial products and services tailored to their requirements. India, with its diverse socio-economic landscape and significant population, has a considerable proportion of its citizens excluded from mainstream financial services. In 2009, only 17% of adults Indians had bank account, 15% were using digital payments, and about 37% had mobile phones. As of 2017, as per World Bank's Global Findex Database, around 190 million adults in the country did not have a bank account, making it one of the countries with the highest number of unbanked individuals globally. The Reserve Bank of India (RBI) has had a significant role in fostering financial inclusion. In 1998, the RBI introduced guidelines for the establishment of microfinance institutions (MFIs) and encouraged the growth of self-help groups (SHGs) as a platform for financial inclusion.

In 2017, India made significant strides in financial inclusion. By that year, approximately 80 percent of the adult population in the country held bank accounts, and nearly 95 percent of the population possessed Aadhaar cards. The rise of FinTech played a significant role in digital financial inclusion by connecting buyers and sellers, thereby creating a solid foundation for e-commerce marketplaces. As of March 31, 2021, the annual Financial Inclusion Index (FI-Index) stood at 53.9, showing substantial growth compared to the 43.4 recorded for the year ending in March 2017 (RBI, Annual Report, 2021). This digital connectivity greatly contributed to the advancement of financial inclusion efforts.

The "Jan-Dhan Aadhaar Mobile" (JAM) pipeline played a crucial role in linking Jan-Dhan accounts with Aadhaar card and mobile number. This infrastructure served as the backbone for various government initiatives, including the direct transfer of benefits under social security and pension schemes, credit facilitation, and the promotion of digital payments. It played a pivotal role in the journey towards achieving a digitally integrated, financially inclusive, and insured society.




**Source:** India Digital Financial Inclusion: Journey Map Report, USAID, March 2019

The India Stack, a digital infrastructure, is fundamentally transforming the way people access financial services. Today, advancements in digital finance have empowered millions of individuals to settle invoices, accept payments, and transfer money across the country with the simple tap of a screen. The COVID-19 pandemic has further enhanced the adoption of contactless digital payments. Overall, India's financial landscape has been reshaped by digital innovations and government initiatives like Digital India and Jan Dhan Yojana, all aimed at extending financial services to the previously unbanked population.

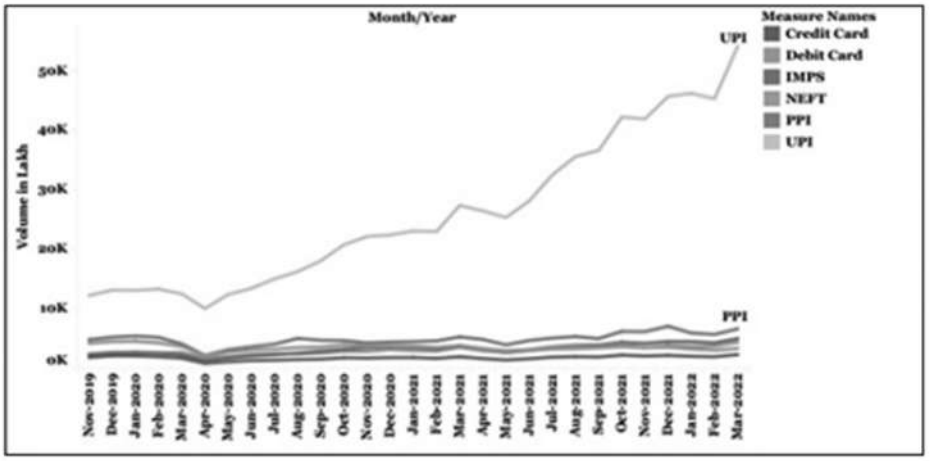
**Significance of Digitisation in the Indian Financial Sector**

Some key aspects highlighting the significance of digital innovations are:

i) Increasing access to financial services
ii) Enabling convenience and efficiency
iii) Cutting transaction costs
iv) Stimulating innovation and entrepreneurship
v) encouraging financial inclusion and socio-economic development

During the year 2021-22, retail digital payments accounted for over 99 percent of total retail payments in terms of volume of transactions and 87% or more in terms of value of transactions. (RBI, NABARD trend report on financial inclusion in India, 2022)

Figure: Trend in usage of various retail digital payments in India




**Source: http://dbie.rbi.org.in**

Digital innovations in the Indian financial sector hold immense significance in driving financial inclusion, improving efficiency, reducing costs, empowering individuals, and stimulating economic growth.

## 2. Research Objectives

This research targets to achieve following objectives:

i) To assess the effectiveness of digital innovations in promoting financial inclusion.

ii) To discuss the significant contribution of Aadhaar in financial inclusion.

iii) To make recommendations for policymakers to enhance financial inclusion in India.

## 3. Literature Review

In previous academic literature, scholars like Demirgüç-Kunt and Klapper (2012) and Hulme and Arun (2011) have put forth frameworks that capture the multifaceted nature of financial inclusion. These frameworks encompass dimensions such as access, usage, and the empowerment of individuals and communities. Davis (1989) gave insights into

the factors influencing the adoption and utilization of digital financial services, including factors like perceived effectiveness and ease of use. Additionally, the diffusion of innovation theory, as articulated by Rogers (2003), offers a framework for comprehending how digital innovations spread and the adoption patterns across different user segments. North (1990) analyzed how regulatory and institutional environments shape the adoption and impact of digital innovations in promoting financial inclusion. Empirical studies have examined the effects of digital innovations on financial inclusion, with Donner and Tellez (2008), for instance, finding that mobile money services in Kenya enhanced financial access and reduced poverty levels.

Several factors influence the adoption and usage of digital financial services. Individual-level factors like demographics, financial literacy, and attitudes towards technology play a role, as demonstrated by Aker et al. (2016) and Nsouli et al. (2019). Regulatory challenges also emerge as policymakers strive to balance innovation with consumer protection, as discussed by Alam et al. (2020). To fully harness the potential of digital innovations for financial inclusion, policymakers and stakeholders must establish an enabling environment. Strategies encompass enhancing digital literacy programs, improving technological infrastructure, and developing regulations that foster innovation while safeguarding consumers' interests, as proposed by Chakraborty et al. (2021) and the World Bank (2016). The COVID-19 pandemic posed numerous challenges to economic growth, resulting in financial difficulties for many, especially those with weaker economic status. However, it also accelerated the adoption of digital financial services, as highlighted by Zubairu Surajo (2022). Devi (2023) analysed the progress and challenges in digitalisation of financial inclusion in India and suggested that the policymakers need to prioritize the development of robust digital infrastructure to enhance financial inclusion the economy. By synthesizing existing research, this study contributes to the ongoing discourse on leveraging digital innovations to promote financial inclusion.

## 4. Research Methodology

The study is of descriptive nature. The information explored is mainly collected from research papers, world bank reports, RBI bulletin, NABARD report and few other websites mentioned in the references.

## 5. Digitisation of Financial Services in India

Digital technologies have revolutionized the financial services, providing new opportunities for financial inclusion, and enhancing the efficiency and accessibility of financial services. The main digitisation techniques introduced in providing financial services include mobile banking**,** fintech, and digital payment systems. Mobile banking has appeared as a game-changer for financial inclusion. Digital payment systems, including electronic wallets, online payment gateways, and digital currencies, have transformed the way financial transactions are conducted.

As per the National Family Health Survey 2019-21 (NFHS-5), adult women (aged 15-49) have a literacy rate of 71.5%, while adult men (aged 15-49) have a literacy rate of 87.4%. These would represent the largely technology compromised group. The gender gap in account ownership has got reduced to 6% in 2022. Having access to financial services opens up opportunities for generating income, accumulating wealth, and actively participating in economic endeavors. This, in turn, fosters social and economic empowerment. Furthermore, financial inclusion provides a safety net during unexpected events like the COVID-19 pandemic, underlining the importance of ensuring that even the most economically disadvantaged populations can access formal financial services.

For women, research has demonstrated that financial inclusion positively affects women's ability to manage household resources, primarily by increasing their savings. However, on a global scale, women still encounter obstacles when attempting to access financial services. The Global Findex Database 2021 reveals that women, along with individuals with lower incomes, are more likely to lack essential documentation, such as proof of identity or access to a mobile phone. They also tend to reside farther from traditional bank branches and may require support in opening and effectively utilizing a bank account.

### 5.1 Aadhaar Boosting Financial Inclusion

India has historically functioned as a cash-dependent economy. However, the recent global pandemic has accelerated the adoption of contactless payments and facilitated a significant surge in digital transactions.

The BHIM Aadhaar empowers merchants to conduct account-to-account transfers and enables customers to make payments without the need for physical cards or smartphones. The Aadhaar Enabled Payment System (AePS) simplifies and secures payments by

utilizing the Aadhaar number, with verification available at points of sale (PoS). The rapid proliferation of smartphones across India has significantly contributed to connecting rural communities with the digital realm, enhancing financial inclusivity. Aadhaar presents a promising avenue to expand access to financial services for underserved and unbanked customers in India. AePS eliminates the need for extensive documentation to open a bank account, thereby improving the inclusion of rural populations in the formal banking sector. With just an Aadhaar number and verification at the point of sale, rural customers can access services like cash withdrawals, fund transfers, and balance inquiries, services that were previously only available at conventional bank branches. Also, money is directly transferred in Direct Benefit Transfers in rural India via its platform.

### 5.2 Impact of Digitisation on Financial Inclusion in India

Digital payment systems have emerged as a transformative force in advancing financial inclusion in India. One of the key impacts of digital payment systems on financial inclusion in India is the increased accessibility to financial services. Digital payment systems, such as mobile wallets and Unified Payments Interface (UPI), have enabled individuals to open digital accounts and conduct transactions using their mobile phones. People can access a range of services, including payments, savings, and credit regardless of their geographic location. The impact of digital payment systems on financial inclusion is not limited to individuals but extends to micro, small, and medium enterprises (MSMEs).

Overall, digital payment systems have significantly contributed to financial inclusion in India by improving accessibility, efficiency, and security of financial transactions. Through the adoption of these systems, individuals and businesses have been able to participate in the formal financial ecosystem, access a broader range of services, and contribute to economic growth and development.

### 5.3 Technological and Infrastructure Barriers in Financial Inclusion in India

i) Limited internet penetration
ii) Inadequate digital infrastructure
iii) Limited access to smartphones and devices
iv) Technological literacy and skills gap
v) Power supply and energy challenges

### 5.4 Recommendations for Fostering Digitisation in Financial Sector in India

**Creating a Supportive Regulatory Framework:** Policymakers should ensure that regulations are adaptable, technology-neutral, and foster innovation, all while maintaining safeguards for consumer protection, data privacy, and financial stability.

**Development of Digital Infrastructure:** Policymakers should give precedence to building resilient digital infrastructure and promoting digital literacy among marginalized populations.

**Promoting Financial Inclusion Initiatives:** Policymakers should concentrate on implementing comprehensive financial inclusion efforts, including the promotion of digital savings and credit products, the facilitation of digital identification systems, and the encouragement of mobile banking and payment platforms.

**Conducting Impact Assessment and Research:** Policymakers should prioritize rigorous assessments of the impact of digital innovations and research studies aimed at evaluating their effectiveness. They should also recommend strategies for ongoing enhancement within this sector.

## 6. Conclusion

The linchpin driving the ongoing transformation in fintech, a sector with significant growth potential in India, is the biometric identity system known as Aadhaar. In nearly every financial transaction, concrete proof of the identities of the parties involved is required. Aadhaar offers this proof through biometric verification, eliminating the need for physical documentation. This represents a significant advantage for the country. While there are still unresolved legal concerns regarding data privacy, currently under the scrutiny of the Supreme Court, both the government and businesses have begun leveraging this asset in innovative ways. The mere presence of technology does not guarantee its adoption by individuals; incentives play a crucial role. This is especially pertinent for small businesses.

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# INFLUENCE OF MARKETING STRATEGIES OF TELECOM OPERATORS ON CUSTOMERS' BUYING DECISIONS

*Shreyasee Das*
*Kushal De*

***Abstract:***

*The Telecom industry in India is the second largest industry in the world and the marketing strategies adopted by telecom operators have an influence on the customer's decisions in choosing the network. The present study tries to analyze the marketing strategies of mobile telecom operators that significantly influence the buying decision of customers and assess if location or choice of operators have any influence on those strategies. Based on a primary study on 150 respondents residing in urban, semi-urban and rural parts of South Bengal it is observed that buying decision is influenced by Customer Retention, People-Process Mix, Four-P Mix and Physical Evidence Mix and they are significantly different across regions. The influence of Customer Loyalty, People-Process Mix and Physical Evidence Mix are different across the choices of mobile telecom operators. The study also identifies that some differences in buying behaviour of customers exist between two groups across regions as well as the choice of mobile telecom operators.*

***Keywords:***

*Buying Decision, Customer, Loyalty, Marketing Strategy, Telecom Operators*

## Introduction:

The telecom industry in India is the second largest industry in the world. The industry is rapidly growing with the number of subscribers rising every year. It has a subscriber base of 1.17 billion as of August 2022 (wireless and wireline subscriber base).

In 1995 Modi-Telstra established the first mobile telephone network in India initially for non-commercial purposes based on the 2G network. Thereafter, the network was rapidly extended to cover the entire nation. MTNL became the first to launch a 3G network in 2008, and Airtel introduced India's first 4G service in Kolkata in 2012 and today, the 5G revolution is already underway.

In 2023 telecom industry is moving towards the oligopolistic market with five mobile telecom operators namely, Reliance Jio, Bharti Airtel, Vodafone Idea, BSNL, and MTNL. The subscriber base of these mobile telecom operators from 2017-18 to 2021-22 are as follows:

**Table 1: Subscriber Base of Wireless Services from 2017-18 to 2021-22 (in million)**

| Service Providers | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | % Growth/ Production over FY 2020-21 |
|---|---|---|---|---|---|---|
| Reliance Jio | 186.56 | 306.72 | 387.52 | 422.92 | 403.99 | -4.48 |
| Bharti Airtel | 304.19 | 325.18 | 327.81 | 352.39 | 360.33 | 2.25 |
| Vodafone | 222.7 | 394.84 | 319.17 | 283.71 | 260.77 | -8.09 |
| Idea | 211.21 | | | | | |
| BSNL | 111.68 | 115.74 | 119.87 | 118.63 | 113.74 | -4.12 |
| MTNL | 3.56 | 3.45 | 3.36 | 3.3 | 3.25 | -1.52 |
| RCOM | 0.19 | 0.02 | 0.0178 | 0.01 | 0 | 0 |
| Aircel | 74.15 | 0 | 0 | 0 | 0 | 0 |
| Tata | 31.19 | 15.85 | 0 | 0 | 0 | 0 |
| Telenor | 37.98 | 0 | 0 | 0 | 0 | 0 |
| Total | 1183.41 | 1161.8 | 1157.748 | 1180.96 | 1142.08 | -3.29 |

| | |
|---|---|
| 1. | Telenor and Tata have merged with Bharti Airtel with effect from (w.e.f.) 14th May, 2018 and 6th February, 2020 respectively. |
| 2. | Vodafone and Idea Cellular merged their commercial service w.e.f. 31st August, 2018 |
| 3. | The subscriber base of Bharat Sanchar Nigam Limited (BSNL) includes subscribers of Virtual Network Operator (VNO) service providers also. |
| 4. | Aircel has stopped providing commercial services since April, 2018 as it has filed insolvency in the National Company Law Tribunal (NCLT). |
| 5. | Reliance Communications (RCOM) have stopped providing retail services, however, are continuing to provide business to business (B2B) services. |

Source: TRAI Annual Report

The following observations and patterns from Table 1 are found:

- There is a steady increase in Reliance Jio's subscriber base since 2017-18, reaching a peak of 422.92 million in 2020-21, and a 4.48% decline in 2021-22 with 403.99 million subscribers.
- A steady increase in the subscriber base of Bharti Airtel can be observed, a 2.25% increase over the previous year.
- Vodafone Idea, on the other side, has experienced a continuous decrease in its subscriber base from its merger till now and has recorded a 260.77 million subscriber base in 2021-22 with 8.09% decrease from the previous year.
- The subscriber bases of BSNL, MTNL, RCOM, Aircel, Tata, and Telenor have also changed over time, with certain operators having no subscribers in recent years.
- During 2020-21 to 2021-22, the overall number of wireless service users fell by 3.29%.
- Growth in subscriber base: The table demonstrates that most service providers' subscriber bases have grown over time. For example, Reliance Jio's subscriber base has increased dramatically, from 186.56 million in 2017-18 to 422.92 million in 2020-21. Bharti Airtel's subscriber count has likewise increased, with the exception of 2019-20.
- Subscriber base decline: While some service providers have witnessed a rise in their customer base, others have seen a decrease. Vodafone Idea, for example, has witnessed its customer base shrink over the years, with just 260.77 million users in 2021-22, an 8.09% decrease from the previous year.

- Competition among service providers: The data in the table reveals that service providers are competing fiercely to build their subscriber base. With its low-cost data plans, Reliance Jio has been able to disrupt the industry and pull a big number of subscribers away from its competitors. Due to aggressive competition the only existing mobile telecom service providers are Reliance Jio, Bharti Airtel, Vodafone Idea, BSNL and MTNL. This has created an oligopolistic wireless telecom market in India.
- Pandemic impact: The data in the table also illustrates the impact of the COVID-19 pandemic on wireless service subscriber base. The overall number of wireless service users fell by 3.29% between 2020-21 and 2021-22, possibly due to the economic impact of the pandemic.

Overall, the table gives insights regarding the mobile or wireless telecom operator service subscriber base and how it has changed over time. It emphasises the rivalry among service providers with Reliance Jio leading the Mobile Telecom Market with 403.99 million wireless subscribers in 2021-2022. Major competition is among Jio and Airtel while Vodafone Idea lags behind. BSNL on the other hand being the public mobile telecom operator doesn't stand by in this competition but still operates throughout India.

**Literature Review:**

Many studies have been conducted to assess the impact of the marketing strategies on consumer's decisions in choosing the network. A few important studies are discussed here.

Laxmi (2017) in her study conducted factor analysis which revealed that quality of service is the most important factor in choosing a service provider by customers. Verma (2018) in his study found that Marketing mix, customer loyalty and customer satisfaction are positively and significantly related to each other. Satisfaction of customers in Indian telecom sector changes with the change in age category. Customer satisfaction of respondents of different age groups was checked by him individually for BSNL and Airtel customers. Kumar (2013) analyzed different dimensions of customer retention strategies for the Indian telecommunication sector and their effectiveness through confirmatory factor analysis. In the study, it has been found that perceived tangibility, perceived reliability, perceived responsiveness, assurance, empathy, network quality, convenience,

interpersonal relationship and switching cost of the mobile operators are highly influenced by the variables namely, physical facilities setup, service provided, service performance, politeness of service staff, customer needs awareness, voice clarity, convenient business hours, association of telecom operators and time factor respectively. The male customers are subjected with hedonic behaviour whereas the female customers are with utilization behaviour as observed by Singh (2014). The discriminating factors among male and female customers are scheme and coverage. The service quality gap has a significant negative impact on the customers' satisfaction towards the service providers. The study identifies the need for appropriate marketing strategy to develop the customer loyalty according to the nature of market segment especially based on the profile of the customers. The study by Nair (2014) reveales that to be successful in the competitive telecom market, service providers must focus on improving customer satisfaction by focusing on underlying factors such as value-added services, service products, tariff, corporate image, and service quality, and boost corporate image by focusing on promotion mix and distribution channel performance. The study by Jeevapriya (2014) investigates the level of perception of customers on services marketing mix, service quality, and service fairness provided by different service providers. In the study by Durga-Anupama (2014) the data shows that factors such as mobile phone quality, brand reputation, and after-sales service are more influential for older age groups, while factors such as mobile phone price and brand goodwill are more influential for lower-income groups.

**Research Objective:**

The objectives of the paper are as follows:

- To assess which marketing strategies of mobile telecom operators significantly influence the buying decision of customers.
- To identify if the buying decision of customers varies in different regions/ locations and which area causes such variation.
- To identify if the buying decision of customers varies with the change in choice of mobile telecom operators and which telecom operator causes such variation.

**Research Methodology:**

To fulfil the above objectives, a primary field study is deemed fit by the researchers. Three locations from South Bengal namely Kolkata, Sonarpur and Patharpratima Block in South Twenty-Four Parganas are selected representing urban, suburban and rural areas. The research instrument selected for the study is a closed ended questionnaire designed by the researchers. Each respondent is asked to evaluate his/her mobile company's marketing strategies on a Five-point Likert scale ranging from 1 (Strongly Dissatisfied) to 5 (Strongly Satisfied). A total of 150 respondents are interviewed. The sample is selected as per convenience of the researchers from these areas. Principal Components Method with Scree Plot based on Eigen Value of 1 is used for factor analysis to find out the factors related to marketing strategies of Mobile Telecom Operators that influence the Buying Decision of the customers. Thereafter Non-Parametric Kruskal-Wallis H Test with Mann-Whitney U Test and Parametric One-way ANOVA with Bonferroni Multiple Comparisons are conducted to find out the differences that exist in buying decision of customers across regions as well as across the choices of Mobile Telecom Operators. Primary data on MTNL could not be collected as it doesn't operate in West Bengal.

**Data Analysis and Findings:**

The demographic profile of the sample is plotted in Table 2 below:

**Table 2: Demographic Profile of the Respondent, M=Male, F=Female.**

| Demographic Profile | Categorical Variable | Frequency | Percent (%) | 96M, 54F | M% | F% |
|---|---|---|---|---|---|---|
| Region | Kolkata | 50 | 33.3 | 26M, 24F | 27.1% | 44.4% |
| | Sonarpur | 50 | 33.3 | 32M, 18F | 33.3% | 33.3% |
| | Patharpratima | 50 | 33.3 | 38M, 12F | 39.6% | 22.2% |
| Plan | Prepaid | 136 | 90.7 | 87M, 49F | 90.6% | 90.7% |
| | Postpaid | 14 | 9.3 | 9M, 5F | 9.4% | 9.3% |
| Mobile Telecom Operators | Jio | 67 | 44.7 | 39M, 28F | 40.6% | 51.9% |
| | Airtel | 31 | 20.7 | 23M, 8F | 24.0% | 14.8% |
| | Vodafone Idea | 48 | 32.0 | 32M, 16F | 33.3% | 29.6% |
| | BSNL | 4 | 2.7 | 2M, 2F | 2.1% | 3.7% |
| Monthly Expenditure (Rs.) | less than 100 | 3 | 2.0 | 1M, 2F | 1.0% | 3.7% |
| | 100-200 | 30 | 20.0 | 22M, 8F | 22.9% | 14.8% |
| | 200-300 | 83 | 55.3 | 53M, 30F | 55.2% | 55.6% |
| | 300-400 | 20 | 13.3 | 12M, 8F | 12.5% | 14.8% |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 400-500 | 6 | 4.0 | 3M, 3F | 3.1% | 5.6% |
| | 500 and above | 8 | 5.3 | 5M, 3F | 5.2% | 5.6% |
| Age (in years) | 15-25 | 35 | 23.3 | 19M, 16F | 19.8% | 29.6% |
| | 26-35 | 36 | 24.0 | 19M, 17F | 19.8% | 31.5% |
| | 36-45 | 29 | 19.3 | 18M, 11F | 18.8% | 20.4% |
| | 46 and above | 50 | 33.3 | 40M, 10F | 41.7% | 18.5% |

Source: Primary Survey, computed in SPSS 26

Factor Analysis:

| **Table 3: KMO and Bartlett's Test** | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | 0.726 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 520.871 |
| | df | 105 |
| | Sig. | 0.000 |

Source: Researchers' computation using SPSS 26

Kaiser-Meyer-Olkin (KMO) value of 0.726 found from Table 3 is greater than 0.05 which indicates that the variables are partially correlated and thus is plausible for factor analysis. Barlett's Test of Sphericity shows that our data is statistically significant. This implies that we are not dealing with an identity matrix and there are some relationships between our variables. In Anti-Image Correlation all the variables except these four variables represented by the questions "With the advancement of new technologies like 5G, I am planning to change my mobile telecom operator", "I am not at all satisfied with the current telecom operator's customer services and support online", "I am totally satisfied with the mobile banking services provided by my mobile telecom operator" and "I am satisfied with the international roaming services provided by my mobile telecom operator" are having Measure of Sampling Adequacy greater than 0.5. These four variables are removed and Factor Analysis is done with the remaining fifteen variables as there is enough variation and enough correlation between them.

**Chart 1: Scree Plot**


The graph shows the Eigenvalues against the factor numbers. From the 5th factor onwards, the line is almost flat showing that each successive factor from here onwards accounts for smaller total variances.

**Table 4: Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 3.582 | 23.883 | 23.883 | 3.582 | 23.883 | 23.883 | 2.431 | 16.209 | 16.209 |
| 2 | 1.832 | 12.211 | 36.094 | 1.832 | 12.211 | 36.094 | 2.074 | 13.825 | 30.034 |
| 3 | 1.457 | 9.711 | 45.806 | 1.457 | 9.711 | 45.806 | 1.821 | 12.139 | 42.174 |
| 4 | 1.233 | 8.218 | 54.024 | 1.233 | 8.218 | 54.024 | 1.532 | 10.216 | 52.390 |
| 5 | 1.020 | 6.803 | 60.826 | 1.020 | 6.803 | 60.826 | 1.265 | 8.436 | 60.826 |

Extraction Method: Principal Component Analysis. Components 6 to 15 have not been shown as their Eigenvalue is less than 1 and not required for the analysis.

Source: Researchers' computation using SPSS 26

Table 4 shows that first five components are identified as the factors in the study and all the fifteen variables are narrated into these five factors. These five factors explain fifteen variables to the extent of 60.826%. The important factors in influencing customer satisfaction are first two with Eigenvalues of 3.582 and 1.832 respectively having percent of variation of 23.883% and 12.211% respectively. As the Eigenvalue in the total column of all these components are greater than 1, these components are been selected as factors in our paper.

**Table 5: Rotated Component Matrix[a]**

| | Factors | | | | |
|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** |
| I am likely to switch to a different mobile telecom operator. | -0.873 | | | | |
| I want to use the current mobile telecom operator for long term. | 0.844 | | | | |
| I am likely to recommend my mobile telecom operator to others. | 0.532 | 0.509 | | | |
| Poor network coverage and call drops are the reasons for my switchover. | -0.501 | | | | 0.453 |
| Network coverage of the current mobile telecom operator makes me frustrated | | -0.665 | | | 0.447 |
| My current mobile telecom operator's data services meet my expectations. | | 0.659 | | | |
| I am totally satisfied by the brand image of my current telecom operator. | 0.384 | 0.571 | | | |
| I am satisfied with the level of customer services offered by the operator's representatives. | | | 0.825 | | |
| If I face any billing and technical issues my mobile telecom operator is responsive and reachable. | | | 0.699 | | |
| I am totally satisfied with the customer service department of my mobile telecom operator in addressing any issues I face. | | 0.457 | 0.585 | | |
| The value-added services offered by my current mobile telecom operator influence my decision to continue using the same. | | | | 0.729 | |
| The pricing strategies of my mobile telecom operator do have an influence on my choice of the same. | 0.317 | | -0.337 | 0.539 | |

| | | | | | |
|---|---|---|---|---|---|
| I was influenced to buy the services of my telecom operator because of the advertisements and promotional campaigns done by my mobile telecom operator. | | -0.407 | 0.254 | 0.528 | |
| The closer location of outlets of my mobile telecom operator influences me to buy its services. | | 0.361 | | 0.525 | 0.367 |
| I am totally satisfied with the user-friendly website and mobile applications of my mobile telecom operator. | | | | | -0.799 |
| Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a] | | | | | |
| a. Rotation converged in 8 iterations. | | | | | |

Source: Researchers' computation using SPSS 26

Table 5 shows the correlations between the factors found and the variables. It shows Factor 1, is highly correlated with the customer retention variables like "I am likely to switch to a different mobile telecom operator" (negatively correlated), "I want to use the current mobile telecom operator for long term", "I am likely to recommend my mobile telecom operator to others", "Poor network coverage and call drops are the reasons for my switchover" (negatively correlated). Thus Factor 1 is named as "Customer Retention". Factors 2, 3, 4 and 5 are highly correlated with the variables "Network coverage of the current mobile telecom operator makes me frustrated", "I am satisfied with the level of customer services offered by the operator's representatives", "The value added services offered by my current mobile telecom operator influence my decision to continue using the same", "I am totally satisfied with the user-friendly website and mobile applications of my mobile telecom operator" and are named likewise as Customer Loyalty, People-Process Mix, Four-P Mix and Physical Evidence Mix.

**Table 6: Shapiro-Wilk Test of Normality**

| Factors | Shapiro-Wilk | | | Descriptives | |
|---|---|---|---|---|---|
| | Statistic | df | Sig. | Skewness | Kurtosis |
| Customer Retention | 0.918 | 150 | 0.000 | -1.005 | 0.569 |
| Customer Loyalty | 0.961 | 150 | 0.000 | -0.56 | 1.109 |
| People-Process Mix | 0.986 | 150 | 0.139 | -0.276 | -0.275 |
| Four-P Mix | 0.990 | 150 | 0.352 | -0.08 | -0.543 |
| Physical Evidence Mix | 0.991 | 150 | 0.454 | 0.043 | -0.406 |

Source: Researchers' computation using SPSS 26

In Table 6 Shapiro-Wilk Test has been computed to observe the normality of the factors found. For first two factors namely Customer Retention and Customer Loyalty, data is not normal as p-value is less than 0.05 and for the other three factors namely People-Process Mix, Four-P Mix and Physical Evidence Mix, data is normal as p value is greater than 0.05. To find out the difference in buying decision of the customers according to both Region and types of Mobile Operators Kruskal-Wallis H Test and Mann-Whitney U Test are used for first two factors and One-way ANOVA with Bonferroni Multiple Comparisons are conducted for the remaining three factors.

**Table 7: Kruskal-Wallis H Test Statistic**

| Factors | Region | | | Mobile Telecom Operators | | |
|---|---|---|---|---|---|---|
| | Kruskal-Wallis H | df | Asymp. Sig. | Kruskal-Wallis H | df | Asymp. Sig. |
| Customer Retention | 8.980 | 2 | 0.011 | 5.589 | 3 | 0.133 |
| Customer Loyalty | 0.270 | 2 | 0.874 | 11.149 | 3 | 0.011 |

Source: Researchers' own computation using SPSS 26

In the above table, Kruskal-Wallis H Test is computed with 5% significance level. It is found that p-value of Customer Retention across region is statistically significant (Asymp. Sig. = 0.011<0.05) while Customer Loyalty is statistically significant across choices of different mobile telecom operators with p-value 0.011. To find out exactly where the difference exists across region and choices of mobile telecom operators, Mann-Whitney U Test is conducted.

**Table 8(i): Mann-Whitney U Test Ranks**

| | | | N | Mean Rank | Sum of Ranks |
|---|---|---|---|---|---|
| **Group 1** | **Customer Retention** | Kolkata | 50 | 42.58 | 2129.00 |
| | | Patharpratima | 50 | 58.42 | 2921.00 |
| **Group 2** | **Customer Retention** | Kolkata | 50 | 43.44 | 2172.00 |
| | | Sonarpur | 50 | 57.56 | 2878.00 |
| **Group 3** | **Customer Loyalty** | Jio | 67 | 43.61 | 2922.00 |
| | | Airtel | 31 | 62.23 | 1929.00 |
| **Group 4** | **Customer Loyalty** | Airtel | 31 | 49.05 | 1520.50 |
| | | Vodafone Idea | 48 | 34.16 | 1639.50 |

Source: Researchers' computation using SPSS 26

The above table indicates the region that is having higher Customer Retention. Higher the mean rank higher is the impact on Customer Retention and Customer Loyalty of those specific components in the groups. In Group 1, Patharpratima is having higher mean rank i.e., 58.42 than Kolkata which indicates that Customer Retention is higher in rural region than in urban region. Similarly, in Group 2, Customer Retention is higher in suburban region namely Sonarpur with mean rank of 57.56 than in urban region namely Kolkata.
The table also indicates the mobile telecom operator that is having higher Customer Loyalty with its mean rank as the measuring unit. In Group 3 and 4 it is observed that Airtel is having higher Customer Loyalty than Jio and Vodafone Idea with mean rank of 62.23 and 49.05 respectively.

**Table 8(ii): Mann-Whitney U Test Statistic**

| Factors | Independent Variables | | Mann-Whitney U | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|
| **Customer Retention** | **Region** | **Group 1** | 854.000 | 0.006 |
| | | **Group 2** | 897.000 | 0.015 |
| **Customer Loyalty** | **Mobile Telecom Operators** | **Group 3** | 644.000 | 0.003 |
| | | **Group 4** | 463.500 | 0.005 |

Source: Researchers' computation using SPSS 26

In Table 8(ii), Mann-Whitney U Test is computed with 1.5% level of asymptotic significance (2 tailed) for region and 1.25% level of asymptotic significance (2 tailed) for types of mobile telecom operators. From the data it can be concluded that Customer Retention in both rural (U=854, p=0.006<0.015) and suburban regions (U=897, p=0.015) are significantly higher than the urban region. The data also concludes that Customer Loyalty of Airtel is significantly higher than that of Jio (U=644, p=0.003<0.0125) and Vodafone Idea (U=463, p=0.005<0.0125).

| Table 9: One-way ANOVA | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Sum of Squares | df | Mean Square | F | Sig. |
| Region | **People-ProcessMix** | Between Groups | 15.411 | 2 | 7.705 | 8.479 | 0.000 |
| | | Within Groups | 133.589 | 147 | 0.909 | | |
| | | Total | 149.000 | 149 | | | |
| | **Four-PMix** | Between Groups | 14.672 | 2 | 7.336 | 8.028 | 0.000 |
| | | Within Groups | 134.328 | 147 | 0.914 | | |
| | | Total | 149.000 | 149 | | | |
| | **PhysicalEvidenceMix** | Between Groups | 33.961 | 2 | 16.980 | 21.698 | 0.000 |
| | | Within Groups | 115.039 | 147 | 0.783 | | |
| | | Total | 149.000 | 149 | | | |
| Mobile Telecom Operators | **People-ProcessMix** | Between Groups | 16.992 | 3 | 5.664 | 6.264 | 0.000 |
| | | Within Groups | 132.008 | 146 | 0.904 | | |
| | | Total | 149.000 | 149 | | | |
| | **Four-PMix** | Between Groups | 6.629 | 3 | 2.210 | 2.266 | 0.083 |
| | | Within Groups | 142.371 | 146 | 0.975 | | |
| | | Total | 149.000 | 149 | | | |
| | **PhysicalEvidenceMix** | Between Groups | 30.527 | 3 | 10.176 | 12.540 | 0.000 |
| | | Within Groups | 118.473 | 146 | 0.811 | | |
| | | Total | 149.000 | 149 | | | |

Source: Researchers' computation using SPSS 26

In the above table a One-way ANOVA is computed to compare the effect of three different regions on the factors found namely, People-Process Mix, Four-P Mix and Physical Evidence Mix. All the factors show statistically significant difference with $p = 0.000<0.05$ across regions. This infers that the mean values of the factors are statistically significant among at least two groups out of three regions.

The One-way ANOVA is also computed to compare the effect of four types of mobile telecom operators on the factors found namely, People-Process Mix, Four-P Mix and Physical Evidence Mix. Here, all the factors except Four-P Mix ($p=0.083>0.05$) are statistically significant. Hence there exist some differences between at least two groups out of four choices of the mobile telecom operators.

To find out the groups that are having significant difference "Test of Homogeneity of Variances" and "Post Hoc Test of Bonferroni Multiple Comparisons" are computed as follows.

| Table 10: Test of Homogeneity of Variances | | | | | | |
|---|---|---|---|---|---|---|
| **Independent Variable** | **Factors** | | **Levene Statistic** | **df1** | **df2** | **Sig.** |
| **Region** | **People-Process Mix** | Based on Mean | 0.331 | 2 | 147 | 0.719 |
| | **Four-P Mix** | Based on Mean | 1.522 | 2 | 147 | 0.222 |
| | **Physical Evidence Mix** | Based on Mean | 1.175 | 2 | 147 | 0.312 |
| **Mobile Telecom Operators** | **People-Process Mix** | Based on Mean | 0.497 | 3 | 146 | 0.685 |
| | **Four-P Mix** | Based on Mean | 1.734 | 3 | 146 | 0.163 |
| | **Physical Evidence Mix** | Based on Mean | 0.858 | 3 | 146 | 0.465 |

Source: Researchers' computation using SPSS 26

In the above table "Test of Homogeneity of Variances" has been computed. This holds the results of "Levene's Test". For all the Factors "Sig." of Levene Statistic based on mean is greater than 0.05. This indicates that in all these cases equal variance is assumed. Hence, "Post Hoc Test of Bonferroni Multiple Comparisons" is computed to observe the differences which existed within the groups.

| Table 11: Post Hoc Test of Bonferroni Multiple Comparisons (K= Kolkata, S= Sonarpur, P= Patharpratima) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Dependent Variable** | | | **Mean Difference (I-J)** | **Std. Error** | **Sig.** | **95% Confidence Interval (C.I.)** | |
| | | | | | | | **Lower Bound** | **Upper Bound** |
| **Region** | **People-Process Mix** | P | K | .56647316* | 0.19 | 0.010 | 0.10 | 1.03 |
| | | P | S | .75403712* | 0.19 | 0.000 | 0.29 | 1.22 |
| | **Four-P Mix** | S | K | -.63679752* | 0.19 | 0.003 | -1.10 | -0.17 |
| | | S | P | -.68723646* | 0.19 | 0.001 | -1.15 | -0.22 |
| | **Physical Evidence Mix** | P | K | .83432356* | 0.18 | 0.000 | 0.41 | 1.26 |
| | | P | S | 1.12196642* | 0.18 | 0.000 | 0.69 | 1.55 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Mobile Telecom Operators** | **People-Process Mix** | Airtel | Jio | .64970223* | 0.21 | 0.012 | 0.10 | 1.20 |
| | | BSNL | Airtel | -1.62438049* | 0.51 | 0.010 | -2.98 | -0.27 |
| | | BSNL | Vodafone Idea | -1.42115487* | 0.49 | 0.028 | -2.74 | -0.10 |
| | **Physical Evidence Mix** | Vodafone Idea | Jio | 1.04408644* | 0.17 | 0.000 | 0.59 | 1.50 |
| | | Vodafone Idea | Airtel | .59433593* | 0.21 | 0.029 | 0.04 | 1.15 |
| *. The mean difference is significant at the 0.05 level. | | | | | | | | |

Source: Researchers' computation using SPSS 26

In the above table "Post Hoc Test of Bonferroni Multiple Comparisons" has been computed. The test has found that the mean value of the factor "People-Process Mix" is statistically significant between rural and urban regions (p=0.010. 95% C.I.= [0.10, 1.03]) as well as rural and suburban regions (p=0.000, 95% C.I.= [0.29,1.22]). The mean value of the factor "Four-P Mix" is statistically significant between suburban and urban regions (p=0.003, 95% C.I.= [-1.10, -0.17]) as well as suburban and rural regions (p=0.001, 95% C.I.= [-1.15, -0.22]). The mean value of the factor "Physical Evidence Mix" is statistically significant between rural and urban regions (p=0.000. 95% C.I.= [0.41, 1.26]) as well as rural and suburban regions (p=0.000, 95% C.I.= [0.69, 1.55]).

The mean value of the factor "People-Process Mix" is statistically significant between Airtel and Jio mobile telecom operators (p=0.012. 95% C.I.= [0.10, 1.20]), BSNL and Airtel (p=0.010, 95% C.I.= [-2.98, -0.27]), and BSNL and Vodafone Idea (p=0.028, C.I.= [-2.74, -0.10]). The mean value of the factor "Physical Evidence Mix" is statistically significant between Vodafone Idea and Jio (p=0.000. 95% C.I.= [0.59, 1.50]) as well as Vodafone Idea and Airtel (p=0.029, 95% C.I.= [0.04, 1.15]).

**Conclusion:**

In the present study, the factors related to marketing strategies that influence the buying decision of customers have been identified. Five factors namely, Customer Retention, Customer Loyalty, People-Process Mix, Four-P Mix and Physical Evidence Mix have been

found to influence the buying decision of customers. Customer Retention, People-Process Mix, Four-P Mix and Physical Evidence Mix are observed to be statistically significant across regions. Buying decision of customers influenced by the factor "Customer Retention" is significantly higher in rural and suburban regions than in urban region. Similarly, buying decisions of customers influenced by the factors "People-Process Mix" and "Physical Evidence Mix" are significantly different between rural and urban as well as rural and suburban regions. Again, buying decision of customers influenced by the factor "Four-P Mix" is significantly different between urban and suburban as well as rural and suburban regions. Customer Loyalty, People-Process Mix and Physical Evidence Mix are also observed to be statistically significant across the choices of mobile telecom operators. Buying decision of customers influenced by the factor "Customer Loyalty" is significantly higher while choosing Airtel than that in Jio and Vodafone. Buying decision of customers influenced by the factor "People-Process Mix" is statistically significant between the choices of Airtel and Jio, BSNL and Airtel as well as BSNL and Vodafone Idea. Buying decision of customers influenced by the factor "Physical Evidence Mix" is significantly different between the choice of Vodafone Idea and Jio as well as Vodafone Idea and Airtel.

In conclusion, it has been found that Customer Retention, Customer Loyalty, People-Process Mix, Four-P Mix and Physical Evidence Mix all are significant marketing strategies/factors in influencing buying decision of customers. The factors Customer Retention, People-Process Mix, Four-P Mix and Physical Evidence Mix influence the buying decision of customers to vary across regions. The factors Customer Loyalty, People-Process Mix and Physical Evidence Mix leads the buying decision of customers to vary across choices of mobile telecom operators. The study also identifies that some differences in buying behaviour of customers exist between two groups across regions as well as the choices of mobile telecom operators. The study recommends that mobile telecom operators focus on these factors to attract and retain customers that in turn will help to enhance their market position and customer base.

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# PERFORMANCE EVALUATION OF STATE BANK OF INDIA BEFORE AND AFTER THE MERGER

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***Abstract***

*Mergers and acquisitions are modern reform techniques that completely transform the Indian banking sector. Mergers improve financial efficiency while avoiding operational issues and growth barriers. This study aims to analyze and compare the performance of the State Bank of India (SBI) before and after the merger using deposit mobilization and employee productivity measures obtained from secondary data. According to the findings, there are significant differences in deposits per employee and expenses per employee, as well as significant differences in the ratios of savings deposits to total deposits, term deposits to total deposits, and insignificant differences in demand deposits to total deposits. It concludes that SBI has performed better overall post-merger than before the merger.*

***Keywords:***

*Merger, Performance, Deposit Mobilization, Employee Productivity*

## Introduction

The banking industry plays a vital role in the country's economic progress. In the last three decades, the Indian banking industry has undergone numerous reforms (Ritesh Patel, 2018). Mergers and acquisitions (M&A) are a relatively recent restructuring strategy to enhance the Indian banking industry (Shrestha et al., 2018). SBI is India's largest public sector bank, and the most recent merger occurred in 2017 when five associate banks and Bharatiya Mahila Bank merged with SBI. State Bank of India remains a major player in the Indian banking sector and is considered one of India's most trusted and reliable banks. This merger was intended to improve the overall efficiency and competitiveness of the bank in India. The merger has also helped to improve the bank's efficiency and cost-effectiveness. By consolidating the operations of associate banks, the merged entity can achieve economies of scale and reduce operational costs. SBI has allowed the bank to offer competitive products and services to customers and support the development of the Indian economy. Additionally, SBI has been investing in technology and digital banking services to stay ahead of the competition and meet the changing needs of its customers.

## Review of Literature

[1]**Baburam Adhikari et al. (2023)** examined the performance of two commercial banks in Nepal using 12 accounting ratios and a paired sample t-test. The study found that the merger had a mixed influence on the performance of banks, despite large gains in return on assets, net interest margin, and earnings per share. The results showed that profitability and liquidity measures, such as ROA and NIM, improved considerably after the merger. However, there were no significant differences in other ratios.[2]**Mansi Mathur (2021)** analysed the performance of SBI using the Camel model from 2014-15 to 2018-19. The study found that SBI's management effectiveness, earning quality, and liquidity all increased after the merger. The study also suggests that the bank must, however, concentrate on raising its capital adequacy ratio and asset quality. [3]**Shweta Yadav and Jonghag Jang (2021)** analyzed the financial performance of HDFC Bank by using the CAMEL Model. The data included in the study are secondary data spanning 10 years, including the five years before the merger (2003–2008) and the five years following the merger (2009–2014). The Paired t-test has been used in the study. The results revealed that the merger positively impacted HDFC's financial performance and

that it had expanded as a result of the merger. [4]**Sujith Kumar Patra and Ajitabh Dash (2019)** analyzed SBI's profitability performance over one year using profitability ratios. The research also discusses the reasons for the merger. The research relies on secondary data. Finally, the results show a significant difference in performance before and after the merger. [5]**Jayaraman et al. (2014)** examined the impact and efficiency of Indian banks due to mergers and acquisitions. Data envelopment analysis was used in the study. The effect was assessed by comparing the merged banks' efficiency three years before and after the merger. The analysis found that the merged banks' technical efficiency decreased after the merger and increased in the third year of the post-merger.

Based on a literature review, a detailed study on the performance of SBI utilizing multiple deposit mobilization and employee productivity indicators has yet to be discovered.

**Need and Objective of the Study**

The merger was aimed at creating a stronger and more efficient banking entity. However, it is important to evaluate if the merger has indeed improved the bank's performance. Many researchers have worked on different dimensions of banking sectors, including mergers and acquisitions, and the findings show mixed results. However, researchers have yet to work on the deposit mobilization and employee productivity of the SBI merger. Therefore, this study focused on filling this gap. Hence, the study is undertaken to evaluate and compare the performance of the SBI pre- and post-merger by using deposit mobilization and employee productivity parameters.

**Hypotheses**

- $Ho_1$: No significant difference in the savings deposits to total deposits ratio of SBI before and after the Merger.
- $Ho_2$: No significant difference in the demand deposits to total deposits ratio of the SBI before and after the Merger.
- $Ho_3$: No significant difference in the term deposits to total deposits ratio of the SBI before and after the Merger.
- $Ho_4$: No significant difference in the deposits per employee of the SBI before and after the Merger.
- $Ho_5$: No significant difference in the expenses per employee of the SBI before and after the Merger.

## Methodology

The study is carried out to analyse and compare the performance of the SBI in the pre- and post-merger period by using parameters like deposit mobilization and employee productivity. The present study used secondary data such as annual reports, websites, etc. The study period is ten years covering five years of pre-merger period (2012-13 to 2016-17) and five years of post-merger period (2017-18 to 2021-22). The collected data were analysed using Statistical Package for the Social Sciences (SPSS) and the measures like mean and Standard Deviation. A paired t-test has been used to test the above hypothesis, whether there is any statistically significant difference in the performance of SBI before and after the merger with the selected parameters.

## Discussion and Analysis

The above hypothesis is tested from the point of view of all five measures/ variables used. See Table 1.

**Table 1: Parameters/ Measures for Comparison**

| Deposit Mobilisation | Employee Productivity |
|---|---|
| Savings Deposits to Total Deposits ratio | Deposits per Employee |
| Demand Deposits to Total Deposits ratio | Expenses per Employee |
| Term Deposits to Total Deposits ratio | |

## Deposit Mobilisation

### Savings Deposits to Total Deposits Ratio

The State Bank of India hopes to mobilize more sporadic and tiny savings by educating people to save money. SBI can entice individuals to save money through bank deposits. The ratio of savings deposits to total bank deposits evaluates the effectiveness of the bank in fostering the saving habit.

$$\text{Saving deposits to Total deposits Ratio} = \frac{\text{Savings Deposits}}{\text{Total Deposits}} X100$$

**Table 2: Shows the Saving Deposits to Total Deposits Ratio from 2012-13 to 2021-2022**

| Pre-Merger Period | | Post-Merger Period | |
|---|---|---|---|
| **Years** | **Saving Deposits to Total Deposits Ratio** | **Years** | **Saving Deposits to Total Deposits Ratio** |
| 2012-13 | 32.39 | 2017-18 | 37.44 |
| 2013-14 | 32.68 | 2018-19 | 37.48 |
| 2014-15 | 31.98 | 2019-20 | 37.16 |
| 2015-16 | 33.05 | 2020-21 | 37.61 |
| 2016-17 | 36.44 | 2021-22 | 37.68 |
| **Mean** | **33.30** | **Mean** | **37.47** |
| **SD** | **1.794** | **SD** | **0.200** |
| **Paired t-test Results** | | | |
| **t-value** | **-5.636** | | |
| **p-value** | **0.005** | | |
| **Correlation** | **0.733** | | |

**Source:** Computed through SPSS at a 5% level of Significance

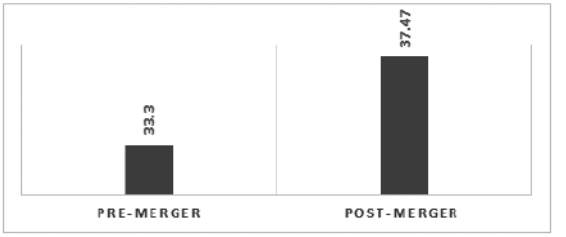


Figure 1: Mean of Saving deposits to Total Deposits Ratio

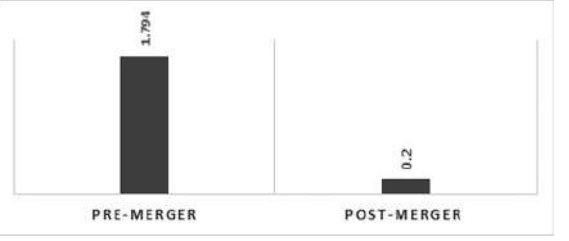


Figure 2: Standard Deviation of Saving deposits to Total Deposits Ratio

Table 2 reveals the information of savings deposits to total deposits ratio of the SBI during the pre-merger (2012-13 to 2016-17) and the post-merger period from 2017-18 to 2021-22. In the pre-merger period, the savings deposits to total deposits ratio were 32.39 percent in 2012-13, which tended to increase in 2013-14 to 13.68 percent and further decreased to 31.98 percent in 2014-15, which tended to increase in 2015-16, 31.98 to 33.05%. The next year, 2016-17, slightly increased to 36.44%. In the post-merger period, the savings deposits to total deposits ratio of the SBI in the first year of the merger was 37.44% in 2017-18, which increased to 37.48 percent in 2018-19. It decreased to 37.16 percent in 2019-20, and it increased to 37.61 percent; the next year, 2021-22, it increased to 37.68 percent.

Figure 1 shows that the annual average savings deposits to total bank deposits ratio of the SBI during the post-merger period is 37.47 percent, which is higher than the 33.30% during the pre-merger period. Figure 2 shows that the post-merger period is found to be better in terms of standard deviation. Since the p-value is less than the 5% significance level, $Ho_1$ is rejected. Hence, there is a significant difference in the savings deposits to total deposits ratio of the State Bank of India during the pre-and post-merger periods, and this is due to the changes in customer preferences and increased competition, leading to shifts in deposit composition and banking behaviour. There is a strong and positive relation between the pre-and post-merger savings deposits to the total deposits ratio as per the paired t-test results.

**Demand Deposits to Total Deposits Ratio**

The bank's efficiency in mobilizing deposits may also be evaluated by its ability to draw deposits from retailers, small company owners, artists, and other clients. According to this theory, the ratio of demand deposits to total deposits reflects how successfully the bank encourages these individuals to save money.

$$\text{Demand Deposits to Total Deposits Ratio} = \frac{\text{Demand Deposits}}{\text{Total Deposits}} X100$$

**Table 3: Shows the Demand Deposits to Total Deposits Ratio from 2012-13 to 2021-2022**

| Pre-Merger Period | | Post-Merger Period | |
|---|---|---|---|
| **Years** | **Demand Deposits to Total Deposits Ratio** | **Years** | **Demand Deposits to Total Deposits Ratio** |
| 2012-13 | 8.36 | 2017-18 | 7.02 |
| 2013-14 | 7.66 | 2018-19 | 7.07 |
| 2014-15 | 7.46 | 2019-20 | 7.01 |
| 2015-16 | 7.57 | 2020-21 | 7.79 |
| 2016-17 | 7.27 | 2021-22 | 6.84 |
| **Mean** | **7.66** | **Mean** | **7.14** |
| **SD** | **0.415** | **SD** | **0.370** |
| **Paired t-test Results** | | | |
| **t-value** | **2.082** | | |
| **p-value** | **0.106** | | |
| **Correlation** | **0.001** | | |

**Source:** Computed through SPSS at a 5% level of Significance


Figure 3: Mean of Demand Deposits to Total Deposits ratio

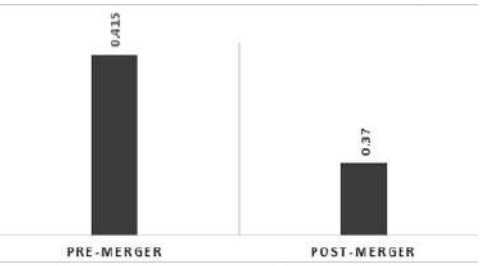


Figure 4: Standard Deviation of Demand Deposits to Total Deposits ratio

Table 3 shows the information demand deposits to total deposits ratio of the SBI during the pre-merger (2012-13 to 2016-17) and the post-merger period from 2017-18 to 2021-22. In the pre-merger period, the demand deposits to total deposits ratio were 8.36 percent in 2012-13, which tended to decrease in 2013-14 to 7.66 percent and further decreased to 7.46 percent in 2014-15, which tended to increase in 2015-16, 7.46 to 7.57%. The next year, 2016-17, slightly decreased to 7.27%. In the post-merger period, the demand deposits to total deposits ratio of the SBI in the first year of the merger was 7.02% in 2017-18, which increased to 7.07 percent in 2018-19. It decreased to 7.01 percent in 2019-20 and increased to 7.79 percent; the next year, 2021-22, it decreased to 6.84 percent.

Figure 3 shows that the annual average demand deposits to total deposits ratio of the SBI during the post-merger period is 7.14 percent, lower than the 7.66% during the pre-merger period. The post-merger period is found to be better in terms of standard deviation (Figure 4). Since the p-value is greater than the 5% level of significance, $Ho_2$ is accepted. Hence, there is no significant difference in the demand deposits to total deposits ratio of the State Bank of India during the pre-and post-merger periods, and this is due to consistent transactional banking needs and customer behaviours, which are less influenced by merger-related changes compared to savings deposits. There is a weak relation between the pre- and post-merger demand deposits to total deposits ratio as per the paired t-test results.

**Term Deposits to Total Deposits Ratio**

The fixed deposits are anticipated to stay with the banks longer and can be used in the traditional lending processes. The percentage of fixed deposits to total deposits at the bank is used to assess the bank's effectiveness in collecting fixed deposits.

$$\text{Term Deposits to Total Deposits Ratio} = \frac{\text{Term Deposits}}{\text{Total Deposits}} X100$$

**Table 4: Shows the Term Deposits to Total Deposits Ratio from 2012-13 to 2021-2022**

| Pre-Merger Period | | Post-Merger Period | |
|---|---|---|---|
| **Years** | **Term Deposits to Total Deposits Ratio** | **Years** | **Term Deposits to Total Deposits Ratio** |
| 2012-13 | 59.25 | 2017-18 | 55.54 |
| 2013-14 | 59.66 | 2018-19 | 55.45 |
| 2014-15 | 60.57 | 2019-20 | 55.83 |
| 2015-16 | 59.38 | 2020-21 | 54.60 |
| 2016-17 | 56.30 | 2021-22 | 55.48 |
| **Mean** | **59.03** | **Mean** | **55.38** |
| **SD** | **1.611** | **SD** | **0.461** |
| **Paired t-test Results** | | | |
| **t-value** | **4.972** | | |
| **p-value** | **0.008** | | |
| **Correlation** | **0.076** | | |

**Source:** Computed through SPSS at a 5% level of Significance

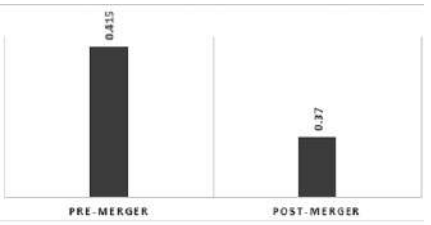


Figure 5:Mean of Term Deposits to Total Deposits Ratio


Figure 6:Standard Deviation of Term Deposits to Total Deposits Ratio

Table 4 discloses the information on the term deposits to total deposits ratio of the SBI during the pre-merger (2012-13 to 2016-17) and the post-merger period from 2017-18 to 2021-22. In the pre-merger period, the term deposits to total deposits ratio was 59.25 percent in 2012-13, which tended to increase in 2013-14 to 59.66 percent and further increased to 60.57 percent in 2014-15, which tended to decrease in 2015-16, 60.57 to 59.38%. The next year, 2016-17, slightly decreased to 56.30%. In the post-merger period, the term deposits to total deposits ratio of the SBI in the first year of the merger was 55.54% in 2017-18, which decreased to 55.45 percent in 2018-19. It increased to 55.83 percent in 2019-20 and decreased to 54.60 percent; the next year, 2021-22, it increased to 55.38 percent.

Figure 5 shows that the annual average term deposits to total deposits ratio of the State Bank of India during the post-merger period is 55.38 percent, lower than 59.03% during the pre-merger period. The post-merger period is found to be better in terms of standard deviation (Figure 6). Since the p-value is less than the 5% level of significance, $Ho_3$ is rejected. Hence, there is a significant difference in the term deposits to total deposits ratio of the State Bank of India during the pre- and post-merger periods resulting from altered market dynamics and investor sentiments after the merger, potentially affecting the bank's ability to attract long-term deposits. There is a weak and positive relation between the pre- and post-merger term deposits to total deposits ratio as per the paired t-test results.

**Employee Productivity**

**Deposits per Employee**

The deposits collected for each bank employee must be the deposit per employee. One of the bank's primary banking services is collecting deposits, which entails taking cash (deposits) from customers (depositors) for safekeeping in an account that will be accessible in the future. A higher ratio denotes better management, a positive perception of the bank, safety, and a higher interest rate, all of which ultimately draw more depositors.

$$\text{Deposit per Employee} = \frac{\text{Total Deposits}}{\text{No of Employees}}$$

**Table 5: Shows the Deposits per Employee from 2012-13 to 2021-2022**

| Pre-Merger Period | | Post-Merger Period | |
|---|---|---|---|
| **Years** | **Deposits per Employee** | **Years** | **Deposits per Employee** |
| 2012-13 | 7.13 | 2017-18 | 10.31 |
| 2013-14 | 8.25 | 2018-19 | 11.43 |
| 2014-15 | 9.63 | 2019-20 | 13.13 |
| 2015-16 | 10.85 | 2020-21 | 15.12 |
| 2016-17 | 12.41 | 2021-22 | 16.73 |
| **Mean** | **9.65** | **Mean** | **13.34** |
| **SD** | **2.083** | **SD** | **2.623** |
| **Paired t-test Results** | | | |
| **t-value** | **-14.532** | | |
| **p-value** | **0.000** | | |
| **Correlation** | **0.997** | | |

**Source:** Computed through SPSS at a 5% level of Significance

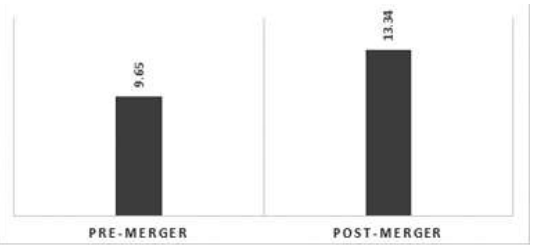


Figure 7: Mean of Deposits per Employee

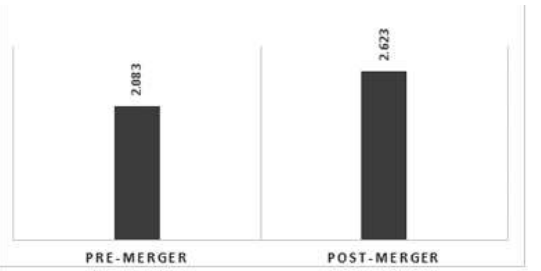


Figure 8: Standard Deviation of Deposits per Employee

Table 5 shows the information deposits per employee of the SBI during the pre-merger (2012-13 to 2016-17) and the post-merger period from 2017-18 to 2021-22. In the pre-merger period, the deposits per employee was 7.13 percent in 2012-13, which tended to increase in 2013-14 to 8.25 percent and further increased to 9.63 percent in 2014-15, which tended to increase in 2015-16, 9.63 to 10.85%. The next year, 2016-17, slightly increased to 12.41%. In the post-merger period, the deposits per employee of the SBI in the first year of the merger was 10.31% in 2017-18, which increased to 11.43 percent in 2018-19. It increased to 13.13 percent in 2019-20, and it increased to 15.12 percent; the next year, 2021-22, it increased to 16.73 percent.

Figure 7 shows that the annual average deposits per employee of the SBI during the post-merger period is 13.34 percent, which is higher than the 9.65% during the pre-merger period. The post-merger period is found to be better in terms of standard deviation (Figure 8). Since the p-value is less than the 5% significance level, $Ho_4$ is rejected. Hence, there is a significant difference in the deposits per employee of the SBI during the pre- and post-merger periods due to changes in operational efficiency and workforce optimization strategies after the merger, impacting the bank's capacity to manage and attract deposits. There is a strong and positive relation between the pre-and post-merger deposits per employee as per the paired t-test results.

**Expenses per Employee**

It stands for the employee operational expense. The salaries given to the bank's employees make up the majority of management. A lower ratio is preferable from the profit point of view.

$$\text{Expenses per Employee} = \frac{\text{Total Expenses}}{\text{No of Employees}}$$

**Table 6: Shows the Expenses per Employee from 2012-13 to 2021-2022**

| Pre-Merger Period | | Post-Merger Period | |
|---|---|---|---|
| **Years** | **Expenses per Employee** | **Years** | **Expenses per Employee** |
| 2012-13 | 0.80 | 2017-18 | 1.20 |
| 2013-14 | 0.96 | 2018-19 | 1.29 |
| 2014-15 | 1.13 | 2019-20 | 1.40 |
| 2015-16 | 1.27 | 2020-21 | 1.47 |
| 2016-17 | 1.44 | 2021-22 | 1.52 |
| **Mean** | **1.12** | **Mean** | **1.37** |
| **SD** | **0.251** | **SD** | **0.130** |
| **Paired t-test Results** | | | |
| **t-value** | **-4.654** | | |
| **p-value** | **0.010** | | |
| **Correlation** | **0.991** | | |

**Source:** Computed through SPSS at a 5% level of Significance

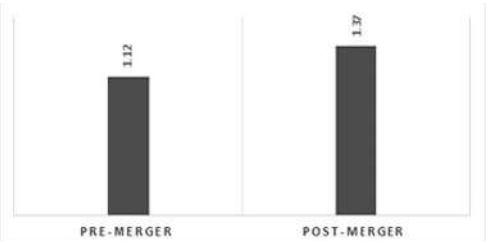


Figure 9: Mean of Expenses per Employee


Figure 10: Standard deviation of Expenses per Employee

Table 6 reveals the information expenses per employee of the SBI during the pre-merger (2012-13 to 2016-17) and the post-merger period from 2017-18 to 2021-22. In the pre-merger period, the expenses per employee was 0.80 percent in 2012-13, which tended to increase in 2013-14 to 0.96 percent and increased to 1.13 percent in 2014-15, which tended to increase in 2015-16, 1.13 to 1.27%. The next year, 2016-17, slightly increased to 1.44%. In the post-merger period, the expenses per employee of the SBI in the first year of the merger was 1.20% in 2017-18, which increased to 1.29 percent in 2018-19. It increased to 1.40 percent in 2019-20, and it increased to 1.47 percent; the next year, 2021-22, it increased to 1.52 percent.

Figure 9 shows that the annual average expenses per employee of the SBI during the post-merger period is 1.37 percent, higher than the 1.12% during the pre-merger period. The post-merge period is found to be better in terms of standard deviation (Figure 10). Since the p-value is less than the 5% significance level, $Ho_5$ is rejected. Hence, there is a significant difference in the expenses per employee of the SBI during the pre- and post-merger period. Because of restructuring efforts, cost-saving measures, or changes in the bank's operational efficiency after the merger, impacting its expenditure per employee. There is a strong and positive relation between the pre-and post-merger expenses per employee as per the paired t-test results.

**Findings**

1. It is evident from the present study that the average ratio of saving deposits to total deposits in post-merger (i.e., 37.47 percent) is more compared to the average ratio in pre-merger (i.e., 33.30 percent). The average higher ratio in post-merger results from the bank's efficiency in mobilizing and utilizing savings deposits. The post-merger period is better in terms of standard deviation (0.200). Since the p-value is less than the 5% significance level, $Ho_1$ is rejected. Hence, there is a significant difference in the savings deposits to the total deposits ratio of the State Bank of India during the study period.
2. It is found that the average ratio of demand deposits to total deposits in pre-merger (i.e., 7.66 percent) is more compared to the average ratio in post-merger (i.e., 7.14 percent). It indicates that SBI collects more demand deposits in the pre-merger period than in the post-merger period. Since the p-value is greater than the 5% level of significance, $Ho_2$ is accepted. Hence,

there is no significant difference in the demand deposits to total deposits ratio of the State Bank of India during the pre-and post-merger periods.

3. It is noticed that the average ratio of term deposits to total deposits in pre-merger (i.e., 59.03 percent) is higher compared to the average ratio in post-merger (i.e., 55.38 percent). The low ratio in the post-merger period indicates that SBI collects more savings and demand deposits from the public, which helps the bank to improve its profitability. Since the p-value is less than the 5% level of significance, $Ho_3$ is rejected. Hence, there is a significant difference in the term deposits to total deposits ratio of the State Bank of India during the pre-and post-merger periods.
4. It is ascertained that the average ratio of deposits per employee in pre-merger (i.e., 9.65 percent) is lower than in the post-merger period (i.e., 13.34 percent). The higher average ratio in the post-merger results from the bank's enhanced management efforts in maintaining a good image, safety, and a higher rate of interest which ultimately attracts deposits from the public. Since the p-value is less than the 5% significance level, $Ho_4$ is rejected. Hence, there is a significant difference in the deposits per employee of the SBI during the study period.
5. It is found that the average ratio of expenses per employee in the pre-merger period (i.e., 1.12 percent) is lower than that post-merger period (i.e., 1.37 percent). The lower average ratio results in low operating costs. Since the p-value is less than the 5% significance level, $Ho_5$ is rejected. Hence, there is a significant difference in the expenses per employee of the SBI during the pre- and post-merger period.

## Conclusion

In the present study, an attempt has been made to evaluate and compare the performance of SBI in terms of certain parameters like deposit mobilization and employee productivity during the pre-and post-merger periods. Thus, it is a proven fact from the study results that there are significant differences in savings deposits to total deposits ratio and term deposits to total deposits ratio and insignificant differences in demand deposits to total deposits ratio in terms of Deposit mobilization parameter. Conversely, regarding employee productivity parameters, there are significant differences in deposits per employee and

expenses per employee. Finally, the overall performance of SBI is better in the Post-merger period than pre-merger.

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## Appendices

### Appendix 1: Saving Deposits to Total Deposits Ratio of SBI

| Pre-Merger Period | | | | Post-Merger Period | | | |
|---|---|---|---|---|---|---|---|
| **Years** | **Saving Deposits** | **Total Deposits** | **Ratio** | **Years** | **Saving Deposits** | **Total Deposits** | **Ratio** |
| 2012-13 | 527129.94 | 1627402.61 | 32.39 | 2017-18 | 1019137.42 | 2722178.28 | 37.44 |
| 2013-14 | 600847.76 | 1838852.36 | 32.68 | 2018-19 | 1102172.37 | 2940541.06 | 37.48 |
| 2014-15 | 656490.39 | 2052960.79 | 31.98 | 2019-20 | 1216783.00 | 3274160.62 | 37.16 |
| 2015-16 | 744908.75 | 2253857.56 | 33.05 | 2020-21 | 1397501.45 | 3715331.25 | 37.61 |
| 2016-17 | 947361.71 | 2599810.67 | 36.44 | 2021-22 | 1539980.57 | 4087410.6 | 37.68 |

**Source:** Annual reports of SBI

## Appendix 2: Demand Deposits to Total Deposits Ratio of SBI

| Pre-Merger Period | | | | Post-Merger Period | | | |
|---|---|---|---|---|---|---|---|
| Years | Demand Deposits | Total Deposits | Ratio | Years | Demand Deposits | Total Deposits | Ratio |
| 2012-13 | 135995.46 | 1627402.61 | 8.36 | 2017-18 | 191036.27 | 2722178.28 | 7.02 |
| 2013-14 | 140945.84 | 1838852.36 | 7.66 | 2018-19 | 207795.33 | 2940541.06 | 7.07 |
| 2014-15 | 153065.4 | 2052960.79 | 7.46 | 2019-20 | 229428.3 | 3274160.62 | 7.01 |
| 2015-16 | 170679.79 | 2253857.56 | 7.57 | 2020-21 | 289278.06 | 3715331.25 | 7.79 |
| 2016-17 | 188882.71 | 2599810.67 | 7.27 | 2021-22 | 279731.4 | 4087410.6 | 6.84 |

**Source:** Annual reports of SBI

## Appendix 3: Term Deposits to Total Deposits Ratio of SBI

| Pre-Merger Period | | | | Post-Merger Period | | | |
|---|---|---|---|---|---|---|---|
| Years | Term Deposits | Total Deposits | Ratio | Years | Term Deposits | Total Deposits | Ratio |
| 2012-13 | 964277.21 | 1627402.61 | 59.25 | 2017-18 | 1512004.59 | 2722178.28 | 55.54 |
| 2013-14 | 1097058.76 | 1838852.36 | 59.66 | 2018-19 | 1630573.36 | 2940541.06 | 55.45 |
| 2014-15 | 1243405.00 | 2052960.79 | 60.57 | 2019-20 | 1827949.32 | 3274160.62 | 55.83 |
| 2015-16 | 1338269.02 | 2253857.56 | 59.38 | 2020-21 | 2028551.74 | 3715331.25 | 54.60 |
| 2016-17 | 1463566.25 | 2599810.67 | 56.30 | 2021-22 | 2267698.63 | 4087410.60 | 55.48 |

**Source:** Annual reports of SBI

## Appendix 4: Deposit per Employee of SBI

| Pre-Merger Period | | | | Post-Merger Period | | | |
|---|---|---|---|---|---|---|---|
| Years | Total Deposits | No. of Employees | Ratio | Years | Total Deposits | No. of Employees | Ratio |
| 2012-13 | 1627402.61 | 228296 | 7.13 | 2017-18 | 2722178.28 | 264041 | 10.31 |
| 2013-14 | 1838852.36 | 222809 | 8.25 | 2018-19 | 2940541.06 | 257252 | 11.43 |
| 2014-15 | 2052960.79 | 213238 | 9.63 | 2019-20 | 3274160.62 | 249448 | 13.13 |
| 2015-16 | 2253857.56 | 207739 | 10.85 | 2020-21 | 3715331.25 | 245652 | 15.12 |
| 2016-17 | 2599810.67 | 209567 | 12.41 | 2021-22 | 4087410.60 | 244250 | 16.73 |

**Source:** Annual reports of SBI

## Appendix 5: Expenses per Employee of SBI

| Pre-Merger Period | | | | Post-Merger Period | | | |
|---|---|---|---|---|---|---|---|
| **Years** | **Total Expenses** | **No. of Employees** | **Ratio** | **Years** | **Total Expenses** | **No. of Employees** | **Ratio** |
| 2012-13 | 183268.41 | 228296 | 0.80 | 2017-18 | 316299.46 | 264041 | 1.20 |
| 2013-14 | 213108.71 | 222809 | 0.96 | 2018-19 | 331191.3 | 257252 | 1.29 |
| 2014-15 | 240648.46 | 213238 | 1.13 | 2019-20 | 350381.02 | 249448 | 1.40 |
| 2015-16 | 263813.83 | 207739 | 1.27 | 2020-21 | 361136.15 | 245652 | 1.47 |
| 2016-17 | 300950.89 | 209567 | 1.44 | 2021-22 | 371135.18 | 244250 | 1.52 |

**Source:** Annual reports of SBI

# ROLE OF A CMA AS SOCIAL AUDITOR FOR ATTAINING SDG GOALS (WITH REFERENCE TO THE LATEST ICAI-SAS)

*Chetna Rath*

***Abstract:*** *The recently released Social Auditing Standards(SAS) by Institute of Chartered Accountants of India ICAI has paved the way for Corporate Professionals to venture into a new dimension-Social Auditing. With a view to obtain a holistic development of balancing economic and sustainable motives, the social auditors will carry out assignments of auditing social impact carried out by the enterprises. This article revolves around integrating social standards with sustainable goals. It determines how a CMA can go a long way in achieving them by contributing to myriad areas of social causes as a Social Auditor.*

***Keywords:***

*Social Auditor, Social Auditing Standards(SAS), SDG Goals, ICMAI-SAO*

## 1.Introduction

Profit maximization has always been the primary motive of business since traditional times. With the rapid industrialization and globalization, the business entities have mindlessly exploited the limited resources available at their disposal. Over-utilization of resources has led to numerous adverse effects on the environmental, social, and economic dimensions such as global warming, pollution, inequality, climate change, poverty, biodiversity loss, unemployment etc. These effects have a far-reaching negative consequence on the ecosystem and their repercussions have the potential to impact future generations. This forced the stakeholders, all around the globe, to make businesses responsible for their actions and re-think the way they carry out their operations.

The concept of sustainability has gained prominence in recent times wherein welfare goals are given importance vis-à-vis economic profits. The desire for sustainable and inclusive development has become even more imperative for the organizations to achieve their motto of growth and development. The businesses are believed to have started showing greater concern and responsibility for the ecosystem in which they operate. This has given rise to the concept of 'social enterprise' wherein the primary objective of the business is to maximize benefits to the society & environment vis-à-vis earning profits. These enterprises conduct various activities, programs or projects that are directed towards creating a positive impact and welfare on the community at large. As per ETCFO Reports (2022), India has around 34 lacs NGO which primarily qualifies to be a Social Enterprise as per Securities and Exchange Board of India(Issue of Capital and Disclosure Requirements) Regulations, 2018 [SEBI(ICDR) Regulations, 2018].

The concept of Social Audit has been introduced in the latest Social Auditing Standards (SAS) released by Institute of Chartered Accountants of India [ICAI] with a purpose of auditing the impact made by the Social Enterprise through its activities, programs, or projects implemented during the reporting period. In other words, it's an assessment of the impact made by Social Enterprise. Social Audit is to be carried out by an eligible Social Auditor who is required to conduct data evaluation/assessment by understanding the project and its impact on the target section. They are also required to enhance project benefits to the poor & vulnerable sections by identifying the underlying challenges of the project and focusing on the mitigation measures.

To conduct Social Audit of a Social Enterprise engaged in activities enumerated under Regulation 292E(2)(a) of SEBI(ICDR) Regulations, 2018, ICAI has released the Social

Auditing Standards (SAS) to provide guidance to conduct the same by the social auditor. Cost Accountants being individuals registered under Institute of Social Auditors or any other SEBI registered agency will be qualified for acting as a Social Auditor once he/she holds a valid certificate program from National Institute of Securities Market (NISM). The current article delves deeper into the role of CMA as a Social Auditor and how they can assist the enterprise in reaching the Sustainable Development Goals (SDGs) as given by the United Nations (UN).

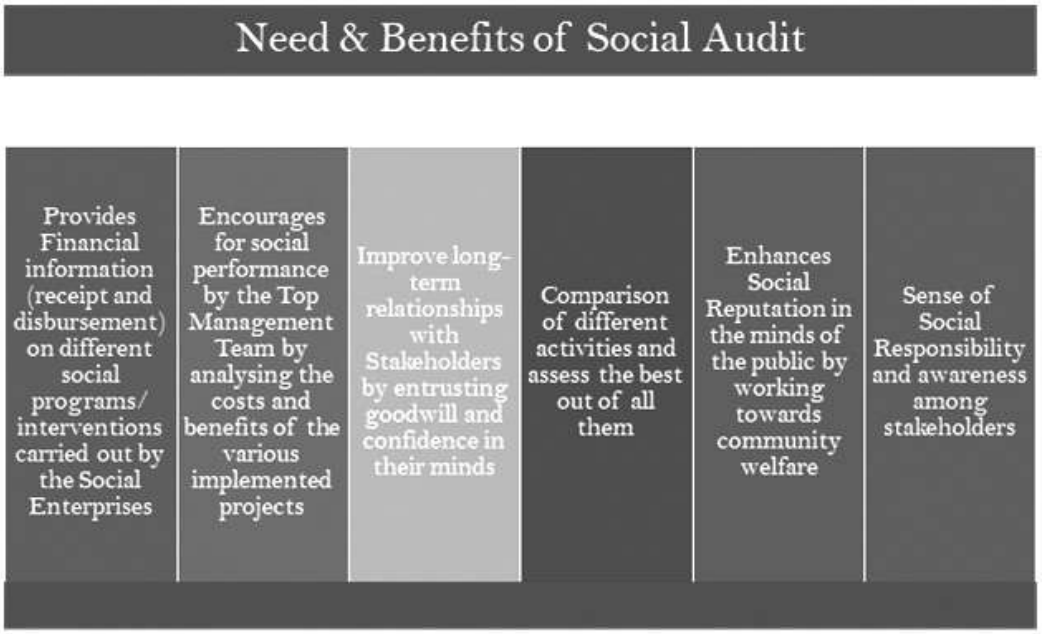
## 2. Social Audit and ICAI-SAS

Social Audit refers to the qualitative and quantitative process of assessing the projects and programs implemented by the Social Enterprise for the knowledge of stakeholders during the reporting period. Apart from that, the audit ensures the adherence of statutory requirements and authenticity of project implementation. It also evaluates the costs/ benefits involved in carrying out the actual projects and any deviations found w.r.t the desired outcomes. The projects are scrutinized in detail and their duration/intensity of impact is gauzed carefully. Follow-up is done to mitigate any unintended effects and improve the future course of action.

With a view to enhance perceptibility and awareness among stakeholders of the Social Enterprise, the Securities and Exchange Board of India (SEBI), vide Regulation 91E of SEBI (Listing Obligations and Disclosure Requirements) Regulations, 2015 introduced the concept of Social Audit. As enumerated in the draft of ICAI-SAS, Social Audit refers to "an independent, qualitative, and quantitative assessment regarding a Social Enterprise engaged in any of the activity enumerated under Regulation 292E(2)(a) of SEBI (Issue of Capital and Disclosure Requirements), Regulations, 2018."

The draft also brings out the essence and numerous benefits of the Social Audit process, a few of which have been provided in Figure 1.

**Figure 1: Essence of conducting a Social Audit**




3. **CMA as a Social Auditor**

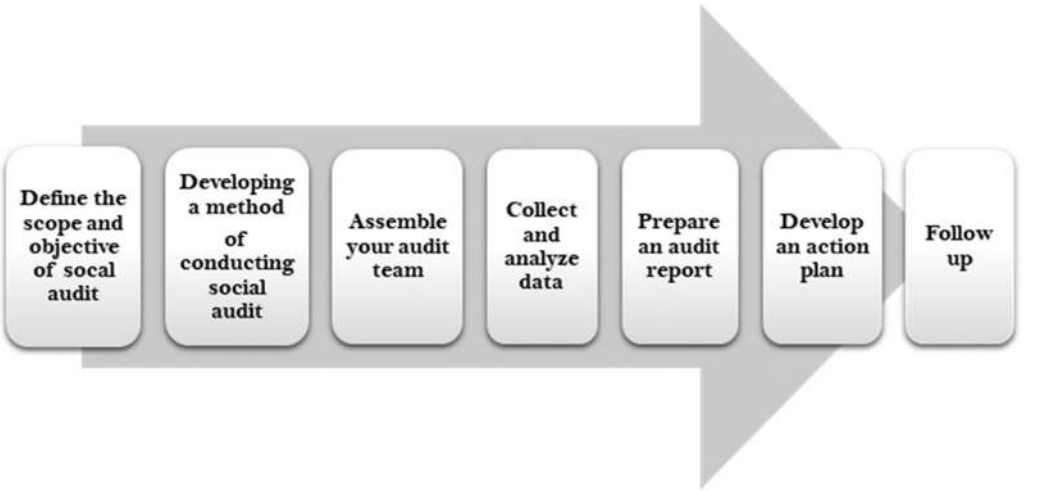
With a view to conduct the social audit in a transparent and systematic manner, the enterprise appoints social auditors who ensures that the activities/programs carried out by the organization is in accordance with the fund-raising document (in both material & financial terms). SEBI (Issue of Capital and Disclosure Requirements) Regulations, 2018 in Section 292A(f) has defined Social Auditor as "an individual registered with a self-regulatory organization under the Institute of Chartered Accountants of India or such other agency, as may be specified by the Board, who has qualified a certification program conducted by National Institute of Securities Market (NISM) and holds a valid certificate."

Considering the above requirements, ICMAI has set up its self-regulatory organization (SRO) named Social Auditors Organization (ICMAI-SAO) for the empanelment and guidance of Social Auditors. The Social Audit Standards (SAS) released by ICAI provides standard guidelines for social audit and is applicable to all Social Auditors empaneled

with ICMAI-SAO undertaking Social Audit assignments. This paves the way for the Cost Accountants to pitch in as Social Auditors post qualifying the NISM Certification program.

Further, Social Enterprises are also required to submit an Annual Impact Report audited by the Social Auditor. This requires the auditor to follow a series of steps before giving the final recommendation. Those steps are enumerated in Figure 2.

**Figure 2: The Social Audit Process**




The picture given above is a non-exhaustive procedure that needs to be followed by the social auditor every time the audit is conducted.

### 4. CMA as Social Auditor for attaining SDG Goals

This section brings in an interesting synthesis of ICAI-SAS with SDG Goals and how the former will aid in achieving the latter. Cost Accountants, being highly qualified professionals having the required set of skills & expertise, can act as Social Auditors of Social Enterprises. Popularly regarded as the law-abiding professionals, the Cost Accountants in Practice can venture into this domain as social auditors for such organizations that work for social causes like environmental sustainability, pay equality,

disaster mitigation, workplace safety etc. and provide an Annual Impact Report indicating the veracity of the activities undertaken in the year.

Table 1 summarizes16 Social Auditing Standards (SAS) released by ICAI and its closely linked Sustainable Development Goals (SDG) along with the extent of linkage between them. The table also elaborates the role of Cost Accountants in Practice under each standard and how they can work on the key focus areas under each of them. The logic is to establish a link showing how SDG can be achieved by working on SAS and to what extent the link exists between them (can be 'high', 'moderate' or 'low').

**Table 1:Presence and extent of linkage between ICAI-SAS and SDG & focus areas of CMA in the Social Audit Process**

| Sl. No. | Social Auditing Standards (SAS) | Sustainable Development Goals (SDGs) linking SAS | Extent of link between SDG & SAS | Key Focus areas of CMA during Social Audit |
|---|---|---|---|---|
| 1 | **SAS 100** Social Audit Standard on eradicating hunger, poverty, malnutrition, and inequality | **SDG GOAL 1** No Poverty **SDG GOAL 2** Zero Hunger **SDG GOAL 10** Reduced Inequality | **High** | The auditor must ensure the enterprise is working towards availability of food all year round, create stable food systems, eliminate food wastages in the target region. It should also focus on meeting nutritional needs of people, creating an awareness regarding birth control, increased productivity and efficient production. To eradicate inequality, improve the income and growth of bottom line via social, economic, and political inclusion also becomes an essential checklist for the enterprise auditor. |

| | | | | |
|---|---|---|---|---|
| 2 | **SAS 200**<br>Social Audit Standard on promoting health care including mental healthcare, sanitation and making available safe drinking water | **SDG GOAL 3**<br>Good Health and Well-being<br>**SDG GOAL 6**<br>Clean Water and Sanitation | **High** | The auditor should investigate the programs of health care including mental healthcare, sanitation, and safe drinking water provided by the company to the target population. |
| 3 | **SAS 300**<br>Social Audit Standard on promoting education, employability, and livelihoods | **SDG GOAL 4**<br>Quality Education<br>**SDG GOAL 8**<br>Decent Work and Economic Growth | **High** | The Social Auditor should ensure educational institutions get access to affordable and quality technical, vocational, and tertiary education. Besides that, sports activities and extra-curriculum activities must be treated equally important. The social organization is also required to provide scholarships, training programs, career counselling initiatives to the needy to make them better aware and competent with their peers. |

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|---|---|---|---|---|
| 4 | **SAS 400**<br>Social Audit Standard on promoting gender equality, empowerment of women and LGBTQIA+ communities | **SDG GOAL 5**<br>Gender Equality<br>**SDG GOAL 8**<br>Decent Work and Economic Growth | **High** | The auditor should ensure the enterprise is working towards gender equality of marginalized genders and giving them equal opportunity and access to justice, wherever necessary. Other measures under this head include equality of pay, protection of LGBTQIA+ rights and assistance to reduce the cases of violence against women and sex workers. |
| 5 | **SAS 500**<br>Social Audit Standard on ensuring environmental sustainability, addressing climate change including mitigation and adaptation, forest, and wildlife conservation | **SDG GOAL 13**<br>Climate Action<br>**SDG GOAL 14**<br>Life Below Water<br>**SDG GOAL 15**<br>Life on Land<br>**SDG GOAL 7**<br>Affordable and Clean Energy | **High** | This standard requires the auditor to look upon measures taken by the enterprise towards environmental sustainability, provision for clean energy research and adaptation of latest technology. It also ensures preservation of soil, water, and air quality along with handling of urban solid waste and their disposal. The auditor also verifies pollution combating tools, forest conservation methods and developmental activities adopted; along with focus given to conservation of endangered species of wild animals and birds. |

| | | | | |
|---|---|---|---|---|
| 6 | **SAS 600**<br>Social Audit Standard on protection of national heritage, art, and culture | **SDG GOAL 9**<br>Industry, Innovation, and Infrastructure | **Low** | The social auditor must check that the enterprise ensures structural safety of national heritage, art, and culture.<br>Actions can be taken towards building infrastructure for tourism purposes, museums, pilgrim sites, archives, libraries, and other institutions of historical and cultural value. |
| 7 | **SAS 700**<br>Social Audit Standard on training to promote rural sports, nationally recognized sports, Paralympic sports, and Olympic sports | **SDG GOAL 3**<br>Good Health and Well-being | **Moderate** | This standard requires assistance, scholarships, and other required sports infrastructure for sports enthusiasts.<br>The enterprise can work towards developing an attitude towards sports as a viable career option and increased participation in various tournaments/ games by identifying potential athletes and provide them with required facilities. |

| | | | | |
|---|---|---|---|---|
| 8 | **SAS 800**<br>Social Audit Standard on supporting incubators of Social Enterprises | **SDG GOAL 9**<br>Industry, Innovation, and Infrastructure | **Low** | The auditor must verify as if the enterprise is working towards building incubators, networks and providing guidance on developing business plans and access to network of mentors for fetching better start-up ideas. Also, proper support must be provided for the number of patent applications filed and patents granted. This would ensure faster growth of other Social Enterprises. |
| 9 | **SAS 900**<br>Social Audit Standard on supporting other platforms that strengthen the non-profit ecosystem in fundraising and capacity building | **SDG GOAL 16**<br>Peace and Justice Strong Institutions<br>**SDG GOAL 17**<br>Partnerships to achieve the Goal | **Low** | The enterprise should work on strengthening the other Non-Profit Organizations and encourage prospective donors for institution resilience and capacity building. |

| | | | | |
|---|---|---|---|---|
| 10 | **SAS 1000** Social Audit Standard on promoting livelihoods for rural and urban poor including enhancing income of small and marginal farmers and workers in the non-farm sector | **SDG GOAL 8** Decent Work and Economic Growth | **Moderate** | For promoting better livelihood, the enterprise should meet the requirement of disbursing minimum wages to workers or marginal farmers. The auditor should also investigate whether the enterprise is providing financial assistance, proper education, and skill empowerment. Other avenues include improvement of rural infrastructure, sound public transport system, access of MSMEs to financial services, looking after small and marginal farmers and workers in the non-farm sector. |
| 11 | **SAS 1100** Social Audit Standard on slum area development, affordable housing, and other interventions to build sustainable and resilient cities | **SDG GOAL 11** Sustainable Cities and Communities | **High** | This involves initiation for Slum Area Development Projects and Housing Development Projects. It involves working towards sustainable and ecofriendly cities and transportation systems as well as giving out necessities in slum areas and social security to the slum dwellers. |

| | | | | |
|---|---|---|---|---|
| 12 | **SAS 1200** Social Audit Standard on disaster management, including relief, rehabilitation, and reconstruction activities | **SDG GOAL 17** Partnerships to achieve the Goal | **Low** | The auditor must ensure that the enterprise is involved in evacuation plans, disaster preparation and management process that include activities like relief, rehabilitation, and reconstruction. |
| 13 | **SAS 1300** Social Audit Standard on promotion of financial inclusion | **SDG GOAL 8** Decent Work and Economic Growth **SDG GOAL 10** Reduced Inequality | **Moderate** | This standard stresses the financial inclusion of low-income individuals and businesses having limited resources. The social activities must be directed towards developing financial inclusion schemes in the target area to open bank accounts and deposits, access to loans facilities, custom-made financial solutions and financial instruments, opening of common service centers in the rural areas, making use of subsidies and other services offered by the Government. |

| | | | | |
|---|---|---|---|---|
| 14 | **SAS 1400**<br>Social Audit Standard on facilitating access to land and property assets for disadvantaged communities | **SDG GOAL 16**<br>Peace and Justice Strong Institutions | **Low** | To ensure availability of rights to own land, property, assets and improve their bargaining power-the social enterprise should work on achieving the same for the target area. Focus must be laid on eradicating ill-defined property rights or unfair enforcement of rights or property related litigations against disadvantaged communities. |
| 15 | **SAS 1500**<br>Social Audit Standard on bridging the digital divide in internet and mobile phone access, addressing issues of misinformation and data protection | **SDG GOAL 9**<br>Industry, Innovation, and Infrastructure<br>**SDG GOAL 16**<br>Peace and Justice Strong Institutions | **Moderate** | This standard seeks to mitigate digital divide and promote digital literacy. It also recognizes working on digital technologies for data protection, online accountability, data management and eradicating data breach. |
| 16 | **SAS 1600**<br>Social Audit Standard on promoting welfare of migrants and displaced persons | **SDG GOAL 17**<br>Partnerships to achieve the Goal | **Low** | The auditor of the social enterprise is required to pay attention with respect to health care, personal hygiene, removing social tensions, disease prevention, financial protection, social security, universal human rights and fundamental freedoms for the welfare of migrants and displaced persons. |

The above table indicates a close overlap between SAS and SDG with six standards indicating high, four moderate and six low linkages between both. The last column also shows the key focus areas for CMA and the multiple range of activities that need to be investigated as a social auditor. Thus, Social Audit has widened the scope for the CMA professionals to venture to a whole new gamut of entities vis-à-vis adding a bit to sustainable development.

**5. Role of CMA and ICMAI regarding conduct of Social Audit**

A Cost Accountant can be well-suited for the role of a Social Auditor due to their financial expertise, analytical skills, and understanding of business operations. Here's how and why a Cost Accountant can excel in this role:

1. **Financial Expertise**: Cost Accountants have a strong foundation in financial management, budgeting, and cost analysis. This expertise can be crucial when assessing the financial implications of various social and sustainability initiatives undertaken by organizations.
2. **Data Analysis**: Social auditing involves analyzing a wide range of data related to social and environmental impacts. Cost Accountants are skilled in data analysis and can effectively assess the quantitative and qualitative data needed for social audits.
3. **Resource Allocation**: Cost Accountants understand how resources are allocated within an organization. This knowledge is valuable when evaluating whether resources are being allocated efficiently for social and ethical initiatives.
4. **Risk Management**: Cost Accountants are trained to identify financial and operational risks. In the context of social auditing, they can help identify potential risks related to non-compliance, reputation damage, or legal issues arising from social or ethical concerns.
5. **Performance Measurement**: Cost Accountants often develop performance measurement systems. Applying these skills to social auditing can help establish key performance indicators (KPIs) to monitor and evaluate the effectiveness of social initiatives.
6. **Cost-Benefit Analysis**: When assessing the impact of social initiatives, Cost Accountants can conduct cost-benefit analyses to determine whether the benefits accrued from these initiatives outweigh the costs incurred.
7. **Transparency and Accountability**: Cost Accountants are well-versed in financial

reporting and ensuring transparency and accountability. These skills can be applied to reporting on social and ethical initiatives, ensuring that accurate information is communicated to stakeholders.

ICMAI (Institute of Cost Accountants of India) can play a more pro-active role in promoting Cost Accountants as effective Social Auditors by:

1. **Curriculum Enhancement**: ICMAI can incorporate social auditing principles, sustainability reporting, and ethical considerations into the curriculum. This would equip aspiring Cost Accountants with the necessary knowledge and skills to excel in the role of a Social Auditor.
2. **Training and Certification**: ICMAI can offer specialized training programs or certifications in social auditing. This would validate the expertise of Cost Accountants in this field and enhance their credibility.
3. **Guidelines and Standards**: ICMAI can collaborate with relevant regulatory bodies and organizations to develop guidelines and standards for social auditing practices. This would provide a framework for Cost Accountants to follow when conducting social audits.
4. **Awareness and Advocacy**: ICMAI can raise awareness within the industry and among organizations about the value that Cost Accountants can bring as Social Auditors. This can be done through workshops, seminars, and publications.
5. **Industry Partnerships**: ICMAI can establish partnerships with businesses, NGOs, and government agencies to create opportunities for Cost Accountants to engage in social auditing projects and gain practical experience.

   By taking these steps, ICMAI can contribute to building a pool of qualified and skilled Cost Accountants who are well-equipped to serve as effective Social Auditors, thereby promoting ethical business practices and corporate social responsibility.

## 6. Concluding Remarks

With the concept of 'social enterprises' emerging, a lot of focus has been laid on meeting environmental/social needs along with economic motive of profit-making. The designation of 'social auditor' has brought a new dimension to the existing auditing roles entailing impact creation by qualified professionals. With the release of ICAI-SAS, a CMA gets a

fresh arena to play as a social auditor by focusing on social causes, thereby meeting the global sustainable goals.

A long way forward awaits for the CMA fraternity to thrive as Social Auditors!

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# TECHNICAL ANALYSIS, TRADING OPPORTUNITY, AND RANDOM WALK HYPOTHESIS - A REVIEW

*Dipen Roy*
*Raju Paul*

**Abstract**

*Though Technical Analysis is an ancient method of investment analysis, yet, even today this method is highly effective in making investment decisions. The assumptions, based on which, technical analysis is developed, are found equally effective in this study. Price-bar chart formations unfailingly convey messages regarding future patterns of price movements. The trading signal postulated corresponding to a kind of price-bar chart formation stands mostly valid. Hence, it can be inferred that while the trend of future price movement and trend reversals can be predicted by studying a technical chart, the premises of the random walk hypothesis are required to be re-examined.*

***Keywords:***

*Technical Analysis, Random Walk Hypothesis, Stock Price, Price-Bar Chart*

## I. Introduction

Technical Analysis is a classical method for tracing the trading opportunity in an asset market. However, the advocates of the academic approach do not support this methodology (Menkhoff and Taylor, 2007; Mitra, 2011). Fama, E. (1965) discards technical analysis on the ground that its methodology contradicts the principles of the random walk model. He argues that the chartists' belief that history repeats itself, is not tenable because the stock price moves in a random walk pattern. He presented a voluminous treatise to generate interest in research studies supporting the random walk model. Following his seminal work, thousands of researchers, across the continents, embarked upon empirical research to gather support in favour of the random walk model. However, the findings of the researchers are enormously conflicting. This paper is dedicated to reviewing the efficacy of technical analysis in making profitable trading decisions. This does not necessarily contradict efficient market hypothesis, rather it is used as an alternative approach to review the hypothesis.

## II. Technical Analysis: the background

The origin of Technical Analysis can be traced back to the tenets of Dow Theory named after Charles, R. Dow (1851-1902). The tenets are extracted by William Peter Hamilton, Robert Rhea and E George Schaefer from Dow's editorials published in the Wall Street Journal. The tenets are enumerated below:

a) Stock prices discount every piece of information. It argues that as soon as a piece of new information is transmitted to the market, stock prices undergo changes to incorporate the new information. This argument is in line with the propositions of the Efficient Market Hypothesis.
b) The market has three movements; these are primary trend, secondary reactions, and day-to-day fluctuation.
c) The Price Bar chart indicates the movement.
d) Price-volume relationship provides the background. It stipulates that a trend should be confirmed by the volume of trading.
e) Price action determines the trend.
f) The averages must confirm (As per Dow's argument, the transportation index and Dow Jones Index should move in the same direction to confirm that the trend is valid).

Compared to technical analysis, professional investment analysts extensively depend on fundamental analysis as an expert methodology. They believe that the true intrinsic value can be estimated from the quantitative estimates of profits, sales, growth, dividends, and many other quantitative variables. The limitation of fundamental analysis is that the analysts make their estimation depending on conventional variables like sales, profits, dividend growth, etc. The puzzle is that other than the conventional set of variables, many extraneous variables such as global shocks, money supply investment flow, etc. can affect the stock price, which, in most cases, the expert equity researchers fail to include in their models. Further to say, market supply and market demand have a strong role in deciding the final price. As fundamental analysts do not cover so many extraneous variables, a sound intrinsic value provides no guarantee of an ensuing bullish trend. Sometimes purchase or sale of a security is led by psychological factors like euphoria, panic, and the market mood. While computing the intrinsic value of a security, fundamental analysts do not count on these qualitative factors.

Compared to the above, the chartists argue that while the market is efficient, the market price incorporates all information in the security price. Price-bar chart reflects the aggregate judgement. Hence, studying the historical sequence of past prices is a reliable methodology for identifying trading opportunities.

**II.A: Assumptions of Technical Analysis**

After the stock price reaches a peak, some downward correction begins and continues for some time; Contrary to this, while the price declines to a bottom, upward correction continues for some time till it reaches a peak again. Based on the scientific observations, the chartists make the assumptions as enumerated below:

1. Once a price change is in force, it persists for some time and forms a pattern or trend.
2. History repeats itself. That is, a similar trend pattern is likely to occur in the future under a given situation. For example, when a stock price reaches its peak, it begins a downward adjustment. This is true for any stock or financial asset.
3. Price volume data lay bare the way the market behaves and indicates how it is likely to behave in the future.
4. Given the belief that history repeats itself, by guessing the trend and trend reversal of future movements, profits can be earned.

**III. Literature Review:**

The seminal work of Fama, E. (1965) makes the beginning of the capital market studies for verifying the random walk hypothesis; the research in the ancient methodology like technical analysis is greatly neglected. Only a limited number of research is available in this area. In those cases, the scholars are observed to undertake fundamental and technical analysis simultaneously with a view to verify the relevance of these two methods in the context of changed objectives.

Vasantha, Dhanraj and Varadharajan (2012) study a sample of five IT sector companies using tools of modern technical analysis like Moving Average and Moving Average Convergence Divergence to detect the opportunities for investing in the securities of the IT sector.

Kulkarni and Kulkarni (2013), in general, observe that technical analysis is undertaken for discovering a trading opportunity; whereas, fundamental analysis is undertaken to make an investment. Investors buy stocks for holding them with a belief that the prices of the stocks are about to increase to enable them to earn a reasonable rate of return, while traders use technical analysis to buy assets with a plan to sell them shortly to book profits.

Caporin et al (2013) show that high and low prices of a stock can be forecast by using the methodology of technical analysis. Hence, technical analysis can be a useful methodology for earning attractive returns on investment.

Taylor (2014) examines the trading rules based on technical analysis and observes that the return earned by applying the principles of technical analysis appears higher than those earned by adopting a simple buy-and-hold strategy.

Costa et al (2015) study the use of Simple Moving Average (SMA), Exponential Moving Average (EMA), and Moving Average Convergence Divergence on some selected stocks enlisted on the Brazilian Stock Market and worked out some trading rules

Researchers such as Oppenheimer and Schlarbaum (1981) and Metghalchi, et al. (2008) observe that return earned by following the trading rules as reflected by the price-bar chart formation appears higher than those earned by following a simple buy-and-hold strategy.

Roy, S. G. (2015) suggests that fundamental analysis and technical analysis can complement each other. Since each of the methods has its advantages and helps the investors in making informed investment decisions, the investors should neither ignore fundamental analysis nor technical analysis

Petrusheva and Jordanoski (2016) observe that investors who want to pick stocks and

hold them for a long time, prefer conducting fundamental analysis, whereas the investors who are interested in undertaking trading in the short run, adopt technical analysis to identify stocks, which are likely to move upward.

Nagendra S Kumar Satish and Jayashree (2018) observe that technical analysis is important in investment decision-making. However, the scholars express concern that relying fully on technical analysis can be misleading, especially when the market is unable to do the price discovery. While making an informed judgement, the fundamental analysis should be simultaneously used with technical analysis.

Picasso, Andrea et al (2019) based on their analysis recommends the combined use of technical analysis and fundamental analysis based on the use of machine learning techniques which extensively depends on computer algorithm and artificial intelligence.

Wang, Jying-Nan et al (2019) Observed that investors, who use technical analysis to find buy and sell opportunities, produce good economic value. Hence, the scholars recommended the continued use of technical analysis while investing in stocks and constructing an investment portfolio.

Pramudya, Rommy and Ichsani, Sakina (2020) empirically tested the effectiveness of various oscillator indices of modern technical analysis such as Moving Average Convergence Divergence (MACD), Relative Strength Index (RSI), and Bollinger Brand. Authors noticed the effectiveness of Bollinger Brand and MACD in forecasting selling opportunities; However, with respect to identifying buy signals, the indices are abnormally slow. Based on their findings, the authors recommended the combined use of all three indices.

## IV. Research Gap

Contemporary research on stock price behaviour places the greatest emphasis on quantitative analysis, where scholars get the scope to apply empirical methods like time series econometrics and other parametric and non-parametric tests to give a scientific orientation to their findings. A negligible number of studies have attempted to apply technical analysis as the academic support for this methodology is very weak. There is a need to examine the usefulness of this methodology in the context of changing scenarios of market and trading mechanisms. The question is – does the collective wisdom get reflected in the market price? If yes, it is good to keep watch on market movements for formulating the trading strategy. While the findings of the quantitative research do

not provide any conclusive evidence in the support of random walk model, testing the relevance of the technical analysis can be the alternative methodology for examining it.

## V. Objectives of the Study

In the days of electronic trading systems, while transaction and payment norms are radically different compared to what these were in the past, there is a necessity to verify the efficacy of technical analysis. The issue is whether the price-bar charts still convey the correct trading signals. Given the changed circumstances, the objectives of the study can be enumerated below:

a) To examine the price-bar chart formations of stock price movements.
b) To understand trading messages conveyed by a price-bar chart formation.
c) To verify the validity of the messages corresponding to a popular price-bar formation.
d) To verify if the assumptions of technical analysis are still valid.
e) To verify if technical analysis is still effective in adopting the trading strategy.

## VI. Research Methodology

This study is based on historical stock price data of thirty blue chips constituting BSE SENSEX. The data have been downloaded from the official webpage of BSE. The time period for the study is one year, defined as the financial year 2022-23. The focus of the study is on constructing price-bar charts and finding the cases where the price-bar chart produces popular formations such as 'head and shoulder', 'double top', double bottom, etc. The purpose has been to see if the trading message indicated for a formation appears true in modern stock markets like BSE. For this, the price movement of the stock following the occurrence of a formation has been carefully noted and compared. The charts were drawn using the chart command of Microsoft Excel.

Subsequently, to trace the presence of a trend in the price bar-chart formations, trend equations have been computed and compiled to see whether a trend is a common feature of the stock price movement. SPSS software has been used for computing trend equations.

## VII. Price-Bar Chart F ormations and Trading Signals

Constructing a price-bar chart and examining the message the price-bar chart reflects constitute the methodology of this paper. Price-bar charts can produce many formations;

even a single price-bar chart can reflect different formations at different intervals in conformity with the movement of the market. As the discussion on so many formations in the limited space of an article is not possible, analysis is confined to the handful of formations stated below:

a) Support and Resistance,
b) Double Top,
c) Double Bottom,
d) Head and Shoulder,
e) Inverted Head and Shoulder, and
f) Flag.

From the 30 stocks of BSE SENSEX, 30 price-bar charts have been drawn. Incorporating so many charts in an article is not feasible. In case many stocks are found to produce a kind of formation listed above, to economize on space, it is decided to display the formation of only one stock graphically, while for other stocks only the dates when such formations were obtained would be reported, not displayed. Interested scholars can verify it from historical stock price data of the concerned stock.

**VII.A: Support and Resistance**

While the price of a stock is on a declining trend, it stops at a given point and bounces back upward. The price level, from which the price bounces back upward repeatedly is defined as the support line. On the other hand, the price level, where the price rally halts repeatedly and takes a downturn, produces the resistance.

Support and resistance define the lower limit and upper limit of the price. Support and resistance can lie parallel to each other, converge to a point, or break out in some situations. When these two lines converge, the price is likely to halt at a point. The price-bar chart of Tata Consultancy Services reflects the formation of support and resistance (see **Fig. 1**). Support imparts confidence to the investors that the price is less likely to tumble below this line.


**VII.B: Double-Top Formation**

Double-top formation signals the possibility of a bear phase in the immediate future; unless the investors offload the stock at this indication, they are subject to incur losses in the immediate future. This message is confirmed by the double-top formation of Bajaj Financial Services on 14th September 2022, when the market price of the stock of Bajaj Financial Services was ₹ 1772 (see **Fig. 2**) Following this double-top formation, it starts a bear phase which made the stock price of Bajaj Financial Services tumble to ₹ 1245 as recorded on 31st March 2023. This similar formation is reflected in the price-bar chart of HCL Infosystem (see **Fig. 3**). In the case of HCL, double-top formation occurred on 19th December 2022, when the price of each HCL's stock was ₹ 18.30 per share. Following this, the stock price of HCL faces the beginning of a bear phase. This made the price of each stock of HCL tumble to ₹ 11.35 on 28th March 2023.

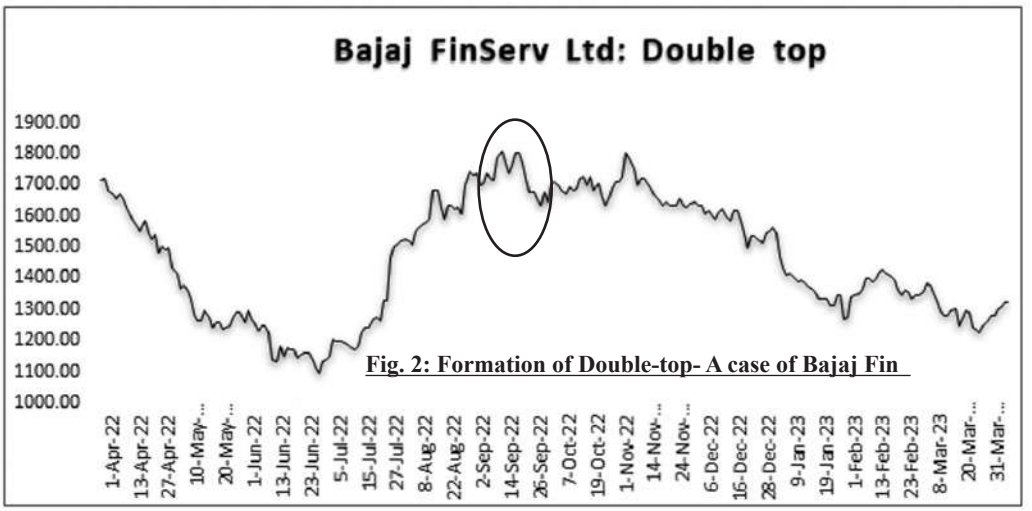


**Fig. 2: Formation of Double-top- A case of Bajaj Fin**

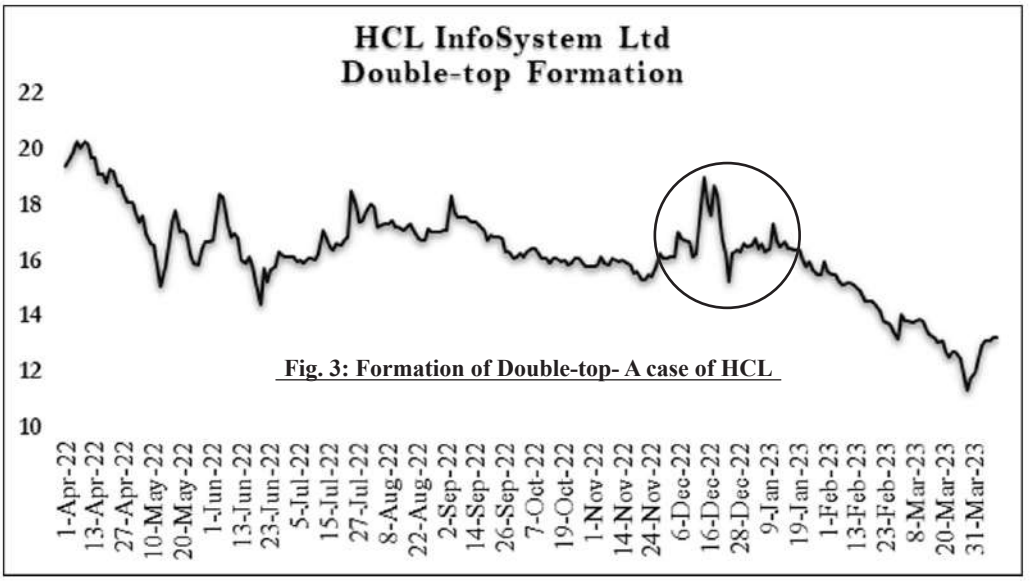


**Fig. 3: Formation of Double-top- A case of HCL**

### VII.C: Double-Bottom Formation

The price-bar chart formations such as double-bottom stands as an indication of the immediate bull phase. The price-bar chart of Axis Bank shows the formation of a double-bottom on 3rd October 2022, when the stock price of Axis Bank was ₹723 (see **Fig. 4**). Following the double-bottom formation, the market price of Axis Bank continued to appreciate to ₹ 962 till 3rd January 2023, when it happened to face a double-top. Consequently, it enters a bear phase.

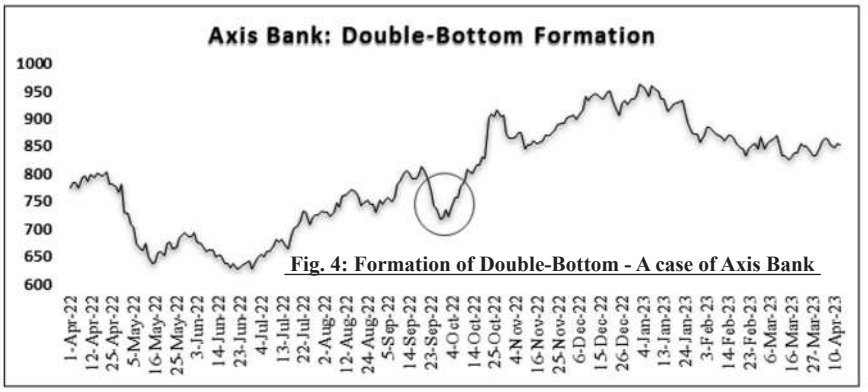


**Fig. 4: Formation of Double-Bottom - A case of Axis Bank**

The price bar chart of Nestle reflects the formation of eight double-bottoms over the same period; each double-bottom subsequently gets followed by an immediate price appreciation. Therefore, a double-bottom can be counted as an index of confidence.

### VII.D: Head and Shoulder

Three subsequent rallies, one short rally followed by a big rally and then a brief rally, produce a hump followed by a peak and then a hump (in the price-bar chart), resulting in the formation of a 'head-and-shoulder'. A 'head-and-shoulder itself does not convey a unique message, rather the actual message depends on the slope of the neckline. If the neckline is upward-sloping it suggests an ensuing bull phase. Contrary to this, if the neckline is downward sloping, it suggests the possibility of an immediate bear phase. For example, the price-bar chart of Ultra Tech Cement evidenced the formation of the Head and Shoulder on 11th November 2022 with a rising neckline (see **Fig. 5**). It produced a bull

phase following the formation of the Head and Shoulder. On the other hand, the price-bar chart of HDFC bank reflected the formation of multiple Head-and-shoulders with rising necklines (dates: 10-23 August 2022, 17-31 January 2023), which evidenced subsequent rallies. Contrary to this, the price-bar chart of ICICI Bank produced a Head and Shoulder formation with a falling neckline (date: 25th Nov to 7th Dec 2022), which indicated a decline in its stock price.

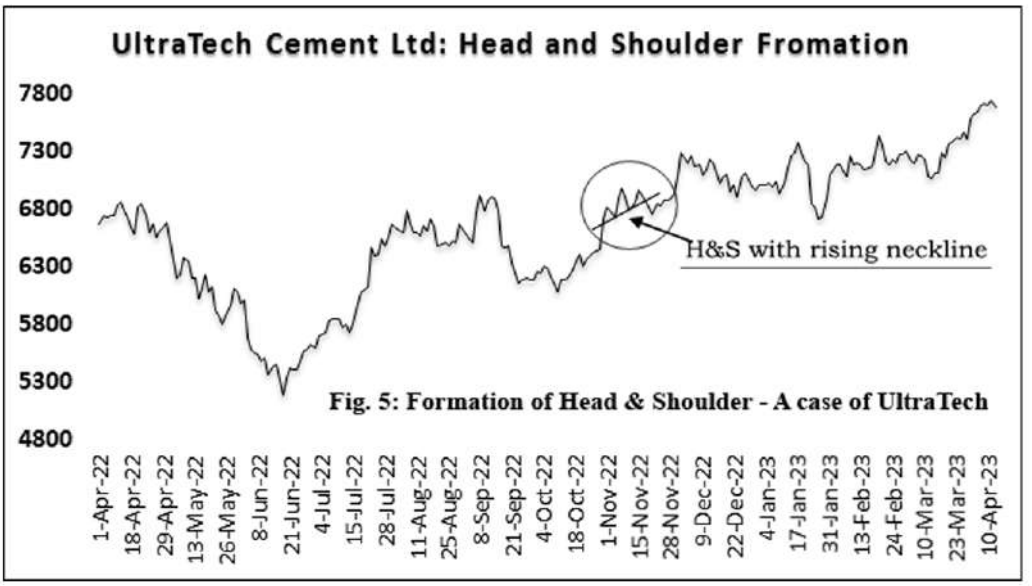


**Fig. 5: Formation of Head & Shoulder - A case of UltraTech**

**VII.E: Inverse Head and Shoulder**

In a price-bar chart, three subsequent declines – a brief decline, followed by a big decline and then another brief decline – produce an Inverse Head & Shoulder. The Inverse Head and Shoulder itself does not reflect a unique message. Rather, the actual message depends on the slope of the neckline. Price-bar chart of Maruti as shown in **Fig. 6** reflects the formation of an inverse head and shoulder (from 9th May to 20th May 2022) with a rising neckline, following which the stock price of Maruti registered a sharp rise.

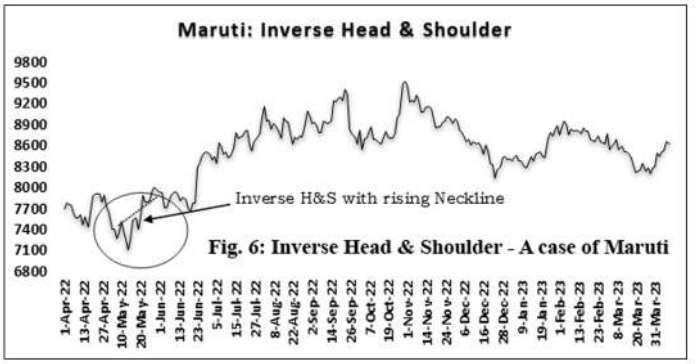


**Fig. 6: Inverse Head & Shoulder - A case of Maruti**

### VII.F: Flag

Flag formation has been documented by the price movement of IndusInd Bank, HUL, ICICI Bank, etc. A Flag is created after a long rally when the price of a stock undergoes corrections constructing its support and resistance. Notice the Flag formation of IndusInd Bank shown in **Fig. 7**. A flag formation is an indication of the end of a rally and the onset of a phase for correction. A flag formation signals the scope of no big price appreciation soon; rather, following the phase of corrections, there is a chance of downward adjustment. Hence, selling the stock and booking the gains already registered is a good strategy at this moment. Otherwise, it may result in sacrificing a part of the gains already registered. This assertion is confirmed by all three flag formations of HUL, IndusInd Bank and ICICI Bank. In each case, the price tumbled after the phase of corrections.

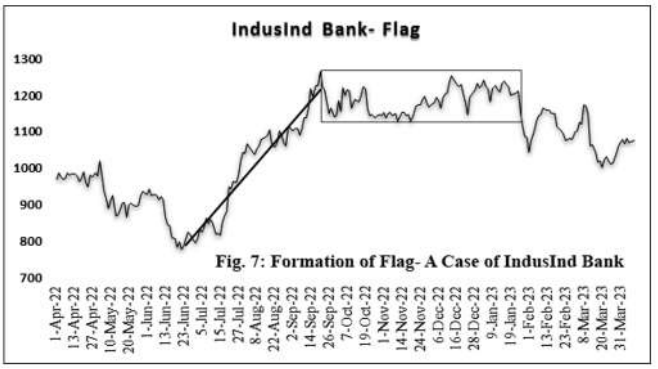


**Fig. 7: Formation of Flag- A Case of IndusInd Bank**

## VIII. Exploring Primary Trend

Technical analysis presumes that the price movement of a stock has three components. These are primary trend, secondary corrections, and daily fluctuations. This paragraph is concerned with ascertaining the presence of a primary trend existing in the price movement of each of the thirty stocks of BSE SENSEX.

**Table 1: Verification of Primary Trend of BSE 30 Stocks, 2022-23**

| Sl. No. | Company | *b* | t-value | Sig. |
|---|---|---|---|---|
| 1 | Asian Paints | -0.875 | -4.567 | 0.000 |
| 2 | Axis Bank | 0.979 | 18.581 | 0.000 |
| 3 | Bajaj Finance Ltd. | -1.528 | -2.785 | 0.006 |
| 4 | Bajaj FinServ Ltd | 0.034 | 0.202 | 0.840 |
| 5 | Bharti Airtel | 0.429 | 11.521 | 0.000 |
| 6 | HCL | -0.016 | -16.784 | 0.000 |
| 7 | HDFC Bank Ltd | 1.295 | 23.307 | 0.000 |
| 8 | HDFC Ltd. | 2.136 | 22.446 | 0.000 |
| 9 | HUL | 1.468 | 12.937 | 0.000 |
| 10 | ICICIC Bank | 0.709 | 15.581 | 0.000 |
| 11 | IndusInd Bank | 1.123 | 13.365 | 0.000 |
| 12 | Infosys | -0.278 | -3.762 | 0.000 |
| 13 | ITC | 0.524 | 48.069 | 0.000 |
| 14 | Kotak Mahindra Bank | -0.098 | -1.47 | 0.143 |
| 15 | Larsen Turbo | 2.802 | 36.052 | 0.000 |
| 16 | Mahindra & Mahindra | 1.509 | 17.55 | 0.000 |
| 17 | Maruti | 3.503 | 9.488 | 0.000 |
| 18 | Nestle | 8.478 | 11.584 | 0.000 |
| 19 | NTPC | 0.112 | 20.329 | 0.000 |
| 20 | Power Grid | -0.031 | -4.665 | 0.000 |
| 21 | Reliance | -1.077 | -11.719 | 0.000 |
| 22 | SBI | 0.399 | 12.043 | 0.000 |

| | | | | |
|---|---|---|---|---|
| 23 | Sun Pharma | 0.657 | 17.23 | 0.000 |
| 24 | Tata Motors | -0.045 | -2.353 | 0.019 |
| 25 | Tata Steel | -0.067 | -0.72 | 0.472 |
| 26 | TCS | -0.445 | -3.278 | 0.001 |
| 27 | Tech Mahindra | -0.605 | -7.851 | 0.000 |
| 28 | Titan | 1.179 | 7.664 | 0.000 |
| 29 | Ultratech | 5.773 | 18.138 | 0.000 |
| 30 | Wirpo | -0.509 | -19.685 | 0.000 |

We define the relationship between the current price and the preceding price of the stock as below:

$P_{t+1} = a + bP_t$ , where '*a*' in the intercept,
$P_t$ is the price of the stock in period *t*
$P_{t+1}$ is the price of the stock in period *t+1*
Coefficient '*b*' represents the magnitude of the relationship

In short, if '*b*' is significant, it represents the presence of a primary trend. After running data analysis using SPSS software, we compile the following results as arranged in Table 1, shown above.

Out of thirty stocks, the price movement of twenty-seven stocks confirms the presence of a primary trend. Of them, the price movement of seventeen stocks reflects a positive trend, while that of ten stocks reflects a negative trend. The price movements of stocks of three companies such as Bajaj Financial Services, Kotak Mahindra, and Tata Steel reflect no trend. It means price movement of 90 per cent of stocks provides evidence supporting the assumption of technical analysis that the price movement of each stock reflects a primary trend.

**IX. Justifying Technical Analysis:**

In this paragraph, we have examined the price-bar chart of Reliance Industries [ See **Fig. 8**]. In this price-bar chart, the trend line is AB. It corresponds to the equation $P_{t+1} = 2649 - 1.07*P_t$ [ $R^2 = 0.99$]. Besides the trend line, the price-bar chart reflects the secondary

corrections that occur in cyclical patterns. Over the period of one year, it has undergone five cycles of corrections. An upward correction continues for some time, it reaches the peak and then starts a downward correction and *vice-versa*. The purpose of this Fig. 8 is to assert that price does not move in a random manner, as postulated in the Random Walk Hypothesis, rather price movement conforms to the pattern postulated in the Technical Analysis.

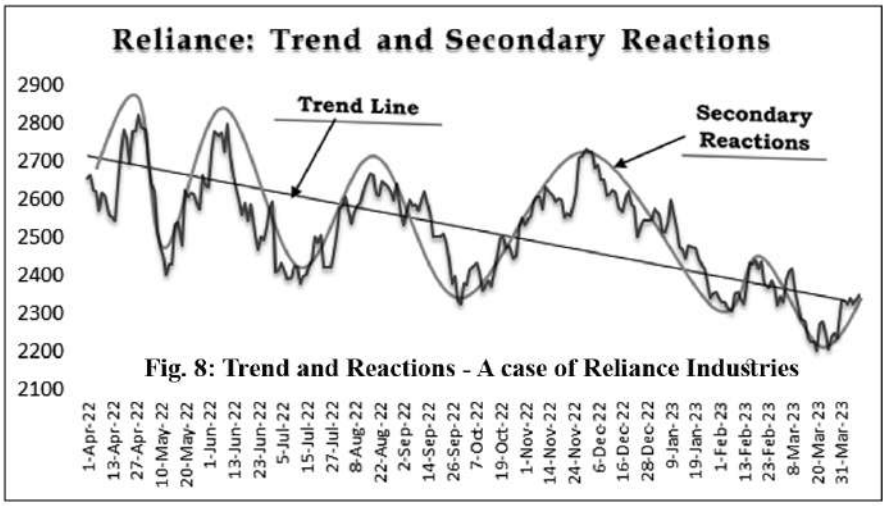


**Fig. 8: Trend and Reactions - A case of Reliance Industries**

## IX. Concluding Observations

Price does not move in a random manner, as postulated in Random Walk Hypothesis; rather, besides establishing a primary trend, it reflects fluctuations to undergo upward and downward corrections. At the onset of a phase, except for minor variations, the price of a stock continues to rise, reaches the peak, and subsequently begins a downward correction. On the other hand, after it reaches the lowest possible level, unless there is an external factor, the price again starts its recovery. This pattern can be taken as the pattern of stock price behaviour. The notable finding of the study is that technical analysis is very much effective in predicting the trend of future prices as well as trend reversals. Hence, it can stand as an effective device in making decisions regarding buying, holding, and selling a stock.

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# TESTING OF RANDOM WALK HYPOTHESIS IN THE CRYPTOCURRENCY MARKET: AFTER DECLARATION OF GLOBAL PANDEMIC

*Mallesha L.*
*Archana H. N.*

***Abstract***

*Due to recent developments, several countries have legalised cryptocurrencies, and large corporations have begun accepting them as a form of payment. One of the major concerns in this field is market efficiency, specifically regarding whether the cryptocurrency market follows the random walk hypothesis. To investigate this issue, analysed the top ten cryptocurrency prices spanning from March 11, 2020, to March 26, 2023, focusing on the period following the declaration of the global pandemic. The study employed several statistical validity tests, including the Ljung-Box test, runs test, Bartels's test, variance ratio test, EGARCH (1,1) and R/S Hurst exponent. The study revealed that most cryptocurrencies do not conform to the random walk hypothesis, indicating that the market is inefficient. This study implies that investors may be able to earn abnormal profits through the use of arbitrage strategies in this young market.*

***Keywords:***

*Cryptocurrency, Efficient Market Hypothesis, R/S Hurst Exponent, Random Walk Hypothesis, VR test, Covid-19*

## Introduction

The concept of Efficient Market Hypothesis (EMH) is central to finance, and it underpins the design of financial models, strategies, and policies in financial markets (Tuyon & Ahmad, 2016). It holds a crucial role in finance because many other theories, such as Portfolio Theory (Markowitz, 1952), the Capital Asset Pricing Model (Sharpe, 1964), the Arbitrage Pricing Theory (Roll & Ross, 1980), and the Black-Scholes-Merton option pricing model (Black & Scholes, 1973), have emerged directly or indirectly from it. Market efficiency assumes prices fully reflect all available information (Fama, 1965, 1970). Fama notes that this definition is too general to be empirically testable, and we must specify what we mean by available information. He introduced the concepts of weak-, semi-, and strong-form efficiency, which describe the degree to which the efficient market hypothesis (EMH) applies to markets. Under the weak form, prices fully reflect the information implicit in the sequence of past prices, and future stock prices are not predictable (Kalsie, 2012; Mallesha & Archana, 2023). The semi-strong and strong forms of EMH assert that prices reflect all public and private information, respectively (Pereira da Silva, 2022). In recent years, cryptocurrencies have gained widespread popularity and usage, attracting the interest of investors, regulators, and academics alike. The origin of cryptocurrencies can be traced back to 2008, when Satoshi Nakamoto introduced them to the world (Aslan & Sensoy, 2020). In light of recent developments, some countries have legalized cryptocurrencies, and major corporations have started accepting them as payment. Moreover, the COVID-19 pandemic has increased investor interest in the cryptocurrency market. However, one of the major concerns in this field is market efficiency, whether the cryptocurrency market follows the random walk hypothesis. This study seeks to address this question by investigating the market efficiency of cryptocurrency in its weak form of EMH. The study's findings may provide valuable insights to investors, analysts, and policymakers seeking to make informed decisions in this emerging market.

The structure of the article is presented in the following manner: in the second section, a brief review of pertinent literature pertaining to the research is provided; the third section provides an overview of the data collected and methodology employed; in the fourth section, the empirical results and their interpretation are discussed; and finally, the concluding remarks are presented in the fifth section.

## Literature Review

In recent years, cryptocurrency has gained widespread attention from investors, academicians, and policymakers alike, being considered a growing important financial asset (Kang et al., 2022). Verma et al. (2022) conducted a study to assess the behaviour of cryptocurrency returns and market efficiency. The authors analysed five popular cryptocurrencies using various statistical tests, including the VR, augmented Dickey-Fuller, Philip-Perron, Breusch-Godfrey serial correlation LM, and the ARIMA model. The findings revealed that the cryptocurrency market is inefficient, as the random walk hypothesis was rejected. Aggarwal (2019) examined the market efficiency of daily Bitcoin returns from July 2010 to March 2018 through robust tests. The study found strong evidence of market inefficiency, which is attributed to the presence of asymmetric volatility clustering. Meanwhile, Latif et al. (2017) observed that cryptocurrency market is inconsistent with random walk model. Their paper employed traditional random walk model tests and performed GARCH (1,1) for the robustness of market efficiency. Cheikh et al. (2020) looked into the characteristics of asymmetric volatility in four different cryptocurrencies: Litecoin, Ethereum, Ripple, and Bitcoin. The study's discovery supports the safe-haven hypothesis that the positive return-volatility relationship observed in cryptocurrencies differs from that of conventional assets. López-Martín (2021) investigated the efficiency of different cryptocurrency markets, including Bitcoin, Litecoin, Ethereum, Ripple, Stellar, and Monero, using five tests in both static and dynamic contexts. The study revealed that overall efficiency tends to increase over time, with Bitcoin, Litecoin, and Ethereum markets exhibiting a clear trend towards greater efficiency. However, Ripple, Stellar, and Monero experienced both efficiency and inefficiency periods, which aligns with the adaptive market hypothesis. Vidal-Tomás (2019) examined the cryptocurrency market over three periods using cap-weighted and equally weighted-portfolios of all available altcoins. The study discovered that the cryptocurrency market is weakly inefficient due to altcoin behaviour and is becoming increasingly inefficient over time. However, introducing new cryptocurrencies has had little impact on market efficiency. Wei (2018) conducted a study on the liquidity of 456 cryptocurrencies and discovered that those with higher market liquidity have reduced return predictability. Despite Bitcoin's efficient returns, other cryptocurrencies still show signs of autocorrelation and non-independence. The research suggests that cross-sectional Hurst exponent and liquidity have a strong connection. As a result, liquidity significantly

influences market efficiency and return predictability in emerging cryptocurrencies. Kurihara and Fukushima (2017) found that while the Bitcoin market is not efficient, Bitcoin transactions are becoming more efficient. The paper highlights the increase in Bitcoin usage and the need for further research on the efficiency of the market, concluding that Bitcoin returns will be random in the future. Yaya et al. (2020) investigated the cryptocurrency market's market efficiency and volatility persistence. They looked at 12 different cryptocurrencies before and after the crash. In both linear and nonlinear settings, they used robust fractional integration methods. Despite being highly volatile, Bitcoin and most altcoins are efficient markets, according to the study. Kang et al. (2022) tested the weak-form efficiency in the cryptocurrency market, and findings indicated that only 6.04% (54 units) of the 893 cryptocurrency units evaluated satisfied the weak-form, and only 2.695% (24 units) met the semi-strong-form. Aslan and Sensoy (2020) investigated the connection between weak-form efficiency and the intraday sampling frequency for the most capitalized cryptocurrencies. They utilized several long memory tests and discovered significant variations in the predictability of cryptocurrency returns for different high-frequency intervals. This demonstrates a U-shaped pattern in efficiency, indicating an optimal intraday sampling frequency that maximizes market efficiency. Palamalai et al. (2021) found that the random walk hypothesis was not supported in the crypto market, indicating the presence of weak-form inefficiency in the daily returns of cryptocurrencies.

## Data Source and Methodology

Data Source

This study used a dataset of cryptocurrency prices spanning from March 11, 2020, to March 26, 2023. The dataset contained daily closing prices denominated in US Dollars for ten widely adopted cryptocurrencies with high market capitalization, including Bitcoin (BTC), Ethereum (ETH), Tether (USDT), BNB (BNB), USD Coin (USDC), XRP (XRP), Cardano (ADA), Dogecoin (DOGE), Polygon (MATIC), and Binance USD (BUSD). The dataset gathered from CoinMarketCap comprised 1110 observations for each cryptocurrency.

Methodology

This study investigated the price behaviour of ten cryptocurrencies, particularly in light

of the global pandemic tweeted by the World Health Organization (WHO) on March 11, 2020. The study utilized several tests, including the Ljung-Box test, the runs test, Bartels test, variance ratio test, EGARCH (1,1) model, and the R/S Hurst exponent. In order to calculate returns, employed the natural logarithm of the ratio between two successive prices, as demonstrated by the following equ ation;

$$Rt = ln\left(\frac{Ct}{Ct-1}\right),$$

Here, Rt represents crypto assets returns, Ct represents the daily closing price at time t, and Ct-1 represents the daily closing price at time t-1.

*Ljung-Box Test*

It initially introduced the Ljung-Box test (Ljung & Box, 1978), which relies on autocorrelation coefficients. The test determines autocorrelation coefficients to define the linear correlation between returns of the time series. This entails that the returns of securities are estimated to see if it can be described by serial dependency. The autocorrelation test statistic is frequently employed to determine any evident trend in security price movements (Nalın & Güler, 2015). It tests the null hypothesis that there is no autocorrelation in the time series data. The Ljung-Box test is described as follows:

$$Q_{LB} = T(T+2)\sum_{j=1}^{k}\frac{\tau^2 j}{T-j},$$

The sample autocorrelation at lag k is denoted by R k, and the number of lags tested is indicated by h.

*Runs Test*

The runs test, developed by (Wald & Wolfowitz, 1940), is a non-parametric approach to assessing the randomness or presence of patterns in a set of values (Archana et al., 2015). In analysing the daily return series of emerging cryptocurrencies, this method can be used to investigate the randomness of the data (Palamalai et al., 2021). The runs test is based on the null hypothesis that the data sequence follows a random process or independence of returns. If the resulting Z-value exceeds the critical value (±1.96) at the chosen significance level, then the data is deemed to possess a discernible pattern and is non-random.

$$\mu_r = \left(\frac{2n_1n_2}{n_1+n_2}\right) + 1$$

Where mr is the mean number of runs, n1 denotes the number of positive returns, n2 denotes the number of negative returns, and r denotes the number of runs (actual sequence of counts).

The standard error of the expected number of runs can be calculated by using the following formula:

$$\sigma_r = \sqrt{\frac{2n_1n_2(n_1n_2 - n_1 - n_2)}{(n_1+n_2)^2(n_1+n_2-1)}}$$

A standardized variable "Z" can express the difference between the actual and expected number of runs as follows:

$$Z = \frac{n - \mu_r}{\sigma_r}$$

*Bartels Test:*

The Bartels rank test, also referred to as the Bartels test, is a statistical method utilized to assess the randomness of time series data. Its development can be attributed to Bartels in 1982. The test's underlying concept is that in an efficient market, returns should be random and not correlated with their sequence of occurrence. The Bartels test is employed to evaluate the null hypothesis that the observed returns are independent. Its formula is as follows:

$$RVN = \frac{\sum_{i=1}^{n-1}(R_i - R_{i+1})^2}{\sum_{i=1}^{n}(R_i - (n+1)/2)^2},$$

Where Ri= rank (Xi), i=1,…n. it is known that (RVN-2)/σ is asymptotically standard normal, where

$$\sigma^2 = \frac{4(n-2)(5n^2 - 2n - 9)}{5n(n+1)(n-1)^2}$$

*Variance Ratio Test*

The variance ratio (VR) test has become a widely used method to investigate whether

stock returns exhibit serial correlation, particularly since the publication of Lo and MacKinlay's seminal work in 1988. This test is designed to assess the predictability of time series data by comparing the variances of returns over different time intervals (Lo & MacKinlay, 1989). This test examines homoscedastic and heteroscedastic random walks in the asymptotic normal distribution series (Verma et al., 2022). Furthermore, if the data is assumed to be random, the variance over a given period must be proportional to the variance of a single period difference (Challa et al., 2020)the study uses descriptive statistics; tests including variance ratio, Augmented Dickey-Fuller, Phillips-Perron, and Kwiatkowski Phillips Schmidt and Shin; and Autoregressive Integrated Moving Average (ARIMA. The null hypothesis that the cryptocurrency returns follows a random walk is evaluated through the VR test.

*GARCH Model*

The GARCH model is frequently employed in analysing time series data, as it enables the examination of volatility within the data - a feature that traditional linear regression methods may not be capable of addressing (Dol, 2021). Future volatility can be predicted more effectively by enabling the estimation of conditional variance. Nonetheless, research has suggested that the asymmetric model, i.e., EGARCH are likely to outperform the standard GARCH model (Cheikh et al., 2020). This is because the models can adjust to significant negative shocks or leverage effects - phenomena often associated with periods of volatility. And the other side, the EGARCH allow for asymmetrical volatility, wherein negative shocks have a more significant impact on volatility than positive shocks of equivalent magnitude (Dsouza & Mallikarjunappa, 2015). Furthermore, they account for time-varying volatility, where the conditional variance may fluctuate over time.

The EGARCH (1,1) model, originally introduced by (Nelson, 1991):

$$r_t = \emptyset r_{t-1} + \varepsilon_t; \varepsilon_t / \phi_{t-1} \sim N\left(0, h_t\right),$$

$$\left| lh_t^2 = \omega + \alpha \left| \frac{\varepsilon_{t-1}}{h_{t-1}} \right| + y \frac{\varepsilon_{t-1}}{h_{t-1}} + \beta \right| nh_{t-1}^2,$$

The logarithm of the conditional variance appears on the left-hand side of the equation, indicating that the impact of leverage is exponential rather than quadratic. Additionally,

this form ensures that any predictions of the conditional variance will be positive. To test for the presence of leverage effects, one can examine whether γ is less than zero. Furthermore, if γ does not equal zero, then the impact is asymmetric.

*Hurst Exponent*

The Hurst exponent is a measure that can be used to determine the efficiency of the security market. It can detect the long-term memory of financial time series and their efficiency. The Hurst exponent was first introduced by Hurst in 1951 to detect long dependence in hydrological time series. Later, Mandelbrot (1972) applied this method to the study of persistence in economic time series. In the field of finance, the Hurst exponent has been used to detect long memory in long-term financial series by Grech & Mazur (2004) and Cajueiro & Tabak (2004). To calculate the Hurst exponent, the study used the R/S statistic, considered the most adaptable method for financial data analysis. The rescaled range (R/S) exponent is calculated over time and is calculated as;

$$(R/\sigma)_n = \frac{1}{\sigma_n}\left[\max_{1\le k\le n}\sum_{j=1}^{k}(r_j - \bar{r}_n) - \min_{1\le k\le n}\sum_{j=2}^{k}(r_j - \bar{r}_n)\right]$$

where $r_j$ is the returns over period $j$, $\overline{r}_n$ is the mean return, and $\sigma_n$ is the standard deviation of returns given by;

$$\sigma_n = \left[\frac{1}{n}\sum_{j=1}^{n}(r_j - \bar{r}_n)^2\right]^{1/2}$$

The Hurst exponent values can be used to categorize indices into three groups based on their characteristics:

- $0 \le H < 0.5$: EMH not confirmed, fat-tailed distribution, anti-persistent series, negatively correlated returns.
- $H = 0.5$: EMH confirmed, random Brownian motion, uncorrelated returns, no memory, cannot "beat" the market.
- $0.5 < H \le 1$: Low market efficiency, fat-tailed distribution, persistent series, positively correlated returns, market trend.

According to the random walk hypothesis, asset prices or time series data follow a stochastic process with no predictable pattern, implying that future movements cannot be

consistently anticipated based on past data (Verma et al., 2022). In order to test the random walk hypothesis of cryptocurrency, a range of testing methods are used. These include the Ljung-Box test, which examines the autocorrelation of returns. Another method is the variance ratio test, which determines whether the variance of the k-period return is equal to k times the variance of the one-period return. The runs test and Bartles test is employed to detect the independence of the return series. EGARCH (1,1), wherein negative shocks have a more significant impact on volatility than positive shocks of equivalent magnitude. Lastly, the R/S Hurst exponent determines the long-term memory of the price series and whether prices are persistent, anti-persistent, or random. All of these testing procedures examine different aspects of predictability and provide a comprehensive analysis of the predictability of cryptocurrencies.

**Results and Discussions**

The return series of the sample cryptocurrency was subject to descriptive statistical analysis, including calculation of the mean, median, skewness, kurtosis, and Jarque-Bera score. A skewness value of 0 and a kurtosis value of 3 indicate a perfectly normal distribution. The Jarque-Bera test's null hypothesis posits that the data series are normal distribution (Jarque & Bera, 1980).

Table 1: Descriptive Statistics of Cryptocurrency Returns

| Cryptocurrency | Mean | Std. Dev. | Skewness | Ex. Kurtosis | Minimum | Maximum | JB test | P-value |
|---|---|---|---|---|---|---|---|---|
| BTC | 0.0011 | 0.0387 | -1.6061 | 20.3754 | -0.4647 | 0.1718 | 19759.0 | 0.0000 |
| ETH | 0.0020 | 0.0507 | -1.3986 | 15.2992 | -0.5507 | 0.2307 | 11235.0 | 0.0000 |
| USDT | 0.0000 | 0.0032 | 0.4986 | 154.5578 | -0.0526 | 0.0534 | 1108940.0 | 0.0000 |
| BNB | 0.0027 | 0.0551 | -0.2628 | 21.0742 | -0.5431 | 0.5292 | 20638.0 | 0.0000 |
| USDC | 0.0000 | 0.0031 | 1.2243 | 87.2871 | -0.0372 | 0.0424 | 353975.0 | 0.0000 |
| XRP | 0.0007 | 0.0621 | -0.1188 | 14.8546 | -0.5505 | 0.4448 | 10252.0 | 0.0000 |
| ADA | 0.0020 | 0.0580 | -0.2971 | 7.2807 | -0.5036 | 0.2794 | 2480.5 | 0.0000 |
| DOGE | 0.0032 | 0.0876 | 5.4768 | 88.6081 | -0.5151 | 1.5163 | 370047.0 | 0.0000 |
| MATIC | 0.0036 | 0.0770 | 0.1272 | 11.6705 | -0.7140 | 0.4578 | 6330.9 | 0.0000 |
| BUSD | 0.0000 | 0.0033 | -0.6488 | 157.3692 | -0.0579 | 0.0536 | 1149678.0 | 0.0000 |

*Note: Significant @ 5% level*
*Source: Author's calculation*

In Table 1, the study can see a summary of statistical data related to cryptocurrencies. According to the random walk theory, the returns of a series should conform to a standard normal distribution. However, after analysing the data, it becomes clear that the returns of cryptocurrencies exhibit skewness and kurtosis values that are inconsistent with this assumption. This indicates that not all observed returns can be modelled using a normal distribution. Moreover, the Jarque-Bera value for cryptocurrency returns is significantly higher than expected under a normal distribution. It can reject the null hypothesis that all observed returns follow a normal distribution.

Table 2: Ljung-Box Test of Cryptocurrency Returns

| Cryptocurrency | X-squared | df (Lag) | P-value |
|---|---|---|---|
| BTC | 19.732 | 10 | 0.0319 |
| ETH | 33.382 | 10 | 0.0002 |
| USDT | 296.340 | 10 | 0.0000 |
| BNB | 49.823 | 10 | 0.0000 |
| USDC | 271.640 | 10 | 0.0000 |
| XRP | 8.786 | 10 | 0.5525 |
| ADA | 30.726 | 10 | 0.0007 |
| DOGE | 43.265 | 10 | 0.0000 |
| MATIC | 48.813 | 10 | 0.0000 |
| BUSD | 300.080 | 10 | 0.0000 |

*Note: Significant @ 5% level*
*Source: Author's calculation*

Table 2 presents the findings of the autocorrelation analysis conducted in this study. Daily returns of cryptocurrencies were examined using the Ljung-Box test with a lag of ten. The results showed that, except XRP, most cryptocurrency returns exhibited significant autocorrelation, rejecting the null hypothesis that there is no correlation. This implies a strong relationship between past and present daily returns, indicating that the market does not operate randomly.

Table 3: Runs Test of Cryptocurrency Returns

| Cryptocurrency | Runs | n1 | n2 | Total Cases | Z Statistic | P-value |
|---|---|---|---|---|---|---|
| BTC | 602 | 555 | 555 | 1110 | 2.7626 | 0.0057 |
| ETH | 600 | 555 | 555 | 1110 | 2.6425 | 0.0082 |
| USDT | 681 | 555 | 555 | 1110 | 7.5071 | 0.0000 |
| BNB | 622 | 555 | 555 | 1110 | 3.9638 | 0.0001 |
| USDC | 709 | 555 | 555 | 1110 | 9.1887 | 0.0000 |
| XRP | 622 | 555 | 555 | 1110 | 3.9638 | 0.0001 |
| ADA | 594 | 555 | 555 | 1110 | 2.2822 | 0.0225 |
| DOGE | 606 | 555 | 555 | 1110 | 3.0029 | 0.0027 |
| MATIC | 597 | 555 | 555 | 1110 | 2.4623 | 0.0138 |
| BUSD | 718 | 534 | 536 | 1110 | 11.1330 | 0.0000 |

*Note: Significant @ 5% level*
*Source: Author's calculation*

The randomness of a dataset can be determined through statistical approaches such as the Runs Test, as shown in Table 3. The results indicate that for almost all the cryptocurrencies Z statistic value exceeds the critical value of ± 1.96, leading to the rejection of the null hypothesis that the cryptocurrency return series are random. This suggests that cryptocurrency returns are predictable, revealing inefficient market behaviour.

Table 4: Variance Ratio Test of Cryptocurrency Returns

| | | Different lags (q) periods | | | |
|---|---|---|---|---|---|
| Cryptocurrency | | 2 (q) | 4 (q) | 8 (q) | 16 (q) |
| | Var. Ratio | 0.4467 | 0.2219 | 0.1225 | 0.0607 |
| BTC | Z-stat | -10.4659 | -8.7591 | -6.8977 | -5.3093 |
| | P-value | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| | Var. Ratio | 0.4306 | 0.2206 | 0.1217 | 0.0597 |

| | | | | | |
|---|---|---|---|---|---|
| ETH | Z-stat | -9.6403 | -7.9318 | -6.2553 | -4.9460 |
| | P-value | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| | Var. Ratio | 0.3108 | 0.1369 | 0.0660 | 0.0362 |
| USDT | Z-stat | -3.2355 | -2.6704 | -2.3138 | -1.8905 |
| | P-value | (0.0012) | (0.0076) | (0.0207) | (0.0587) |
| | Var. Ratio | 0.4004 | 0.2123 | 0.1106 | 0.0568 |
| BNB | Z-stat | -7.0571 | -5.6284 | -4.6042 | -3.7249 |
| | P-value | (0.0000) | (0.0000) | (0.0000) | (0.0002) |
| | Var. Ratio | 0.4094 | 0.1627 | 0.0778 | 0.0329 |
| USDC | Z-stat | -3.8504 | -3.3586 | -2.6853 | -2.0679 |
| | P-value | (0.0001) | (0.0008) | (0.0072) | (0.0386) |
| | Var. Ratio | 0.4781 | 0.2283 | 0.1215 | 0.0604 |
| XRP | Z-stat | -6.7499 | -6.0757 | -5.1695 | -4.3243 |
| | P-value | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| | Var. Ratio | 0.4297 | 0.2169 | 0.1177 | 0.0587 |
| ADA | Z-stat | -10.5690 | -8.5973 | -6.7444 | -5.1657 |
| | P-value | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| | Var. Ratio | 0.5281 | 0.2491 | 0.1358 | 0.0669 |
| DOGE | Z-stat | -3.2919 | -3.0916 | -2.6810 | -2.4068 |
| | P-value | (0.0010) | (0.0020) | (0.0073) | (0.0161) |
| | Var. Ratio | 0.4312 | 0.2296 | 0.1209 | 0.0575 |
| MATIC | Z-stat | -9.5471 | -7.6254 | -6.0184 | -4.7203 |
| | P-value | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| | Var. Ratio | (0.2934) | (0.1399) | (0.0648) | (0.0355) |
| BUSD | Z-stat | -2.9614 | -2.3708 | -2.0746 | -1.7348 |
| | P-value | (0.0031) | (0.0177) | (0.0380) | (0.0828) |

*Note: Significant @ 5% level*
*Source: Author's calculation*

Table 4 shows the outcomes of the variance ratio test. The results indicate that the returns on cryptocurrency are statistically significant at a confidence level of five per cent for various lag periods, including 2, 4, 8, and 16, as shown by their respective p-values. This indicates that firmly rejecting the random walk hypothesis, which posits that the returns of a cryptocurrency influence its future movements. Thus, the observed return series for these digital assets are considered weak-form inefficient. In other words, past prices of crypto assets provide an advantage in forecasting future prices.

Table 5: Results of EGARCH (1,1) Model

| Cryptocurrency | Leverage effect (γ) | t-value | Pr(>\|t\|) |
|---|---|---|---|
| BTC | 0.14217 | 9.6409 | 0.0000 |
| ETH | 0.189031 | 6.44728 | 0.0000 |
| USDT | 0.49918 | 28.454 | 0.0000 |
| BNB | 0.250057 | 8.64257 | 0.0000 |
| USDC | 0.156612 | 23.65932 | 0.0000 |
| XRP | 0.580082 | 9.34116 | 0.0000 |
| ADA | 0.924137 | 0.248498 | 0.0000 |
| DOGE | 1.209156 | 19.6629 | 0.0000 |
| MATIC | 0.253728 | 7.9086 | 0.0000 |
| BUSD | 0.417035 | 2.0396 | 0.0000 |

*Note: Significant @ 5% level*
*Source: Authors' calculation*

The results of the EGARCH (1,1) model analysis is contained in Table 5. The γ coefficient, which represents the leverage parameter, is positive, significant, and greater than zero for all cryptocurrencies examined in the study. This indicates asymmetric volatility, where positive shocks have a greater impact on volatility compared to negative shocks. Specifically, the analysis suggests that positive shocks increase future volatility, demonstrating a leverage effect in the return series of cryptocurrencies.

Table 6: R/S Hurst Exponent of Cryptocurrency Returns

| Cryptocurrency | R/S Hurst Exponent |
|---|---|
| BTC | 0.5722 |
| ETH | 0.5728 |
| USDT | 0.4582 |
| BNB | 0.5774 |
| USDC | 0.4490 |
| XRP | 0.5209 |
| ADA | 0.5966 |
| DOGE | 0.5774 |
| MATIC | 0.5827 |
| BUSD | 0.4571 |

*Source: Author's calculation*

Table 6 presents R/S Hurst exponent values for various cryptocurrencies such as BTC, ETH, USDT, BNB, USDC, XRP, ADA, DOGE, and MATIC. The results indicate that most cryptocurrencies exhibit persistent behaviour in their price movements, as evidenced by Hurst exponent values greater than 0.5. This suggests that cryptocurrencies such as BTC, ETH, BNB, XRP, ADA, DOGE, and MATIC tend to follow past trends and that future price movements are positively correlated with past trends. Conversely, USDT, USDC, and BUSD have Hurst exponent values below 0.5, indicating that they exhibit anti-persistent behaviour, with future price movements negatively correlated with past trends. These findings confirm that cryptocurrencies do not exhibit random walk behaviour or Brownian motion.

**Summary and Conclusion**

The market efficiency of cryptocurrency was investigated in this study using several tests. These tests included the Ljung-Box test to assess autocorrelation, the runs test to examine randomness, the VR test to verify the random walk hypothesis, the EGARCH (1,1) model to analyse asymmetric volatility, and the R/S Hurst exponent for long memory persistency.

The Ljung-Box test indicated that there was a strong correlation between past and present daily returns, suggesting that the market does not function randomly. The runs test demonstrated that cryptocurrency returns are predictable, indicating market inefficiency. The VR test rejected the weak form of efficiency, implying that past crypto asset prices can be used to forecast future prices. The EGARCH (1,1) model showed that positive shocks had a greater impact on volatility than negative shocks, indicating a leverage effect where good news increases volatility. The R/S Hurst exponent further confirmed that the returns of cryptocurrencies are persistently inefficient. In conclusion, the study demonstrated that most cryptocurrencies do not hold the random walk hypothesis. This study implies that there are opportunities for investors to achieve abnormal returns by making speculative trades in this inefficient market. The findings of this study have important implications for the growing cryptocurrency market and investment managers, market stakeholders, and regulators. This study is to provide support for investors, portfolio managers, and regulators. However, it's important to understand that this study has limitations. It only looks at a short period and analyses ten specific cryptocurrencies. The applicability of the Ljung-Box test and VR test complicated by the intricacies surrounding the selection of lag determination. The Runs and Bartels tests are restricted in identifying deviations linked to consecutive sequences. The utilization of the R/S Hurst exponent is not accurate for short series or non-stationary data. To broaden the scope of this study, future research should consider exploring market efficiency using a more significant number of cryptocurrencies. Moreover, researchers could extend the study's timeframe to provide more robust observations and employ different econometric models for more reliable results.

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