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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Climate change: role of banks and financial institutions in greening the banking system

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Abstract Global warming and climate change are hot topics of environmentalists globally. The World Bank's 'Climate Change Action Plan' for 2021 to 2025 explains the policies and programs to be implemented by banks and financial institutions to combat climate change. The UN and World Bank have taken actions towards achieving minimal carbon emissions that in turn reduce global warming. In India, national-level financial institutions such as RBI, NABARD, SIDBI and Exim Bank took the lead in formulating policies to achieve the goal of greening the banking system. SBI granted financial assistance for windmills and kick-started green financing activity, followed by all other banks. Financial assistance at the concessional interest rate to renewable energy and energy-efficient projects and buildings, electric vehicles, start-ups, trading green bonds and issues of green mutual funds are introduced by various banks. Additionally, within the bank, a sea change in the form green ATMs, digitalization of banking, issue of electronic bank statements and e-mail communication are started. Various other changes, such as green bank building, purchasing electric equipment conforming to green standards, changing LED lighting systems, conducting conferences and meetings electronically, etc., are implemented in the banks. Thus, both the internal changes within the bank and external changes address the issue of climate change. The study reveals that even though banks have taken the green initiatives a decade back, it is not widely popularized among customers and common people for a nationwide speedy adoption of green banking.

Keywords: climate change, global warming, GBS, SBG, green bonds

1. Introduction

Over the years, the atmospheric temperature has increased at an alarming rate. This phenomenon is known as 'global warming.' The experience of global warming has been prevalent on earth for the past many decades; however, its impact has predominantly started to affect people only a few years ago. There are many reasons for this situation, viz. Industrialization, population increase, and economic growth (Caire ME 2007). Uneven industrialization has disturbed the ecological balance and has resulted in natural and industrial disasters (Rehman et al 2021). Global warming occurs when greenhouse gases such as carbon dioxide, nitrogen dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are released into the atmosphere. These gases continue to increase in concentration in our atmosphere, creating a "greenhouse effect" by entrapping heat from the sun, resulting in an upsurge in Earth's normal temperature. One of the consequences of global warming is climate change. Its aftermath is experienced in the form of floods, draught, tsunami, famine, water crisis, severe climate change, heat waves, storms, wild fire, natural calamities and increase in sea water level.

Climate change is a global economic challenge. It is expected to accelerate in the future and is no longer considered an environmental threat since it affects all economic sectors (Park H2020). Climate change will negatively affect world trade by disturbing the supply chain, resulting in an increase in the cost of products. To establish an equilibrium between nature, people, and profit and to create legislation to contain issues related to climate change, the WTO, UN, World Bank and UNFCCC (United Nations Framework Convention on Climate Change) have conducted various international conferences and adopted policies and programmes to be adhered to by member countries. The 'Climate Change Action Plan' of the World Bank contains detailed guidelines to be followed during 2021 to 2025. This includes (i) reducing greenhouse gases, (ii) aligning climate and development, prioritizing key systems of transitions such as energy, agriculture, cities, transport, and manufacturing, and (iii) financing to support transition in the form of concessional finance to support global effort. Channelizing bank credit for purposes that promote the reduction of greenhouse gases is termed greening the banking system.

The World Bank's action plan is for impactful mitigation and adaptation opportunities and thereby controls climate finance. This is achieved by the emissions of the largest emitters with curves and helps to successfully achieve resilience and

adaptation to climate change. Record levels are achieved by the bank, which has an impact on delivering climate finance to seek solutions (World Bank 2021).

2. Greening the Banking System

The average temperature of India over the past few centuries has increased by 0.7 degrees and has increased due to climate change. India is currently the world's third-largest carbon emitter, followed by China and the United States of America. In view of this alarming position, many solutions are needed by India for adaptation and mitigation of climate change. This includes the development of green sectors such as renewable energy, creating energy efficiency, and a low-carbon footprint. To achieve the structural transformation, enormous funds are needed. The banking sector has a main role in providing financial resources. It has become the backbone for the real economy. Green banking is facilitating the growth of green sectors.

Greening the banking system or green banking is a potential drive for growth. A growing number of countries are now exploring green banking systems. The Reserve Bank of India establishes ***IDRBT or the "Indian Institute for Development and Research".*** It defines the term umbrella for green banking with reference to guidelines and practices with makes sustainability in the environment, economy, and social dimensions. (IDRBT 2013). Green banking is denoted according to the Association of Indian Banks, and the normal banking system is denoted by green banking, which involves all aspects of the environment as well as society with the aim of ensuring the utilization of the best natural resources and ecological sustainability. Banks can play a vital role in this regard by channelizing funds to finance climate-friendly and sustainable projects such as the production of energy from renewable sources such as solar, wind, and biogas, the construction of energy-efficient green buildings, inspiration to adopt clean transportation, and the implementation of efficient methods for recycling waste to support the greening of the economy (RBI Bulletin 2021). Green banking adopts the practices and guidelines that make banks environmentally, economically, and socially accountable. Moreover, banking business should be conducted to reduce the emission of external carbon overall along with the footprint of internal carbon. (Garg 2015).

3. Greening Schemes of Global Banks and Financial Institutions

International organizations such as WTO, UN, G20, etc., set green growth as one of the top priorities (Rakic and Mitic 2012). The central bank score card on green banking activities based on the four parameters of research and advocacy, monetary policy, and financial policy and leading by example reveals that most countries are active in research and advocacy, but little progress has been made in other parameters. China, Brazil, France, the United Kingdom, and the European Union ranked on the top list of countries with higher scores for implementing green monetary and financial policies. The rank of the United States of America is 13 and that of India is 15 as of March 2021 (Barmes and Livingstone 2021).

The Green Climate Fund (GCF), the largest global fund committed to climate change, is USD 137 million and is focused on India's 1st Green Growth Equity Fund (GGEF) for climate**.** Activities for climate-resilient and low-carbon across chain value of energy. Technologies for renewable efficiency, generation of renewable energy, and transport of low carbon, along with the conservation of resources, are included. This also includes waste management and water. Grants and equity are provided by the fund to quicken the infrastructure of green projects in India.

The World Bank's Sustainable Development Bonds (SDB) Impact Report 2020 states that an amount of 124.6 USD billion was committed to various green field sectors, such as agriculture, renewable energy and energy efficiency, clean transportation, and water and wastewater management. The funds were committed to two functional areas: first, to mitigate the existing sustainability risks and second, to adapt new technologies or programmes to ensure sustainable and balanced growth. Out of the committed amount of 124.6 USD billion, allocated amount stands only at 72.1 USD billion. Sector wise allocation of funds is depicted below in figure 1 and table 1 below.

Table 1 World Bank SDB - Sector wise commitment and allocation of funds.

Sector	Committed. USD eq. billion	Allocated. USD eq. billion
Fishing, forestry, and agriculture	6.9	2.4
Education	6.0	2.6
Extraction and Energy	19.0	11.7
Sector of finance	8.4	5.2
Health	8.3	3.4
Trade, services, and Industry	9.0	4.9
Communications and information	0.3	0.1
Administration in public	15.7	11.7
Protection socially	10.9	7.3
Transportation	24.6	15.1
Sanitation, management of waste, and water	15.5	7.7
Total	124.6	72.1

Source: World Bank SDB Impact Report 2020.

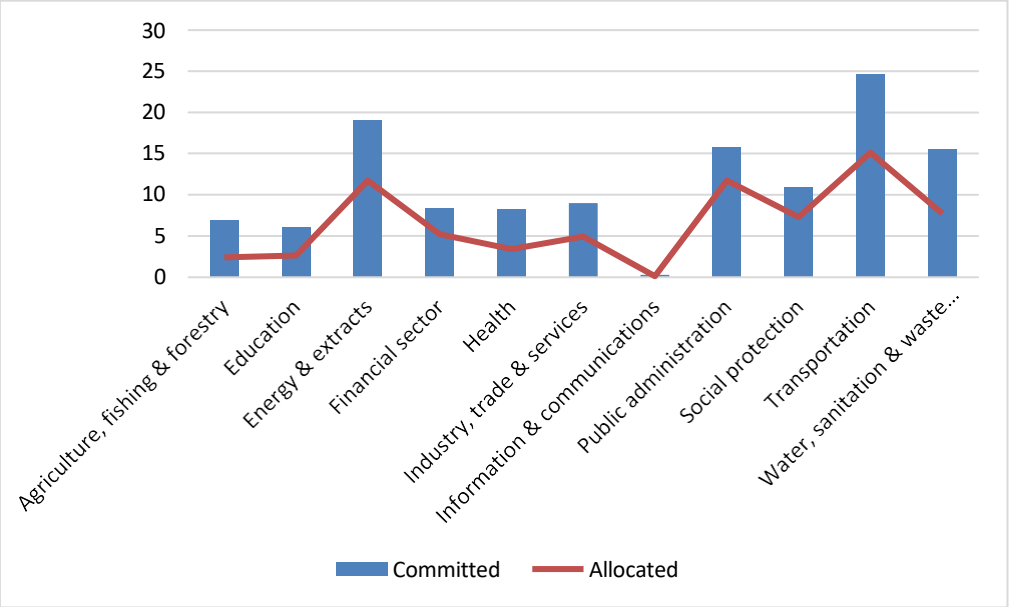

Figure 1 World Bank SDB - Sector wise commitment and allocation of funds. Source: World Bank SDB Impact Report 2020.

Region wise commitment and allocation of funds is illustrated in table 2 and figure 2 below.

Table 2 World Bank SDB - Region wise commitment and allocation of funds.

Region	Committed USD eq. billion	Allocated USD eq. billion
Africa	7.8	5.2
East Asia and Pacific	26.2	15.6
Europe & Central Asia	23.7	14.5
Latin America & Caribbean	27.9	17.9
Middle East & North and Africa	18.5	10.4
South Asia	20.5	8.5
Total	124.6	72.1

Source: World Bank SDB Impact Report 2020.

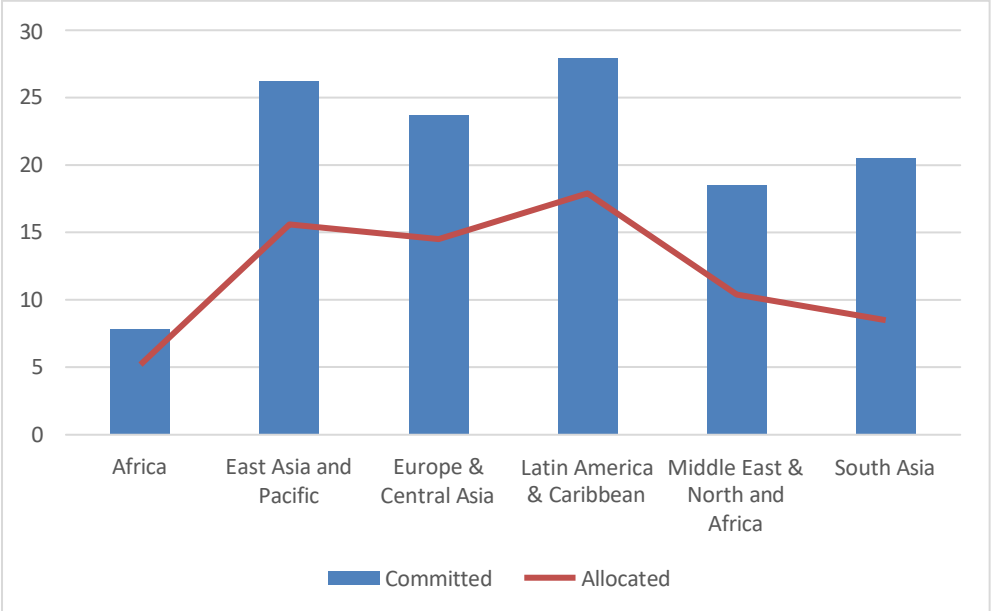

Figure 2 World Bank SDB - Region wise commitment and allocation of funds. Source: World Bank SDB Impact Report 2020

A summary of green bonds issued country wise from January 1, 2018, by corporations and governments with the percentage (amount and number) of green bonds out of all bonds issued is given in Table 3. It shows that the percentage amount of green bonds vis a vis all bonds issued ranges from 0.05% to 1.17% only. Considering the huge requirement of green financing, it is observed that the issue of sustainable green bonds is to be increased substantially.

Table 3 Green bond issuance since January 1, 2018 (issued by both corporations and governments).

Country	Amount issued ($Mn)	No of bond issued	Amount issued as % of all bond issued	Number of bonds issued as percentage of all bond issuance
Euro area	1,96,854	594	1.7	0.4
China	63,023	183	0.3	0.2
USA	35,421	71	0.2	0.2
Japan	11,815	88	0.1	1.1
South Korea	11,781	44	1.0	0.4
Central & Southern America	8,869	53	0.5	1.0
India	7992	22	0.7	0.3
South East Asia	7208	86	0.6	1.4
Australia and New Zealand	5878	15	1.1	0.8
UK	5311	17	0.4	0.5
Hong Kong	4781	19	0.5	1.0
Singapore	496	9	0.05	1.2
	359429		7.15	

Source: RBI Bulletin January 2021.

Several green bonds have been issued by the World Bank for different projects in India (Table 4). Based on the Green Bond Impact Report 2019 of the World Bank, it is estimated that the outstanding amount of green bond proceeds allocated to support projects in India is US$640 mn, as of June 30, 2019. World Bank Green Bond Commitment towards India as of June 30, 2019, is given in table 4 below. The allocated amount shown below is the amount of green bond proceeds allocated to support the financing of the projects as of June 30, 2019.

Table 4 World Bank green bond commitment towards India.

Sector	Name of Project	Status	Date of Approval	Closing Date	Cost of the Total Project (in US$ mn)	Amount of Allocation (US$ mn)
Efficiency of energy & Energy that is renewable	Development Project of Power System IV	Closed	18th March 2008	July 31, 2014	2114	400
Efficiency of energy & Energy that is renewable	Project of Rampur Hydropower	Closed	September 13, 2007	December 31, 2014	670	400
Efficiency of energy & Energy that is renewable	Solar Program of Rooftop connected with Grid	Active	13th may, 2016	30th November, 2021	915	282.2
Efficiency of energy & Energy	Project of Solar Parks for Shared Infrastructure	Active	30th march, 2017	31st July, 2022	200	8.5
Transportation Cleanly	Sustainable Urban Transport	Closed	10th December, 2009	31st March, 2018	**328.33**	**88.8**
Transportation Cleanly	Corridor - II of Eastern Dedicated Freight	Active	22nd April, 2014	December 31, 2020	**1650**	**295.7**
Management of Wastewater & Water	Improvement of Andhra Pradesh Water Sector	Closed	June 3, 2010	28th July, 2018	**988.97**	**399.2**
Use of land, Ecological Resources & Agriculture, Forests	Climate Resilient Project on Agriculture of Maharashtra	Active	February 27, 2018	30th June, 2024	**599.55**	**4.2**
Use of land, Ecological Resources & Agriculture, Forests	Management Project for Landscapes of Meghalaya led community	Active	March 13, 2018	30th June, 2023	**60**	**0.3**
Use of land, Ecological Resources & Agriculture, Forests	Project of Tamil Nadu Modernization on Irrigated Agriculture	Active	December 1, 2017	June 2, 2025	**455.8**	**48.9**

Source: RBI Bulletin January 2021.

4. Greening Schemes of National-Level Specialized Apex Institutions in India

"NABARD" or ***"National Bank for Agriculture and Rural Development***" is referred to as an apex institution of India for the promotion of rural development and sustainable agriculture through sustainable agriculture that is advanced along with prosperity in rural areas by technical support and financial offerings. Several partnerships have been built with different financial institutions and national entities, along with some nongovernmental organizations. The reason behind building

partnerships is to execute ideas that are novel through guarantees, loans, and finance that are blended in such areas as natural resource management, fisheries, coastal management, and improvement of rural livelihood, roof top model of solar, renewable energy, ecosystem services, and development of watershed, microfinance and coastal management. Disbursment of approximately one-third of cumulative loans is related to climate adaptation changes along with mitigation activities. (***NABARD*** 2021).

SIDBI or the ***"Small Industries Development Bank of India"*** is referred to as India's apex institution of finance that aims to promote and develop financing that includes micro sized enterprises, medium-sized enterprises and small-sized enterprises, namely***, MSMEs,*** mainly in the sectors of services and manufacturing. Plans of national actions are aided by ***SIDBI*** on the topic of climate change. Concentrated initiatives have been taken under the direct financing energy efficiency schemes of the World Bank project to promote responsible business practices, including sustainable financing and cleaner production in the MSME sector, through both financial and nonfinancial support (SIDBI 2021).

Indian Renewable Energy Development Agency Limited (IREDAL 2021) is a public sector financial institution registered as a Non-Banking Finance Company (NBFC) with Reserve Bank of India (RBI) for promoting, developing, and granting financial assistance to green projects of renewable sources of energy and energy conservation. IREDAL performs the functions of a green bank, and its loan portfolio includes only green financing, such as assistance with wind energy, solar energy, small hydro projects and biomass cogeneration projects.

TATA Cleantech Capital Limited (TCCL), the first private sector green bank in India, is a joint venture of Tata Capital Limited (TCL) and International Finance Corporation (IFC). TCCL is registered with RBI as an NBFC. It offers end-to-end business solutions, advisory services, and finance for projects with clean technology in renewable energy, energy efficiency, waste management, water management and other infrastructure projects (TCCL 2020).

Reserve Bank of India (RBI), the regulatory authority of the Indian banking sector, made policies, issued directives on green financing activities and prepared a National Action Plan on Climate Change (NAPCC). It acts as a coordinating agency for banks and other institutions accountable for green finance in India. RBI took the initiative in the development of local green bond markets and improved green finance in India. RBI is a member of the Network for Greening the Financial System (NGFS), a platform for central banks to share the best practices adopted globally in greening the financial system.

The Climate Change Finance Unit (CCFU), founded in 2011 within the Ministry of Finance, coordinates the activities of the banking sector. GOI provides a subsidy of 30% for roof top solar panel installation. The small renewable energy sector is included under Priority Sector Lending (PSL) and is eligible to obtain loans at a concessional rate of interest up to Rs.30 crore for organizations and up to Rs.10 lakh for households.

5. Greening Schemes Implemented by Commercial Banks in India

Commercial banks have played an important role in greening the banking system in India. There are a total of 21 PVBs or "private sector banks" along with 12 PSBs or "public sector banks" in India. In addition, the Indian banking sector has 6 payment banks, 10 small finance banks and 45 banks of the foreign sector (RBI 2021). All institutions have implemented various schemes to achieve the motto of greening the banking system. These schemes can be classified into two, i.e., internal and external.

Financial institutions worldwide are generating exclusive funds for financing green projects, and in this line, India started to issue green bonds from 2015 onwards. Initially, the quantum of green bonds was very limited. However, now it stands at 0.70% of total bond issues. Table 1 below shows the performance of Indian green bonds vis a vis other countries.

6. Internal Green Process

Internal green includes the following arrangements made within the bank.

- Installing more green ATMs and Cash deposit Machines (CDMs).
- Encouraging customers to use electronic means of online banking, mobile banking and WhatsApp banking helps them to carry on banking business anytime, anywhere.
- Encourage online payment of various bills
- Issue of soft passbooks. Account statements to customers and annual reports to shareholders instead of hard copies.
- Shifting internal communication within the bank and to customers from traditional forms of letters, memorandums, etc., to soft communication modes such as e-mail and WhatsApp.
- Using digital platforms to conduct meetings, proposal presentations, credit appraisals, etc.
- Installing energy saving and low carbon emission electrical equipment fixing solar panels, etc., in the bank building and residential quarters.
- Manage the internal business function of the bank in order to reduce the footprint of carbon.
- Arrange to conduct energy audit within the bank. Additionally, yearly energy audit reports should be obtained from assisted manufacturing companies.

- Activities of ***CSR*** or ***"corporate social responsibility"*** conduction in the backdrop of greening the environment.
- Any other measures to reduce usage of hard currency, paper usage, travel, and low emission of carbon footprint.

7. External green services and products

External green services along with products include the following green banking products and services granted to customers.

- Loans and advances at concessional interest rate to small enterprises, medium, micro enterprises and enterprises that are large sized for the investment in green projects that are environmentally friendly in power projects, in renewable energy, projects for energy efficiency, infrastructure projects that are climate resilient, forestry, and agriculture.
- Loans and advances at concessional interest rate to individual customers to construct energy efficient houses, purchasing energy efficient equipment and vehicles.
- Loans and advances at concessional interest rate to individual house owners for investing energy efficient renovation and upgradation of their existing houses.
- Reduction of insurance premium for electric vehicles.
- Use venture capital funds for start-ups developing green technologies.
- Trade in green bonds.
- Introduce green mutual funds and allocate funds exclusively to green companies.
- Granting incentives in the form of redeemable credit points to debit/credit card holders based on the volume of transactions carried by using cards and encouraging them to shift from traditional banking to electronic banking.

Banks have realized their role in environmental sustainability and adopted various initiatives in this regard. Export Import Bank of India, IDBI Bank and Yes Bank issued green bonds in 2015 for the first time in India and set a path to be followed by other banks.

A small sector of renewable energy under the Reserve bank of India was included under the ***PSL*** scheme ***or "Priority Sector Lending"*** in 2015. Energy sector of nonconventional back credit of total outstanding was around Rs.36,543 crore, at the end of 2020 march. Thus, it constitutes 7.9 percent of ***"outstanding bank credit"*** to the generation of power (Table 5), in contrast to 5.4 percent as of 2015 March. These data show the government's commitment to speeding up green financing.

Table 5 Outstanding of bank credit in India to nonconventional energy as of 31 March 2020.

	Banks in Public Sector	Banks in Private Sector	Banks in Foreign	Total Banks
Outstanding amount (Rs. In crore)	21,655	12,302	2,586	36,543
Total credit percentage of power sector	6.2	11.9	27.1	7.9
Total bank credit percentage (personal loans are excluded)	0.5	0.5	0.7	0.5

Source: RBI Bulletin January 2021. BSR, RBI Auditors calculation.

As per the annual report of the State Bank of India (SBI) for FY 2020-21, the Green Channel Counter (GCC) is deployed in almost all their branches. Customers can carry out all transactions in GCC. The Green Remit Card (GRC) is another facility by which customers can deposit cash into predefined accounts at any time. SBI's YONO is the flagship digital banking application providing investment, insurance, and shopping solutions and advisory and market-related information. YONO Krishi serves the farmer's needs online. During FY 2020-21, 13.97 lakh preapproved personal loans were opened digitally. More than 100 traders are active in the online marketplace platform dealing transactions of Rs.641 crore in FY 2020-21. YONO is a path breaking initiative of SBI with more than 79 million downloads and 37.10 million registrations as of March 31, 2021 (SBI 2021).

Punjab National Bank has implemented a rainwater harvesting system in their existing buildings and encouraged environmentally friendly new construction. Bank is spreading the message of the 'Catch the rain" initiative of the government (PNB 2021).

As per Canara Bank's annual report for FY 2020-21, there is a surge of digital transactions in the bank, and the ratio of e-transactions stood at 88.7% in March 2021. Wide publicity is given through social media and lobbies of ATMs along with sending SMSs to customers to utilize digital banks. Online application facilities are available for account opening, Kisan Vikas Patras (KVPs), credit cards, KCC loans, insurance and almost all banking facilities, including Gold Loan. Under Gold Loan, after submitting the online application and details of gold, the eligible amount will be communicated to the customer. After this process, the customer must walk in to the bank and complete the process of pledging. Cheque issue, cancellation, demat account, credit/debit/prepaid cards and a variety of applications are routed online through the OMNI channel of the bank. Card-less withdrawal from ATM is also available to Canara Bank customers. As part of digitalization, Canara Bank has implemented digitalization of documents, centralized storage, work-flow automation and creation and storage of digital files. All these innovations are towards the motto of 'go-green' initiative and reduced paper usage. (Canara Bank 2021).

Union Bank of India is using digital applications in their all-banking services. During 2020-21, the overall digital transactions stood at 79.11%. As part of technology innovation and implementation of hassle free 24x7 service to its employees, HRMS mobile application and iOS platform for employees are introduced (UBI 2021)

Axis Bank issued the Green Bond of USD 500 million in June 2016. The Bond is the first certified bond of any Asian bank under Climate Bonds Initiatives standard version 2.1, and it is the first such bond issued by an Indian company listed in the London Stock Exchange. In terms of transportation for low carbon, energy projects that are renewable, and building's energy efficiency, the proceedings of the issues had been allocated. In addition, the bank has taken various steps to greening the banking system, viz. Solar panel installation, solar power purchase, use of lithium-based batteries across branches, replacement of conventional lighting with LED lights, inverter-based air conditioning, installation of motion sensors for workstations, common areas and rainwater harvesting (Axis Bank 2021).

To reduce the greenhouse effect, the Bank of Baroda does not finance new projects producing or consuming ozone-depleting substances and units manufacturing aerosol units using chlorofluorocarbons (BOB 2021).

ICICI Bank has availed a line of credit from multinational agencies for financing green projects such as wind, solar, bio mass plants and energy efficiency projects. As of March 2021, total outstanding assistance granted under the line of credit to green projects amounts to USD 70.8 million (ICICI 2021).

"IDBI Carbon Developments" is a newsletter of IDBI Bank. This gives a price analysis for ***CERs*** or ***"Certified Emission Reductions"*** for the future as well as in the present. There are changes in the market of carbon, trading of ***rec or "Renewable Energy Certificate".*** Mechanism of ***PAT or "Perform Achieve and Trade"*** has been launched by the Indian government. This information facilitates the lenders.

8. Conclusion

Greening the banking system is gaining momentum in India. The banking sector has a role in the nation's progress towards reducing the carbon footprint and building a sustainable and resilient environment. Construction of new green building, renovation of existing building by adopting green initiatives, conducting energy audit internally and in assisted industrial units, moving towards paperless banking, efficient sewage treatment, waste water treatment, management of waste (including e-waste) and adopting plastic less system, green data center, adoption of water conservation methods, conducting internal meeting & committees by electronic means and thereby follow the ***"ESG"*** **or,** ***"Environmental, Social and Governance"*** policies related to the Government, obtaining shareholders consent to receive annual reports and other notices through e-mail, sending bank account statements and other communication to customers electronically, encourage customers to use electronic banking, granting concessional loans to projects and products complying to energy saving, utilizing green technology that is environmentally friendly, and energy efficient. International organizations such as the UN and World Bank are working towards sustainable economic growth in all countries. Eventually, to attain the desired result of green financing, the issuance of green bonds must be enhanced. Despite the fact that banks have taken the green initiatives a decade back, schemes of financial assistance under green banking are not widely popularized among the customers and common man for a nationwide speedy adoption of green banking. Banks and regulators should see that the message of environmental protection is to be passed on to each customer and society.

Ethical considerations

Not applicable.

Declaration of interest

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Blockchain in banking: a study on central bank digital currency

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Abstract The banking sector has been greatly impacted by the technological outburst of the twenty-first century. Bitcoin, the first crypto asset created on block chain technology, has firmly established itself in the financial sector since its introduction in 2009. The market capitalization of uncontrolled crypto assets has grown at an unprecedented rate, posing a threat to the banking industry and the economy. Illegal activities such as terrorist funding and money laundering find refuge in the unregulated world of crypto assets. To keep up with the demands of the computer-savvy Generation Next, banks worldwide have adopted various technologies and improved their service standards. However, central banks continue to follow the traditional system of issuing hard currency bank notes, which do not match the aspirations of most end users. As a result, Central Banks worldwide are currently brainstorming the introduction of a Central Bank Digital Currency (CBDC). This study aims to explore the theoretical aspect, feasibility, and status of CBDC. Four Central Banks have already issued CBDC, while others are in the process of doing so. Block chain under Distributed Ledger Technology is the most suitable and widely accepted platform for issuing CBDC. Robust computer security measures must be established to prevent hacking and ensure monetary stability for CBDC. During the initial stages of CBDC implementation, hard currency banknotes and CBDC will run parallelly until any possible initial hiccups are resolved. CBDC has the potential to boost banking and finance, trade finance, and cross-border international settlements.

Keywords: block chain, DLG, CBDC, crypto asset, crypto currency

1. Introduction

Technological innovations have been a recurring aspect of human evolution. The global barriers have been dismantled by the Internet and have opened up a plethora of knowledge and information to users. Smartphones have revolutionized the way people communicate. The latest technologies, such as Augmented Reality, Virtual Reality, Internet of Things (IoT), Artificial Intelligence, Machine Learning, Robotic Process Automation, Smart Workplace, Edge Computing, 5G, and Blockchain technology have changed the pace of the global industry, finance, education, trade, and business. In 2009, Satoshi Nakamoto introduced Blockchain technology. Bitcoin, the first crypto asset, was developed using Block chain technology. Data or information is preserved in each block of the chain, which is interconnected with a hash, making the data safe. Of the nearly 10,000 crypto assets in circulation, the most widely circulated assets are Bitcoin, Ethereum, Tether, USD Coin, and Binance Coin.

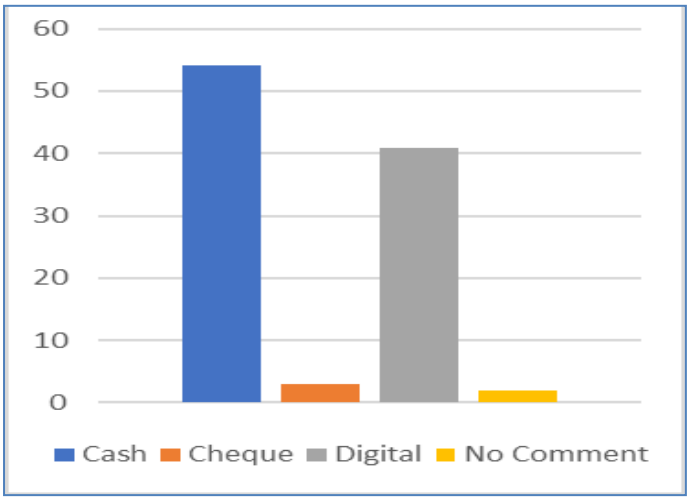
The twenty-first century has witnessed a great leap in global economic activities. Start-ups and venture capital companies are being developed in the business and financial sector by new-generation entrepreneurs. However, the banking sector has been passing through various setbacks due to the all-round decline in economic activities resulting from the Covid-19 pandemic and an increase in non-performing assets. Though the pandemic has turned global economic activity upside down, people have started to use more technologies like Internet banking, Mobile banking, National Electronic Fund Transfer (NEFT), Real-Time Gross Settlement (RTGS), Immediate Payment Service (IMPS), Unified Payments Interface (UPI), National Electronic Toll Collection (NETC- Fastag), Bharath Bill Payment System (BBPS), WhatsApp banking, online and virtual assistance chatbot, and various other digital Apps in their day-to-day financial activities. Digital banking has helped customers transfer funds, make investments, pay bills, and conduct shopping from their comfort zones. As per the Digital Payment Index (DPI) published by Reserve Bank of India (RBI), the Indian digital payments index has shown a remarkable increase from an index of 100 in the base year 2018 to an index of 347.30 in 2022 (Table 1). However, a study conducted by RBI during December 2018 and January 2019 in six Indian cities to find out the most preferred mode of receipts (Table 2) and payments (Table 3) revealed that the mode of cash ranks higher in demand, with 54% for payments and 50% for receipts compared to other modes of transactions like digital and cheques (RBI 2022). The year 2021-22 witnessed an increase in the circulation of bank notes by RBI due to high demand from the public as they hold more currency notes to withstand any possible outbreak of another variant of covid pandemic (RBI 2022).

Table 1 RBI Digital payment index.

Period	RBI – DPI Index
March 2018 (Base)	100.00
March 2019	153.47
September 2019	173.49
March 2020	207.84
September 2020	217.74
March 2021	270.59
September 2021	304.06
March 2022	347.30

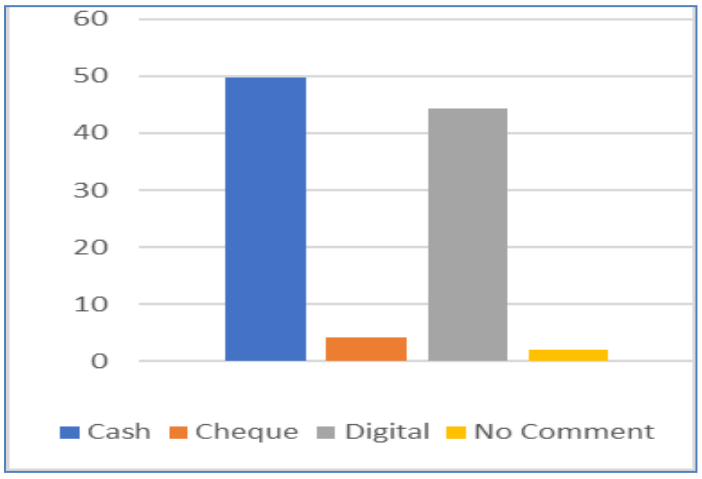
Source: RBI Concept note on CBDC, October 2022.

Table 2 Preferred mode of payment.



Source: RBI Concept note on CBDC, October 2022

Table 3 Preferred mode to receive money for regular expenses.



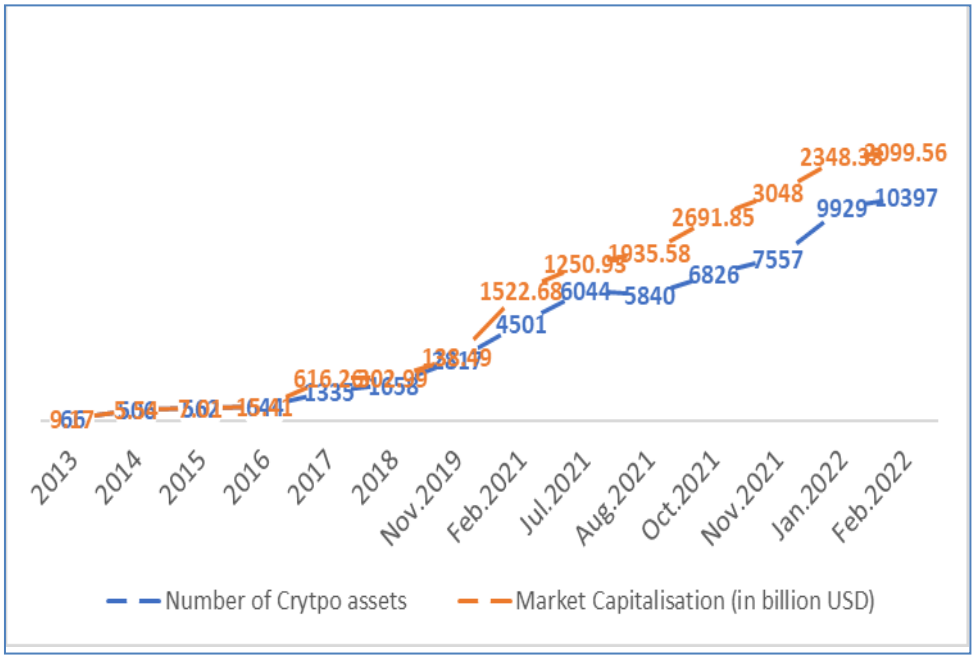
Source: RBI Concept note on CBDC, October 2022.

The financial sector landscape has been changed by Fintech firms directly or indirectly. The growth of non-bank Fintech firms worldwide is another recent development in the financial sector. Various banking services are being provided by these firms, either fully or partially skipping some of the statutory checks, such as Know Your Customer (KYC) or Anti Money Laundering & Combating Financing of Terrorism (AML& CFT) rules, or crucial Asset Liability Management (ALM) criteria. Additionally, financial assistance is being granted to sub-prime business ventures for short-term gains, which may compromise the monetary and economic stability of the nation.

The financial sector has witnessed the growth and acceptance of crypto assets based on blockchain technology, which has led to the mushrooming and development of such assets among investors. The number of crypto asset firms increased from 66 in 2013 to more than 10,000 in 2022. During the same period, the market capitalisation of these assets surged from USD 9.17 billion to USD 2099.56 billion (Table 4). However, it is noteworthy that the top twenty crypto assets hold around 90% of the total market share, and the remaining assets remain inactive.

Crypto assets are highly speculative and volatile as they are created privately. Central Banks are concerned that these crypto assets may undermine their official risk-free currencies, thereby reducing their ability to control inflation and execute monetary policies effectively. These developments may also have a negative impact on the retail banking business. Consequently, the traditional banking system must upgrade to match the technology that meets the demands of the new generation of end-users and establish a seamless and robust global economic system. In this article, digital money issued by Central Banks is only referred to as cryptocurrencies. Bitcoin, Ethereum and similar other cryptos are called crypto assets as private firms issue them and not by any monetary and regulatory authorities authorized to issue currencies.

Table 4 Crypto assets: growth in number and market capitalisation.



Source: Statista.

These developments have prompted Central Banks worldwide to demonstrate their inclination towards digital currency, commonly known as Central Bank Digital Currency (CBDC). CBDC is the digital form of the physical currency notes issued by the Central Bank and possesses all the main features and functions as a medium of exchange and store of value. CBDC is the liability of the Central Bank (RBI 2022). The Central Bank of The Bahamas, Eastern Caribbean Currency Union (ECCU), Central Bank of Nigeria and Peoples Bank of China have successfully issued CBDC, while the Central Banks of three other countries, namely Sweden, Jamaica, and Ukraine, have completed testing the pilot project of CBDC. Many other countries, including India, are currently in initial discussions for the development of CBDC. The Bank for International Settlements (BIS), established to discuss and finalise monetary and regulatory policies and provide banking services to Central Banks, has conducted various projects in association with central banks of different countries, supporting them to adopt CBDC quickly.

2. Objectives

Possibilities have been opened for central banks worldwide to switch from physical currencies to digital currencies due to the progression of blockchain technology and crypto assets. The objectives of the present study are as follows:

- To grasp the theoretical aspect of Central Bank Digital Currency (CBDC).
- To determine the need, feasibility, and explore the implications of issuing CBDC.
- To highlight the current scenario on the adoption of CBDC by various central banks.

3. Literature Review

The traditional banking model is at risk of being disrupted by the power of blockchain technology, which has the potential to create a new cashless banking model that reduces risks and frauds, facilitates cost-effective and rapid transfer of funds and information between banks, and optimizes global financial infrastructure to accelerate economic growth and support a greener banking system (Cocco, 2017). Block chain technology will significantly change payment clearance and credit information systems in banks, and present-day concerns regarding this technology include adequate regulation and security (Guo 2016). Blockchain technology is secure, auditable, accelerates digitalization, and reduces the cost of banking services (Semenchenko 2016).

In India, government financial transactions such as tax collection and distribution of social security amounts face significant delays due to the involvement of several intermediaries in the process. Implementing blockchain technology can reduce these delays by eliminating intermediaries, making financial inclusion and correspondent banking more accessible and profitable (Saripalli 2021). The introduction of a Central Bank Digital Currency (CBDC) directly impacts monetary policy, improves money demand, optimizes payment systems between institutions, and expands the money multiplier effect (Yang J, 2022). Factors such as the financial inclusion strategy of the country and the method adopted for risk mitigation from fraudulent operations will influence the implementation of CBDC (Engert 2017). The introduction of CBDC significantly affects the financial system and the economy, and complete anonymity is recommended. While central banks worldwide do not have strict rules in place to address the risks associated with digital currency on blockchain platforms, innovative technologies in finance, such as digital payment systems, and an increase in crypto assets in the market make it necessary to introduce a digital euro without hesitation (Pelagidis 2022).

4. Theoretical Aspect of CBDC

CBDC is implemented on Distributed Ledger Technology (DLT), specifically using blockchain, the platform utilized to create crypto assets such as Bitcoin and Ethereum. DLT and blockchain are interconnected, with blockchain being a distributed ledger. DLT is the latest and most popular technology for recording and sharing information across multiple ledgers. Transactions are recorded in blocks, with subsequent transactions linked to the initial transaction in a chain-like manner, creating the blockchain. All participants have access to the distributed ledger, allowing them to view the entire chain of transactions. DLT is highly reliable and ensures protection against data tampering. This disruptive technology can render current bank notes obsolete and lead to a fully digital currency system in the long run, significantly changing the banking and financial sector.

There are two variants of CBDC under consideration. The first is called 'wholesale CBDC,' exclusively available by participating intermediaries, such as banks and financial institutions. The second variant, called 'general purpose CBDC,' is open to the general public.

There are two main operational models for CBDC, with central banks able to choose the most suitable option based on their specific requirements. The first model is known as 'unilateral CBDC,' where central banks take full responsibility for issuing, distributing, and dealing with end-users without the help of intermediaries. The second model is known as 'intermediated CBDC,' where central banks are responsible for issuing CBDC but receive assistance from intermediaries such as banks, financial institutions, or even private entities for distribution and dealing with end-users. Under this model, central banks are more responsible for monitoring private entities. The prevailing banknotes operate under an intermediated operational model, making this model the generally accepted one for CBDC (Soderberg 2022).

5. Need, Feasibility, And Implications of CBDC

The technology boom of the 21st century has been fueled by digitalization, which received a boost during the Covid-19 pandemic. Visible changes include the widespread use of smartphones and tablets, social media, and increased digital transactions. Investment in crypto assets has gained wide acceptance, particularly among the tech-savvy Generation Next, which has pushed Central Banks to consider the possibility of transitioning their currency to CBDC. CBDC uses blockchain technology, which streamlines the country's monetary policy, facilitates fast money circulation, and promotes rapid money multiplication (Yang J 2022). Effective payment systems are promoted by quick peer-to-peer settlements, which do not create additional risks to monetary stability. CBDC is expected to result in tremendous improvements in trade finance settlements, reducing intermediaries to a minimum, reducing transactions, saving time and expenses, and seamless auditing.

Transactions made in blockchain under DLT remain permanently in the system and cannot be modified or deleted, ensuring a reduction in fraud and improving operational and service efficiency. This system eliminates the circulation of counterfeit notes and puts a brake on money laundering and using the money for criminal activities such as terrorism, drug deals, etc. In the long run, there will be a considerable reduction in ATMs, personnel, and machinery engaged in printing, upkeep, and distribution of banknotes, resulting in cost savings. CBDC also addresses the issue of climate change and boosts the goal of greening the banking system. It also acts as an efficient medium for financial inclusion.

Although CBDC presents opportunities, it is not free from risks. There may be chances of security threats and hacking of the system. To ensure transparency in transactions and check security threats, a study by the Central Bank of Canada recommended continuous testing, authentication, following best practices, conducting periodic audits, and using dedicated single-purpose devices instead of shared devices (Minwalla 2020).

6. Adoption of CBDC by Various Central Banks

6.1. Countries issued CBDC

CBDCs have been issued by a limited number of countries so far, with blockchain technology being the platform of choice for all four central banks. The status of CBDCs in these countries is detailed below.

The Bahamas: The Central Bank of The Bahamas issued 'Sand Dollar', the world's first CBDC, in October 2020. The country's geography makes it difficult to achieve financial inclusion, with only 20 to 25 percent being achieved so far. As of December 2021, the total amount of banknotes and CBDC in circulation was $535.5 million and $0.304 million, respectively.

Eastern Caribbean Currency Union: (The Eastern Caribbean Central Bank 2022) issues the official currency, the 'EC Dollar', for eight Caribbean countries. In March 2021, the central bank launched 'D Cash', its CBDC. Although it experienced some initial technical issues in January 2022, these were resolved, and there is now 40,000 D-Cash wallet holders.

Nigeria: (The Central Bank of Nigeria 2019) issued 'eNaira', its CBDC, in October 2021 in response to the widespread use of unregulated private crypto assets in the country.

China: CBDC study was initiated by the Peoples Bank of China from 2014 and 'e-CNY' pilot testing has been conducted in batches in various cities since 2019. More than 25 cities have now introduced 'e-CNY'. As of December 2021, around 260 million personal 'e-CNY' wallets and 10 million public 'e-CNY' accounts have been opened, with a cumulative amount of approximately 87.5 billion yuan, as reported by Yang (2022).

6.2. Countries started the pilot project of CBDC

The pilot projects of CBDC in three countries have been completed, and they are waiting for final rollout.

Sweden: Riksbank, which is the central bank of Sweden, a developed country in Europe, has completed the pilot study of CBDC named 'e-Krona' that began in 2017, and the technical and legal checking is ongoing.

Jamaica: Bank of Jamaica completed its pilot study in 2021, and it has invited interested providers for developing a test of potential CBDC as the bank has decided to go ahead with it. The official currency of Jamaica is known as the Jamaican Dollar.

Ukraine: The National Bank of Ukraine issued its official currency 'Hryvnias.' The bank initiated its discussion on CBDC, named 'e-Hryvnias,' in 2018, and the pilot study began under blockchain technology. However, it is not finalized due to technology issues and war.

6.3. Countries started a formal discussion on CBDC

On September 16, 2022, the government approved the issuance of CBDC and released a framework indicating digital currency regulations. A paper was published by the Board of Governors of the Federal Reserve System in January 2022 as an initial step towards gathering public opinion on CBDC in the United States of America. CBDC issuance is being planned by twenty European countries, with initial discussions starting and the final decision set to be taken by October 2023.

Respective Central Banks have reached different levels in their pursuit of CBDC. Project studies on CBDC have been initiated by the Bank for International Settlements (BIS) jointly with many Central Banks to help them roll out their CBDC and ensure international monetary stability and cooperation. Brief information on such project studies is given below, which is a clear indication that Central Banks around the globe are now chasing for introducing digital currencies (Bank for International Settlements 2022).

Project Icebreaker is exploring the advantages of using retail CBDC for settling international settlements conducted by BIS jointly with Bank of Israel, the Central Bank of Norway, and Sveriges Riksbank of Sweden. Project Dunbar is basically for studying the impact of international settlements using multi CBDCs conducted by BIS jointly with Reserve Bank of Australia, Bank of Negara Malaysia, Monetary Authority of Singapore, and South Africa Reserve Bank. Project Rosalind is being conducted for developing a prototype for CBDC by BIS jointly with Bank of England.

Several projects related to CBDC have been initiated by the Bank for International Settlements (BIS) in partnership with different central banks. The settlement project named 'Project Helvetia' is being studied by BIS and the Swiss National Bank, while 'Project Jura' is being conducted for cross-border settlements between French and Swiss commercial banks. 'Project Multiple CBDC Bridge' aims to explore the capability of DLT to support multiple CBDCs for cross-border settlements, while 'Project Aurum' is focused on studying a hybrid model of CBDC and private CBDC.

In India, the adoption of digital technology has been increasing rapidly, and the COVID-19 pandemic has further accelerated the use of digital payments. Investment in crypto assets is also rising quickly, which the Reserve Bank of India perceives as a threat to monetary stability. As a result, the bank has issued a circular advising against transactions related to the purchase and sale of crypto assets. However, this order has been overturned by the (Supreme Court of India 2018), which ruled that the ban would negatively impact the economy if bank accounts used for crypto trading were no longer operational. Although there is no legal ban on crypto assets or regulation of crypto assets in India, technological advancements indicate a quicker adoption of new technology and the introduction of CBDC.

According to (Cocco 2017), amendments to the RBI Act were made through Section 125 of The Finance Act of India 2022, which included the insertion of digital form of notes in the definition of bank notes (Section 2 [aiv] of RBI Act 1934). (The Reserve Bank of India 2022) has completed the initial stage of feasibility testing for introducing the Central Bank Digital Currency (CBDC), ensuring conformity with the objectives of monetary policy, financial stability, effective currency operations, and payment systems.

On December 1, 2022, the Reserve Bank of India introduced the Retail E Rupee on a pilot basis in selected cities in India, including Mumbai, Delhi, Bengaluru, and Bhubaneswar, and will later be extended to Ahmedabad, Gangtok, Guwahati, Hyderabad, Indore, Kochi, Lucknow, Patna, and Shimla. The Retail E Rupee is circulated through identified participating banks, such as State Bank of India, ICICI Bank, IDFC First Bank, and Yes Bank, and later also through Bank of Baroda, Union Bank of India, HDFC Bank, and Kotak Mahindra Bank. All features of existing legal tender currency are included in the Retail E Rupee except the physical existence. Participating banks will circulate the Retail E Rupee among closed user groups through digital wallets which can be stored in mobile phones or any other devices. The holder can use it for payments either to person to person or use it in merchant establishments using QR codes with them.

(Lu 2022) found that while studying the progress of implementation of CBDC in 109 countries, they stand at different stages - pilot study, development, research, etc. According to the Atlantic Council CBDC Tracker 2022, 11 countries have already launched CBDC (8 countries in ECCU are individually counted), 14 countries are in the pilot study stage, 26 countries are on the development stage, 47 countries are carrying out research, 10 countries are not active so far, and 2 countries have currently cancelled their proposal (Figure 1). The global and continental-wise map showing the status of CBDC progress is presented from Figure 2 to 7.

Figure 1 Status of CBDC progress in 109 countries. Source: Atlantic council, CBDC tracker 2022.

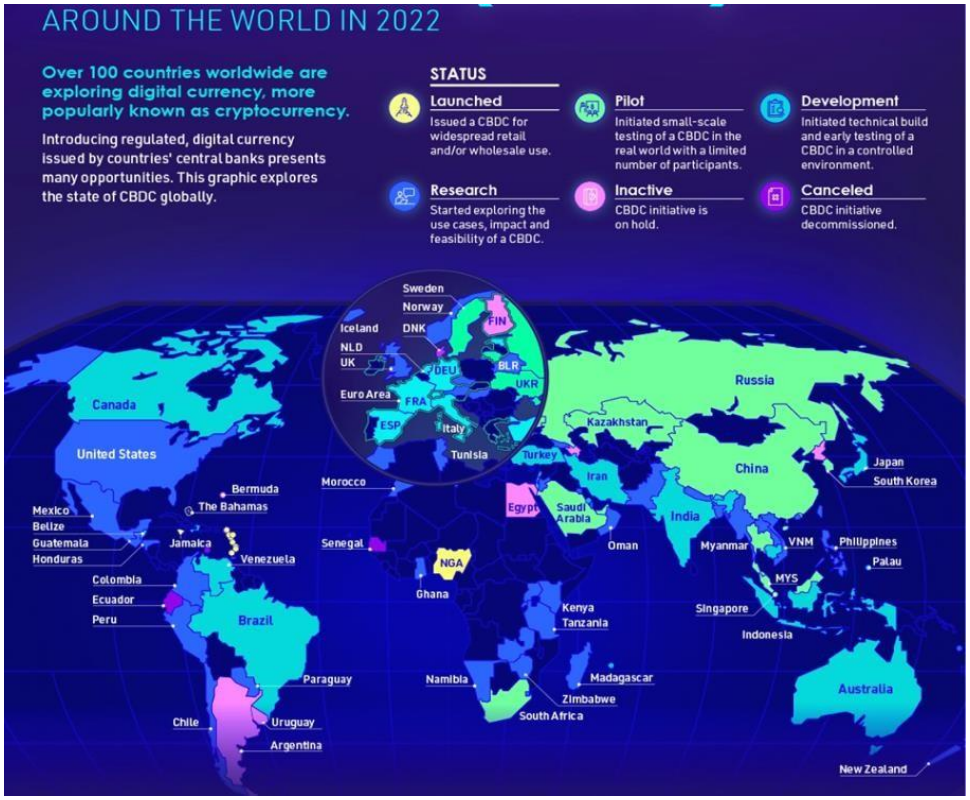


Figure 2 Global status of CBDC progress - at a glance. Source: Atlantic council, CBDC tracker 2022.

Figure 3 Status of CBDC progress in Africa. Source: Atlantic council, CBDC tracker 2022.

Figure 4 Status of CBDC progress in East Asia and Oceania. Source: Atlantic council, CBDC tracker 2022.

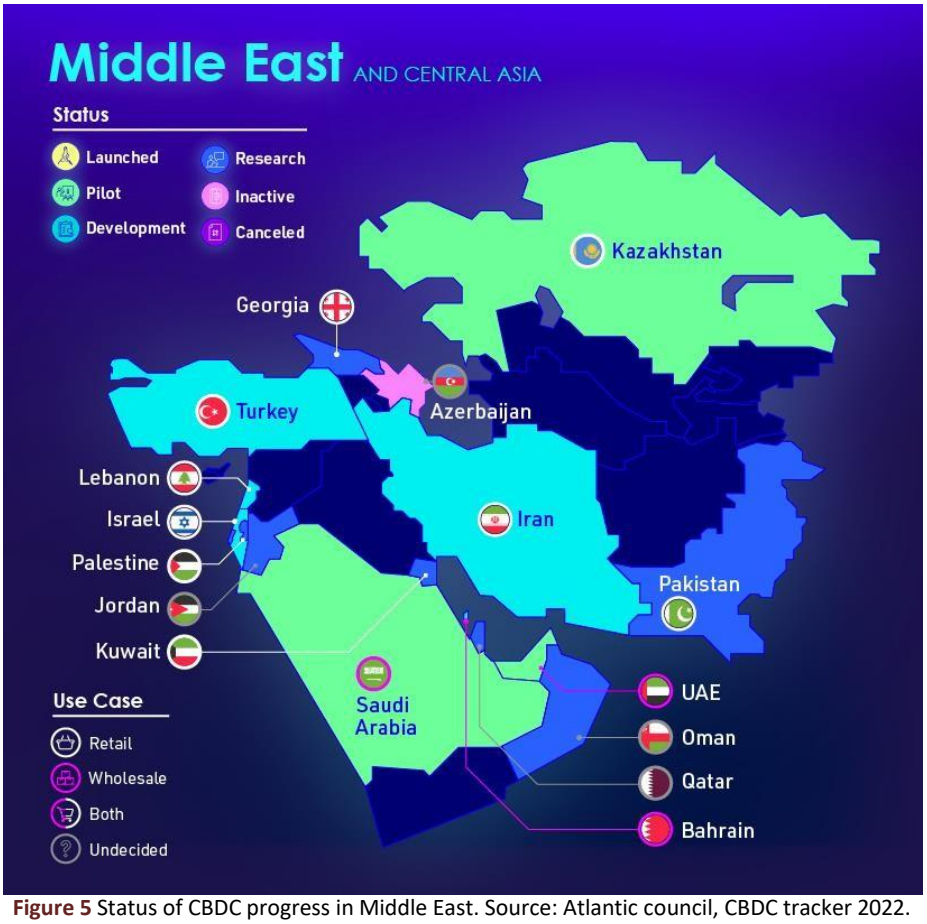


Figure 5 Status of CBDC progress in Middle East. Source: Atlantic council, CBDC tracker 2022.

Figure 6 Status of CBDC progress in South America. Source: Atlantic council, CBDC tracker 2022.

Figure 7 Status of CBDC progress in North America. Source: Atlantic council, CBDC tracker 2022.

7. Future Challenges of CBDC

(i) The non-acceptance and unwillingness of the public to switch from physical currency to embrace CBDC is observed.
(ii) Infrastructure and other resources, such as staff and finance, need to be arranged for the project, including pilot studies, testing, and implementation, as the process incurs significant costs.
(iii) A fool proof cyber security system needs to be established.
(iv) Technological uncertainty is also a concern.

8. Conclusions

The CBDC is still in its early stages, and central banks are compelled to shift from physical banknotes to digital currency due to technological advancements and digitalization. Although existing crypto assets have gained widespread acceptance, they are highly volatile and insecure. CBDC has been introduced by some central banks, and it is recommended that others do the same; otherwise, countries that have issued CBDC may gain an advantage by establishing an efficient network, potentially usurping a large amount of business from other countries.

Ongoing discussions are taking place regarding the operational aspect of CBDC, including whether it should be operated by the central bank itself or partially outsourced to private agencies. However, involving private agencies in the process may pose a security risk, leading to data breaches and negatively impacting the economy, given that central bank money plays a significant role in monetary policy and establishing a robust economy.

The success of CBDC depends on the technology platform and how it is developed to meet the specific needs of each country. Therefore, a series of pilot studies and testing must be conducted before CBDC issuance. Furthermore, physical currency notes should be issued parallel to CBDC as they are a complement rather than a replacement to the current system of paper currency until CBDC is accepted and stabilized.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Impact of legislation on banks portfolio risk and its failure effects

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Abstract The banks work on very strong compliance norms, as they are the custodians to the customer's money. They need to ensure that the money does not belong to them, and it needs to be managed with maximum precision as it becomes a liability on the part of banking institutions. The financial system needs to work on a defined line with a focused approach. There is always a dotted line mechanism to run the business with certain specifics. Banks need to work with the primary objective of protecting depositors' investments, managing risk and ensuring the proper flow of information to all stakeholders. The banking sector needs to always work on preventive and protective mechanisms, and it needs to manage the critical ratio of assets and liabilities, and its mismatch cannot be afforded at any point in time. In recent times, we saw the failure of two banking giants, Yes Bank and Laxmi Vilas Bank, which makes us think about legislation and regulatory compliance in the right spirit.

Keywords: baking risks, legislation, financial systems, corporate governance, risk analysis

1. Introduction

1.1. Background

Banks in India have been working in a very restrictive manner, but the scenario is taking a transformation, as banks have started working in an open environment with a certain degree of innovation in business and have created a more competitive environment for themselves for a healthy and trending business (Danisman and Demirel 2019). The advancement in technology, cross-border intermingling, innovation in products and processes, advanced technological applications and increase in volume of business have necessitated the proactive strengthening of regulatory and supervisory frameworks (Danisman and Demirel 2019) (Mendoza and Rivera 2017). The banks need to be Basel 3 Compliant on all aspects. Indian banks usually have a capital adequacy of approximately 8%, which should at least be raised to the standard of 10.5%, as capital needs should have an additional margin of approximately 2.5%.

1.2. Legislation and banking regulations

The current legislation in India is primarily managed by the Banking Regulation Act, 1949, which evolved from the Companies Act, 1913, which was also applicable to banking companies. The first failure was of Tranvancore National and Quilon Bank in 1938, which actually created the background of RBI's effective functioning, and it was brought to the notice of general public and media galore. Much deliberation during pro-independence and subsequent analysis led to the creation of the Banking Companies Act. 1949. This act resulted in the proliferation and nontangential growth of unregulated banking services (Faleye and Krishnan 2017). There has been regular continuation and updating of the Banking Regulation Act since then. It has become a Paramount medium of Managing Banking structure in our Country. The Onus of Development of Branch Banking was given to Reserve Bank of India. RBI became the solo authority as central banker and has to issue branch licences (Harnay and Scialom 2016).

1.3. Objectives

This paper aims to explore banking risks and the interference of banking regulations, corporate governance and supervision in mitigating and managing associated financial risks and failures.

2. Literature Review

Operational risk management and supporting systems have many aspects attached to it, including works on exposures and incidents resulting from people, processes, information technology networks and uncontrollable events at all points in

time. A very important aspect of this is to integrate qualitative and quantitative data into one aspect, which can be used as a reference point to make all important business decisions.

Cross-border transactions are very critical in terms of BASEL 2, and the same requires multiple levels of approvals at all points of time in different dimensions. The different level of approval in first point checks on FEMA aspect that all transactions are done under regulatory compliance and all parts are taken care of in understanding the taxonomy of transactions and the transaction is also understood best in terms of all compliance aspects at all points of time (Srivastava 2017). The banking group might be managing transactions across the globe, but it needs to obtain approval from all the countries where they are operating in terms of BASEL2 norms, and it needs to comply with the right spirit (Sharifi et al 2016).

3. Monitoring and Risk Management

The Department of Banking Supervision (DBS) was set up within the premise of RBI to monitor the effective functioning of the banking system across all aspects. The Indian banks have now been designed to work on the CAMELS model (Capital adequacy, Asset quality, Management earnings, Liquidity and System). The Foreign Bank works on the CACS standards (Capital Adequacy, Asset Quality, Compliance, Systems and Control). The offsite monitoring and surveillance system (OSMOS) was operationalized in 1955 as a part of Crisis Framework Management for early warning and control. Banks with Growth in Business must also consider managing the critical ratio (Samanta and Chakraborty 2016). All compliance ratios need to be maintained in a very strict manner to have better control of business.

3.1. Corporate Governance

Corporate governance plays a critical role in the long-term financial health of institutions. As we discuss this aspect, the role of Board members becomes very important as they become the Pillar of running the institution. They are experts in framing strategy objectives, compliance, corporate culture and objectives on a long-term and short-term basis. It is very important that banks should be transparent in dealing with both internal and external stakeholders. Every Decision should be communicated in a very rational basis and with Correct Logics and Background. There must also be a periodic internal check in the bank, and it needs to be done on a regular basis. These checks should be performed in addition to external audits or compliance by regulators or any independent agency.

The role of rating agencies such as Standards and Poor, ICRA, CRISIL, and Moody's on all aspects of rating becomes very important. Apart from compliance control, these agencies provide an important reflection on the bank's work and the financial health of all the major customers banking with that particular institution. Banks cannot afford to have a distorted credit structure, as it reflects very poorly on the governance of banks at all levels. Incomplete credit information, poor selection of risks, lack of supervision, overdue of interest and classification of assets are some factors that play a very key role (Faleye and Krishnan 2017; Swain and Samantray 2019).

3.2. Capital adequacy

Capital adequacy is very critical, as banks need to manage optimum capital for all their requirements, whether liquidity conditions or some international cross-border transactions. Banks should always possess a level of liquidity so that they are never out of capital at any point in time. Bank's capital adequacy requires a better understanding and its constitution. Capital adequacy tries to understand the liquidity positioning in the bank as it becomes important so banks are able to meet all their obligations and liabilities in terms of liquidity and commitment (Sehgal and Agrawal 2017).

3.3. Asset Quality

The asset quality is also measured on various parameters, and if there is any misunderstanding or no clarity, it leads to very serious impacts, which need to be managed in the best circumstantial way.

3.4. Risk Management

Risk management is the key for banking at this moment, and as banks are now expanding in international patents, it becomes more imperative to work on a robust risk management process and schedule. Banks should view compliance as a process to manage profitability (Sindhu 2020) (Haque and Shahid 2016). A more advanced approach for data creation and analysis gives us an advanced method of understanding and managing different asset business data. Banks that are able to manage their risk proposition in an effective manner can utilize their capital in a more optimum manner to obtain the best results in terms of profitability and business expansion.

Therefore, the bank's risk management function is very important and the role of Audit Committee and Internal Audit is very important, they have some very important and critical role to perform. They help in the identification of business risk and its magnitudes in an independent manner and the evaluation of the efficiency and economy of operations. Risk management has its own role, and the bank's asset and liability composition play a very important role in the bank's healthy business management.

3.4.1. Credit Risks

Credit risk is a critical component, as it is determined by assets of bank and off-balance sheet items and comparing it with commitments of various risk assessing factors at all points in time. On the basis of risk weights, there is a rating of particular instruments and institutions. The ratings range from AAA to B- as per the risk weights. The lesser the risk involved, the higher the ratings will be. This is very important currently to assess the level of risk in financial institutions.

3.4.2. Non-Performing Assets

NPA (Non-Performing Assets) became a Regular issue with banks with an immediate focus on resolution, which led to the creation of corporate debt restructuring legislation. In terms of lending, different banks have different levels of authority and decentralization, as large banks have to define authority for all individuals at all levels. The large bank keeps different levels of authority at all places for better management of lending or asset business at all amounts and all points of time (Brahmaiah 2019). The appraisal process is standardized as per the compliance norms, and the rate of lending is decided as per the case and business-specific strategy.

3.4.3. Liquidity Regulations

The liquidity regulation is very important, as the bank needs to manage all its ratios at all points of time in proper control and manage it in a better manner, as the ratios form a very important and critical part in the entire scheme of things at all points of time. There must be a limit on the loan to deposit ratio, loan to capital ratio, proper guidelines for the usage and end usage of funds, managing the liquidity ratio at all points of time, stable liquid assets, proper control system mechanism at all points of time, regulatory framework for off balance sheet items and proper methods for asset-liability management with respect to the compliance and governance guidelines.

3.4.4. Operations Risk Management

The consistent framework of operations risk management helps in the improvement of controls and documentation, automation of all activities and control, increased level of risk management understanding, monitoring of risk and control, managing repositories for risk and control processes, and creating proper standards for processes and risk management (Sharifi et al 2016). There are various compliance norms in operations risk management, such as the identification of key risk performance parameters, databases for negative results, mathematical presentation of all data and proper self-assessment processes to understand the operation risk management framework in a better manner.

3.4.5. Market Risk Management

Market risk management is an important tool for compliance, as banks are increasing their ambit of activity, specifically in investment management and trading, as there are the major activities of yielding proper profits and business orientation, and the factor of risk also increases. Banks are now changing very swiftly in their investment activities, and the change is dynamic. A proper risk management structure and strategy need to be placed in a proper and executable manner. Banks need to manage open positions in terms of Commodities, Fixed Income, and Equities and, more importantly, major Trading foreign Currencies at any fixed point in time.

3.4.6. Risk Reporting

Risk reporting is very important, as any dilution can have serious repercussions for bank performance management and impact the health of financial institutions in a very adverse manner. Risk reporting should include an analysis of a portfolio's risk characteristics and various factors that impact them, such as modified duration, value and changes in currency valuation and rate analysis, which means the level of the existing rate at this point in time. Risk reporting should analyse all aspects of risk in terms of return on portfolio and accrued profit or loss on the portfolio.

3.4.7. Performance Reporting

Performance reporting is a very important part of compliance, as it includes various parameters. There is always a benchmark performing index and banks portfolio is compared with that benchmark performing index, the current portfolio risk is measured using value added returns and its numerous calculations, the uniform performance parameter must be used in price comparing strategies.

3.5. Risk Analysis

The risk scenario is more diversified now as we have a specific agenda to work upon and calculate the risk in a very staggered manner. Banks always have financial, operational and environmental risks that impact them at the majority of

times. The central focus of risk analysis on banks is understanding of balance sheets. The balance sheets of banks appraise us with various quantitative factors, and on the basis of these quantitative factors, we work on various ratios to understand the financial health of a particular institution (Sindhu 2020) (Sehgal and Agrawal 2017). The analysis of these ratios helps us understand how a particular institution is performing in its peer group, what are the good practices that one institution is doing for better results and how it can be replicated in an institution where the expected results are not coming and the same can be implemented by imbibing good practices.

When risk analysis is being performed, certain considerations must be kept in mind while doing the same, and the concerned people making the process should be very familiar with cash flow happening periodically where the control of Portfolio manager is very less and it is also not advisable, Time weighted methods, Internal rate of return and Annualized return.

3.5.1. Compliance and Assessment of Risks

The important part of compliance is risk assessment, and we need to understand the level of risk clearly before dealing with it. The level of risk gives us an understanding of the magnitude of risk and proper management. The primary goal is to understand the sources of risk, which include people, processes, systems and other factors at different magnitudes. As information technology is a critical component, we need to better understand the risks associated with it. There is always some level of marketing and technological risk while implementing a new product and process (Swain and Samantray 2019).

The role of compliance becomes very critical, as compliance ensures that all the functions in the treasury, which involve a high value of transactions and other high-volume and critical business activities, involve compiling with appropriate laws and legislation, policies, guidelines, ethical management techniques and other professional standards, which comes with the passage of time at all points in time (Agrawal and Sehgal 2018). Strong compliance functions bring about customer confidence and stronger business propositions, and customer confidence is built very strongly on these aspects and helps in the long run. One very crucial aspect is that all the open items in compliance should be closed in a time-bound manner, and if anything pertains to customers or any other stakeholder, it should be managed more professionally and, in a time, -bound manner.

3.5.2. Supervision process

The supervisory process in compliance is very important, as this helps us understand that all the institutions are following all the norms necessary for the business at all points of time, as if the business does not follow a single norm, which might lead to some penalty and some restriction in terms of business growth. As we have seen currently, RBI has completely issued the strictures for the issuance of new cards by HDFC BANK due to the periodic issues in their systems. RBI has directed the bank to make the systems full proof and reduce the failure/limitation level to almost negligible level, after which they will be allowed to grow the business in the way they want (Haque and Shahid 2016). These are all limitations in the approach to business growth and reaching the desired and set goals, and it has also resulted in a very strong dent in terms of the profitability of the institution. We all understand the criticality of profitability in terms of customer confidence and business development at all points of time.

3.6. Case Studies

The cases of Yes Bank and Laxmi Vilas Bank are very fresh in our minds, as RBI has to impose moratorium on withdrawals due to the poor health of these two banks, and had this not been done, it would have led to serious impacts on financial aspects for stakeholders, shareholders and customers. We will analyse this situation with the help of two live ceases that we saw very recently in terms of the moratorium placed on Yes Bank and Laxmi Vilas bank. The compliance part is very critical at all aspects, and the business has to run in sync with compliance principles, and it needs to be grown from that perspective only at all points of time.

3.6.1. Yes, Bank Failure

Yes, bank started as a very conservative bank, but as time passed and its growth in the business started, the bank started taking some risky calls for faster business growth, which led to great growth in terms of customer acquisition and strong portfolio growth, and the best institutions were screened and landed. The institutions included Anil Ambani group, DHFL, CG Power, Essel, IFF&S, Vodafone, Cox and Kings, to name a few. Some of these were big names, but their business model did not work effectively. These companies were not able to manage business in a way it should have been managing and started incurring heavy losses as the time kept on moving.

In the case of Yes Bank, the balance sheet is approximately 3 Lakh crores in the current scenario, with deposits of approximately 1.5 Lakh Crore and Lending of approximately 75 thousand crores and remaining other liabilities with business and compliance compulsions. NPAs have increased from 1% in 2017 to approximately 7% in 2021, and we can see a negative growth of business denting at 700%, which is never a sign of positive business growth and will reduce profitability. The

deposit in March 19 was approximately 2.25 Lakh crore, which fell to approximately 1 lakh crore in March 2020, this was down by approximately 125%, which was a drastic reduction at all points of time and had a very adverse impact on business. The advances in March 2019 were approximately 2.41 lakhs crores, which decreased to 1.71 Lakh crores in March 2020, and it was a drastic fall; the bank was not able to meet all its liability obligations, and it was under tremendous stress on its liquidity factor, which is evident in terms of deposit and advance correlations (see Table 1).

However, the Governance and compliance standards of Yes Bank were so weak that the Finance Ministry has been personally monitoring the bank since 2017, various advisories were issued to improve efficiency, and Rana Kapoor's approval for extension as an MD was rejected by the regulator. If we look at the lending portfolio of the "yes" bank, the growth in lending was approximately 35% on average for the tenure of five years, and looking at its portfolio quality, the NPA increased by approximately 1000%. This was truly an alarming situation, and it was supposed to be controlled in the best possible and compatible manner at all points of time.

Table 1 State of Financial position of Yes Bank for 5 years.

Year	Total Advances (in Crore)	Gross NPA	Net NPA	EPS	ROE
2019	Rs. 2,41,500 crores	3.22%	1.86%	7.4	6.5%
2018	Rs. 2,03,534 crores	1.28%	0.64%	18.4	17.7%
2017	Rs. 1,32,263 crores	1.52%	0.81%	15.8	21.5%
2016	Rs. 98,210 crores	0.76%	0.29%	12.1	19.9%
2015	Rs. 75,550 crores	0.41%	0.12%	9.9	19.0%
2014	Rs. 55,633 crores	0.31%	0.05%	9.0	25.0%

The problem with Yes Bank was that it could not find proper lenders from the market to support its capital infusion of a minimum of $2 billion, and the regulator also participated in joint meetings with investors, but when nothing materialized, the regulator had to come forth and take the command of Yes Bank, and the moratorium was placed very strongly and restricting the people on withdrawal, as the assessment needed to be done strongly before going ahead on the same.

The Condition is now improving with an inflow of approximately 7000 crores from SBI, and other lenders and banking institutions such as ICICI, HDFC, AXIS, KOTAK MAHINDRA and other lenders have infused a good number of investments coupled with depositors' confidence, which has improved the financial conditions. Consequently, the RBI has replaced the entire Board of directors of Yes Bank and replaced by its own nominees to run the bank in a healthy and better manner at all points of time across all dimensions.

3.6.2. Laxmi Vilas Bank Failure

The Laxmi Vilas bank failure is also a big eye opener for all of us as the shareholders wanted the top management to be removed due to rise in bad loans and subsequent impact on the liquidity health of the bank, there was mismatch in Assets and Liability composition and due to this mismatch, the bank was in bigger trouble and all the parameters were not working as per the designed aspects.

The bank had done lending of approximately 800 Crore to one of the major corporate groups, and they have secured fixed deposits worth the same amount in lieu of collateral security. Some delinquency in transactions was observed, and some employees were also arrested. As a result of this non-payment of loans, the bank was kept in the category of the PCA (Prompt Corrective Action) Group, and the focus of the regulator due to ill financial health immediately shifted on them. The strategy formulation started to manage the banking institution in a better and professional manner. The regulator also appointed a committee to run the day-today business of the bank and maintain effective monitoring and management.

4. Discussion

Banks in business are necessary for the growth of institutions and organizations, but they cannot take the back seat, as compliance is the background of robust business growth, and this can happen only when we support the business in strong terms and all the comparisons and parameters are performed in better aspects and analyses. The regulations have very critical impacts on bank productivity, and they are completely driven by the same. The bank's total factor productivity has a very strong impact on all its macro and micro economic factors, which impacts the functioning of the bank very strongly and at all points of time.

There are various bank-specific variables of productivity and equity that need to be handled and controlled, which helps in the growth of banks' balance sheets and productivity across all dimensions. The balance sheet of the new entity gave a very comfortable picture in terms of strong financial health, as the capital to risk weighted asset ratio (CRAR) stands at 12.51% and common equity tier 1 (CET-1) at 9.61%, which made the business a viable one.

RBI constituted a committee headed by Senior Banker Mr. K V Kamath for restructuring the loans in post pandemic impact, the committee recommended for the restriction of a big loan portfolio as many industries are performing below benchmark due to tough business surroundings. Some industries, such as retail, manufacturing, and wholesale trade, were under stress during the pandemic. Some industries, such as reality and infrastructure, power, steel and automobiles, were

already under stress before the start of the pandemic, and the pandemic caused greater damage to them under the complete scenario. This committee studied the Loan portfolio and found that approximately 37 Lakh Crores of Loan portfolio is under stress and borrowers are finding it difficult to serve the debt obligations, which constitutes approximately 72% of the debt portfolio already given to industry by banking institutions at all points of time. This is the calculated debt by banking industry.

The industry needs to be more careful in terms of funding and needs to ensure that strong compliance is practised while lending in the corporate sector, and all the norms, parameters and guidelines are very strictly adhered to with any iota of mistake and prejudice. The lending process should not be an individual decision; it must be a collective decision where all the norms are followed very strictly and compliance is not compromised at any point in time.

5. Conclusion

Three parameters that were the issue of concern for RBI were the capital to risk weighted asset ratio (CRAR), NPAs and return on assets, as these were very critical parameters for analysis, and the things were not moving in very suitable direction in terms of all the compliance ratios and parameters. Thus, the banking system needs to divide the process into different aspects to manage it better on various fronts, including planning, strong governance with a process-driven approach and strong business development with a growth approach and improvements. There are various functions at the operational level that need to be worked on better and managed effectively, including new client setup, portfolio management, settlement and control and proper risk analytics for managing compliance better.

Ethical considerations

Not applicable.

Declaration of interest

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Study on consumer food preference and brand association in India: A socio-economic study

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Abstract In both small and large cities of India, urbanization is observed, accompanied by significant developments across all industries, resulting in increased prosperity. The success of the food and beverage business is further fuelled by the aspirations of the emerging middle class to emulate Western lifestyles and explore new culinary experiences (Bamberg 1997). A significant driver of this transformation is the shift from traditional joint families to nuclear families, leading to changes in dietary habits as people veer away from traditional meals. Manufacturers have sought to attract new customers and retain their existing market by strategically marketing their products (Bamberg 2006). These dynamics necessitate an examination of consumer behaviour in relation to specific food brands. The primary objective of this study is to assess how various socioeconomic factors influence consumer food preferences (Gabriel 2004). Specifically, the study aims to identify the food brands that residents of Delhi-NCR associate them with. Furthermore, the study investigates the relationship between brand association and consumer behaviour, exploring how this connection influences consumer preferences, recommendations of a specific brand, acceptance of its extended product line, and willingness to pay a premium price.

Keywords: nuclear families, emerging economies, CJF, CFP

1. Introduction and Literature Review

To plan and carry out branding operations, millions of dollars are spent. Daily fresh papers and studies are produced that address new advancements in brand management. This has been a unique occurrence since the 1980s, when independent markets, competitors, and customer choices first appeared. Since then, a wide variety of theories and books have been written about conceptualizing and managing brands. In this sense, various authors have offered various opinions on brand conceptions. Any product or service's identity is fundamentally provided by its brand. When a brand name is connected to a thing, it gains value, much like when a name or title is attached to a person. In actuality, a brand is an abstract idea that is challenging to define and comprehend. As a result, it takes considerable teamwork to define the brand and its management pitch from many aspects (Caroline 2006).

For millennia, storytelling has been an integral part of human interaction. People utilize stories to make sense of their experiences, shape their perspectives, and evaluate situations, thereby gaining a deeper understanding of the world around them (Escalas 2004). Stories also serve as a means to explain natural disasters and other significant events. Bennett & Royle, as cited in Delgado-Ballester and Fernández-Sabiote (2016), define a story as "a series of events in a specific order, with a beginning, middle, and an end." The power of stories lies in their ability to be remembered, persuade, and foster social communication (Aaker 2016). Storytelling is a means of sharing knowledge, experiences, lessons, and ideas through oral or written performances involving two or more individuals interpreting past or anticipated experiences.

Recognizing that human memory is intrinsically tied to storytelling is a fundamental aspect of effective storytelling, as stories serve as a framework for indexing, storing, and retrieving information. One perspective on brands views them as complex narratives, as individuals interpret brands through their own experiences. Consequently, the concept of brand storytelling has become prominent in marketing. Many companies have incorporated journalists, editors, and filmmakers into their teams to create or discover meaningful brand stories and present them in a compelling manner (Aaker and Aaker 2016). Brands increasingly leverage the intellectual and emotional power of storytelling, using it as the foundation for their marketing communications, encouraging consumers to relate to and envision their brands as stories (Carnevale 2018).

"Brand association" is the process of associating a product with a purpose to leave a lasting impression on customers (Gambetti et al 2012). It is one in which a brand is connected to specific concepts, helping it stand out in the marketplace. With the help of these concepts, clients may recall a company or item and generate mental pictures. It actually has a variety of aspects, such as those that are concerned with perception, cognition, and attitude. The purpose of brand association is to

link a brand with favourable attributes. Customers select food goods based on the quality of the brand and conduct in-depth research on the nutritional value of the products. Packaging and labelling have a direct impact on brand choice. Food producers are in a position to comprehend the relevance of the factors influencing customers' purchasing intentions in a market economy and environment of fierce industry competitiveness (Gasson and Waters 2013). Brand managers are therefore developing new techniques to increase brand connection, which associates symbolic imagery with a certain brand, to successfully adapt to the always evolving business environment. With this background, the researcher has attempted to study how Delhi-NCR residents react when they become linked with particular food brands (Burnkrant and Unnava 1995).

A brand story is "a company-designed story about the brand and consists of a plot, actors, causality, and temporality." Brand tales, according to Solja and colleagues, might depict characters engaging with the products and enjoying them, or they can provide knowledge about the origins and development of the brands (Erdem and Swait 1998). Consumer perceptions of a brand might be influenced by compelling origin stories. Some studies have shown evidence of successful brand revival and relaunch, turning long-forgotten brands into "retro" brands by persuading brand tales. A brand narrative places a brand within a framework that enables it to communicate details about the company's founder, legacy, difficulties, mission, and values, as well as the psychological and practical advantages it provides. Good brand storytelling enables consumers to emotionally engage with their brands and supports the development of brand meanings in consumers' minds. Brand equity is increased by the positive and distinctive connotations that well-crafted brand stories provide to a product or service. According to other research, even short stories placed on the packaging of fast-moving consumer goods (FMCG) have a favourable effect on customers' perceptions of the value of the product as well as their attitudes and behavioural intentions towards the brand. People desire happiness, which is a fundamental human drive; when they are pleased, they judge and interact with the brand more favourably (Bruner 1986). Evoking emotions such as pleasure is an essential approach for a brand story to connect with its audience. According to Delgado-Ballester and Fernández-Sabiote (2016), employing compelling storytelling strategies to tell brand tales is an important part of brand-building initiatives and brand strategy communications. According to an assessment of marketing literature, the brand story idea merits more research. Previous studies (Arsel et al 2006) have established the significance of the brand story concept in brand building across a variety of situations as well as in certain areas, such as improving brand equity (Aaker 1996). The lack of study focused on brand stories has been highlighted by earlier authors, who have asked for more empirical investigations. According to the literature, most brand story research examines the persuasive power of tales in the context of branding and advertising (Chaffey et al 2009).

Further research is needed to explore the persuasive power of different types of narratives in advertising, as highlighted by (Carnevale et al 2018). In addition, there is a lack of studies examining the preferred communication channels through which customers would like to acquire and share brand stories in the marketplace, as noted by (Granitz and Forman 2015). Responding to the growing demand for brand narrative research, researchers have begun to delve into this area. Recent literature has shown increased interest in brand stories, not only as a component of advertising but also as a crucial aspect of brand strategy management and creation (Delgado-Ballester and Fernández-Sabiote 2016). However, understanding the importance of conveying a brand narrative and knowing how to effectively do so are two distinct matters, as emphasized by (Kent 2015). Marketers need to grasp the art of crafting captivating brand stories to optimize the impact of their brand messages (Gensler et al 2013).

Despite the various perspectives on the concept of brand stories in the literature, there is a lack of a cohesive conceptual model outlining the steps and components involved in creating brand stories for the market, particularly from the viewpoint of practitioners who make daily brand management decisions. Examining this area of study would be beneficial, as brand stories are company-designed narratives about brands. Investigating and understanding the perspectives of modern brand practitioners involved in the strategic development of brand stories in the market can contribute to the systematic generation of high-quality brand stories for enhancing brand equity. Aaker (2016) emphasized that many marketers have successfully leveraged stories to influence audience behavior beyond mere brand presentations. Therefore, research that adopts a practitioner's perspective is both necessary and timely.

2. Research Methodology

Within the realm of scientific inquiry, the research methodology can be regarded as a branch of science that examines the process by which scientific investigations are conducted. In this context, the research methodology is characterized by two distinct stages: firstly, a comprehensive description is provided regarding the data types and data collection techniques that are relevant to the study; secondly, suitable statistical techniques are employed to test the hypotheses formulated during the initial stage, which aims to address the research questions at hand. The ultimate objective of research is to solve a particular problem, and therefore, it is of utmost importance to establish a connection between the known facts and the unknown elements of the problem in order to draw a meaningful conclusion (Barber 2007).

2.1. Primary Objective of the Study

The study's primary goal is to examine how people react after becoming acquainted with a particular food brand (Georgakopoulou 2006). The study aims to statistically examine the relationship between consumers' socioeconomic status and brand preferences.

2.2. Hypothesis of the Study

The following assertion is made in light of the objective of the study:

H1: Consumers' socioeconomic profiles significantly correlate with their chosen brands.

Foundation for Hypothesis Formulation:

The researchers presume that consumer socioeconomic status and brand preference are strongly correlated. In general, sociodemographic aspects are the most important variables influencing consumer choices for branded goods. Therefore, consumers' sociodemographic characteristics should be considered when evaluating brand decisions. According to brand strategies that should be developed using research findings to target the unique demands and requirements of different consumer groups while also taking into consideration demographics apart for income, the study found that demographic characteristics are unrelated to brand preference (Carroll and Ahuvia 2006).

2.3. Research Design

The study is descriptive because there has already been much research on consumer brand preferences. However, researchers want to draw attention to brand preferences for food because it is well known that in today's fast-paced society, people are more concerned with saving time than anything else. Since food is one of the necessities of life, the study aims to highlight whether socioeconomic antecedents have an impact on the consumer's choice. Examples of descriptive research include surveys and fact-finding investigations. It has a limited scope and only looks at a few aspects of the current problem. The main objective of descriptive research is to explain the current situation. Giving detailed information that could be used to perform further in-depth research is its main goal. The study includes data analysis as well as descriptions of the survey respondents' ages, genders, and educational backgrounds, as well as information on their employment and income levels (Geertz 1973).

2.3. Sampling Technique and sampling size

The target population, the sampling frame, and the criteria used to choose sample responses are all included in the sample design. The purpose of the study is to examine how Delhi NCR residents' associations with food brands affect their decisions to prefer the brand, accept brand extensions, advocate the brand to others, and pay more for it as a result of these associations. Using an easy sampling approach, the respondents were chosen. A total of 683 replies were tallied. The researcher wanted approximately 1000 respondents; however, owing to some limitations, they only managed to gather 683 responses.

2.4. Selection of sample food brands

The study's goal is to look at how people react when food brands are mentioned. However, there are more than 100 food brands accessible in India, making it difficult to conduct the study while taking into account every brand. The following brands were chosen by the researchers based on their shared understanding and general knowledge of the favoured brands: Britannia Industries Ltd (bread, pastries, and dairy goods), Hindustan Unilever Ltd (Kissan squashes, ketchups, juices and jams), Kohinoor Foods Ltd (basmati rice, wheat flour, ready-to-eat meals, and frozen food),

LT Foods Ltd. (Daawat Rice and other specialty foods), McCain Foods India Pvt Ltd (Frozen French Fries, Potato Products, Appetizers), Mondelez India Foods Pvt Ltd (Chocolates under the brand Cadbury, Dairy Milk Celebrations and Chocolairs), MTR Foods Pvt Ltd. (Breakfast mixes, ready-to-eat meals, snacks), Nestle India (Coffee, dairy goods, snacks), Venkys India Ltd-Chicken items, Parle Agro Pvt (Beverages, Water, and Foods).

2.5. Sources of Data

Both secondary and primary data were used in the research.

2.5.1. Method of Secondary Data Collection

Books, articles in a variety of journals and magazines, theses that have been published and those that have not are a few examples of secondary data sources. Websites, papers, and articles related to brand association and consumer reaction were gathered by the researcher (Deighton 1992).

2.5.2. Method of Primary Data Collection

The primary data for the study consist of information on numerous brand characteristics, perceived brand benefits, brand preference elements, brand association factors, brand association aspects, and various consumer response facets (Nandagopal and Chinnaiyan 2003). The first stage of the research method involved conducting an informal, unstructured interview to generate thoughts about the topic being studied. The purpose of the informal interview was to learn respondents' opinions on particular topics to create the final questionnaire. The respondents were encouraged to convey their real sentiments and ideas regarding the topic under consideration. It resembled a spontaneous dialogue or a story told in narrative form. Determining what should be explored and which variables needed more research was the aim of the unstructured interviews. These interviews enable the interviewer to converse informally on the research issue.

2.5.3. Development of the Questionnaire

The questionnaire consists of three sections. The demographic data of the study's sample participants, which includes age group, gender type, level of occupation, level of education, income group, geographic area, family type, and the number of family members, are included in the first section. Information about Delhi-NCR residents' food purchase habits is included in the second section. The concepts of brand choice, factors impacting food choice behaviour, alternative purchasing plans, and the choicest brand are covered in the second section. Four significant facets of brand connection are covered in the third section. The statements under each component are further chosen by examining numerous financial literacy academic works.

The questions were set on a 5-point Likert scale, ranging from strongly disagrees to strongly agree (Charmaz 2012).

2.6. Statistical Tools and Techniques Used

Using SPSS-21 software, the data were analysed using the chi-square test. The chi-square statistic can be used to establish the relationship between categorical variables. The conclusion is supported by statistical evidence when the null hypothesis is rejected and there is evidence of association between the variables. If not, there is no association between the variables.

3. Data Analysis and Discussion

Profiling consumer purchasing behaviour revealed the following results: 77% of the total consumers preferred ready-to-eat food, 80% preferred ready-to-cook and frozen food, 57% preferred noodles and Vermicelli, and 43% preferred pasta and soups. It was also calculated that 54% of them preferred breakfast cereals, and only 26% of them preferred rice and pulses. (Eisner 2017)

In regard to brand choice, 47% of the consumers preferred branded food, and only 29% preferred non branded food, whereas 24% stated that their preference was brand on hand, primarily because of cost-effectiveness. (Easterby-Smith 2008)

No. of advertisements was the major factor influencing purchase decisions, at 38%, followed by social media (24%), the number of family members (20%), store personnel (11%) and peer groups (7%).

When asked about the brand chosen, Nestle was the most preferred brand (12%), followed by Britannia and Lt Foods. (11%) The next in-line choice was McCain Foods India Pvt. Ltd., Mondelez India Foods Pvt. Ltd. (Cadbury) Hindustan Unilever Ltd., Kohinoor Foods Ltd. (Satnam Overseas Ltd.), and Parle Agro Pvt. Ltd. (10%), followed by MTR and Venky (8%).

When asked about alternate purchase plans, 42% stated that the purchase was usually postponed for a definite period, 33 stated that they chose another brand, and 25% stated that they changed stores (Charmaz 2006).

3.1. Hypothesis Testing

All research has certain underlying presumptions based on its theories and literature. These population-based presumptions are generally referred to as hypotheses. By various statistical measurements, the researcher merely makes an effort to determine whether the assumptions are true. The process of testing hypotheses enables the acceptance or rejection of presumptions made in regard to certain goals (Charmaz 2010).

3.1.1. Association of Brand Preference with Socio-Economic Profile

Brand preference is essential for businesses that want to keep target market clients since it raises awareness and helps them build a solid reputation. One of the long-term strategies for increasing sales, earnings, and customer base is to foster brand preference. (Calder 2010). Kellogg on Marketing, John Wiley and Sons Inc, Hoboken, New Jersey. (Carnevale 2018) Additionally, it promotes brand association, which affects a company's acceptance and market power. In light of this, it is crucial to examine sample respondents' brand preferences in relation to their socioeconomic status. These preferences include satisfactory feeling (BP1), Hygienic product (BP2), More Reliable to Eat (BP3), Value to My Lifestyle (BP4), Trustworthy (BP5), and Standardized Product (BP6). To determine whether brand choice correlates with the sample participants' demographic characteristics and whether hypothesis 1 is true, the chi-square statistic is used.

H_1: Brand preference is associated with the socioeconomic profile of consumers.

$H_{1.1}$- Brand preference is associated with age.
$H_{1.2}$- Brand preference is associated with gender.
$H_{1.3}$- Brand preference is associated with marital status
$H_{1.4}$- Brand preference is associated with occupation.
$H_{1.5}$- Brand preference is associated with education.
$H_{1.6}$- Brand preference is associated with income.
$H_{1.7}$-Brand preference is associated with family type.
$H_{1.8}$- Brand preference is associated with the number of family members.

The percentage analysis of the demographic profile of the sample respondents is tabulated below (Table 1).

Table 1 Demographic Profile.

Age (in years)		Number	Percentage
a)	Below 30	145	19
b)	30-50	455	61
c)	More than 50	153	20
Gender		Number	Percentage
a)	Male	403	54
b)	Female	350	46
Marital Status		Number	Percentage
a)	Married	432	57
b)	Unmarried	321	43
Occupation		Number	Percentage
a)	Student	185	25
b)	Govt./private employee	355	47
c)	Business	132	17
d)	Professional	83	11
Education		Number	Percentage
a)	Under graduate	87	12
b)	Graduate	278	37
c)	Postgraduate	259	35
d)	Professionally/Technically qualified	129	17
Annual Income		Number	Percentage
a)	Less than Rs. 5-lakhs	301	40
b)	5-10lakhs	383	51
c)	More than 10 lakhs	69	9
Geographical Area		Number	Percentage
a)	Urban	490	65
b)	Rural	263	35
What is the type of your family		Number	Percentage
a)	Nuclear	536	71
b)	Joint	217	29
Total number of members in your family		Number	Percentage
a)	Below 4	225	30
b)	(4-8)	441	59
c)	More than 8	87	11
	Total	753	100

Source: Primary data collected by the researcher

3.1.2. Agewise Analysis ($H_{1.1}$)

Null Hypothesis

H_0: Brand preference is not associated with age.

Alternative Hypothesis

H_1: Brand preference is associated with age.

The statistical test depicts a weak correlation between age and "Satisfactory feeling". "Hygienic product" is found to be related to respondents' ages. The test results depict a positive correlation between age and "Hygienic product", although the relationship is weak (Ashley and Tuten 2015).

In addition, the test explains a positive correlation between age and "more reliable to eat" in weak form. When used to assess the correlation between "age" and "Value to my lifestyle" as a factor of brand preference, it was found that a weak positive correlation exists between the two factors. Regarding the relationship between "age" and "trustworthiness" as a

component of brand preference, a weak positive correlation was found. The statistical relationship between "age" and "Standardized product" resulted in a weak positive correlation (Eggers et al 2013) (Table 2).

Table 2 Age wise Chi-Square Tests of Brand Preference.

		Value	df	Asymp. Sig. (2-sided)
	Chi-Square	37.763	8	0
BP1	Phi	0.221		0
	V	0.156		0
	Chi-Square	26.42	8	0.001
BP2	Phi	0.183		0.001
	V	0.13		0.001
	Chi-Square	49.882	8	0
BP3	Phi	0.242		0
	V	0.171		0
	Chi-Square	45.236	8	0
BP4	Phi	0.242		0
	V	0.171		0
	Chi-Square	41.93	8	0
BP5	Phi	0.223		0
	V	0.165		0
	Chi-Square	39.479	8	0
BP6	Phi	0.236		0
	V	0.18		0

3.1.3. Genderwise Analysis ($H_{1.2}$)

Null Hypothesis
H_0: Brand preference is not associated with gender.
Alternative Hypothesis
H_1: Brand preference is associated with gender.

The statistical test results depict a weak positive correlation between "gender" and "satisfaction, "gender" and "hygiene", and "gender" and "reliability." & gender and "trust factor" (Table 3).

Table 3 Gender wise Chi-Square Tests of Brand Preference.

		Value	df	Asymp. Sig. (2-sided)
	Chi-Square	12.246	4	0.025
BP1	Phi	0.112		0.025
	V	0.112		0.025
	Chi-Square	13.896	4	0.009
BP2	Phi	0.146		0.009
	V	0.146		0.009
	Chi-Square	13.314	4	0.010
BP3	Phi	0.122		0.010
	V	0.122		0.010
	Chi-Square	8.147	4	0.079
BP4	Phi	0.116		0.079
	V	0.116		0.079
	Chi-Square	17.901	4	0.002
BP5	Phi	0.246		0.002
	V	0.246		0.002
	Chi-Square	8.825	4	0.097
BP6	Phi	0.112		0.097
	V	0.112		0.097

Source: Computed and compiled from primary data.

3.1.4. Marital Statuswise Analysis ($H_{1.3}$)

Null Hypothesis
H_0: Brand preference is not associated with marital status.
Alternative Hypothesis
H_1: Brand preference is associated with marital status.

Statistical analysis of data represents a weak positive relation between marital status and satisfaction level with the food product, one's lifestyle, and trust factor in the food product. It was also found that food reliability and product standardization are statically unrelated to marital status (Table 4).

Table 4 Marital Status wise Chi-Square Tests of Brand Preference.

		Value	df	Asymp. Sig. (2-sided)
	Chi-Square	7.297	4	0.121
BP1	Phi	.098		0.121
	V	.098		0.121
	Chi-Square	10.574	4	0.032
BP2	Phi	.119		0.032
	V	.119		0.032
	Chi-Square	9.157	4	0.057
BP3	Phi	.110		0.057
	V	.110		0.057
	Chi-Square	5.892	4	0.207
BP4	Phi	.088		0.207
	V	.088		0.207
	Chi-Square	12.679	4	0.013
BP5	Phi	.130		0.013
	V	.130		0.013
	Chi-Square	4.589	4	0.332
BP6	Phi	.078		0.332
	V	.078		0.332

Source: Computed and compiled from primary data.

3.1.5. Occupationwise Analysis ($H_{1.4}$)

Null Hypothesis

H_0: Brand preference is not associated with occupation.

Alternative Hypothesis

H_1: Brand preference is associated with occupation.

Post-statistical analysis revealed that there exists a weak positive relationship between occupation and satisfaction with food products, reliability of food products, lifestyle, and trust in food products and standardization of food products; however, it was also found that the hygiene factor is not statistically related to one's occupation (Table 5).

Table 5 Occupation wise Chi-Square Tests of Brand Preference.

		Value	df	Asymp. Sig. (2-sided)
	Chi-Square	26.468	12	0.012
BP1	Phi	0.187		0.012
	V	0.112		0.012
	Chi-Square	18.144	12	0.139
BP2	Phi	0.139		0.139
	V	0.078		0.139
	Chi-Square	33.787	12	0
BP3	Phi	0.205		0
	V	0.132		0
	Chi-Square	38.101	12	0
BP4	Phi	0.218		0
	V	0.111		0
	Chi-Square	23.805	12	0.018
BP5	Phi	0.9		0.018
	V	0.102		0.018
	Chi-Square	28.97	12	0.004
BP6	Phi	0.189		0.004
	V	0.105		0.004

Source: Computed and compiled from primary data.

3.1.6. Education wise Analysis ($H_{1.5}$)

Null Hypothesis

H_0: Brand preference is not associated with education.

Alternative Hypothesis

H_1: Brand preference is associated with education.

The statistical examination of the relationship between education level and consumers with the satisfaction level of food, hygiene of the food product, reliability of the brand, trust in the food brand, and standardization of product is weak yet positive (Table 6).

Table 6 Education wise Chi-Square Tests of Brand Preference.

		Value	df	Asymp. Sig. (2-sided)
	Chi-Square	45.524	12	0
BP1	Phi	0.449		0
	V	0.154		0
	Chi-Square	24.371	12	0.019
BP2	Phi	0.17		0.019
	V	0.113		0.019
	Chi-Square	26.106	12	0.014
BP3	Phi	0.194		0.014
	V	0.104		0.014
	Chi-Square	31.104	12	0.003
BP4	Phi	0.205		0.003
	V	0.109		0.003
	Chi-Square	47.151	12	0
BP5	Phi	0.27		0
	V	0.134		0
	Chi-Square	40.929	12	0
BP6	Phi	0.334		0
	V	0.125		0

Source: Computed and compiled from primary data.

3.1.7. Income wise Analysis (H_{16})

Null Hypothesis

H_0: Brand preference is not associated with income.

Alternative Hypothesis

H_1: Brand preference is associated with income.

The statistical results pertaining to income and other food antecedents revealed that income is positively related to trust in the food brand and standardization of the food product. However, it was also discovered that the income of the consumer is statistically unrelated to the satisfaction level, reliability of the food product and value added to the lifestyle of the consumer (Table 7).

Table 7 Income wise Chi-square tests of brand preference.

		Value	df	Asymp. Sig. (2-sided)
	Chi-Square	13.715	8	0.089
	Phi	0.135		0.089
BP1	V	0.095		0.089
	Chi-Square	10.113	8	0.257
	Phi	.116		0.257
BP2	V	.082		0.257
	Chi-Square	13.897	8	0.084
	Phi	.136		0.084
BP3	V	.096		0.084
	Chi-Square	12.942	8	0.114
	Phi	.131		0.114
BP4	V	.093		0.114
	Chi-Square	19.285	8	0.013
	Phi	.160		0.013
BP5	V	.113		0.013
	Chi-Square	17.341	8	0.027
	Phi	.152		0.027
BP6	V	.107		0.027

Source: Computed and compiled from primary data.

3.1.8. Family member wise Analysis ($H_{1.8}$)

Null Hypothesis

H_0: Brand preference is not associated with the number of family members.

Alternative Hypothesis

H_1: Brand preference is associated with the number of family members.

It was found that statistically, the number of members in a family is unrelated to the satisfaction level of the food product, hygiene of the food, reliability of the food product and its brand and value addition to the lifestyle and it is related to standardization of the food product in a positive manner (Arsel and Thompson 2011).

Table 8 Family Member wise Chi-Square Tests of Brand Preference.

		Value	df	Asymp. Sig. (2-sided)
	Chi-Square	4.127	4	0.389
	Phi	.074		0.389
BP1	V	.074		0.389
	Chi-Square	5.146	4	0.273
	Phi	.083		0.273
BP2	V	.083		0.273
	Chi-Square	4.730	4	0.316
	Phi	.079		0.316
BP3	V	.079		0.316
	Chi-Square	4.911	4	0.297
	Phi	.081		0.297
BP4	V	.081		0.297
	Chi-Square	6.652	4	0.155
	Phi	.094		0.155
BP5	V	.094		0.155
	Chi-Square	1.153	4	0.886
	Phi	.039		0.886
BP6	V	.039		0.886

Source: Computed and compiled from primary data.

4. Findings and Conclusion

The following hypotheses were disproved: "age and education" for all aspects of brand preference; "gender" not for "value to my lifestyle" and "standardized product"; "marital status" except for "satisfactory feeling", "more reliable to eat" "value to my lifestyle" and "standardized product"; and "family type except for "hygienic product". Except for "trustworthy" and "standardized product," "region," "number of family members," and "income" is acceptable. Hence, it can be said that:

- In a weak form, age is correlated with all facets of brand preference.
- All components of brand selection are correlated with gender, with the exception of "Value to my lifestyle" and "Standardized product" in weak form.
- All characteristics of brand choice, with the exception of "Satisfactory feeling," "More trustworthy to eat," "Value to my lifestyle," and "Standardized product," are weakly correlated with marital status.
- All characteristics of brand preference, with the exception of "Hygienic product," are related to occupation.
- In its weakest form, "education" is linked to every facet of brand selection.
- "Income" is not related to brand preferences for "Satisfactory feeling," "Hygienic product," "More Reliable to Eat," or "Value to My Life Style. "
- "Area" is not connected to any preferences for certain brands.
- “Family type” is associated with all aspects of brand preference except “Hygienic product” in weak form.

4.1. Percentage analysis of demographic profile

- Just 19% of respondents are under 30, 61% are between 30 and 50, and 20% of the sample respondents are above 50.
- There are more men than women, 54% to 46%; 57% are married, while just 43% are single.
- The majority, 47%, work for the government or private organizations, followed by 25% students, 17% business owners, and 11% professionals.
- Just 12% of them hold undergraduate degrees, 37% hold graduate degrees, 35% hold postgraduate degrees, and 17% hold technical or professional qualifications.

- The majority (51%) of respondents are in the income bracket of "between 5 and 10 lakhs," while 40% are in the bracket of "less than 5 lakhs" and 9% are in the bracket of "more than 10 lakhs."
- The majority (65%) were from urban areas, and 35% of the participants were from rural areas. Only 29% of the participants were from joint families, and the remaining 77% were from nuclear families.
- A majority (59%) had family members between 4 and 8, 30% had fewer than 4 members, and 11% had more than 8 members in the family.

5. Recommendations and Suggestions

1. Because branding is so important to customers' decision-making processes, it is a desirable brand trait for advertisers. Brand association studies are crucial to gain a deeper understanding of consumer behavior. This will help marketers build a powerful brand name. In other words, creating brand associations may be the key to success for many companies (Chaffey et al 2009).
2. The Indian food industry continues to draw considerable investment, and it continues to experience rapid growth and the emergence of new chains. Established businesses must expand in this industry to keep up with the pace and shifting consumer preferences and behaviour. Given that most consumers prefer branded food products, these companies will need to understand their clients and handle the shift methodically (Bacile 2014).
3. Since the advent of marketing communications tools, businesses from all client segments have had to adjust to emerging trends. It makes sense that food companies would use social media in this day and age. Additionally, regardless of the uniqueness of their services, companies need to interact with customers via social media to obtain feedback on their goods because 24% of people use social media to influence their choice of food brand (Baek 2010).
4. The Indian food industry continues to draw considerable investment, and it continues to experience rapid growth and the emergence of new chains. Established businesses must expand in this industry to keep up with the pace and shifting consumer preferences and behaviour (Bagozzi 2000). Given that the majority prefer branded food products, these businesses will need to understand their clients and handle the move methodically.
5. Based on brand credibility, consumers form psychological notions such as brand associations and brand liking in their minds. It enables marketers to create more persuasive marketing messages that will influence consumers' attitudes and actions. Those who become identified with a food brand because of the brand's credibility frequently highly promote it to others. Only its extended food brand products are accepted and recommended by happy customers. To build a strong brand, marketers must comprehend the phenomenon of brand credibility.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Roles of customer and employee satisfaction on corporate performance: An empirical investigation

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Abstract Employee satisfaction must be improved since it is essential to any organization's ability to succeed financially. This research aims to investigate the link between customer satisfaction and employee satisfaction as well as how each affects organizational success. The impact of several organizational elements on employee satisfaction is examined in this research. In this cohort study, qualitative research techniques were used. A self-administrated questionnaire with multiple choice and release ruined questions were used to gather the data. The results of the principal component analysis (PCA) based on the correlation matrix showed that among the cohorts examined, where consumers had also indicated satisfaction with the current services, there was a high level of employee (hotel staff) satisfaction. Customers' comfort and subsequent satisfaction have mostly been influenced by ambient cleanliness, wholesome meals, and hotel services. From the viewpoint of the workers, a positive work environment combined with rewards like pay and regular training motivated the staff to work devotedly to improve the organization, which is reflected in the customers' satisfaction levels. Our research supports the existence of an indirect relationship mediated by customers between organizational performance and employee happiness. In conclusion, it is plausible to assume that awareness of employee roles is crucial since it seems to be a crucial component of the success of contemporary organizations.

Keywords: customer satisfaction, employee satisfaction, job satisfaction, organizational success

1. Introduction

Organizational success is largely determined by employee happiness. Understanding how to maintain employee satisfaction and motivation to produce exceptional achievements is essential. Customer satisfaction and staff satisfaction appear to go hand in hand naturally, and as a result, both contribute to organizational success. The quality of work also improves as a result of increased employee satisfaction. It is essential for a business to understand how its personnel feels, thinks, and desires, as well as how to better motivate and engage them. Businesses may get better results, increase productivity, deepen engagement, and see a decrease in turnover rates by magnifying employee dedication. The levels of staff happiness and consumer satisfaction are causally related. Without staff loyalty, it is impossible to maintain consumer loyalty. Customer service ultimately relies on the neighborhood that offers that service. Employee fidelity and voluntarism are necessary, particularly for individuals who work in front-line positions. People cannot be compelled to act with loyalty, dedication, or voluntarism. It can only be accomplished by giving them a supportive and enjoyable working environment (Mikalef and Gupta 2021). Corporate performance is a key concern for any business organization as it determines its success and sustainability in the market. Customer and employee satisfaction are two important factors that can have a significant impact on corporate performance. Customers who are pleased with the products or services a company offers are more likely to become repeat buyers and to suggest the business to their acquaintances and members of their family, which might result in a rise in both sales and income. Similarly, when employees are satisfied with their jobs, they tend to be more productive, engaged, and committed, which can lead to improved quality of products or services, reduced turnover, and lower recruitment and training costs (Sharma and Modgil 2020). The success of any business depends on various factors, and two crucial ones are customer satisfaction and employee satisfaction. In latest years, there has been increasing attention to considering the relationship between these factors and corporate performance. Studies have shown that both client and worker fulfillment have a momentous collision on the financial presentation and achievement of a corporation. Customer satisfaction refers to the level of contentment a customer experiences with a company's products, services, or overall experience. On the other hand, employee satisfaction refers to the level of contentment an employee experiences with their job, work environment, and the company as a whole (Tzenios 2019).

It is essential to establish a work environment that inspires employees to provide superior customer service. By performing at a high level, happy people create customer satisfaction, which in turn boosts organizational success and

increases financial success. Therefore, there is a clear link between staff and consumer happiness (Otto et al 2020). The satisfaction of customers and employees is widely recognized as critical to the success of a company. Similarly, worker fulfillment has been linked to lower revenue duty higher productivity, and enhanced consumer repair, all of which can positively impact a company's financial performance. Given the importance of customer and employee satisfaction on corporate performance, many researchers have investigated the relationship between these factors. Empirical investigations have been conducted to understand how customer and employee satisfaction can be measured and improved, and how they can be linked to various performance measures such as sales growth, profitability, and customer loyalty (Akdere and Egan 2020). Business professionals alike have been interested in the link between employee and consumer happiness and organizational success. Empirical research approaches will be used as we investigate the impact of employee and customer satisfaction on the profitability of businesses (Auh et al 2019). Consumer fulfillment is the level of contentment a consumer feels after purchasing a product or service. Employee satisfaction, on the other hand, refers to the amount of contentment a worker feels towards their job, colleagues, & organization. Both customer and employee satisfaction have been shown to have an important collision on corporate performance (Zhang et al 2019). However, the specific mechanisms through which customer and employee satisfaction influence corporate performance are not yet fully understood. The current corpus of knowledge involves investigating the connection between high levels of customer and staff happiness and successful business operations, as well as investigating the possible moderating variables that could be able to explain this connection. By doing so, this research can provide insights and practical implications for managers and decision-makers who seek to improve their company's performance by enhancing customer and employee satisfaction (Rather et al 2019).

The conception, measurement, and examination of several organizational culture factors on company performance were presented by Pathiranage (2019). An analysis of the organizational culture and business success is done. The importance of organizational culture in boosting productivity and performance, which leads to organizational business excellence. Lee et al (2022) explored the connections between organizational performance and the advantages and difficulties of IoT adoption. Therefore, it is anticipated that wounding border expertise, such as the Internet of Things (IoT), would significantly affect corporate operations and supply chain management (SCM). In addition, the moderating functions of supply chain presentation in the link between the advantages and disadvantages of IoT adoption and managerial presentation. The inhabitant of these researches consists of 3019 manufacturing enterprises, whereas 43 manufacturing companies constitute the bare minimum sample size. Hanaysha and Alzoubi (2022) assessed the role of supply chain efficiency as a mediating element in the association between organizational performance and the supply chain in the developed sector. Quantitative research is used to accomplish the goals. Using a stratified sample approach, the researchers sent the online survey questionnaire to the eleven hundred and sixty manufacturers registered in the Federation of Manufacturers database, and they obtained sixty-three replies. Eklof et al (2020) established empirical links between client devotion and satisfaction, and productivity as determined by profit margin, operational income, and market indices. These results should be noted by bank decision-makers as well as investors. They argue that based on the level and pattern of customer happiness, decision-makers and investors may predict the bank's profitability & market success. Sarwenda (2020) provided a framework for investigating how intellectual capital affects the commerce presentation and aggressive improvement of the East Javan pharmaceutical sector. These findings show that the theory is true and is backed by empirical data, which show how human capital influences structural relational capital, competitive advantage, and capital. Relations between capital structures and competitive advantage are impacted. Relational capital has an impact on company performance, which in turn has an impact on competitive advantage. Ali and Anwar (2021) looked at the level of employee happiness and motivation and also discussed the impact of culture on employee happiness. Job fulfillment, motivation, and incentives disparities are a few of the topics covered in this thesis' theoretical framework. One of the most important aspects of the organization is the contact and communication between the staff and the organization. Using partial least squares structural equation modeling (PLS-SEM) and a selection of minute and intermediate-sized food and beverage production corporation, we discovered that CSR does have an influence on company performance when efforts are primarily focused by Gimeno-Arias et al (2021). The outcomes show the way to the conclusion to facilitate, depending on the stakeholder organization at which these events are directed, it may be more advantageous to promote a certain strategy alignment for the business. Na-Nan et al (2021) investigated how worker appointment, managerial assurance, and employment fulfillment serve as incomplete or full intermediaries among the straight and tortuous impacts of self-efficacy on the performance of corporate citizenship as it is expressed. According to the findings of the investigation, self-efficacy not only had a statistically considerable direct impact on the residency performance of corporations, but it also had an indirect effect that was shown in the form of worker appointment, managerial assurance, and work fulfillment. The findings indicated that commitment to the organization, satisfaction with work, and employee involvement all serve as mediators in the spread of exemplary corporate citizenship activity.

2. Materials and Methods

2.1. Measurement

In this study, we look at how employee satisfaction aspects impact organizational performance. To investigate such aspects, firsthand client feedback was gathered. Employee pleasure would lead to consumer satisfaction, which would provide organizational success. Two self-administrated questionnaires were created using the results of the literature research. One questionnaire was made to ask guests about their experiences at hotels, while the other was made to ask staff members about their happiness with their jobs. The following findings were noted in a questionnaire used to gather information on customer satisfaction:

- Personal characteristics of the respondents/customers included gender, level of education, income, and propensity to stay in hotels.
- The atmosphere, environmental cleanliness, meal quality, and service quality that clients experience.

The following findings were made using a questionnaire used to gather information on employee satisfaction:

- Salary and promotions for employees.
- The degree to which workers are satisfied with their physical working environment and the direction and training they get.
- Reaction from workers on their workload and contribution.

All of the replies were scored using a Likert-type scale, with 1 denoting strong disagreement and 5 denoting strong agreement.

2.2. Data Collection

Data for this study was gathered from twelve renowned (five or seven-star) hotels in four major Pakistani cities. Customers and workers were given the questionnaires and asked to fill them up with their particular preferences. Customers provided a whole of one hundred and fifty questions, while staff provided twenty-five questionnaires. Among these, one hundred and thirty-two questionnaires from customers and twenty from employees were chosen for examination since the replies to the other questions were not full.

2.3. Data Analysis

The Statistical Package for the Social Sciences (SPSS) application was used to capture the acquired information and analyze it. To analyze differences between male and female clients, contingency table 1 were created.

The Chi-square test of independence was performed to determine whether or not the visiting customers' educational backgrounds varied by gender. In addition, the Chi-square test was used to investigate the preferences of male and female clients about the length of their stays in hotels. On both kinds of data sets those of customers and those about employees a principal component analysis was carried out to locate the components (variables) that had the greatest loading scores and accounted for the most variation in the data. This would provide us the ability to pick characteristics of the client experience as well as the staff's happiness.

3. Results

A case processing summary of the survey's overall description is given for both male and female respondents. Here, two factors are discussed, one of which is the customers' educational standing and the other of which is the length of their hotel stays. 100% of consumers responded to the first variable, whereas some customers chose not to answer to the second. As a result, during analysis, an instance with missing standards was excluded from the rare information.

3.1. Customer Satisfaction

i) The chi-square test for homogeneity was used to assess the link between the gender of hotel guests and their level of education. The findings show a substantial relationship between male and female clients' levels of education.

ii) The difference in the desired length of stay between male and female clients didn't seem to be statistically significant, and it seems that both sexes are equally likely to choose the hotels assessed for this research when determining how many days they want to remain there.

Due to the huge negative ratings which are also shown in the bi-plot diagram the score of slightly agree and robustly disagree are divided in the 1st dimension. This shows that the majority of guests are picky about the ecological sanitation they have seen in the hotels. This pattern is supported by the PCA, which divided customer answers into several category points that could be seen in the bi-plot diagram (Figure 1).

Each eigenvalue in Table 2 and Figure 2 correspond to an aspect, and each aspect to a dimension. The first three components showed the highest eigenvalues, which indicates a significant proportion of variance and ensures that the first three dimensions (D) account for the greatest amount of variation.

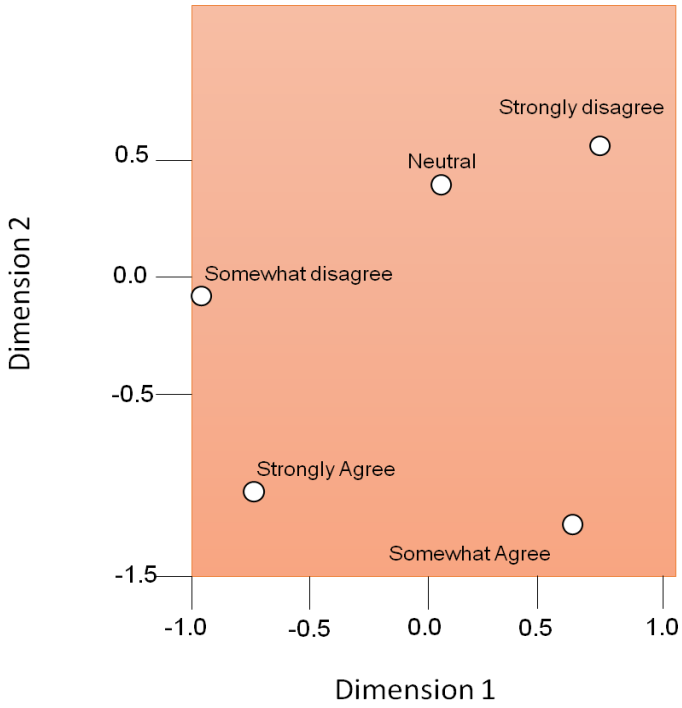

Figure 1 Customer feedback on hotel hygiene using principal component analysis biplot.

Table 1 Education Level.

		Education Level					
		Bachelor's Degree	**Doctorate**	**High school**	**Graduate Degree**	**Less than high school**	**totality**
Male	Count	24	10	24	8	18	84
	Percentage within Gender	28.6%	11.9%	28.6%	9.5%	21.4%	100 %
Female	Count	6	1	14	15	12	48
	Percentage within Gender	12.5%	2.1%	29.2%	31.3%	25.0%	100 %
Totality	Count	30	11	38	23	30	132
	Percentage within Gender	23.7%	8.3%	28.8%	17.4%	22.7%	100 %
				Pearson χ^2 = 15.45			
				P < 0.005			

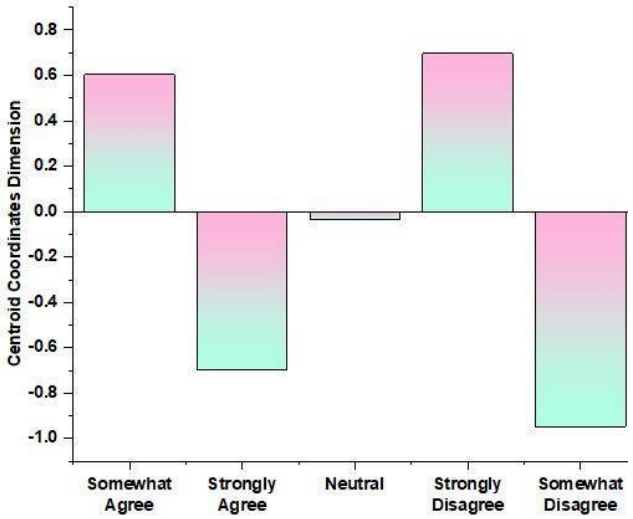

Figure 2 Centric coordinates dimension - Analyzing Categories.

Table 3 shows the Summary of Case Processing and Table 4 shows the PCA-derived variable principal normalization.

Table 3 Summary of Case Processing.

	Summary of Case Processing					
	Applicable		Missing		Totality	
	N	%	N	%	N	%
Education vs. Gender	131	100 %	0	.0%	131	100 %
Stay vs. Gender	88	66.4%	43	31.6%	131	100 %

Table 4 The PCA-derived variable principal normalization.

	Stay in Hotel						
	1 day	2 days	3days	4days	5 days	6 or more days	totality
Male Count	6	14	15	17	15	5	75
percentage within Gender	9.3%	18.6%	22.1%	22.6%	22.2%	5.4%	100 %
Count for Female	3	2	4	3	2	0	12
percentage within Gender	15.5%	22.2%	38.6%	15.3%	7.6%	.0%	100 %
overall Count	8	19	22	21	16	5	88
percentage within Gender	11.2%	21.3%	23.7%	22.4%	19.2%	4.6%	100 %
				Pearson $\chi 2 = 3.97$ Non-significant			

Table 5 shows the results of the PCA for variables expressing customer satisfaction included in this study if the scores were more than 0.5.

Table 5 Outcomes of the PCA for variables expressing customer satisfaction were included in this study if the scores were more than 0.5.

Description for Variable	Derived primary components				
	D1	D 2	D 3	D 4	D 5
Eigenvalues	1.597	1.514	1.384	1.273	1.174
Overall customer satisfaction	0.72	-	-	-	-
Education	0.71	-	-	-	-
Duration of Hotel Stay	0.68	-	-	-	-
Environmental cleanliness is closely monitored	-	-	-	-	0.78
Healthy hotel atmosphere	-	-	-	-	0.61
Being played appropriate music.	-	-	-	–0.75	-
Perfect interior decoration and design	-	-	–0.64	-	-
workforce pays attention	-	-	-	0.68	-
Employees are polite and helpful	-	-	-	-	-
excellent room services	-	0.67	-	-	-
decent food quality	-	-	0.72	-	-
Good beverage quality		0.77			
Excellent in both appearance and flavor	-	-	-	-	-
The excellent variety on the menu	-	-	-	-	-

Table 6 and Figure 3 show the results of the PCA for variables expressing employee satisfaction included in this study if the scores were more than 0.5. The data showed here show that overall customer satisfaction was pretty good, especially among educated customers who chose to stay in hotels for longer periods. Along with good-quality food, drinks, and room services, environmental cleanliness and a healthy atmosphere also played a role in raising consumer satisfaction levels.

Table 6 Results of the PCA were included in this table for variables expressing employee satisfaction with scores greater than 0.5.

Description for Variable	Derived primary components			
	D 1	D 2	D 3	D 4
Eigenvalues	3.420	2.045	1.428	1.150
Monthly Income	0.59	-	-	
Training and guidance		0.67	-	-
The physical working environment is excellent	0.66	-	-	-
Rules and restrictions have a detrimental impact on your performance	-	-	-	–0.54
All employees at your hotel are promoted with their performance	–0.72	-	-	-
Salary is reasonable according to the job	0.88	-	-	-
Many colleagues left the job because the Salary was not reasonable	–0.81	-	-	-
You are satisfied with this job	-	0.55	-	-
Appropriate recognition is given for my contribution	-	-	0.59	-
The workload of my job is reasonable	-	0.68	-	-
I spend parts of my daydreaming about a better job	–0.68	-	-	-

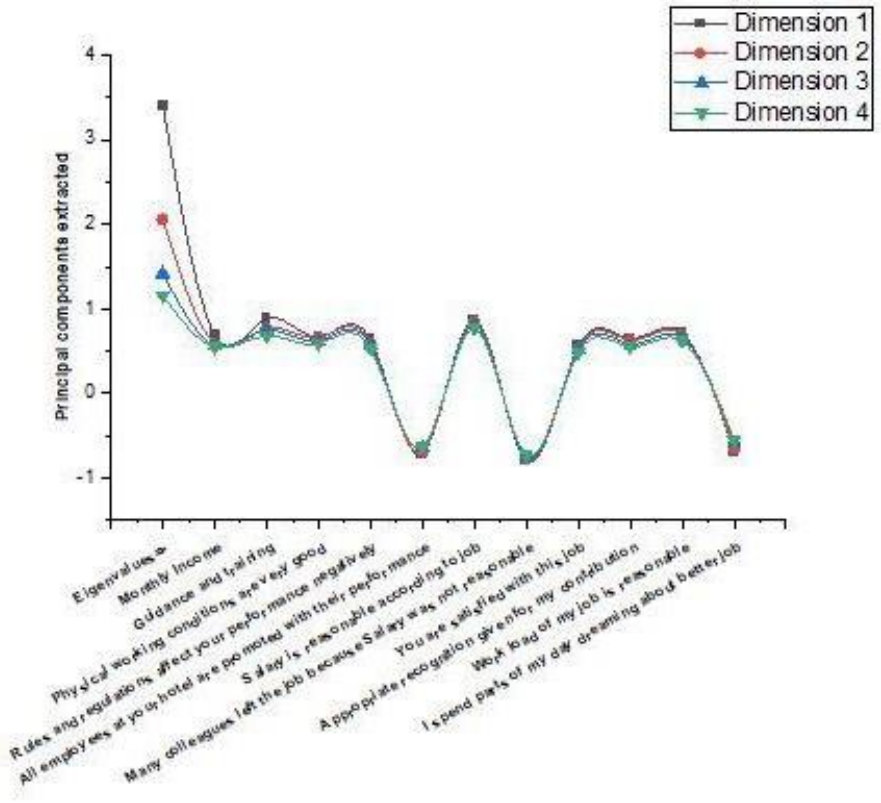

Figure 3 Outcomes of employee satisfaction with scores (>0.5).

3.2. Employee Satisfaction

The PCA that was carried out on the variables that were relevant to workers' levels of satisfaction demonstrated a clear connection between those levels of satisfaction and the parameters that were examined. The data set showed that the first two dimensions of the main component axis had the greatest eigenvalues, which indicated that these dimensions had the most variation. The majorities of the workers were able to continue working at their current jobs and did not leave their jobs due to an insufficient wage, which was one of the characteristics that were assessed. Monthly income and working circumstances allowed this. The principal component analysis scores obtained on the 2nd-factor axis also explain why workers haven't considered looking for or fantasizing about alternative professions since they are content with the supervision and training facilities.

4. Discussion and implications

The major conclusions are as follows:

- Hotel cleanliness is a concern for the patrons. Additionally, it demonstrates the attention of staff if cleanliness in hotels is carefully watched.
- According to the variables with the highest principal component analysis scores, general customer satisfaction is particularly listening carefully to appreciating certain hotel features, such as a healthy environment and high-quality food and drinks. Additionally, room service has been a priority for clients who appreciate their happiness.
- Among the majority of the factors found in our research, one element stands out: it would be difficult to increase customer satisfaction unless the involved personnel worked hard. However, this was not the case, since the majority of the concerns relating to the fulfillment of the needs of the customers were satisfactorily handled in the absence of any big influx. This, on the one hand, indicates an enthusiastic workforce of hotel workers and effective managerial performance at the management scale, which, on the additional handover, contributed to the development of enthusiasm and passage along with workers, which is reflected in an elevated stage of customer satisfaction.
- The importance of every organization's long-term commitment to growing its human resources is made clear. Since the significance of the chosen attributes in customer experience and employee satisfaction were found to be interdependent in the survey results, it is important to note that hotel managers who plan their policies and allocate resources while giving their employees top priority will simultaneously advantage from significant customer satisfaction and organizational success.

- The consequences of matching client needs in the future have always been a difficult issue. Our research is thus rather important in establishing the standards for customer satisfaction connected to the hotel sector, especially in the highly competitive atmosphere that exists in our day. Therefore, it could be vital for hotel managers and owners to have more relevant information, date, and accurate regarding different elements of consumers such as demographics, age groups, and financial position to create incentives to attract the attention of the greatest number of customers.

5. Conclusion

The purpose of this research was to investigate the aspects of employee satisfaction that contribute to satisfied customers and organizations' successful. This study looks at how different organizational factors affect employee satisfaction. According to the findings of the PCA based on the correlation matrix, there was a high degree of employee satisfaction among the cohorts studied where clients had also shown satisfaction with the existing services. Ecological hygiene, healthful food, and hotel services have the most impacts on patrons' pleasure and subsequent contentment and we conclude that restricted community enterprises, such as those examined in this research, are not autonomous and are linked by characteristics that are only loosely connected. The study's findings showed that there is no ignoring the impact of employee satisfaction on an organization's success. This research has several drawbacks. Even though the poll was only done in four Pakistani cities, since so few additional cities were included, it is not reasonable to generalize the results. In addition, it is important to thoroughly and meticulously evaluate and interpret SPSS findings. Furthermore, sustaining customer satisfaction is an ongoing process whose foundations are closely tied to the employees whose performance is reflected in client satisfaction and organizational success.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Examining the relationship between employee retention and hr policies in the education industry

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Abstract: The study's goal was to ascertain that procedures in the Hazara Division of Pakistan's education sector were regarded to be related to staff retention. The descriptive survey approach was utilized for the research because it guarantees a thorough account of the circumstances, assuring slight bias in data collect and lower mistakes into the explanation of the data acquisition. A structured questionnaire was used to gather primary data in support of the research. The data were analyzed with expressive statistics that comprised occurrence ranges, distributions percentages, averages, and standard deviation. The study participants discovered a significant favorable association involving training and development (T&D), Performance Management (PM), recruiting and selection, and Employee Retention (ER). The main finding of the present research is that recruiting and selection procedures should be focused on or adopted by education sector personnel to enhance organizational performance. By using PM, organizations inspire others and provide fresh concepts and methods to boost productivity inside the firm. Similar to other professions, education employees undertake T&D to advance their abilities. It is also advised that educational administrators include employees in decision-making since it offers guidance to raise performance standards.

Keywords: employee retention, HR policies, training & development, education industry

1. Introduction

ER is the phrase used to characterize a business's ability to keep its employees motivated and engaged for an extended time. A business may benefit from high staff retention in several ways. A key component of HR strategies and techniques is retention. It starts with choosing the appropriate people and continues implementing numerous initiatives to maintain workers' motivation and engagement in the firm. To build organizational competency, staff retention has received a lot of attention. People now have higher expectations for their employment and responsibilities. Staff performance will ultimately benefit from staff retention. Organizations that can control their workforce can only take full advantage of internal employee development (Alhmoud and Rjoub 2020). Among the problems that managers have is understanding the connection among employee interactions and job happiness that has drawn the most attention regarding numerous professions. Because it has an impact on a business's' profitability, efficiency, and sustainability, ER is also a crucial concern for its competitiveness. ER refers to the practice of motivating people to continue working for the company for as lengthy as is practically possible or until the completion of the assignment, whichever comes first. Keeping employees is challenging now but benefits the business and the individual (Biason 2020). Employees are the most critical asset of a business, and the achievement or failure of a business is often connected with its ability to hire, retain, and adequately compensate skilled and competent employees. Any firm may see the capacity to retain qualified employees as a critical source of advantage. Innovative employees are often asked to stay with their employers, but underachievers or poor producers are advised to go. Employees that increase a business's value, earnings, and overall positive influence should be retained by the organization, provided that this is calculable (Kurdi and Alshurideh 2020).

Early research in company management points to knowledge as the most crucial asset for businesses intent on competing and gaining competitive advantages. Retaining experienced and highly qualified educators and staff personnel is essential for delivering high quality instruction and an effective learning environment, making ER a crucial problem in the education sector. Organizations must establish efficient HR policies and strategies that prioritize employee engagement, job happiness, and career development if they want to achieve high staff retention in the education sector (Papa et al 2020). Providing opportunities for professional growth and progress is a crucial HR strategy. Teachers and other employees in the education sector are highly qualified professionals dedicated to development and learning throughout their lives. Organizations can keep their personnel by providing professional development options like seminars, training sessions, and mentoring programs. These changes may aid workers in learning new things and advancing in their professions, increasing their motivation and job satisfaction (Choy and Kamoche 2021). Another essential element of HR policy for ER in the

education sector is effective communication. Teachers and staff must believe that their organization respects and values their thoughts and concerns. Employee trust and engagement may be fostered via regular communication channels, including town hall meetings, suggestion boxes, and one on one meetings with management ER is among the most significant issues in the education industry (Elsafty and Ragheb 2020). Kalyanamitra et al (2020) assessed the efficiency of HRM procedures used in Thailand's pharmaceutical industry, such as education services, rewards and the term compensation, and achievement appraisal. Satisfaction with work is believed to operate as a mediating factor between HR policies and ER. The study is qualitative, and information was acquired by mailing questionnaires to six pharmaceutical companies using purposive sampling. According to the research, these HR initiatives promote skill development and increase work satisfaction; these are good for ER. Generation Y is starting to work in the hotel industry, but more is needed to know whether they want to stay with it. The study was to discover whether or not certain parts of the organizations inside marketing strategy may impact an employee from Generation Y's willingness to stay with the business. A self-administered questionnaire survey was sent and collected using Qualtrics, an internet service provider. Structural equation modeling assessed a theoretically provided model (Frye et al 2020). Gilal et al (2019) indicated that Green Human Resource Management (GHRM) practices, through workers' environmental enthusiasm, significantly boost ecological performance. In addition, the research findings suggest that the influence of GHRM procedures on ecological infatuation be much more significant once a worker already has elevated ecological values compared to once the employee already possesses poor environmental values. The current study links sustainable GHRM methods to ecological performance to provide new theoretical perspectives to the literature on managing the environment. The research Ju and Li (2019), that are based on person assets theory and hard precise person capital hypothesis, enable us to understand that training and the matches between education and employment, as well as between skills and work, may affect turnover intention non-Western contexts. Additionally, it offers a perspective on the way training involves Employee Turnover (ET) to assist HR development experts in designing employee training.

Ashraf (2019) investigated the impact of operational conditions on ER and educational quality in the concealed superior learning diligence; to determine whether faculty retention mediates working conditions and high-quality instruction at Bangladesh's private institutions. Islam et al (2020) extended to collecting knowledge on millennials' intentions to leave their jobs and work environments and GHRM. Additionally, this is the initial empirical investigation of its kind to be published in the literature of the hotel sector on GHRM practices and millennial turnover intentions. The results' implications, the limits of the study, and recommendations for future academics have all been examined. Wassem et al (2019) investigated to understand better that managers' assistance and capacity development might improve employee performance in the textile sector. The moderating impact of ER resting on the profit of capacity development and management assistance on employee concert is also explored in this paper. Through the use of convenience sampling, data were gathered. To better understand the connections between Turnover Intentions (TI), Perceived Supervisor Support (PSS), and Task Performance (TP), the research Afzal et al (2019) explains the mediational processes at play. According to the study's findings, the academic staff must have appropriate support from the supervisor to grow in self-efficacy. Self-efficacy aids workers in lowering their TI and raising their TP. Oruh et al (2020) examined the connection between managerial employment practices and ET intentions in Nigeria. The public hospitals in Nigeria serve as the location for this study. These hospitals have a record of poor Human Resource Management (HRM) procedures, a non-participatory culture, and managerial relations with employees, and a elevated degree of ET. All of these factors are included in the research.

1.1. The theoretical foundations of the research

The concept is founded on an intellectual and sociological viewpoint that views parties engaging in transactional negotiation as advancing the stability and wellbeing of society. Based on social exchange theories, relationships are developed between individuals via option comparison and individual cost benefit analyses. Studying culture, psychology, and economics provides theoretical underpinnings for the idea. Many of the fundamental concepts of structural and rational thought are included in social exchange theory. The phrase is frequently used in business to refer to an enjoyable; two-way contract that provides for transactions or a direct exchange. The notion of exchange views the working relationship as a social or commercial transaction with consequences for HRM and retention tactics. Economic exchange relationships often include formal, legally enforceable contracts and involve trading monetary benefits in return for labor. On the other hand, social exchange connections are voluntary behaviors that may be inspired by the way a business handles its employees in an attempt that them as well would choose to repeat the favor.

1.2. Recruitment and selection & ER

Recruitment and selection have defined many concepts throughout the past twenty years. For instance, the term recruitment refers to any organizational procedures and choices that influence the quantity or kind of candidates that will submit applications for or accept a particular position. The recruiting decision making process often involves several interviews and evaluations by interviewers and the potential usage of competency tests and assessment centers. The method

of collecting and assessing data regarding a person to present an offer of employment is known as recruitment and selection. Activities aimed at boosting workers' loyalty to the company and giving employees a broad range of aspirational chances that may excel above their peers are collectively referred to as employee engagement activities. Considering the emergence of novel management strategies for ER, changing characteristics of the employees, with the advancement of investigative methods and expertise, it is not unexpected that employee income remains a hot topic of study, with over fifteen hundred studies being conducted on the issue. Recruitment and selection are crucial tools that assist HR managers and the firm as a whole in finding and keeping the best personnel. Although it is well recognized and accepted that bad recruiting choices impact ER in the company, many businesses across various industries still need more efficient hiring techniques. Strategic hiring and selection are hampered in some businesses by current rules, while in others; it is hindered by management inertia.

2. Hypothesis Development

2.1. H1 ER and recruitment and selection have a substantial relationship

2.1.1. Performance Evaluation and Retention of Employees

PM aims to improve outcomes across the board of a business by comprehending and operating within a predetermined framework while also fulfilling set goals, objectives, and competence criteria. Employees in educational institutions assumed they were succeeding better in everyday duties, according to an investigation on employee perceptions of organizational performance management, but there was no connection between their personal achievement and observations of the evaluation and assessment efforts the establishment have within position. The research accomplished that employee opinions about PM only sometimes influence a person's performance in the educational sector. Due to recruiting and training new personnel being expensive, keeping existing staff is one approach to safeguard investments in HR. Productivity is initially impacted by the loss of experienced staff, followed by the period required to train a replacement before it finally suffers from the new employee's absence. Establishing a PM strategy is one step towards keeping workers. The advantages of PM may be used to justify the cost. Making a growth plan for each employee based on their yearly performance evaluation is one aspect of performance management. The leader and the employee work together to design a program to help the employee enhance their career and professional standing in the company. The employee develops a feeling of loyalty and dependency on the organization because it requires time to support themselves with their profession. Companies that demonstrate an interest in their employees' performance tend to retain them.

2.2. H2 ER and PM have a considerable relationship

2.2.1. T&D and ER

Concerning ER, T&D strategies are the second most researched HRM practice. The majority of research discovered that T&D significantly and favorably impacts ER. Positively viewed T&D procedures have also been shown to lessen the desire to quit. According to some, T&D boosts work happiness, the results in more ER. Most research done to determine a connection among T&D and behavioral employment outcome has not looked at ER. This suggests that present is an essential theoretical and methodological gap in the empirical investigation of the effect of T&D on retaining workers.

According to the respondents' responses, 40% were satisfied overall, whereas 10% expressed extreme dissatisfaction. 15% of respondents expressed dissatisfaction, compared to 10% of the general population and 25% of extremely satisfied respondents (Figure 1).

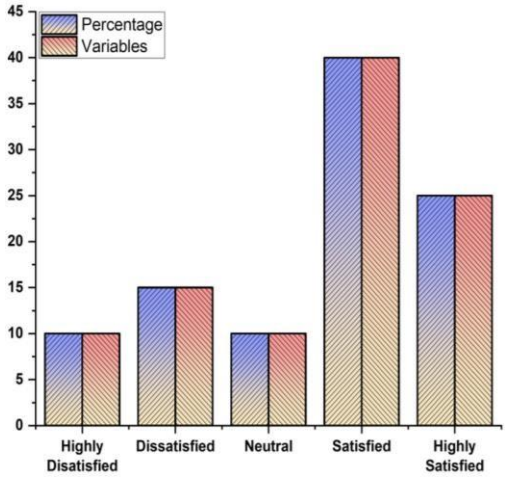

Figure 1 T&D and ER.

According to the respondents' responses, 80% agreed that T&D is more effective than other methods for keeping personnel. If workers get the proper training, they can efficiently carry out their assigned tasks, increasing the organization's production and effectiveness. According to 20% of respondents, T&D does not improve an organization's productivity (Figure 2).

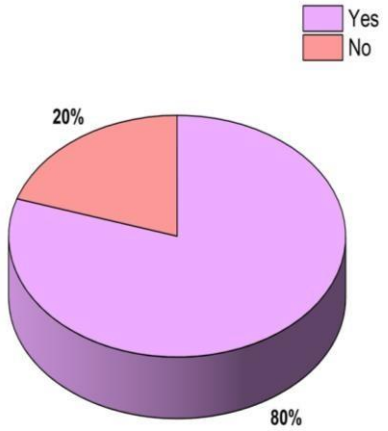

Figure 2 T&D increase the efficiency in retaining the employees.

2.3. H3 There is an important relationship among T&D and ER

The expansion of positive work culture, the provision of competitive pay and benefits packages, the availability of possibilities for professional growth, and the recognition and appreciation of employee achievement are some strategies for ER. In an organization, the process of identifying, vetting, and employing suitable applicants for employment opportunities is referred to as recruitment and selection. Various tasks may be included in the hiring process, such as advertising employment opportunities, examining resumes and applications, holding interviews, and verifying references. PM is the process of establishing objectives, tracking outcomes, giving feedback, and assessing performance. Giving people the information and skills required to do their employment well is referred to as T&D (Figure 3).

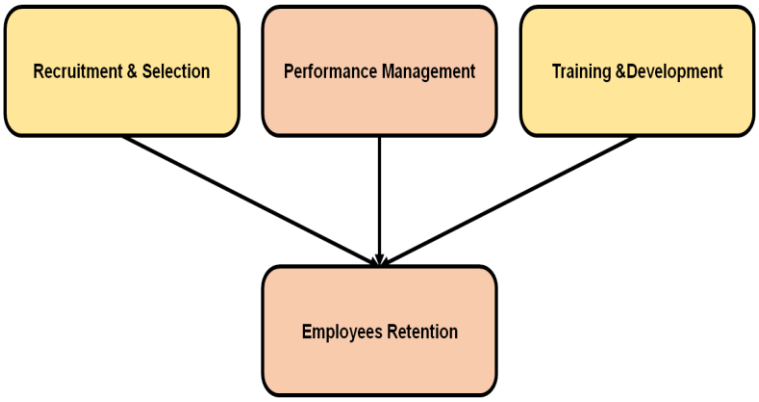

Figure 3 ER.

3. Methodology

3.1. Data Collection, Sample Size & Sampling Technique, Design

The present study focuses on the Hazara division's educational system in Pakistan and its personnel on every level. The education industry is the focus of our sample. The respondents to the study sample will all work in the education sector, and a questionnaire will be used to gather data. A suitable sampling method was used in this investigation. There must be ten times as many samples as there are variables. More than 30 samples may be used, but not more than 500. The example for the current research consists of 178 employees in the education sector, in line with this recommendation. The present research used various tools developed by earlier researchers in conjunction with the study's variables and the questionnaire administered. All items were updated following the study's setting. A questionnaire was created for performance management, a questionnaire for training and development, and a questionnaire for recruiting and selection. Primary data were collected in Pakistan among the Hazara Division of education employees using a standardized questionnaire. A five

point Likert scale, one denoting entire disagreement and five total agreement, was used to rate each questionnaire. Various statistical tests, including factor analysis and Cronbach Alpha, were used to evaluate the instrument's validity and reliability. Testing hypotheses is the primary goal of this investigation. Testing a hypothesis aims to clarify the link between the variables. The SPSS data analysis program was utilized to evaluate causal and correlative correlations in the present investigation. Regression and correlation analyses were also performed.

4. Result and discussion

It is impossible to exaggerate the significance of providing an equitable work life balance, competitive remuneration and benefits, chances for professional growth, and a supportive company culture if it comes to increasing ER. It is possible for effective HR policies to assist in recruiting and retaining qualified education professionals, resulting in better quality educational services and more significant results for students. These policies should emphasize the characteristics listed above. Therefore, educational institutions need to make the retention of their personnel a top priority by putting in place HR policies that cater to the requirements of their staff members and foster a constructive culture within the workplace.

The Cronbach's alpha value for the research variables is shown in the above table 1 and Figure 4. According to the table, the instrument employed in the present research to assess the variables has a Cronbach value of 764,707,794,715, which suggests it is trustworthy. The variables include ten items of ER, eight pieces of R & S, seven items of PM, and six items of T&D.

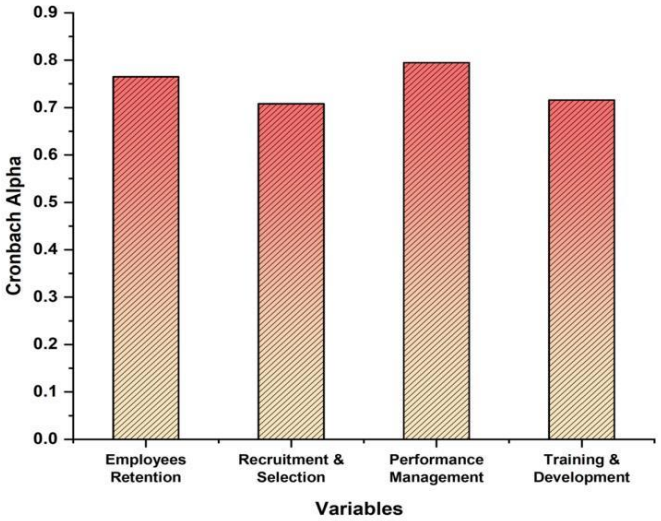

Figure 4 Reliability and Selection Instrument.

Table 1 Dependability and Selection Instrument.

Variables	Cronbach Alpha	No. of Items
T&D	.716	6
R &S	.708	8
ER	.765	10
PM	.795	7

The following table 2 lists the KMO and Bartlett test results for each factor. The KMO amounts are more significant than the average value recommended by earlier studies at 753, 602, 890, and 684. The researchers recommended average for KMO is.6. Bartlett's test was used to determine the related variables. Additionally, the Bartlett test was used to examine the null hypothesis. If Bartlett's test yields an important outcome, the alternative hypothesis is considered valid, and the null hypothesis is disregarded. Bartlett's test outcome is essential, which means that the other possibility must be adopted, and the null hypothesis ought to be ignored, as can be seen from the table above.

Table 2 Validity of the Research Instrument KMO and Bartlett's Test.

Variables	Approx. ChiSquare	Kaiser Meyer Olkin	Bartlett's	Test of Sphericity
			df	Sig
T&D	277.676	.685	16	.000
R &S	510.039	.603	29	.000
ER	484.200	.754	46	.000
PM	193.355	.891	3	.000

Table 3 illustrates the degree of correlation between the research's different aspects. This table has one dependent variable, ER, and three independent variables, PM, TD, and RS. As was shown, a positive and significant association exists between PM, T&D, R&S, and ER.

Table 3 Correlation Matrix.

ER	ER	PM	T&D	R&S
ER	2	.241**	.266**	.373**
PM	.241**	2	.320**	.236**
T&D	.266**	1.320**	2	.347**
R&S	.373**	.237**	.347**	2

The study's causal variable was modeled using what is known as employee retention. The model for the separate variables related to performance management, staff retention, and T&D are summarized in Table 4, which can be found above. A result of.740, 722, and .765a for R squared indicate that our separate variable describes 74%, 72%, and 76% of the variance in our dependent variable, respectively. Using the Durbin Watson statistic, researchers investigated the autocorrelation. Aware that the DW statistic has an acceptable value range of between 1.5 and 2.5, and since the table shows that the DW consider is 1.504, 1.65, and 1.93, all of that are within the acceptability range, there is no issue with autocorrelation.

Table 4 Model summary of variables (EM and PM, TD, RS).

Variables	Adjusted R square	Std. Error of the Estimate	R	Durbin Watson	R square
ER&TD	.457	.463969	.766[a]	1.626	.511
ER& RS	.135	.43157	.723	1.94	.139
ER&PM	.705	.416	.741	1.505	.707

ANOVA The statistical information for the investigation's parameters is shown in Table 5 earlier. The important numbers in the following chart are the F and p values. It's a good indicator if the F value is greater than 10, and provided that the value of p is statistically significant, our model successfully matches the information. The table above makes it quite evident whether the model is suitable.

Table 5 ANOVA.

Variables	Model	Sum of square	Df	Mean square	F	P sig
P&M	Residual	35.862	177	.205		
	Regression	2.187	2	2.187	10.728	.001[b]
	Total	**38.049**	179			
T&D	Residual	37.887	177	.216		
	Regression	.168	2	.168	.748	.000
	Total	**38.49**	179			
R&S	Residual	32.56909	177	.187		
	Regression	5.268	2	5.268	28.488	.000[b]
	Total	**38.049**	179			

The regression attending for the dependent and independent variables appears in Table 6 above. In this case, ER is the dependent variable, and PM, R&S, T&D, and ER is the variable that operates independently in the model. Figure 1 shows how strongly and favorably the correlations among PM, R&S, T&D, and ER. The personalized correlation attending is.240, .372.65, meaning that a modification in the independent variable of one unit causes an increase in a dependent variable.240, .372, .65 values.

Table 6 Attending.

Variables	Un standardized coefficient		Standardized coef.	T	Sig
	B	Std.Error	Beta		
Constant	.311	0.59	.373	19.91	.000
R&S	2.405	.240		10.040	.000
Constant	.259	.080	.241	21.26	.001
PM	2.654	.312		8.536	.000
Constant	.311	.097	.66	17.931	.000
T&D	4.023	.417		9.682	.000

5. Conclusion

HRM procedures are methods businesses use to maximize employee potential and boost operational efficiency. The authors advise businesses to adopt effective HRM practices to guarantee that different stakeholders are satisfied to stay

competitive. ER refers to a company's capacity to hold onto the people it needs for longer than its rivals. For businesses to retain a long term competitive edge, it takes skilled personnel and for people to grow professionally, to have career possibilities. All organizational activities and actions that influence the number or kind of people eager to apply for or accept a particular position are collectively called recruitment. Different writers have defined T&D in various ways. The improvement of workforce skills is the fundamental concept as each of them focuses on their studies. By comprehending and monitoring the attainment of specified objectives, standards, and competence requirements within an accepted framework, PM is a strategy for improving outcomes throughout a company. A detailed description of the Situation is guaranteed by a descriptive survey design that additionally assures low bias during the gathering of information and minimizes inaccuracies in the assessment of the gathered data. Based on the entire population's opinions, the research employed the consensus approach to arrive at its conclusions. The study made use of primary information gathered via a structured questionnaire. The data collected was analyzed utilizing statistical techniques, including frequency, percentage distribution, indication, and deviation from the mean. The research findings show that hiring and selecting employees, managing performance, and learning and growth are positively correlated. The key conclusion of the current study is that individuals in educational institutions should focus on and execute the recruitment and selection procedure in addition to improving organizational efficiency. Organizations can inspire their workforce through PM by employing innovative ideas and techniques to enhance activities. The results of this study plainly show a positive correlation between T&D and ER. Thus, education personnel should put these principles into effect. Instructors should also give students a voice in decision making since it gives them something to strive toward. It is implied that procedures, mainly through channels like evaluations, IQ assessments, assessments of personality, working example assessments, academic tests, et, significantly impact the retention of educators at colleges and universities in the area.

6. Future research

Essential and substantial knowledge of the idea of retaining employees with R&S, PM, and T&D is provided by this research. There are several restrictions, such as the study's small sample size. The educational institutions in Pakistan's Hazara Division were chosen for the present analysis. To further understand the findings and occurrences, a bigger sample size and including other institutions and organizations, might be more beneficial. In addition, due to time restrictions, the current research ignored other aspects such as organizational culture, remuneration, salary, etc. It concentrated on the three elements of recruiting and selection, T&D, and achievement evaluation. Future research should look at the ways ER affects business culture, pay, and salary. Third, not all aspects of the independent and dependent variables, professional knowledge exams, etc., were examined in the present research.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Assessing the interaction between internal control and financial management in local government

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Abstract A well-designed internal control (IC) system should reveal how well the government manages its finances and how effectively they employ its resources. This study studied the interaction between the local government's effectiveness in IC and its financial management. Some issues with IC practice include insufficient accountability, when everyday interactions are not reported for, and inefficient mechanisms are taken into action to catch perpetrators who interfere with the money. The method used in the study depends on a survey research strategy. The research's statistical data were gathered by distributing 250 questionnaires to employees of the ten (10) local governments that were taken into consideration. Selective sampling was used to choose these respondents, and regression analysis was used to examine the questionnaire's results. The analysis's findings demonstrate that IC and financial management are significantly correlated, with a $p\ value = (0 < 0.05)$. Because of this conclusion, the research recommends that the management of local governments develop more robust ways for internal control. These approaches will ensure that IC is practical and efficient, allowing for the successful management of financial problems.

Keywords: Internal control, local government, finances, accountability, financial management.

1. Introduction

IC is a vital part of any organization, which includes local government. A system of IC is the collection of rules, processes, and policies that it has put in place to secure its assets, guarantee that its financial reports are accurate, and ensure that the business complies with all applicable laws and regulations (Hajawiyah and Mahera 2020). In local government, IC is essential for promoting transparency, accountability, and good governance. Local governments are responsible for providing critical services to their communities, such as public safety, infrastructure development, and social services. These services require significant financial resources, and practical financial management is necessary to ensure that these resources are utilized effectively and efficiently. IC systems play an essential role in achieving this objective by providing a framework for monitoring financial transactions and preventing fraud, errors, and other irregularities (Sujana et al 2020).

Effective IC systems can help local governments to identify and prevent financial fraud, errors, and other irregularities. By establishing clear policies and procedures for financial transactions, local governments can minimize the risk of misappropriation of funds and other financial improprieties. Moreover, IC systems can help local governments to identify areas where financial management practices can be improved and develop strategies for enhancing those practices (Handoyo and Bayunitri 2021). Despite the importance of IC in promoting effective financial management in local government, local governments need help implementing effective IC systems. One of the most significant challenges is resource constraints. Local governments often need more financial resources to invest in developing and implementing comprehensive IC systems. Moreover, the regulatory environment governing financial transactions is complex, making it challenging for local governments to keep up with regulation changes and ensure compliance (Dagilienė et al 2021).

1.1. Local government's IC concept

An essential component of financial management in local government is IC. Following the "Government Finance Officers Association, "IC is defined as "a process, affected by an entity's governing body, management, and other personnel, designed to provide reasonable assurance regarding the achievement of objectives in the following categories: effectiveness and efficiency of operations, reliability of financial reporting, and compliance with applicable laws and regulations" (Park and Maher 2020).

Effective IC systems can help local governments to identify and prevent financial fraud, errors, and other irregularities. IC systems provide a framework for monitoring financial transactions and preventing misappropriation of funds and other financial improprieties. Additionally, IC systems may assist local governments in determining areas of their financial management practices that can be enhanced and developing plans for improving those practices. It is a significant benefit to local governments (Shonhadji and Maulidi 2022).

The GFOA identifies the five essential elements constituting an efficient IC system: “risk assessment, monitoring, information and communication, the control environment, control activities, information, and communication." Risk assessment involves identifying and analyzing the risks that may affect the achievement of the organization's objectives. Control activities consist of the procedures and guidelines put into place to minimize the chances discovered during the risk assessment process. The term "monitoring" refers to the continuous evaluation of the efficiency of the IC system. The control environment refers to the tone at the top of the company, which is set by the governing body and management. This tone encompasses the moral principles and integrity of the organization. Information and communication involve collecting, processing, and disseminating information related to financial transactions (Gabrini 2021).

The interaction between IC and financial performance management has been investigated in several studies. Mardiana and Rahim (2022) sought to ascertain the degree to which the IC system and information technology implementation impacted the credibility of the financial reports of that local government’s problem. Multiple linear regression was utilized to analyze the data, and “Statistical Product and Service Solutions” was employed as the software for performance.

Dewi et al (2019) evaluated the relation between establishing an efficient IC system and the level of financial transparency and accountability in local governments. The data is analysed using the t-test and Path Analysis in SPSS 20.00. The outcome demonstrates that the IC system and human resource competency favorably impacted the quality of local government financial statement information.

Okiror (2022) analyzed how PDLG's IC mechanisms impacted their financial management. A descriptive study was conducted using quantitative methods of data collection and analysis. The data analysis and statistical displays employed descriptive statistics. The connection between ICS and FM was investigated using correlations and linear regression analysis.

Afiah et al (2020) aimed to offer concrete evidence of an interaction between employee competency, the IC system, and the reliability of accounting data. Each local government sent out six research questionnaires, while the “SKPD, PPKD, and Regional Inspectorate on Local Government” all participated as respondents. It was determined using “structural equation modeling (SEM)” to analyze the data. As the data reveal, a combination of employee competence and IC system concurrently had a substantial impact on accounting information quality.

Yuliza et al (2021) designed to evaluated the effectiveness of the Nagari machinery in ensuring responsibility in the administration of village funds, as well as the impact that accounting information technology has on this process. The data in this study were gathered by a questionnaire and analysed through multiple regression techniques.

Wibowo et al (2023) investigated the performance and accountability of government agencies' organizational structures, as well as their internal controls and financial information systems. The present quantitative research collected primary data from Regional Financial and Asset Management Agency employees in Sumatera via questionnaires. The software SPSS version 20 was utilized for the data analysis process.

Basmar and Rosihan (2022) determine whether or not regional government managers in the GOWA district SKPD are impacted by the IC System and Organizational Commitment. The data were analysed using a “multiple linear regression approach." According to the research findings, local governments' managerial performance was affected by both the IC system and organizational commitment. According to the results of this investigation, the R square test is relatively high.

Bernard Kabweine (2022) analysed the connection between Kabale Municipal Council's IC System and the district's financial results. Descriptive research methods were employed, emphasizing finding patterns in the data. Questionnaires and personal interviews were used to compile the data, then analysed with SPSS

This study tackle these issues and aims to assess the interaction between efficient IC and effective financial management in local government. The rest of the paper is structured as follows: Part 2 provides an explanation of the methods and a description of the model; part 3 presents the results, part 4 discuss about the findings; and part 5 provides a conclusion to the paper.

2. Materials and Methods

2.1. Sample

This study used a questionnaire research design as its methodology. Thirty (30) Local Government Councils in Lagos State comprise the study's sample. Based on their past performance as important divisions of administration in the LCDA of Lagos State, ten (10) of these Local Governments were explicitly chosen. Lagos State was selected because it is an important financial centre for Nigeria and has a well-functioning local government structure. In this stage, we employ a selective sampling technique.

A non-probability sampling technique, selective sampling, involves selecting individuals or cases for a study based on particular criteria pertinent to the research question being investigated. Unlike probability sampling, Selective sampling does not include randomly selecting participants from a larger population. Instead, researchers use their judgment to choose participants most likely to provide relevant and valuable information. Using this technique, three hundred (300) questionnaires were given out to the local government staff selected, encompassing all relevant departments such as IC and financing, accounting, and procurement. Of the three hundred (300) questionnaires, 250 were returned and considered for this research

2.2. Description of the model

2.2.1. Regression model

The statistical method known as regression analysis may be utilized to evaluate the degree of interaction that exists between two or more variables. A regression model may be utilized in the context of determining whether or not there is a significant association between these two variables, as well as to quantify the strength and direction of that interaction. In the context of local government, this may be done in the context of conducting an examination of the interaction that is present between IC and the management of finances. The regression equation for the IC in local government is as follows:

$$Z = \beta_0 + \beta_1 Y_1 + \varepsilon t \qquad (1)$$

Where,

Z = Financial management: This is the dependent variable (Predictor). In this case, it is the degree to which local government is able to manage its finance, which is influenced by the quality of its IC system.

β_0= constant: This is the intercept term, which represents the value of the variable which is dependent (financial control) when the variable which is not depended (IC environment) is zero. It is the expected financial control when there is no IC environment in place.

β_1= parameter to be estimated: This is the slope coefficient, which measures an alteration in financial management for the change in units in the environment of internal control. It refers to the magnitude of the influence that the variable, which is not a dependent variable, has on the variable that is being measured.

Y_1 = IC environment: In this context, it relates to the effectiveness of the IC system in local government, which can be evaluated with the use of a number of different indicators such as the “compliance with laws and regulations, dependability of financial reporting and efficiency of risk management."

3. Results

3.1. Response percentage

The response percentage of the study is important since it shows if the approach was effective. The study's sample of 300 questionnaires, which were given to local government employees in Lagos State, had a response rate of 90% and a non-response rate of 10%. Table 1 displays the distribution and proportion of respondents who answered the survey.

Table 1 Outcome of response rate.

Response	Returned	unreturned	Total
Total	200	100	300
Percent	90 %	10 %	100

3.2. Regression analysis

Objective: Local government financial oversight in Lagos State is impacted by the IC environment.

The results of the regression connection research between the IC environment and the financial management environment are presented in Table 2. The interaction between R and R^2 in the regression analysis is R=0.622 and R^2=0.572. This indicates that a change in the IC environment might account for 57.2% of the variation in financial management. 42.8% of the rest of the number can be determined by elements that are lacking in the equation.

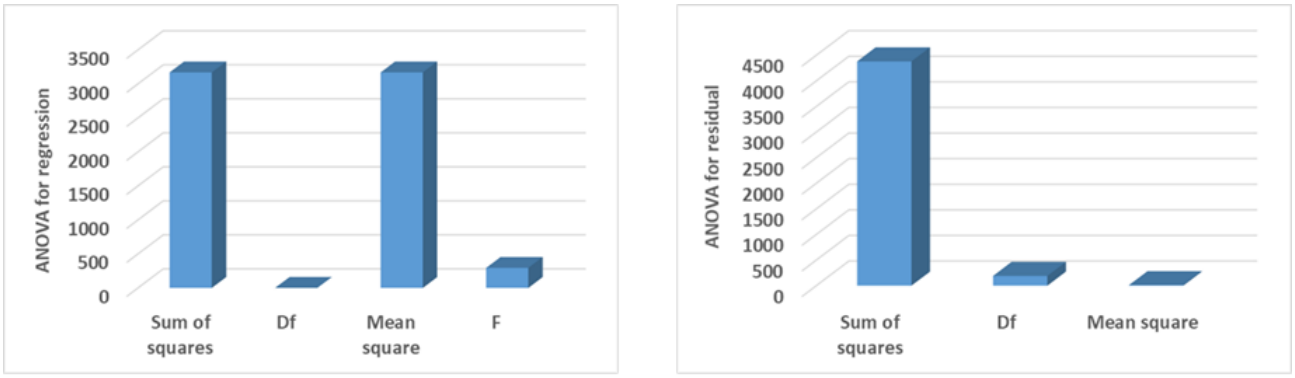
Table 2 Result of regression analysis.

Parameter	Value
R	0.622
R^2	0.572

3.2.1. Predictors: (Constant), IC Environment

An F-test was utilized in order to evaluate the zero hypothesis that there is no association between the IC environment and the management of finances. This hypothesis states that there is no connection between them. The

significance of the F-statistic 0 is lesser than 0.05, indicates that the zero hypothesis can be excluded and that there is an interaction between the IC environment and the management of finances, as shown by the results of the ANOVA test in Table 3, which suggest that the zero hypothesis may be rejected. Figure 1 (a) and (b) depicts the outcome of ANOVA.



(a) (b)

Figure 1 Outcome of ANOVA.

Table 3 ANOVA value for Financial Management and the IC Environment.

	Regression	Residual	Total
Sum of squares	3168.231	4380.210	7548.441
Df	1	190	191
Mean square	3168.231	9.815	
F	294.442		
Sig.	0		

T-test was used to examine the zero hypothesis that the value of the coefficient is 0, suggesting the existence of a statistically significant regression between the IC environment and the management of finances. Regression coefficients (β), the intercept (α), and the statistically significant value of each coefficient in the statistical model were evaluated using a t-test. The zero hypothesis maintains that there is no statistically significant interaction between the IC environment and financial management if the slope of the variable (beta) is 0 (i.e., there is no link between the two variables). This is often referred to as the hypothesis that there is no link between the two variables. The p-value is lesser than 0.05 because the constant value is 13.104 is significantly different from 0, as demonstrated by the values for the beta coefficient of the resulting model in Table 4 and Figure 2. With a p-value of 0, which is lower than 0.05, the coefficient is 0.721 in the equation is also substantially different from 0. This is due to the fact that the p-value is 0.

(a) (b)

Figure 2 Interaction with coefficient among IC Environment and Financial management.

This means that the equation Y=13.104 +0.721FI (IC environment) is significantly fit, and the alternative hypothesis $\beta_1 \neq 0$ is accepted, thereby rejecting the zero hypothesis$\beta_1 = 0$. The aforementioned analysis suggests that the model, financial management = $\alpha + \beta$(IC environment), is valid. This proves that a strong IC environment directly correlates to well-managed finances.

3.3. Hypothesis test

H1: IC environments do not significantly affect local government financial management in Lagos State.
Standard beta coefficients on the line of greatest fitting were utilized to first build regression equations that could be used to analyze the significance of the regression interaction with the IC environment and financial management. This was done so in order to determine whether or not the regression association is significant.

Each beta coefficient in the resulting regression models was also subjected to a t-test as part of the research. According to Table 4, there is a strong and favourable correlation between the quality of the environment for IC and the amount of financial oversight performed by the local governments in Lagos State (β =0.721, p-value =$0.000 < 0.05$). It means that a 0.721-unit improvement in financial management may be anticipated for every unit enhancement in the quality of the organization's IC environment.

Table 4 Interaction with coefficient among IC Environment and Financial management.

Coefficients	Constant	IC Environment
Unstandardized (B and Std. Error)	13.104 and 1.148	0.721 and 0.058
Standardized (β)		0.622
T	10.805	12.711
Sig.	0	0

4. Discussion

A regression study reveals a correlation between IC and financial management (R^2 =0.552). This suggests that an individual adjustment in the quality of internal controls might account for 57.2% of the variance in financial management. The remaining 42.8% of the overall variation is due to the presence of extraneous factors. To determine whether or not there is a statistically significant regression between the IC environment and financial management, T-tests were conducted on the regression coefficients (beta (β)), the intercept (alpha (α)), and the statistical significance of all coefficients in the model. The goal of these tests was to determine whether or not there is a correlation between the two variables. The zero hypothesis claims that there is no significant correlation between the IC environment and the management of finances if the slope (beta) equals 0 (i.e., there is no interaction between the two variables). This is referred to as the "no link between the two variables."

As can be seen in Table 4 results for the beta coefficient of the outcome model, the constant = 13.104 deviates considerably from zero, with a p-value of 0.000 being lesser than 0.05. A p-value of 0.000, which is lesser than 0.05, indicates that the coefficient is 0.721, which is similarly significantly different from 0. This indicates that the zero hypothesis, which states that there is no significant association between the IC environment and financial management, has been disproved, and the alternative hypothesis, which states that the IC environment is significantly fit, has been validated. In other words, the IC environment and financial management are linked in a way that favors a linearly favourable interaction.

5. Conclusion

The study's goal was to determine whether IC methods affected the local government's ability to manage its finances in Nigeria. The regression analysis estimates demonstrate that IC techniques have an influence on the management of finance, which suggests that these practices have a significant favorable effect on the management of finance in Local Governments that were surveyed and investigated. It is suggested that any inconsistencies in finance be thoroughly explored in order to guarantee that the finances have been executed properly. In addition, suitable procedures should be implemented for situations in which management is discovered to have interfered with finance statistics in order to activate the alarm and avoid identical procedures. This will allow for an even greater reduction in the amount of financial mismanagement that occurs within the Local Government. At the moment, there are not enough standardized evaluation methods available to conduct an analysis of the connection that exists in local governments among IC and financial management. The development of evaluation tools that are also thorough and standardized can assist in determining the areas of IC and financial management that require improvement, as well as make it possible to make meaningful comparisons between the various local governments.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Maximizing Financial Management efficiency with a novel Machine Learning algorithm

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Abstract Any firm must successfully manage its financial assets to succeed. To make wise choices for handling resources, possibilities for investment, and allocation of funds, accountants rely on reliable forecasting of finances. To enhance the effectiveness of Financial Management (FM), this research develops hybrid long short-term memory and hierarchical analytic process (HLSTM-AHP) technique. The LSTM approach is applied to develop the financial evaluation system, while the AHP approach is employed to establish the weightings of economic variables incorporated into the LSTM framework. To show how well the suggested HLSTM-AHP approach works at enhancing FM effectiveness, real-time accounting information from a company that is publicly traded are implemented. To further address the issue of anomalous data regarding finances, this research employs a unique sampling data collected by linear discriminant analysis (LDA) to develop a multiscale convolutional neural network (MCNN), which improves the framework's forecasting performance and demonstrates conclusively that machine earning (ML) is practicable in the study of FM forecasting, with plenty of opportunity for future investigations.

Keywords: HLSTM-AHP, LDA, MCNN, financial management

1. Introduction

Financial intelligence(FL) is a topic of interest to businesses all over the world as it becomes more pervasive in society. Machine Learning(ML) technology has been carefully linked as a prominent direction in the computer industry. The issue of effective automatic data analysis in the financial sector can be resolved by using reasonable DL technology. This technology also offers managers useful prediction information and trustworthy early warning for sound institutional operation. The primary focus of domestic and international research trends on FM assessment is on the models and indicators of financial evaluation. Existing research mostly focuses on which indicators can reliably forecast business crises when choosing FM evaluation. it has gone through the common application stage of multidimensional indicators. The aforementioned studies have produced some results in terms of prediction. There is no universal agreement on which indicators to choose, and the selection process is more complicated. Early researchers frequently employed univariate models, logistic models, discriminant analysis models, and other models when choosing early warning models. The data frequently reflect the company's historical risk position and some aspects of the risk of the entire capital market. As a result, researchers started using artificial intelligence-based models like support vector machines, neural networks. In general, the artificial intelligence-based early warning model has greatly improved the process and systematic nature of early warning. In addition to overcoming the models based on analytical methods, including extensive calculation and analysis and the need for data to follow normal distribution.

Yan and Aasma (2020) suggested a unique DL prediction approach and built the CEEMD-PCA-LSTM DL hybrid prediction methodology. The model's CEEMD, which functions as a sequence smoothing and decomposition module, can break down time series fluctuations or trends into a variety of IMFs with various characteristic scales. Santekidis et al. (2017) proposed a DL approach that uses recurrent neural networks and can be applied to large-scale high-frequency time-series data to forecast future price changes. A sizable dataset of limit order book events was used to assess the suggested technique. Mahmood et al. (2022) investigated the effects of WCF on company performance while examining the moderating function of the CCC. Multiple proxies for each research variable using more than 18000 observations were calculated. Liu (2019) conducted a fresh, unbiased assessment of these two modeling approaches for regression issues. And also compare to a well-known regression model for financial volatility or risk forecasting, the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. According to financial data studies, the LSTM RNNs outperformed the v-SVR for large interval volatility forecasting, and both significantly outperformed the GARCH model for two financial indices. The goal of effectively capturing the nonlinearity inherent in multivariate financial time series with a novel forecasting framework was

provided [Niu et al. 2020]. The system was built on a two-stage feature selection model, DL model, and error correction model. The best feature set to further enhance the proposed DL model's generalization was found using the proposed two-stage feature selection methodology, which was based on three DL units. A financial derivatives instrument was projected [Das et al. 2018]. By utilizing methods based on recently created ML algorithms. In various applications, it has been demonstrated that these approaches function remarkably well. The suggested approach was successful and outperformed the particle swarm optimization, according to experimental findings.

The suggested hybrid CNN-LSTM model performs better than conventional DL and ML methods in terms of precision, recall, f-measure, and accuracy [Rehman et al. 2019]. For the purpose of problem detection and diagnosis, the hybrid LSTM-KLD approach has been used on two malfunctioning wind turbines, one with a gearbox bearing issue and the other with a generator winding issue. In order to determine whether the suggested method was superior, it was then contrasted with three other widely used ML algorithms. The outcomes demonstrated [Wu, MA 2022], the suggested approach can result in a more accurate and effective detection. The frequency response analysis (FRA) approach was used to locate and categorize faults by evaluating the impacts of impedance and fault location. The method's interpretation of the FRA procedure's results was thought to be a shortcoming. C-LSTM, CNN, and LSTM are ML and DL applications that were used to accurately categorize the types and locations of different transmission lines faults, such as asymmetric faults and symmetric faults, in order to solve the problem [Moradzadeh et al. 2022]. The purpose was to use recent studies that go into further detail on the topic. Al Ahbabi and Nobanee (2019) researched the relationship between FM and long-term business growth was widely available. According to the findings , financial executives must address risks that have an impact on corporate sustainability, integrate FM into sustainability-related issues, and comprehend the connections between corporate sustainability reporting disclosure, sustainable financial growth, and sustainability practices. In order to train a stock trading strategy by maximizing investment return, it proposes an ensemble method that makes use of deep reinforcement schemes. When compared to the Dow Jones Industrial Average index and the conventional min-variance portfolio allocation approach, the trading agent's performance using various reinforcement learning algorithms was reviewed and assessed [Yang et al. 2020]. The goal of Helm et al. (2020) was to objectively assess the most recent and innovative orthopedics research on ML and to discuss how it can affect future musculoskeletal therapy. Nikou et al. (2019) aimed to assess the accuracy of stock market predictions made using ML models. Four machine-learning algorithm models were used in the prediction procedure. The outcomes show that the DL method outperforms the other methods in terms of prediction.

Mosavi et al. (2020) suggested that DRL can deal with actual economic issues in the face of risk parameters and ever-increasing uncertainties with greater performance and higher efficiency than standard algorithms. Wu et al. (2019) proposed Deep reinforcement learning techniques and adaptive stock trading strategies. From raw market data and technical indicators, stock market features are extracted using the DL module. The GRU was used to implement the DL module for the time-series nature of financial data. Lee and Shin (2020) provided a brief introduction to the different types of ML before presenting three different ways that ML was used in businesses. The trade-off between machine-learning algorithms' accuracy and interpretability was then covered. This is an important factor to take into account while choosing the best algorithm for the task at hand. It presents three examples of ML advancement in the financial services industry. Lei (2018) proposed a TFJ-DRL model that combines the DL model with the reinforcement learning model. Wang et al. (2020) suggested a combined approach using mean-variance modeling, LSTM, and asset selection to create the best possible portfolio. The suggested model is compared to the other five baseline methods to validate this methodology; in this comparison, the proposed model clearly surpasses the others in terms of cumulative return annually. The purpose was to consider recent research and fresh information on games that could be used to improve AI/ML integrated pedagogy for efficient curriculum delivery. Alam (2022) demonstrated how a variety of games offer a remarkable and creative opportunity to instruct a multitude of AI and ML concepts and themes.

2. Materials and Methods

2.1. LSTM methods

An advanced RNN that can address RNN's disappearing problem is LSTM. Three gates, including input, forgets, and output, make up the LSTM, a proposed gating system. Every time, the adaptive gating mechanism generates output based on the current conditions, remembers it, and delivers it as input to the following step. A memory cell called d_s is part of the LSTM, and it takes arbitrary time intervals into account while determining its state. The memory cell d_s that takes into account the time interval of its state over arbitrary is a part of the LSTM. There are three separate nonlinear gates in it. Input gate (j_s), Forget gate (e_s), Output gate (p_s), In charge of directing information to and from d_s. Equation 1 to 6 describes how LSTM gates work.

$$e_s = \sigma(X_e g_{s-1} + V_e w_s + a_e) \quad [1]$$

$$j_s = \sigma(X_j g_{s-1} + V_j w_s + a_j) \quad [2]$$

$$v_s = tang(X_d g_{s-1} + V_d w_s + a_d) \quad [3]$$

$$d_s = e_s \odot d_{s-1} + j_s \odot v_s \quad [4]$$

$$p_s = \sigma(X_P g_{s-1} + V_P w_s + a_P) \quad [5]$$

$$g_s = p_s \odot tang\ (d_s) \quad [6]$$

In order to increase financial efficiency, LSTM networks have been extensively deployed in the finance sector. In time series forecasting, one of the most popular uses of LSTM models, future stock prices, exchange rates, or other financial indicators can be predicted. The ability of LSTM networks to identify intricate patterns in financial data and forecast future trends makes them a valuable tool for traders and financial analysts. LSTM networks can be made to perform better for financial forecasting using a variety of techniques. One strategy is to include outside variables in the model, such as social media mood, news events, or economic data. By considering pertinent information that can have an impact on financial markets, this can help increase the predictions' accuracy. Additionally, it has been demonstrated that ensemble approaches, which mix many LSTM models, enhance financial prediction accuracy. Additionally, strategies like hybrid models that combine LSTM with other neural network topologies and attention mechanisms.

Input, output, forgetting, and memory cell are the four gates of the LSTM structure. The forgetting gate, the output gate, and the input gate are all logical units as well. Instead of sending their output to other neurons, they are in charge of adjusting the weights at the edges of the other neural network components connected to the memory unit in order to correct the selective memory feedback system's gradient-based error correction function.

2.2. Analytic Hierarchy Process for FM Evaluation

The Analytic Hierarchy Process (AHP), a framework for making decisions that assist in evaluating complicated issues containing several criteria and options, can be used to analyze FM. AHP can be used in FM to assess a range of financial choices, including investment options, project choices, and risk management tactics. The first step in using AHP in FM evaluation is to precisely characterize the issue. The next step is to determine the criteria that will be used to assess the alternatives. Financial measures like return on investment, net present value, and cash flow, as well as other elements like risk, market trends, and social impact, can all be included in these criteria. The next step after establishing the criteria is to give each criterion a weight based on how important they are to the decision-making process. By requesting pairwise comparisons of the criteria from decision-makers, AHP offers a methodical technique to assign weights. The alternatives can be assessed against each criterion and given a score depending on how well it fulfills the criterion once the criteria and weights have been established. The scores for each criterion can then be multiplied by the weights given to each criterion, and the results can be added to determine an overall score for each alternative. To determine whether a decision is resilient to changes in the weights given to criteria or the scores given to alternatives, sensitivity analysis can be used. This can assist decision-makers in identifying the main elements influencing the choice and modifying it as necessary.

The significance of FM evaluation indicators is determined by AHP. The problems are divided into various constituent factors by the AHP method, which then collects and combines these factors at various ranges as per the correlation and influence. The procedure of generating judgments about complicated systems that are challenging to completely quantify. Following are the steps: Create an index system for FM evaluation first. The highest eigenvalue of the judgment matrix B, $|\lambda_{max}|$ shown in equation 7.

$$B.X = \begin{bmatrix} b_{11} & b_{12} & \dots & b_{1m} \\ b_{21} & b_{22} & \dots & b_{2m} \\ \dots & \dots & \dots & \dots \\ b_{n1} & b_{m2} & \dots & b_{mm} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ \dots \\ X_m \end{bmatrix} \quad [7]$$

We build the FM assessment system from the viewpoints of the external environment and decision-making in order to create an accurate evaluation of FM, as illustrated in Figure 1. There are specific connected components in managerial decision-making, evaluation of the external environment, and corporate governance structure.

2.3. Financial Data's Intelligent Detection Model

Time series data are data columns that are logged chronologically by the same unified indication. The quality and comparability of each piece of data within a given data column must be the same. We must time slice the time series data because IOT generates a big amount of it. Traditional techniques for processing time-series data include the periodic, extreme value, deviation, variance, and median procedures. The target data are time-sorted and time-counted, each window's size and duration are established, its attributes are calculated and summarized, Various data with the same

dimension are examined over a continuous time period to establish the target data's changing trend. MCNN will be used in this study to solve the issues shown in Figure 2.

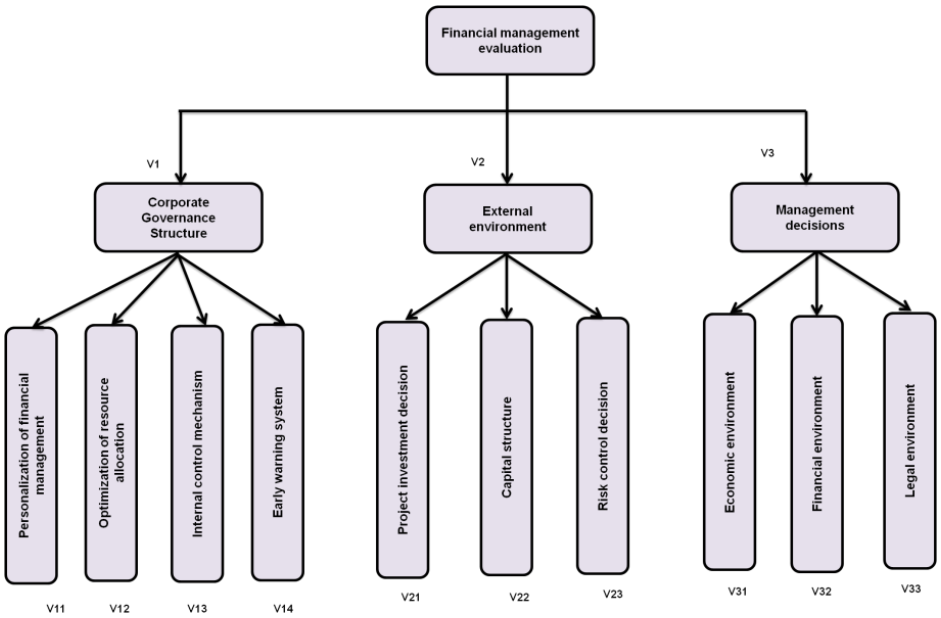

Figure 1 Comprehensive financial management evaluation system.

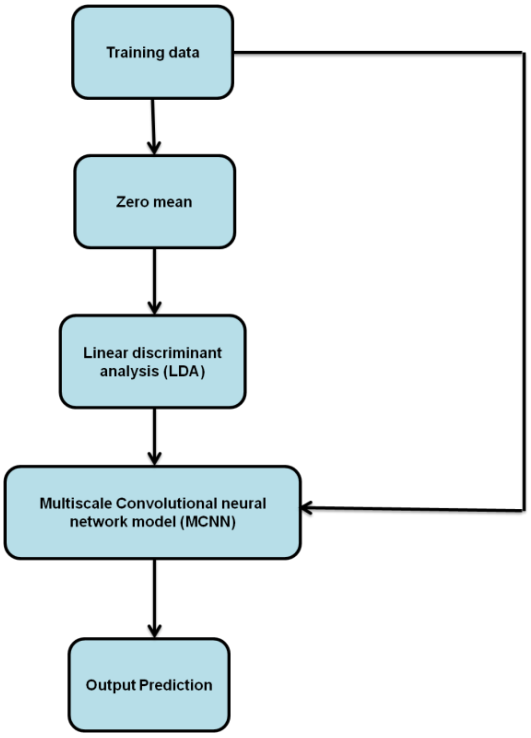

Figure 2 MCNN-based FM model framework.

First, LDA is performed with lower input parameters of the MCNN and lessens the correlation between input variables. The MCNN'S parameters are then iteratively altered by gradient descent on a dataset sample generated by LDA for MCNN. In order to confirm the model's test, sample data and predictive accuracy are lastly applied to the model.

The application and data types being studied to determine the intelligent detection model for financial data. However, generally speaking, such a model would entail employing ML or DL methods to examine significant amounts of financial data and spot patterns or anomalies that could be signs of fraud, mistakes, or other kinds of financial irregularities. The model may include several steps, such as feature selection, model training, and evaluation. Depending on the type of data and the precise objectives of the study, different algorithms and methodologies could be employed.

3. Results and Discussion

Fundamental components of conducting research and offering conclusions that are supported by evidence are data and empirical design. Information from numerous sources must be gathered using particular techniques that are in line with the study topic or hypothesis. It entails giving careful thought to the kinds of data that are needed, the sample size, and the sampling techniques. The data is meticulously analyzed after it has been gathered to find patterns, trends, and connections. Designing an experiment or study to test a research hypothesis or provide a response to a research topic is known as empirical design. The research topic must be clearly stated, the independent and dependent variables must be determined, the sampling strategy must be chosen, the study or experiment must be planned, and data must be gathered and analyzed. To guarantee that the outcomes are trustworthy and accurate, the design must be systematic, transparent, and well-documented.

Conduct an empirical analysis, compare the predicted outcome to the actual one, and determine how accurate the forecast was. Four thousand firms in total are chosen for this study. Data normalization is necessary since each set of data has a separate set of measurement units, and the processed data will range from 0 to 1. The gradient descent is performed in one unit if the data is not normalized, resulting in the same descending step in each direction. When the gradient declines due to non-standardized data, the slope will take a snaking path in the opposite direction of the outline, which will slow down iteration. Generally speaking, normalization can make each stock index's magnitude match to the length of a gradient fall.

Figure 3 indicates that the model's accuracy in determining whether a business would encounter an emergency might be sustained by more than 82%. The accuracy of the prediction increases with a number of years of data used. Figure 4 shows that after training, the model's accuracy is 80%, while its accuracy of the test set was 92%. This accuracy is marginally greater than the training set's, according to the findings, demonstrating the model's superior generalization ability.

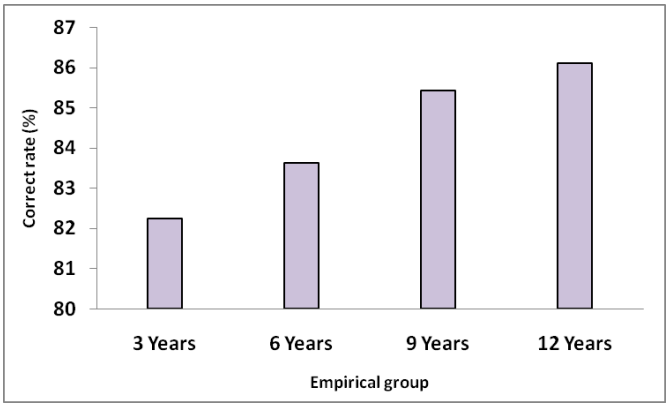

Figure 3 Empirical results.

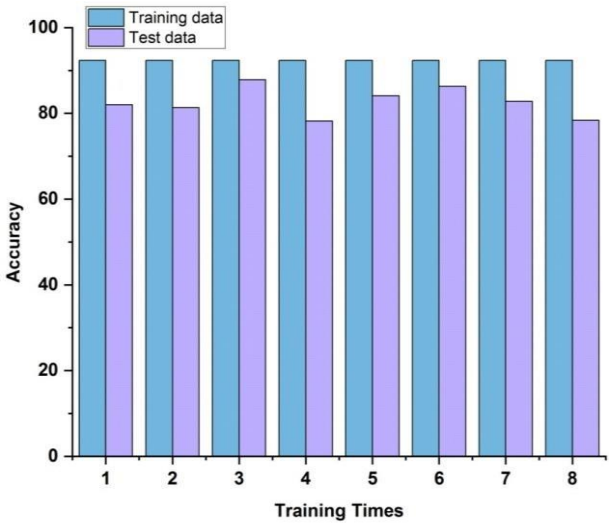

Figure 4 Accuracy of training and testing datasets changes with the learning cycle.

The data and empirical design are essential elements of a research paper's results and discussion part. In this section, the study's findings are presented together with an interpretation of the findings concerning the research question or hypothesis. It is important to provide the findings in an unbiased manner without any debate or interpretation. The findings

are interpreted, and the consequences of the findings are discussed in the discussion section. The section should also emphasize any fresh additions to the corpus of current knowledge and tie the findings to earlier research. This section should cover the empirical design, any constraints or potential sources of bias, and recommendations for further study.

Intelligent analysis of financial data using ML techniques has transformed how financial information is interpreted and used. ML enables the extraction of valuable insights, pattern identification, and predictive modeling from many sources of financial data by utilizing algorithms that can learn from data. Due to the fact that these algorithms can work with both structured and unstructured data, a variety of datasets, including market data, economic indicators, financial statements, news articles, and social media feeds, can be analyzed. To address certain financial analysis tasks, methodologies including regression, classification, clustering, time series analysis, and ML are used. Scalability, automation, improved accuracy, and the capacity to identify intricate linkages and patterns that conventional approaches could miss are just a few advantages that ML provides to the study of financial data. To ensure the appropriate and successful application of ML in financial analysis, however, issues like data quality, model interpretability, overfitting, and ethical considerations must be addressed.

The most accurate model is the time series index model expressed as a difference. The precision rate and recall rate both demonstrate the rule of one change causing another. Figure 5 compares the MCNN's classification accuracy for various hidden layer structures.

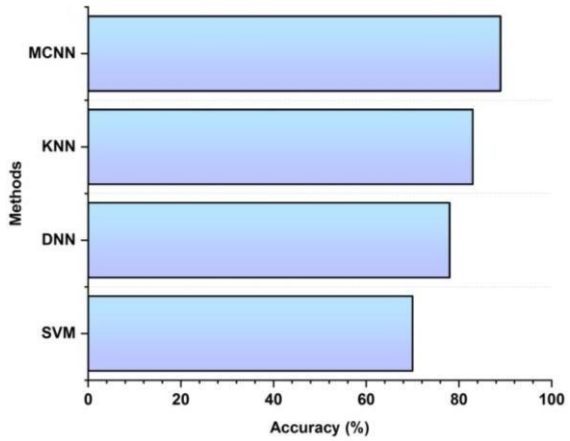

Figure 5 Comparison of prediction accuracy of different methods.

Figure 6 depicts concealed layer 1, 2, and 3 with better accuracy, all of which are greater than 91%.The second level's classification accuracy achieves its maximum of 98.57% after 600 iterations, which is the highest classification accuracy. As a result, the Three-layer Hidden Convolutional Layer MCNN Model has Good Classification Accuracy.

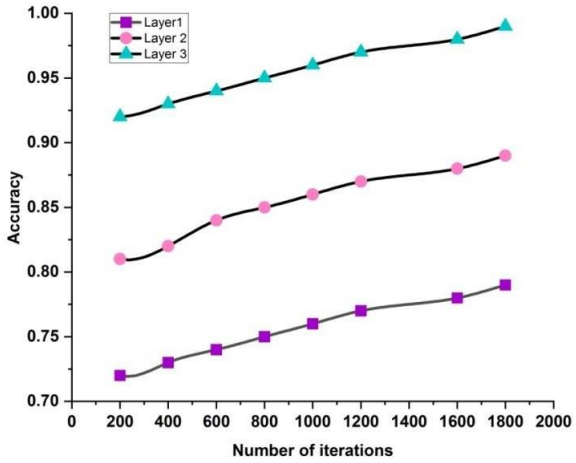

Figure 6 MCNN classification accuracy of different hidden layers.

5. Conclusion

To increase the accuracy of corporate FM analysis, the financial evaluation system was developed using the LSTM method, while the AHP method is used to determine the relative importance of the economic factors included in the LSTM

algorithm. Implementing real-time accounting data from a publicly listed corporation demonstrates the efficacy of the LSTM-AHP strategy in improving FM efficiency. And that is generally applied using data from A-share listed companies from 2017 to 2022. Additionally, it can be inferred from the use of data from different years that the amount of data years used increases the predictive power of the model created for this research. Improving the framework's forecasting performance, this study provided a conclusive proof that Machine learning (ML) is feasible to FM forecasting, and opens up numerous avenues for future research by employing a sampling data collected by linear discriminant analysis (LDA) to develop a multiscale convolutional neural network (MCNN). The test results demonstrated the accurate and efficient ML-based intelligent analysis of aberrant financial data. The efficiency and applicability of the intelligent analysis method are finally demonstrated. The utilization of novel ML algorithms has the potential to maximize FM efficiency in various ways. Financial institutions can automate and streamline procedures, improving accuracy, speed, and cost-effectiveness by utilizing the power of ML algorithms. Large amounts of financial data can be processed by ML algorithms in an effective manner, yielding insightful conclusions, spotting patterns, and producing precise forecasts. This can enhance risk management, portfolio optimization, and financial decision-making. These algorithms can also spot irregularities and possible fraud, enhancing financial system security measures. However, to ensure the ethical and transparent application of ML in FM, it is critical to address issues with data quality, model interpretability, and ethical considerations.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Next-generation attendance tracking: Automated face detection for lecture attendance

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Abstract Face detection technology has garnered much interest due to its potential uses in industries like face identification and video surveillance systems. In addition to being a component of the automatic face recognition framework, real-time face detection is now becoming its study area. There are numerous methods to handle the problem of face detection. Traditional methods of manual attendance tracking in lecture halls are time-consuming, prone to errors, and lack efficiency. Next-generation attendance tracking systems are incorporating automated face detection technology to address these challenges. This paper explores the implementation of automated face detection for lecture attendance, leveraging computer vision and facial recognition algorithms. Initially, students' data were gathered and preprocessed using a Median filter (MF). Then the preprocessed data features were extracted using a histogram of gradients (HOG). And finally, extracted features were classified using a Backpropagation Bayesian neural network (BBNN). To prove the efficiency of the suggested method, that is compared and contrasted with specific conventional methods. Experimental outcomes show that the recommended method performs superior when contrasted to traditional methods.

Keywords: face detection, median filter, HOG, BBNN.

1. Introduction

Today, student attendance significantly impacts how classes are track and students are graded depending on authentically attendance is recorded. This calls for greater accuracy and latitude for both lecturers and students. Colleges presently use various ways to record student attendance, most of which could be more effective in accuracy and security. Handling many students makes it difficult for an administrator to supervise student data submission for a different method of tracking attendance (Alburaiki et al 2021). Human faces play a significant role in our daily lives, particularly when recognizing persons. Face detection is a biometric detection in which facial features are extracted from a person's face and saved as a unique face print. Biometric facial identification has captured the importance of several academics due to its variety of uses. Face detection technology is superior to other biometrics and depends on detection methods such as finger, palm, and iris scans because of its non-contact operation (Hl et al 2020). Paper tracking is no longer necessary due to an automated system. Instead, it employs biometrics (fingerprints, retinal scans, and facial features), electronic tags, touch displays, magnetic stripe cards, and barcode badges. It simplifies life for the employee and the company because work hours are automatically entered when the employee arrives and exits the workplace. It removes the chance that timesheets may need to be found or altered. Additionally, because automated systems frequently have integrated reporting features that handle the majority of payment processing, it saves time for the payroll department. Many different automated attendance systems are available, including RFID-based systems, barcode tracking systems, punch card systems, smart card access control systems, magnetic stripe card systems, biometric systems, etc. Measuring individual or group activities and attendance has become more accurate to the biometric time and attendance system. It also includes many choices, such as face-recognition attendance systems, retina-based attendance systems, and fingerprint-based attendance systems (Rahman 2021). Automatic face identification requires taking essential details from an image, turning them into a meaningful representation, and then quietly categorizing them. Open CV is an open-source module that can be used for target recognition, face recognition, and three-dimensional reconstruction. Once a student enters the classroom, this technique has the drawback of only capturing one image of that student at a time (Trivedi et al 2022). The objective of automated face identification for lecture attendance is to create a system capable of quickly and precisely identifying the faces of students or other attendees in a lecture or classroom situation. By utilizing computer vision and face recognition technology, the system intends to automate the method of taking attendance.

The further part of the study includes Phase 2 indicates materials and methods; Phase 3 shows results; and Phase 4 suggests a conclusion.

The study Filippidou et al (2020) created a visual-based attendance application for real-time use; they concentrate on the issue of a single sample face detection issue in this research. The experiment outcomes demonstrate that DenseNet121 is the ideal model for handling practical matters. The study Ali et al (2022) offered a comprehensive analysis of the attendance management tools with great promise for managing, documenting, and monitoring user presence across several domains. An extensive literature review framework for classifying papers is also presented in this research. 90 of the 204 publications were considered relevant to the review's subject. The study Anisha and Reddy (2022) suggested a proposed system consisting of KNN, SVM, CNN, Haar Classifiers, and Gabor filters. Utilizing a collection of student photos, the technique is trained and put to the test. After successful face recognition, an Excel sheet will be prepared and updated with the kids' attendance information. With the new method, taking attendance in a classroom may be done more quickly and efficiently. The strategy they created is simple to adopt and also enables cost savings. The study Dmello et al (2019) proposed a method for managing attendance that can identify every student in a class from a few photos and record their attendance. IoT cameras have been utilized instead of smartphone cameras to improve coverage and lower the amount of missed attendances. The study Shah et al (2021) offered an automatic attendance system dependent on face detection. It tracks students' occurrences by identifying their faces from a picture of everyone seated in the classroom and comparing them to a trained set. The study Alburaiki et al (2021) created a mobile application that will enable instructors to develop class attendance reports and students to submit them by taking a photo of their faces with their phone's camera and entering their location. The study Pawaskar and Chavan (2020) focused on the execution of an automated attendance system that records class attendance and manages the class database using facial recognition techniques. The strategy should be implemented in every classroom to replace outdated attendance methods and intelligently track students' attendance.

2. Materials and Methods

An innovative strategy that uses cutting-edge technologies to streamline and improve gauging student involvement in educational settings is next-generation attendance tracking employing automated facial detection for lectures. It substitutes conventional manual attendance procedures with automated systems which recognize and track students' attendance during lectures using facial identification approaches and computer vision technologies. This strategy includes gathering pictures or video feeds from cameras placed strategically in the lecture hall or classroom. The automatic face detection system examines these visual inputs and applies advanced algorithms to appropriately discover and distinguish individual faces. It contrasts them to a database of registered pupils or well-known people to uniquely identify the faces. The automated face detection system can watch students in real-time, continuously evaluating the visual data collected to keep tabs on their presence and absence. Each student's attendance may be tracked during the lecture, negating the need for teachers or office personnel to take attendance manually. Figure 1 indicates the representation of the suggested technique.

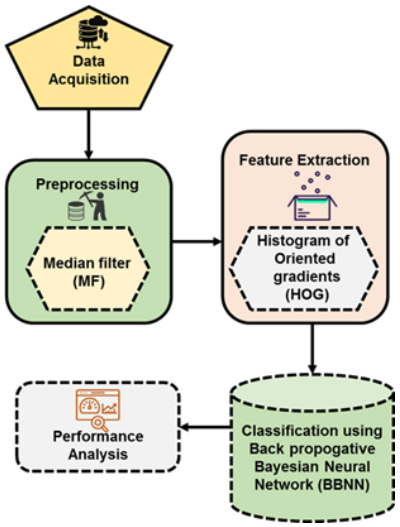

Figure 1 Representation of the suggested technique.

2.1. Data acquisition

650 skin and non-skin patches are included in the first image database. Images in color are gathered from various sources and with diverse lighting conditions. The second dataset comprises 800 face images and is titled "face vs. nonface (FvNF)." Depending on the number of pixels labeled as skin, Nanni and Lumini utilized this dataset to assess how well a skin detector algorithm could identify the presence of a face. By hiding portions of the skin in 450 photographs in FvNf and labeling them with the concealed human set while leaving the other images unobscured, we constructed a synthetic dataset for our tests (Hosni et al 2021).

2.2. Preprocessing using Median filter (MF)

We use MF method to remove unwanted noise. Assume $\{Y_1, Y_2, .., and\ Y_m\}$ is the n random variables. We create the analysis in ascending order $Y_{(1)} \leq Y_{(2)} \leq \cdots . Y_{(m)}$. The random variable $Y_{(j)}, i = 1,2, .., m$ is the ith order statistic of the n random variables. Let m=2n-1 be an odd number. $Y^m = \{Y_1, Y_2, \ldots Y_m\}$ denotes the collection of random variables. The outcome of the MF is defined in equation (1):

$$median(Y^m) = Y_{(n)} \qquad (1)$$

The MF is a nonlinear filter. Its behavior is much different from that of the averaging filter.

2.3. Feature extraction using histogram of oriented gradients (HOG)

For the detection of people, objects, and pedestrians, the HOG descriptor is frequently utilized. The magnitude and orientation of HOG are evaluated. It depends on the accumulation of gradient directions across the pixel of a tiny spatial region known as a "cell" and in the subsequent building of a 1D histogram concatenated, which offers the features vector to be taken into consideration for further reasons. Let F represent the intensity (grayscale) function best describes the image under study. The image is separated into cells that are M pixels wide and M pixels high θ_(y,x) of the gradient in every pixel is evaluated by the below equation (2):

$$\theta_{y,x} = tan^{-1} \frac{F(y,x+1)-F(y,x-1)}{F(y+1,x)-F(y-1,x)} \qquad (2)$$

The orientations $\theta_j^i = 1 \ldots . . M^2$ belonging to the same cell i are quantized and accumulated into an M-bins histogram. The result of this algorithm phase, or the features vector to be considered for further processing, is an individual HOG histogram created by ordering and concatenating all the obtained histograms.

2.4. Classification using Backpropagative Bayesian neural network (BBNN)

Classification using a Backpropagation Bayesian Neural Network (BBNN) uses the backpropagation method to train a neural network model to categorize incoming data into predetermined classes or categories. To accurately forecast new, unforeseen data, the BPNN learns from labeled training samples and modifies its internal parameters. BP neural networks are ANN that performs computations using multilayer feedforward networks. Upgrade the neural network's weights and biases utilizing the backpropagation technique. Using an optimization approach like gradient descent, determine the gradients of the loss functions about the network variables. The weights are modified in this step to reduce loss and raise prediction accuracy. Input, hidden, and output layers and classifiers are typically present in BP neural networks when employed as classifiers. A method for learning that optimizes classification outcomes is called the softmax classifier. It creates a probability distribution from the output of a BP neural network. Every class's probability is between 0 and 1, and the total of all the classes' probabilities is 1. The output of the hidden layer is as follows if l_1 and l_2 are employed as the hidden layers and the original output layer's respective activation functions:

$$z_r = l_1(\sum_{j=1}^{t} y_j u_{jr}) \qquad (3)$$

The outcome of the original output layer is:

$$y_j = l_2(\sum_{r=1}^{o} z_r c_{ri}) = l_2 \left(\sum_{r=1}^{o} c_{ri}\ l_1(\sum_{j=1}^{t} y_j u_{jr})\right) \qquad (4)$$

The outcome of the final output layer is:

$$q_i = softmax \begin{bmatrix} x_1 \\ \vdots \\ x_i \\ \vdots \\ [x_I] \end{bmatrix} = \frac{a^{x_i}}{\sum_{i=1}^{I} a^{x_i}} \qquad (5)$$

By assigning distributions to their weights, BNNs give deep learning frameworks a probabilistic meaning. Instead of being fixed values, the weights in BNNs are now viewed as random variables drawn from a distribution, the variables that are learned during training. As a result, each forecast for a given input is distinct, and for many forwards passes, the mean behavior produces relevant results. Additionally, the diversity of these forecasts enables the evaluation of the method's credibility.

Assume $T = \{Y, X\}$ represent the input-filled set for training $Y = \{y_1 \ldots, y_m\}$ and expected outcomes or targets$X = \{x_1, \ldots x_m\}$ where $y_m \in$, $\mathbb{R}^t$and $x_j \epsilon K^V$, C is the number of classes. The posterior distribution of weights is roughly approximated by the Bayesian models $b\ (u|T)$which produced the outcome vector X. This strategy results in the previous distributions $b(u)$, indicating that the fundamental ideas regarding the weights must be developed.

$$b(\hat{x}|\hat{y}, T) = \int b(\hat{x}|\hat{y}, u) b(u|T) tu \qquad (6)$$

T assessments of the neural network on the identical input must be carried out in this case, $\hat{x}$and weights w_t tested from the posterior distributions b (u|T). Consequently, we get T outputs from the algorithm rather than just one. D=50 strikes an excellent balance between intricacy and precision. Based on the input, the BNN's final prediction can be viewed as the sample average of the predictive distribution.

$$\mathbb{A}[b(\hat{x})] \approx \frac{1}{D}\sum_{d=1}^{D} b(\hat{y}, u_d) = \frac{1}{D}\sum_{d=1}^{D} \hat{x}_d ; u_d \sim b(u|T) \qquad (7)$$

The uncertainty in neural networks determines how well a prediction-making system performs. The statistics spread of the predicative distributions $b(\hat{x}|\hat{y}, T)$ indicates ambiguity. In conclusion, it is attainable to acquire an estimate of the predictive distribution for each input x if the posterior distribution is established. The BNN predictions and an uncertainty evaluation can then be estimated. Yet, due to the large dimensionality and no convexity of sophisticated models like neural networks, determining and sampling the posterior distribution is a computationally challenging.

3. Results

Automated face detection outcomes in managing attendance are quite advantageous for educational institutions. Here, we compared some of the traditional methods with our suggested technique; they are Local binary pattern (LBP Elias et al 2019), Adaboost [Sharma et al 2022], Haar Cascade classifiers (HCC [Bairagi et al 2021].

The precision of automated face detection systems for tracking lecture attendance can differ based on several variables, including the system's quality, the setting that it is utilized, and the particular face detection algorithms employed. Modern face detection techniques, such as convolutional neural networks (CNNs), have recently attained remarkable accuracy. These methods can detect faces in different positions, lighting conditions, and occlusion scenarios because they were trained on vast datasets of tagged face images.

Figure 2 and Table 1 denotes the accuracy compared with traditional and suggested techniques, and the numerical outcomes of accuracy. Automated face detection systems can attain excellent accuracy rates, frequently exceeding 98 percent or even higher, in controlled situations, like well-lit classrooms with few obstructions. However, the accuracy may be less accurate in real-world problems because there may be occlusions, changing lighting conditions, or people positioned differently from the camera. Our proposed approach offers a 98% high level of accuracy in comparison to previous methods. The time it takes a computer program or algorithm to detect faces is referred to as execution time, also known as processing time or runtime. It estimates the time taken from the beginning of the face detection procedure to its conclusion, demonstrating how long it takes the system to examine an input image or video frame and determine whether or not faces are there and where they are located. Based on the level of granularity needed, the execution time for face detection is often expressed in units of time, such as seconds, milliseconds, or microseconds. It shows how long it took the system to accurately recognize facial regions by doing calculations, processing data, and applying methods.

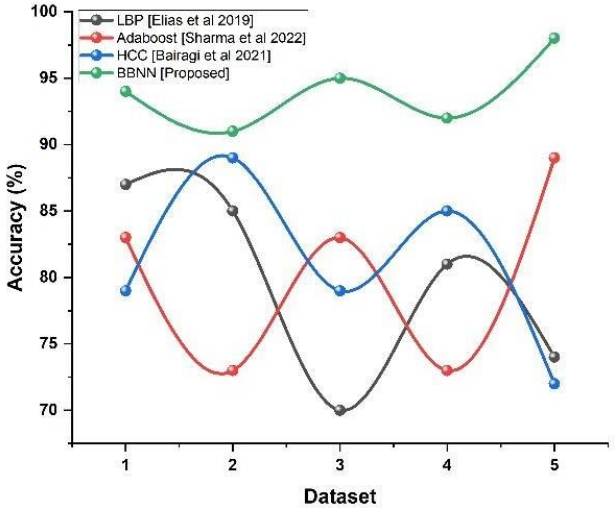

Figure 2 Comparison of accuracy with traditional and suggested technique.

Table 1 Numerical outcomes of accuracy.

Dataset	Accuracy (%)			
	LBP (Ellias et al 2019)	Adaboost (Sharma et al 2022)	HCC (Bairagi et al 2021)	BBNN (Proposed)
1	87	83	79	94
2	85	73	89	91
3	70	83	79	95
4	81	73	85	92
5	74	89	72	98

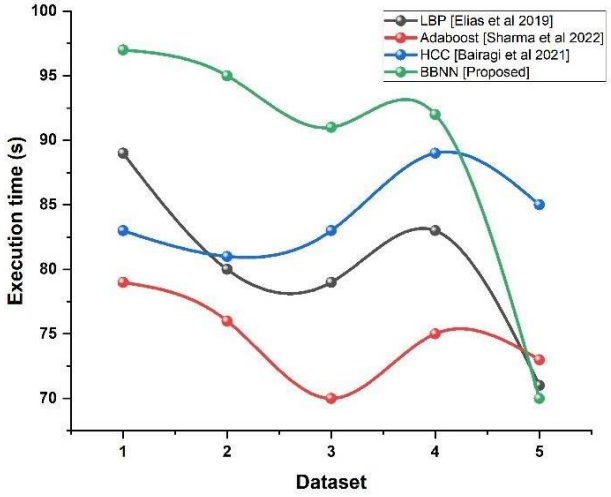

Figure 3 Comparison of execution time with traditional and suggested technique.

Table 2 Numerical outcomes of execution time.

Dataset	**Execution time (s)**			
	LBP [Ellias et al 2019]	Adaboost [Sharma et al 2022]	HCC [Bairagi et al 2021]	BBNN [Proposed]
1	89	79	83	90
2	80	76	81	95
3	79	70	83	91
4	83	75	89	92
5	71	73	85	85

Figure 4 and Table 3 shows the comparison of the mean error rate using the traditional and recommended techniques and the numerical results of the MER. Our recommended strategy offers a 70 percent low level for MER compared to conventional approaches.

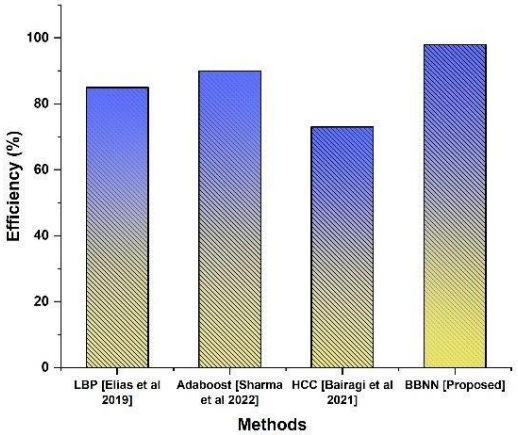

Figure 4 Comparison of mean error rate with the traditional and suggested technique.

Table 3 Numerical outcomes of mean error rate.

Methods	Mean error rate (%)
LBP (Ellias et al 2019)	92
Adaboost (Sharma et al 2022)	75
HCC (Bairagi et al 2021)	85
BBNN (Proposed)	70

The capacity of a face detection system or method to swiftly and reliably identify faces while making the best use of computational resources is referred to as performance in face identification. It entails obtaining accurate outcomes in a timely manner, utilizing hardware abilities effectively, and reducing needless computing overhead. Effective face detection techniques aim to utilize computing resources as efficiently as possible, including CPU and GPU use, memory usage, and energy economy. The approach can enhance efficiency and lower the total computational demands on the system by eliminating pointless computations, memory utilization, or energy consumption.

Figure 5 and Table 4 contains the numerical efficiency results, compares performance with conventional and proposed techniques. Our recommended solution offers 98% of the high-level performance for efficiency in automated face detection compared to traditional approaches.

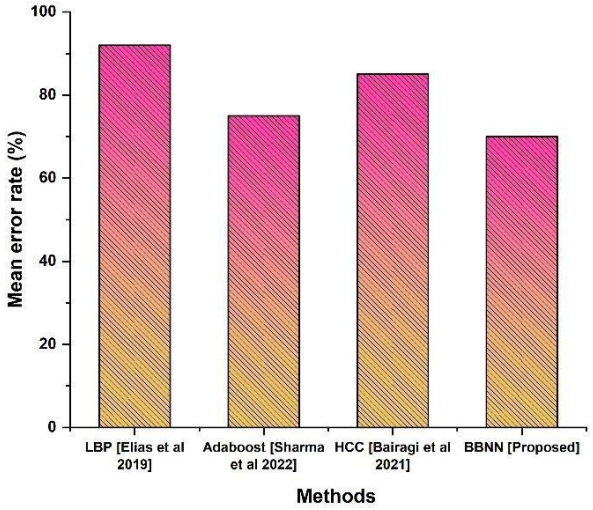

Figure 5 Comparison of efficiency with traditional and suggested technique.

Table 4 Numerical outcomes of efficiency.

Methods	Efficiency (%)
LBP (Ellias et al 2019)	85
Adaboost (Sharma et al 2022)	90
HCC (Bairagi et al 2021)	73
BBNN (Proposed)	98

4. Conclusions

In summary, automated face identification for lecture attendance presents a viable approach to simplify attendance administration in educational contexts. This system uses computer vision and facial detection technology to reliably and quickly detect and recognize the faces of students or attendees in a lecture or classroom setting. The system can automate taking attendance by accomplishing precise face identification and trustworthy face recognition, eliminating the necessity for manual tracking and recording. Real-time processing capabilities allow for prompt feedback and timely attendance tracking throughout the presentation to improve productivity and lessen administrative strain. Automated face detection for lecture attendance has the potential to streamline administrative processes, increase precision, and offer insightful data to educational institutions. Automation of attendance management frees up time and resources, which may be used more effectively for instructional activities. In this study, we proposed the BBNN method to enhance the efficiency of attendance tracking in educational environments. By comparing other traditional methods with our suggested approach, our BBNN method provides better efficiency. Although real-time processing is preferred for instant attendance tracking, face detection,

and identification techniques can still be sped up and made more effective. Future research can look into methods to shorten the processing time needed for attendance management and increase computational effectiveness.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Analyzing customer churn in banking: A data mining framework

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Abstract Customer churn, the loss of customers to a business, is a significant challenge in the banking industry. Retaining existing customers is crucial for banks to maintain profitability and sustain growth. This paper focuses on analyzing customer churn in the banking sector. The study utilizes data mining and predictive analytics techniques to analyse customer behaviour, identify churn patterns, and develop predictive models. This research uses a data mining technique called Gaussian mixture model clustering-based adaptive support vector machine (GMM-ASVM) to forecast customer loss in the banking industry. By analyzing consumer competency and loyalty to the banking industry using GMM, this study predicts customer behaviour using a clustering approach. An accuracy of 98% was attained while classifying the clustering results using ASVM. This study gives bank administrators the ability to analyse the behaviour of their clients, which may trigger appropriate tactics based on engaging quality and increase appropriate actions of administrator capacities in interactions with customers.

Keywords: customer churn, GMM-ASVM, banking industry

1. Introduction

Customer churn refers to the phenomenon where customers discontinue their relationship with a business or organization. In the context of the banking industry, customer churn occurs when individuals or businesses close their accounts, switch to another financial institution, or cease using certain banking services (Sun 2021). Analyzing customer churn in banking is crucial for financial institutions as it helps them understand why customers are leaving and enable them to take proactive measures to retain their valuable clientele. Customer churn, also known as customer attrition, is a critical challenge faced by banks and financial institutions (de Lima Lemos et al 2022). It refers to the loss of customers who discontinue their relationship with a bank, such as closing their accounts or shifting their business to a competitor. Customer churn has significant implications for banks, affecting their profitability, market share, and overall customer satisfaction.

To address these issues, banks are increasingly using data mining techniques to analyze customer churn patterns and identify factors contributing to customer attrition. The practice of gathering helpful information and recurring patterns from massive amounts of data is known as data mining. By leveraging data mining approaches, banks can better understand customer behavior and develop targeted strategies to retain customers and reduce churn (Wu and Li 2021; Tao et al 2020)

Authors of the study (Kaur and Kaur 2020) utilize many machine learning models to the bank dataset in an effort to forecast the likelihood of customer churn. These models include logistic regression (LR), decision trees (DT), K-nearest neighbor networks (KNN), random forests (RF), and others.

In the article Satria et al (2020), a deep learning model was developed to forecast the loss of customers in the banking industry by employing ANN architecture to address a categorization challenge. In order to accomplish tasks like extraction of features, recognition of patterns, regression, and categorization, ANN makes use of its many layers and its numerous existing nodes/neurons.

The research Muneer et al (2022) aims to create a model that provides valuable churn prediction for the financial sector. They use the three innovative models “random forest (RF), AdaBoost, and support vector machine (SVM) to develop a method for predicting customer attrition. Using the synthetic minority oversampling method (SMOTE)” to correct for under sampling and oversampling in an imbalanced dataset yields the most accurate results.

In order to identify the customers that provide the most significant risk of leaving the bank, the authors in the study Dalmia et al (2020) employed a supervised machine learning approach to develop a unique algorithm. With different datasets, various classifiers can provide varying degrees of accuracy. K-nearest neighbor (KNN) is a revolutionary new method for improving accuracy using weighted scales and the XGBooster algorithm. Using weighted scales and the KNN technique, the dataset is appropriately divided into training and testing models.

A study, Gholamiangonabadi et al (2019), suggested anticipating the loss of customers at an Iranian bank, where they presented a novel methodological strategy. They use data pre-processing to clean up their data first. Then, the k-medoids technique is used to group the data. Clustering efficacy is measured with the Davies-Bouldin index. Several types of neural networks (NNs) were used to analyze the data for patterns, including “radial basis function (RBFNN), generalized regression (GRNN), multilayer perceptron (MLPNN), and support vector machine (SVM)." MLPNN and SVM models were shown to have higher precisions with lower costs than other models.

In the study Amuda and Adeyemo (2019), a predictive model that utilizes the Multi-layer Perceptron of Artificial Neural Network structure was constructed with the purpose of predicting the degree of customer turnover in financial organizations.

The goal of the research Imron and Prasetyo (2020) was to improve the efficiency of the K-Nearest Neighbor technique for classifying data by determining how Z-Score normalization works and how best to determine the ideal K value parameters using Particle Swarm Optimization. Z-score and Particle Swarm Optimization were employed for data normalization in order to locate the best potential K value.

The study's objective Sjarif et al (2019) was to provide a method for predicting customer turnover utilizing the “Pearson Correlation and the K Nearest Neighbor algorithm." The outcome demonstrates that the K Nearest Neighbor algorithm outperforms other algorithms' accuracy.

The objective of this study is to apply a data mining approach to analyze customer churn in banking. By examining historical customer data, including demographic information, transactional records, customer interactions, and other relevant factors, we aim to identify key predictors of churn and develop a predictive model to forecast customer attrition. This research will contribute to the existing body of knowledge by providing valuable insights into customer churn behavior in the banking industry. The findings can help banks develop proactive churn prevention strategies, improve customer retention efforts, and enhance overall customer experience.

The rest of this paper is as follows: part 2 explores the related works, part 3 explores the methodology used for predicting the customer's chunks in the banking industry, and Part 4 shows the performance of the proposed and existing method. And part 5 concludes with the conclusion part.

2. Materials and Methods

This work aims to utilize efficient data mining techniques to generate accurate early forecasts regarding the loss of customers at a commercial bank. A diagrammatic representation of the recommended model may be seen in Figure 1.

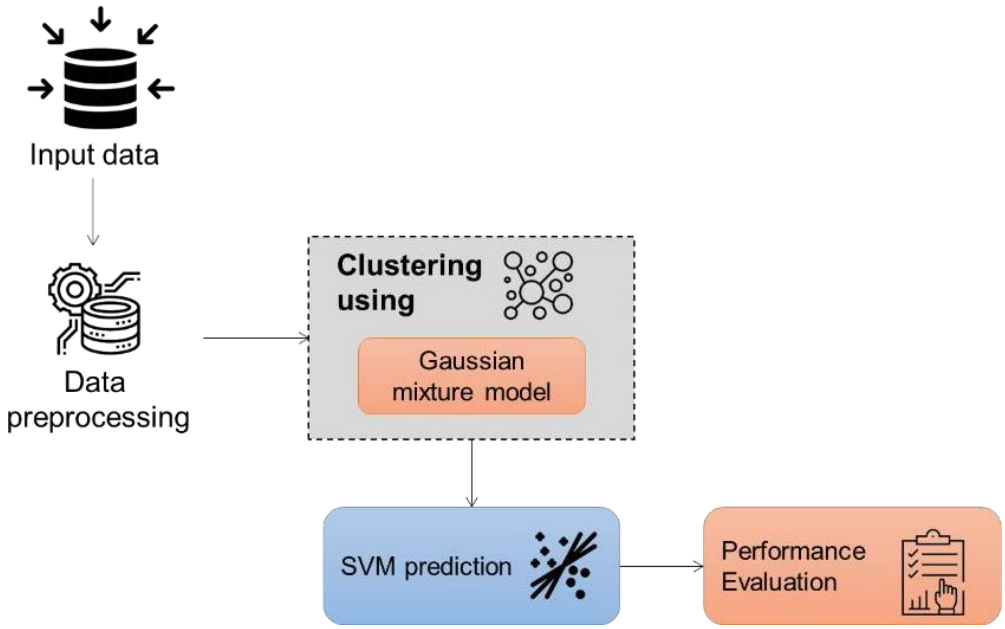

Figure 1 Outline of the suggested methodology.

2.1. Data sample

In order to model churns, the dataset that was utilized for this investigation was taken from Kaggle. This dataset consists of ten thousand bank customer data records, each of which has fourteen variables, including sociodemographic factors, account level attributes, and behavioral aspects, as outlined in Table 1.

Table 1 Dataset description.

Description	Attribute
ID of customer	Customer ID
Number of customers	Row Number
Location of customer	Geography
Age of Customer	Age
Customer gender	Gender
Customer name	Surname
Score of credit card usage	Credit Score
No of products used by customer	No. of. Products
The period of having the account in months	Tenure
Estimated salary of the customer.	Estimated Salary
Indicates customer leaved or not	Churn

2.2. Data pre-processing

Data pre-processing plays a crucial role in data mining. Since they impact task completion rates directly, it has to handle irrelevant, noisy, and unreliable information. And if that data conversion is required, too. In this analysis, these factors were used to determine churn rates.

• Irrelevancy: Relevant information is defined as facts or characteristics that do not affect the conversation topic. A classifier's performance may occasionally be impacted by maintaining such features. Row number, Customer Id, Surname, and Geography are factors that have no bearing on the forecast when considering into account the churn dataset. Therefore, these traits were manually disregarded in our investigation.

• Transformation: The process of converting one set of data into another format is referred to as data transformation. The data quality is improved, and applications are protected against potential minefields when the data have been appropriately formatted and verified. Possible minefields include null values, undesired duplication, inaccurate indexing, and incompatible file formats. In the course of this study, a modification to the data will be carried out.

2.3. Model building

Step-1: Using clustering, you may divide an immense amount of data into manageable sets of related records. It's able to pick up on broad themes discussed throughout the corpus. Document clustering has several applications beyond simply creating information maps from extensive document collections. The succeeding learning recoveries and accesses can be enhanced by this. For instance, document clustering has been used to improve the effectiveness of text layout and identify occurrence scenes in records that are only frequently used. Similarly, several early studies and emerging search engines use an archive clustering strategy to manage and consequently compose list items into vital classifications and thus offer cluster-based perusing instead of displaying query items as one not-insignificant list.

A parametric probability density function is referred to as a Gaussian mixture model, abbreviated as GMM. A weighted average of Gaussian densities is used to describe this model. A model based on the Gaussian mixture is a weighted average of the Gaussian densities of M different components, as shown in equation 1:

$$(Y|\lambda) = \omega_j h(Y|\mu_j, \Sigma_j) \qquad (1)$$

In this case, Y is a D-dimensional continuous data vector, $\omega_j$and $j = 1, \ldots.,$ N is the values for the mixture $weights$ $(Y|\mu_j, \Sigma_j), j = 1, \ldots., N$ are the parts of the Gaussian density functions. Each component density function is a D-variate Gaussian function of the form.

$$h(Y|\mu_{j}, \Sigma_{j}) = \frac{1}{(2\pi)^{E/2}|\Sigma_j|^{1/2}} exp\{-\frac{1}{2}(y-\mu_j)' \sum_j^{-1}(y-\mu_j)\} \qquad (2)$$

They were considering a covariance matrix of Σ_j and a mean vector ofμ_j. The mixing weights are permitted to deviate from the requirement$\sum_{j=1}^{N} \omega_j = 1$. The variables that comprise the parameters of a Gaussian mixture model are the densities of the individual components, their variances, and the weights assigned to each component in the final mixture. The notation $= \{\omega_j, \mu_j, \Sigma_j\}\, j = 1, \ldots., N$ can be used for these variables.

Step 2: Prediction: ASVM is used to create a prediction model for determining which customers are likely to churn based on the output of clustering findings. The use of binary classification is commonplace in model prediction. It is effective for many real-world problems and may resolve both linear and non-linear ones. In (3) above, $f(y)$ is the function used to categorize data, w is the weight, U is the carriage, y is the input, and c is the bias.

$$f(y) = xUy + c \qquad (3)$$

Decreasing the distance $2/\|x\|$ is comparable to optimizing $1/2\|x\|^2$, as illustrated in Figure 2, where the margin between the classification face is defined as $xUy + c = 1$ and $xUy + c = -1$ is$2/\|x\|$. Then, we may reframe the challenge of finding the best experience for categorization as the following optimization problem:

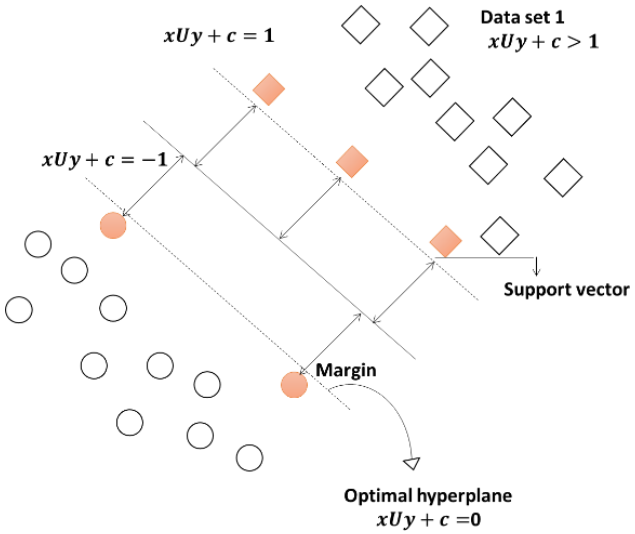

Figure 2 Representation of ASVM structure.

$$Min_{x,c}\ 1/2\|x\|^2 \quad (4)$$

$$\text{S.t } z_j((x.y + c)) \geq 1\ for\ any\ j = 1, \ldots n \quad (5)$$

In this research, the non-linear classification problem is solved by employing the radius basis function (RBF) kernel method. RBF kernel applied to two vectors of features in a particular input space, y andy', representing two samples.

$$L(y, y') = exp\ (-\frac{\|y-y^1\|^2}{2\sigma^2}) \quad (6)$$

$$L(y, y') = \exp\ (-\gamma\|y - y'\|^2) \quad (7)$$

Where $\|y - y'\|^2$the squared Euclidean distance among the two features is vectors and σ is an arbitrary constant. Then, GridSearchCV is utilized in adaptive support vector machines (ASVM) to locate appropriate hyper-parameters, such as (to use C or gamma values), that enhance accuracy and prediction outcomes. It thoroughly explores the parameter grid utilizing all possible parameter permutations. The initial task we need to do is to compile a dictionary of all the parameters and the ranges of values for them that we intend to try out. In order to proceed, a new instance of the "GridSearchCV-class" must be constructed. The final step is to invoke the fit class method of the "GridSearchCV class" and supply it with the training and test sets. As soon as the technique finishes operating, we look for the parameters that yield the maximum accuracy.

3. Results

We include a comparison of the suggested method's performance to that of current approaches in this section. The existing method such as convolutional neural network (CNN), decision tree and multinomial regression (DT-MR), and artificial neural network (ANN). The parameters used for the comparison are accuracy (%), precision (%), and recall (%), F1-score (%).

An accurate forecast is one in which the sum of the positive and negative samples is proportional to the entire sample size. It primarily evaluates the accuracy of the model's global predictions. Figure 3 and Table 2 depict the accuracy result. This demonstrates that our suggested technique, GMM-ASVM, has a greater accuracy in forecasting customer churns in the banking industry than the existing methods, CNN, DT-MR, and ANN. When comparing it with the currently employed methods.

The proportion of the number of positive samples that were accurately predicted in relation to the total number of positive samples is known as precision. This metric is primarily used to indicate the reliability of the positive samples. Figure 4 and Table 3 depict the precision result. This demonstrates that our suggested technique, GMM-ASVM, is superior in forecasting customer churns in the banking industry than the existing methods, CNN, DT-MR, and ANN. When comparing it with the currently employed methods.

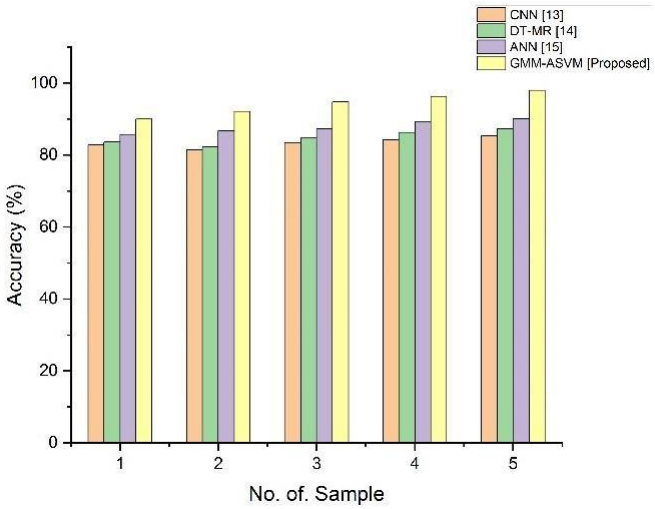

Figure 3 Accuracy result.

Table 2 Values of accuracy.

No. of. sample	Accuracy (%)			
	CNN (De Caigny et al 2020)	DT-MR (Rouhani and Mohammadi 2022)	ANN (Yahaya et al 2021)	GMM-ASVM [Proposed]
1	82.8	83.62	85.75	89.92
2	81.5	82.25	86.75	92.15
3	83.5	84.65	87.25	94.75
4	84.2	86.25	89.35	96.32
5	85.3	87.35	90.15	98

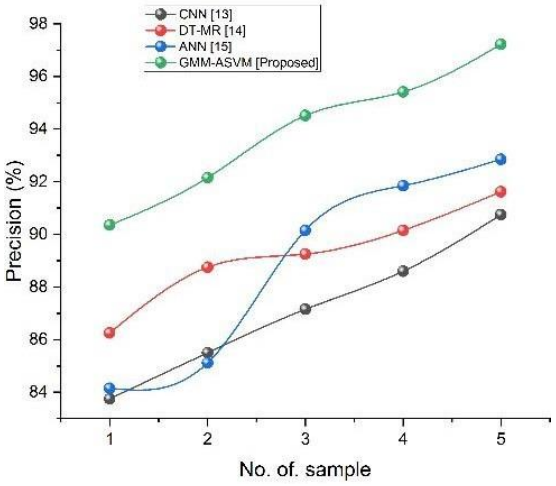

Figure 4 Precision result.

Table 3 Values of precision.

No. of. sample	Precision (%)			
	CNN (De Caigny et al 2020)	DT-MR (Rouhani and Mohammadi 2022)	ANN (Yahaya et al 2021)	GMM-ASVM [Proposed]
1	83.75	86.25	84.15	90.35
2	85.5	88.75	85.12	92.15
3	87.15	89.25	90.15	94.51
4	88.6	90.15	91.85	95.41
5	90.75	91.62	92.85	97.22

The recall is the proportion of precisely anticipated positive sample size to the actual number of positive samples, and it represents the coverage of the prediction model. Recall may be expressed as a percentage. Figure 5 and Table 4 depict the recall result. This shows that when compared to the currently in use techniques, CNN, DT-MR, and ANN, our proposed methodology, GMM-ASVM, has a higher value in recall for forecasting the customer churns in the banking business.

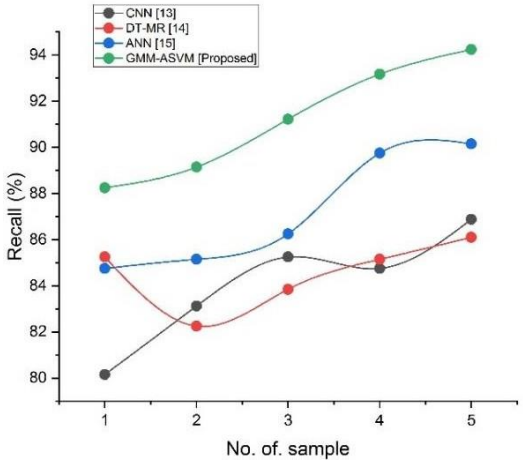

Figure 5 Recall result.

Table 4 Values of recall.

No. of. sample	Recall (%)			
	CNN (De Caigny et al 2020)	DT-MR (Rouhani and Mohammadi 2022)	ANN (Yahaya et al 2021)	GMM-ASVM [Proposed]
1	80.15	85.25	84.75	88.25
2	83.12	82.25	85.15	89.14
3	85.25	83.85	86.25	91.22
4	84.75	85.15	89.75	93.17
5	86.88	86.1	90.15	94.24

The amount of time required by our suggested algorithm to complete its assigned work is referred to as the computation time. It is represented as seconds. Figure 6 and Table 5 depict the outcome of computational time. This shows that when compared to the currently in use approaches, CNN, DT-MR, and ANN, our recommended methodology, GMM-ASVM, takes less time to anticipate customer churns in the banking business. This demonstrates that the model we offered will be effective.

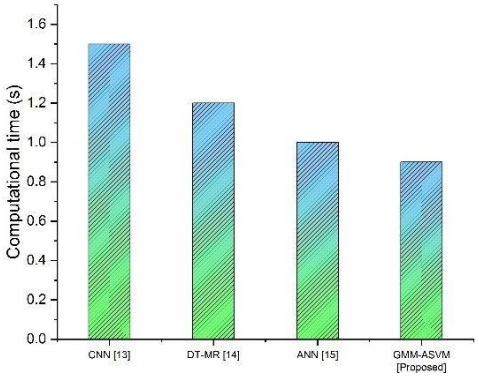

Figure 6 Outcome of Computational Time.

Table 5 Values of computational time.

No. of sample	Computational time (s)
CNN (De Caigny et al 2020)	1.5
DT-MR (Rouhani and Mohammadi 2022)	1.2
ANN (Yahaya et al 2021)	1
GMM-ASVM [Proposed]	0.9

4. Conclusion

The rapid growth and arrangement of many administrations within the financial sector increase the probability of the industry losing profitable customers. Rapid advancement in data innovation in a variety of organizations, such as the financial sectors, which create enormous datasets, enables reasonable investigation to be performed to anticipate the behaviour of consumers and build up the connections of customers, with the goals of satisfying customers, attracting customers, and

retaining customers. Data mining techniques are used to effectively discover previously interred information and to learn from customers' data. In order to predict customer losses in the banking sector, this study employs a Gaussian mixture model clustering-based adaptive support vector machine (GMM-ASVM). This research predicts customer behaviour using a clustering method by examining consumer competence and loyalty to the banking business using GMM. The clustering results were classified with 98% accuracy using ASVM. This research provides executives at banks with the knowledge they need to assess customer behaviour, which might lead to the implementation of strategies based on the engaging quality of customer contacts and boost the appropriate actions of administrator capacity.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Predicting software defects with swarm-intelligence-based machine learning algorithm for improved process quality

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Abstract The quality and effectiveness of software systems may be significantly impacted by Software Defects (SD). Therefore, enhancing process quality is essential for controlling and minimizing the incidence of faults. Implementing reliable Software Development (SDe) processes and best practices is one way to do this information. SD, commonly referred to as software bugs or software mistakes, are defects or errors that occur in computer programs and cause them to act up or create unintended outcomes. These vulnerabilities may appear for several causes, including programming mistakes, poor design choices, or issues with the SDe cycle. The prediction of software problems based on Machine Learning (ML) using an Enhanced Artificial Neural Network (E-ANN) is implemented in this study to increase software quality and testing effectiveness. Particle swarm optimization and grey wolf optimization, these two algorithms named grey wolf swarm optimization algorithm (GWSA), are combined to recognize the corresponding compensation of the methods following the respective benefits and drawbacks. The hybrid algorithm-based model to the conventional hyperparameter optimization strategy and a single swarm intelligence algorithm's investigation of investigational consequences from six data sets shows that the hybrid algorithm-based model has high and enhanced indicators. Processed by the autoencoder, the model's performance has also improved.

Keywords: software defects, E-ANN, GWSA, SDP

1. Introduction

Software reliability model-based Software Defect Prediction (SDP) is critical to assessing software superiority. Several primary duties make up the issue. The initial objective is to determine the suitable software reliability model's estimation parameters that provide the most significant match to software failure data. The second is to predict the time when SD will occur. An SD, sometimes called a software bug or software mistake, is a weakness or malfunction in a computer program that makes it act unexpectedly or provide inaccurate results. Numerous things, including programming mistakes, design faults, or issues with the SDe process, might lead to these defects (Yang et al 2021). In the process of building embedded software, one of the components considered to be among the most complex and costly is the process of locating and fixing defects. Measuring and attaining high standards is challenging, especially in automobile-embedded systems. This is primarily due to the complex infrastructure and its scope, cost, and time restrictions. Even so, achieving high standards for product quality and dependability is essential. Software testing requires the same time, money, infrastructure, and experience as software development. While developing safety-critical software systems, expenses and efforts rise. Consequently, every industry with significant SDe expenditures must have a solid testing plan. The software sector is expanding rapidly and technologically. Therefore, predicting software dependability is crucial in the SDe process (Thota et al 2020).

SD programmers often utilize debugging tools and procedures to find and fix coding issues. To identify flaws early on and stop them from becoming issues later, testing is a crucial component of the SDe process. Additionally, procedures for code review and software quality assurance may aid in lowering the possibility that errors would ever arise. Identification and reporting of SD are necessary for effective management of them. To find flaws, developers, and testers utilize a variety of methodologies, including manual testing, automated testing, code reviews, and user input. It's essential to have a well-organized defect reporting procedure to guarantee accurate and valuable information (Li et al 2020). The practice of identifying components of a software system that could have flaws is known as Defect Prediction (DP) in software. In addition to easing up on the maintenance effort, this results in lower labour expenses throughout development. At first, the frameworks utilized in DP were developed using statistical methods. Still, learning techniques must be used in building DP models for the model to be intelligent, that is, capable of modifying evolving data so that as the creation process matures,

the DP model also matures. Priorities should be determined by considering a defect's severity, frequency of recurrence, possible business effect, and user impact. Critical flaws should be fixed as soon as possible if they threaten the system's security, stability, or fundamental functioning (Son et al 2019).

Digital software systems are becoming more sophisticated, and the resulting software applications often include flaws that may negatively affect the reliability and resilience of these programs as individuals. A departure from the software requirements or specifications is a typical definition of an SD. Such flaws might result in failures or unexpected outcomes. The number of software failures may be reduced, and the program's quality can be improved via a variety of software quality assurance activities. Techniques for SD predictions aid in locating software system components that are more probable to have flaws. Model assessing software modules by anticipated quantities of defects, defect likelihood, or classification outcomes may be created using DP methods (Qiao et al 2020). By examining the problem of SD, we suggested using ML and an E-ANN to forecast SD, which enhances testing and software quality. Particle swarm optimization and grey wolf optimization are used in grey wolf swarm optimization (GWSA) to maximize their complementary benefits and problems. The application of Ensemble Learning (EL) for the prediction of SD is the topic of five research issues covered in this article. After a comprehensive, methodical search procedure, the 46 articles that are the most pertinent to the issues at hand are selected. The research findings can be used as a standard for future enhancements and in-depth analyses while offering brief details about the most current trend and breakthroughs in EL for SDP (Matloob et al 2021).

Liang et al (2019) developed a Long Short-Term Memory (LSTM) network; users will need to use the vector sequences and their labels. The LSTM model can do fault prediction and effectively learn the semantic content of programs. According to the assessment findings on eight open-source projects, Seml beats three cutting-edge DP algorithms on most data for both within and cross-project defect predictions. Introduce a hybrid strategy by merging deep neural networks (DNN) for classification with genetic algorithms (GA) for characteristic optimization. A novel method for chromosomal constructing and computing fitness functions is included in an updated version of the GAA adaptive auto-encoder, another improvement made to the DNN approach that better represents certain software aspects. Case studies show that the suggested hybrid approach's increased effectiveness results from optimization technology (Manjula and Florence 2019). Dam et al (2019) discussed the practical utility of a novel deep learning tree-based DP model. The Abstract Syntax Tree (AST), a depiction of the source code, is directly matched by the tree structured Long Short-Term Memory (LSTM) network on which the model mentioned above is constructed. As they create the model and test it on two datasets, one from open-source projects supplied by their client Samsung and the other from the public PROMISE repository, they share several things they have learned. The profession of software engineering is now primarily interested in the early detection of software problems. Several SDP strategies based on software metrics have been implemented over the last two decades. In predicting faults, bagging, decision trees (DS), and random forests (RF) classifiers are known to perform effectively. Alsaeedi and Khan (2019) analysed and contrasted these supervised ML and ensemble classifiers. The experimental findings demonstrated that, compared to the others, RF was the classifier that performed the best in most instances. Jayanthi and Florence (2019) presented a concept for feature reduction as well as artificial intelligence, with features reduction being carried out using the commonly used Principal Component Analysis (PCA) method and further enhanced by the addition of estimation of the maximal likelihood for the purpose of defect reduction in PCA data reconstruction. The DP, through the attention-based recurrent neural network (DP-ARNN) present in the present work, can forecast defects. To be more precise, DP-ARNN first extracts vectors from the program's abstract syntax trees (ASTs). Then, using word embedding and dictionary mapping, it encodes the vectors that are utilized as the inputs for the DP-ARNN (Fan et al 2019). Balogun et al (2019) The repository of the National Aeronautics and Space Administration (NASA) was used in order to acquire the five SD datasets that were required for the assessment of the fourteen-filter feature subset selection (FSS) techniques and the four-filter feature ranking (FFR) methods. The effectiveness of the forecasting models used in the FFR approaches was noticeably boosted by the addition of Information Gain. The study provides a one-of-a-kind model by using a local tangent space alignment support vector machine (LTSA-SVM) approach, allowing it to handle the problem of software failure prediction. The SVM technique is used throughout the modelling process as the principal classification for the SD distributed prediction model. The model parameters are then improved by combining the grid search method with ten-fold cross-validation. This process is repeated 10 times. The accuracy of SVM is decreased in classic dimensionality reduction techniques due to data loss brought on by the poor characteristics of data nonlinearity (Wei et al 2019). Majd et al (2020) provided a novel method called Statement-Level SD prediction using the Deep-learning model (SLDeep). Because it shows a unique application of deep-learning models to resolve a real-world issue encountered by software engineers, SLDeep is significant for intelligent and expert systems.

2. Methodology

Stable SD predictive technologies and dynamically SDP technology are the two primary subcategories that make up SDP technology. The diverse aims and findings of the study are used as the basis for making these differences. Analyses are performed on the static SDP technology, with the goal of creating SDP via the use of chronological data and metrics. The depiction is used to do an analysis of the software module's tendency to have defects.

2.1. Static SDP Technology

The analysis of the software element convention, creation of the relevant dimension component, establishment of an opposite SDP structure constructed based on the measurement factor, and application of created SD are steps involved in the static SDP technology. Figure 1 shows that prediction results often come in two types: faults and non-defects. Software static measurement data and SD have a clear nonlinear connection that neither follows the established exact model nor is an essential combination of elementary nonlinear association methods.

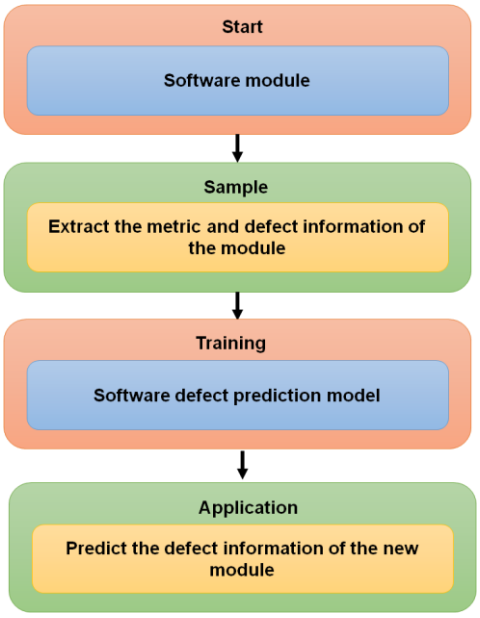

Figure 1 Basic rocket ship design.

2.2. *Data Set for Training*

There are two pieces to the software capacity and fault data. The static capacity data of each software function makes up one component, and the fault label (0 or 1) of each software function makes up the other. A web crawler tool was developed to gather the code that needs to be determined and defect details from open-source websites. Additionally, fixed metrics using standard concepts and Test Bed were expanded to compensate for the limited number of statistics and documents in the existing data set.

2.3. Basic Software Measurement

The static metrics have been concluded based on general principles, and Test Bed is an extensively used tool for doing fixed examinations on software. Table 1 has a complete listing of the metrics.

Table 1 software metrics that are often used for process-oriented software.

Category	Metrics
LOC metrics	LOCphy
	LOComment
	LOBlank
	LOCComment
Dataflow information	Globals in procedure
	File fan in
	Fan out
Complexity metric	Knots
	Quantity of loops
	the intensity of loop nesting
Procedure information	process entry points
	process exit points
	entire comments

2.4. Cutting Software into Function

The syntax and semantic requirements for process-oriented languages are quite stringent. The languages must also adhere to formal programming and coding standards regarding the design of functions and the composition of code. These

grammatical and semantic requirements effectively improve the reliability of SDP by utilizing technology that provides code Function Level (FL) slicing and slicing criteria for code FL slicing.

2.5. Data collection and fusion for training

The method of data gathering based on web crawlers is shown in Figure 2 by using the process-oriented C language program as an example. The process shown in Figure 2 primarily consists of three elements. The first is to create function-level software measurement findings for the C language using code-slicing technologies. The second option is to use web crawler technology to automatically gather and recognize code and defect data gleaned from free software websites. The third phase entails the creation of measurements and defect data for a program written in the C language via the informational verification of function names. In order to offer data that can be used to produce superior and practical measures for SDe and defective details for SD prediction models, the data production process makes use of self-developed software tools. These metrics may then be employed in the models. These technologies feature high information excellence, rapid velocity, exact comparison, and function-level information granularity.

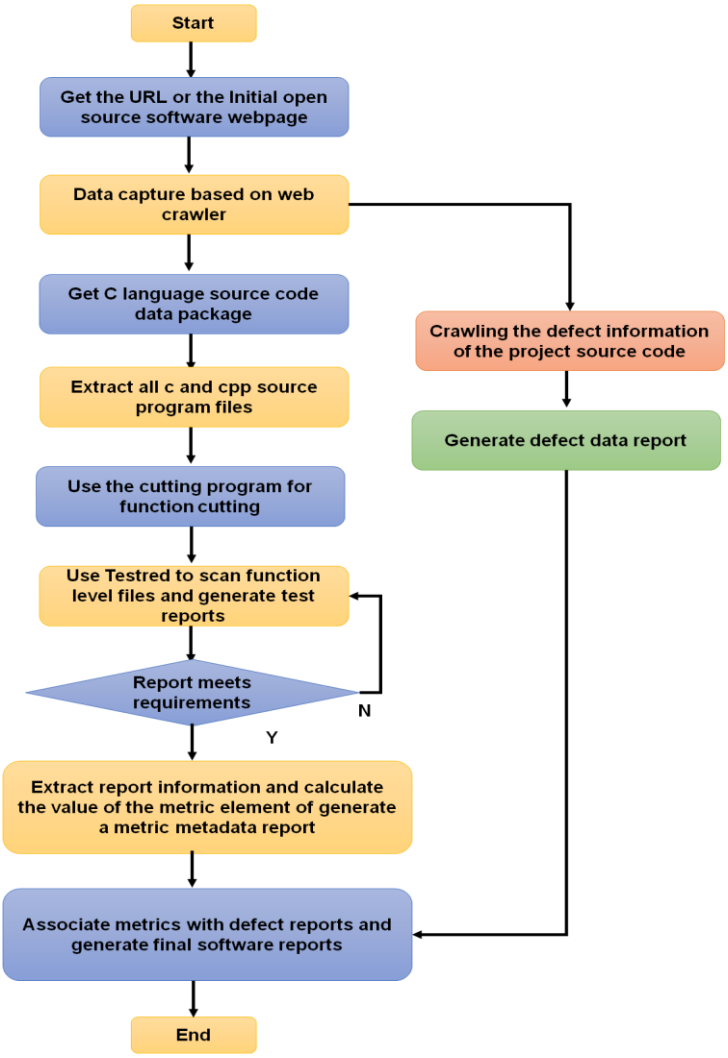

Figure 2 Process for generating measurements and defect data for software written in C.

2.6. Enhanced Artificial Neural Network (E-ANN)

E-ANN, utilized in adaptive learning systems, may approximate a nonlinear input and output data transition. The outputted numbers indicate factors that are challenging to measure but are believed to be intimately dependent on the input variables. E-ANN is a powerful supervised learning model that has been used in a few areas, including the study of chemical interactions and the prognosis of SD. E-ANN adaptability enables independent parameter changes all through a training phase. In an SL scenario, pairs of specific instances are given to the network during training. An external supervisor provides the targeted output vector and the corresponding input vector. While the E-ANN model was built, it is learned and can offer an output vector based on an input instance that has not yet been seen (Figure 3).

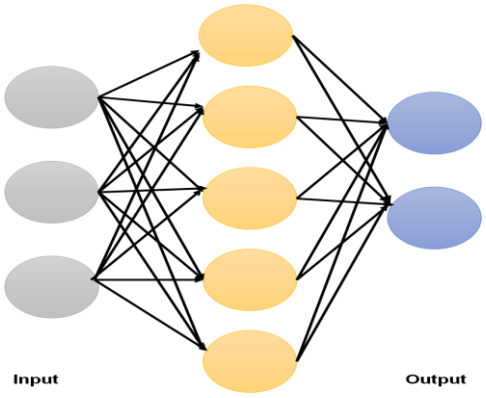

Figure 3 Enhanced Artificial Neural Network.

A feed-forward E-ANN comprising many ultimately linked layers of neurons is called a multilayer perceptron (MLP). The backpropagation algorithm, an inductive learning method, trains the MLP. The fault discovered is sent back into the network, and its settings are modified during the input-output example given to it. Until a satisfactory performance is achieved, this procedure is repeated. The radial basis function network (RBFN) is a different neural network design. Mitchell claims that the output of the hidden units is dictated by a Gaussian activation function centred at a particular input instance. The output of an RBFN is the linear result of the hiding unit activations. The structure of the assumption that an RBFN learns provided an input u is illustrated in equation (1).

$$\hat{e}(u) = \sum_{l=1}^{L} v_l \, \emptyset_l((d_{ocal}. u)) \qquad (1)$$

In equation (1), L stands for a specified number of Radial Basis (RB) functions, d_l is the center selected for the L^{th} RB function, and v_l are positive real integers indicating the parameter values of the RB functions.

The metric d is often the Euclidean distance, and the function $\emptyset_l(c(d_l. u))$ is frequently chosen as a Gaussian function focused on the position d_l with a variance ${\sigma_l}^2$(equations (2 and 3).

$$\emptyset_l(c(d_l. u)) = f^{\frac{c^2(d_l - u)}{2\sigma_l^2}} \qquad (2)$$

$$\sigma_l = \alpha \frac{1}{o} \sum_{j=1}^{o} c(d_l . d_j^l) \qquad (3)$$

2.7. Grey Wolf Swarm Optimization Algorithm (GWSA)

The GWSA resolves several industry optimization issues and effectively produces very competitive outcomes. The GWSA algorithm is based on the SD. The GWSA splits its SD into four groups based on the prevailing hierarchical leadership order: alpha (α), beta (β), delta (δ), and omega (ω). Consequently, the leaders with the highest ranks corresponding to the top three potential outcomes in the search field serve as the direction for prediction and optimization processes. These leaders are, respectively, α, β, and δ.

The remainder of the solutions is represented by the ω SD, which is the smallest in the hierarchy and must change its position to accommodate the other dominating DP. Provided that it is expected that each alternative solution of dimensions n be expressed by the vector $\vec{\vec{U}}^{\rightarrow}$, the location vector of the grey wolf is provided in equation 4 as follows:

$$\vec{U}^{\rightarrow} = \{u_1, u_2, \ldots, u_m\} \qquad (4)$$

The GWSO and DP model combination can improve defect management tactics and reduce the effects of software problems, thereby boosting the quality and dependability of software systems. Equations 5 and 6 could be used to depict this behavior in GWSA quantitatively:

$$\vec{U}^{\rightarrow} = |\vec{D}. \vec{U}(s)_o - \vec{U}(s)| \qquad (5)$$

$$\vec{U}(s+1) = \vec{U}_o(s) + \vec{B}^{\rightarrow} . \vec{C}^{\rightarrow} \qquad (6)$$

where $\vec{U}_o^{\rightarrow}$ is the position vector of the defects, $\vec{U}^{\rightarrow}(s)$ is the position vector of the Grey wolf, s is the current iteration, $\vec{\vec{a}}^{\rightarrow}$ $\vec{\vec{n}}^{\rightarrow}$ $\vec{\vec{d}}^{\rightarrow}$ $\vec{B}^{\rightarrow}$ and $\vec{E}^{\rightarrow}$ are coefficient vectors vary to allocate the wolf to adjust their positions in the space approximately the defects. The coefficient vectors $\vec{B}^{\rightarrow}$ and $\vec{E}^{\rightarrow}$ are computed according to equation 7.

$$\vec{B} = 2\vec{b}q_1 - \vec{b}$$
$$E = q_2 \quad (7)$$

The elements $\vec{b}$ are assumed to linearly decrease within an initial value of 2 to a value of 0 during the search process, while $\vec{q}_1$ and q_2 are random vectors chosen from the range [0,1]. Then, the GWSA preserves the top three solutions and lets the remaining solutions move into place following the best solutions' locations. To get the difference between the present location and α, β, and δ, respectively, equation 8 is employed.

$$C_\alpha = |\vec{D}_1.\vec{U}_\alpha - \vec{U}|$$
$$C_\beta = |\vec{D}_2.\vec{U}_\beta - \vec{U}| \quad (8)$$
$$C_\delta = |\vec{D}_3.\vec{U}_\delta - \vec{U}|$$

where $\vec{U}$ is the location of the current solution, $\vec{D}_1$, $\vec{D}_2$, and $\vec{D}_3$ are random vectors, and $\vec{U}_\alpha$, $\vec{U}_\beta$, and $\vec{U}_\delta$ are the locations of the α, β, and δ respectively. Then, using equation 9, it is possible to determine the final location of the present solution.

$$\vec{U}_1 = |\vec{U}_\alpha.\vec{B}_1 - C_\alpha|$$
$$\vec{U}_2 = |\vec{U}_\beta.\vec{B}_1 - C_\beta| \quad (9)$$
$$\vec{U}_3 = |\vec{U}_\delta.\vec{B}_3 - C_\delta|$$

Thus, $\vec{U}(s+1)$ can be computed as follows (equation 10):

$$\vec{U}(s+1) = \frac{\vec{U}_1+\vec{U}_2+\vec{U}_3}{3} \quad (10)$$

where s represent the number of iterations, and $\vec{B}_1$, $\vec{B}_1$, and $\vec{B}_3$ are random vectors that vary to allow the defects. SD may significantly impact software system performance and dependability. Researchers have recently been experimenting with different optimization methods to improve error identification and prevention. Using the GWSA algorithm is one option that shows promise. GWSA, which derives its cues from the social interactions of unclear, may be used to improve the settings and characteristics of DP models like ANNs. The performance of DP models may be enhanced by GWSA, resulting in more precise and trustworthy detection of SD.

3. Result and discussion

Software quality and testing may be enhanced by using ML and an Enhanced Artificial Neural Network (E-ANN) to anticipate SD. The grey wolf swarm optimization algorithm (GWSA) combines particle swarm optimization with grey wolf optimization to maximize their complementary benefits and downsides. A suggested method's effectiveness is evaluated with that of existing techniques such as K-Nearest Neighbor's algorithm (KNN) (Mabayoje et al 2019), Support Vector Machine (SVM) (Goyal 2022), and Convolutional Neural Network (CNN) (Pan et al 2019). These techniques are compared with previous techniques using several parameters, including accuracy, precision, recall, and f1 score.

3.1. Accuracy

One of the most often used measures for assessing classifier models is accuracy, which reflects the total impact of prediction. Still, using accuracy as the criterion for measuring a prediction model's effectiveness in DP is pointless because of the severe division inequity problem in the defect data.

$$Accuracy = \frac{TP+TN}{TP+FP+FN+TN} \quad (11)$$

Figure 4 and Table 2 shows the accuracy of the proposed and existing system. EANN can be used as a predictive model to detect or categorize SD, and GWSO can be used to optimize the parameters or features of the EANN to increase its accuracy. KNN has attained 0.76%, CNN has attained 0.88%, SVM has acquired 0.82%, and the proposed system reached 0.94% accuracy. It demonstrates that the suggested method is more accurate than the existing one.

Table 2 Accuracy.

	Accuracy (%)
CNN (Pan et al 2019)	0.88
KNN (Mabayoje et al 2010)	0.76
SVM (Goyal et al 2022)	0.82
E-ANN+GWSA [Proposed]	0.94

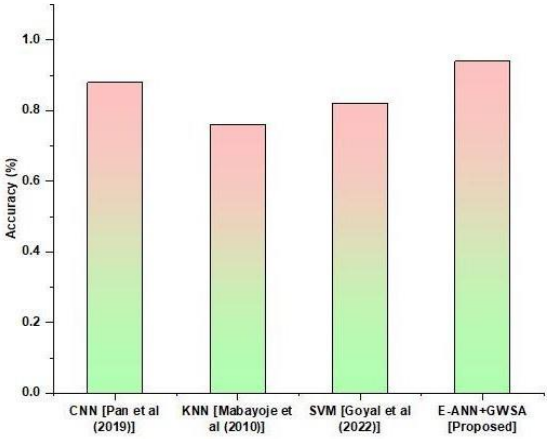

Figure 4 Accuracy.

3.2. Precision

Precision in the context of SD refers to the percentage of defects accurately recognized out of every reported defect. It highlights the capacity to prevent false positives by evaluating the reliability and accuracy of fault detection.

$$Precision = \frac{TP}{TP+FP} \qquad (12)$$

Figure 5 and Table 3 shows the precision of the proposed and existing system. GWSO is an optimization method to improve the EANN's features or parameters. Although it has little immediate effect on precision, it might make the EANN function greater general. KNN has attained 0.69%, CNN has attained 0.74%, and SVM has attained 0.83%, whereas the proposed system reached 0.92% accuracy. It demonstrates that the suggested method is more precise than the existing one.

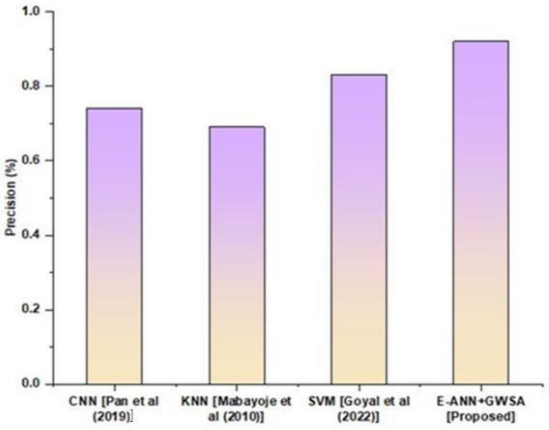

Figure 5 Precision.

Table 3 Precision.

	Precision (%)
CNN (Pan et al 2019)	0.74
KNN (Mabayoje et al 2010)	0.69
SVM (Goyal et al 2022)	0.83
E-ANN+GWSA [Proposed]	0.92

3.3. Recall

Recall, as referring to SD, is the percentage of defects accurately recognized out of all the actual defects present in the software system. It gauges whether comprehensive and accurate fault detection is, demonstrating the capacity to prevent false negatives.

$$Recall = \frac{TP}{TP+FN} \qquad (13)$$

Figure 6 and Table 4 shows the recall of the proposed and existing system. It concentrates on the EANN's capability to accurately discover or identify genuine faults from the available data while taking into account the recall of an EANN with

the aid of GWSO for SD.KNN has attained 0.79%, CNN has attained 0.85%, and SVM has attained 0.82%, whereas the proposed system reached 0.96% accuracy. It demonstrates that the suggested method is more recall than the existing one.

Table 4 Recall.

	Recall (%)
CNN (Pan et al 2019)	0.85
KNN (Mabayoje et al 2010)	0.79
SVM (Goyal et al 2022)	0.82
E-ANN+GWSA [Proposed]	0.96

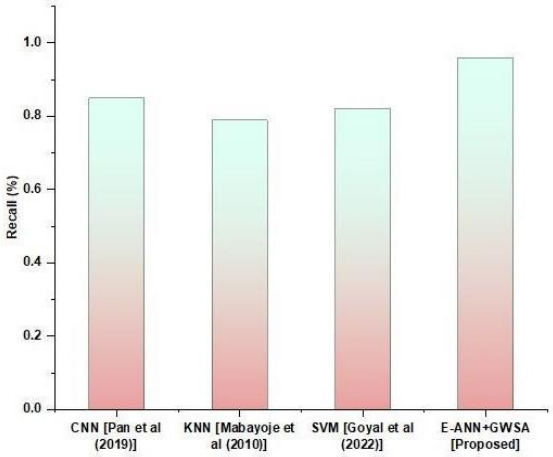

Figure 6 Recall.

3.4. F-measure

A statistic often used to assess the overall effectiveness of fault detection or classification systems is the F-measure, sometimes known as the F1 score. It provides a balanced measurement of both measures by combining recall and accuracy into a single number.

$$F1 - score = 2\left(\frac{Precision \times Recall}{Precision + Recall}\right) \quad (14)$$

Figure 7 and Table 5 shows the F-measure of the proposed and existing system. Network design, enhancement methods, and optimization parameters affect EANN with GWSO. To estimate the F-measure and performance of the EANN with GWSO for SD prediction, experimentation, and assessment are necessary. KNN has attained 0.78%, CNN has attained 0.71%, and SVM has attained 0.85%, whereas the proposed system reached 0.91% accuracy. It demonstrates that the suggested method is more F-measure than the existing one.

Table 5 F-measure.

	F-measure
CNN (Pan et al 2019)	0.71
KNN (Mabayoje et al 2010)	0.78
SVM (Goyal et al 2022)	0.85
E-ANN+GWSA [Proposed]	0.91

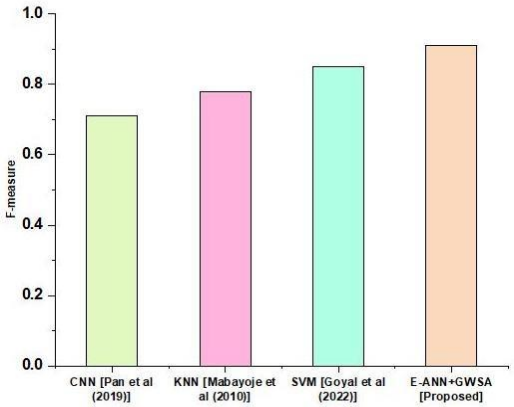

Figure 7 F-measure.

4. Conclusions

Software defects, additionally referred to as software bugs or software faults, are defects or errors in the code of a piece of software that might cause it to behave in a manner that is not consistent with what it was intended for it to do or to create outcomes that are erroneous or unanticipated. Errors in logic or syntax, inconsistencies in the design, or problems with compatibility are some of the ways that these faults may appear. The use of ML and an Enhanced Artificial Neural Network (E-ANN) to predict SD is one way to improve software quality and testing. The grey wolf swarm optimization method (GWSA) combines particle swarm optimization with grey wolf optimization to optimize their complementing advantages and drawbacks. SD constitutes a substantial barrier in SDe owing to many fundamental restrictions. Due to time and resource limitations, limited testing coverage makes the issue worse by making it impossible to test software in all scenarios and configurations. SDe groups should continue to place a high priority on fixing SD in their future work. It is crucial to keep researching cutting-edge methods to identify, avoid, and manage software faults, given the complexity of software systems and the rising need for dependable and secure applications.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

A hybrid approach to predicting daily stock market returns with deep learning

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Abstract It is quite difficult to correctly forecast returns on stock markets because of the economic stock industry' extreme volatility and complex nature. Programming methods of prediction have shown to be increasingly effective at forecasting stock values with the development of artificial intelligence and improved computational capability. Deep learning (DL) algorithms and big data analytics are becoming more and more crucial in a variety of application areas, including stock market investing. However, other research has focused on predicting daily stock market returns, particularly when employing DL approaches to carry out powerful analysis. The DL algorithm is used in this paper's big data analytics approach to forecast the SPDR S&P 500 ETF's daily stock market return direction. The complete dataset was then run through a DL algorithm, such as the MultiDepth NeuroNetwork (MD-NN) technique, to forecast path of the projected index for the stock market daily returns. The simulation results demonstrate that the MD-NN datasets provide much greater classification accuracy than those utilizing the existing approaches.

Keywords: BDA techniques, deep learning, daily stock market, MNED

1. Introduction

Market participants may safeguard their cash investments via futures contracts thanks to the superior hedging instruments provided by futures markets. This hedging strategy reduces some of the uncertainty brought on by erratic changes in market pricing. For instance, because to the unequal distribution of crude oil around the globe, manufacturers of products and services worldwide actively follow price changes, and there is a thriving futures marketplace for it (Ghosh et al 2022). Because good forecasting has the potential to benefit investors greatly, stock price forecasting is a crucial topic in the financial industry. Forecasting is of importance to financial professionals. Traders are also keen on these trends, which are behavioural models of stock prices (Cheng et al 2022). Insights may be gained through easy financial information for analysis, however in recent times, investment firms have increasingly turned to artificial intelligence (AI) systems to sift through vast volumes of real-time equities and economic data for trends. These systems assist with human decision-making, and since they have been in Since they have been in use for a while, it can be done to research and analyse their traits and performance to determine which ones outperform other methods in terms of prediction (Strader et al 2020).

Companies list their stocks on the stock market, a financial marketplace, to raise money for their activities. Investors invest in stocks in the hopes of making money through an annual dividend or a growth in the stock's value. The price change is erratic. The method that securities are exchanged on the stock market has evolved as a result of developments in communications and software technology (Tabar et al 2020). For anticipating the future market, there are several optimization technologies available, including genetic algorithms, particle swarm optimization, and artificial neural network (ANN) methodologies. For time series prediction, ANN is the finest optimization tool. They could anticipate hidden and undiscovered records (Chandar 2019). The basic goals of every investing in the share market are to generate a high return and limit losses since the stock market is the foundation of any economy. Therefore, because improving stock markets is linked to economic development, nations should work to do so. Making successful stock market forecasts is a possible path to economic self-reliance since the stock market can provide speedy returns on investment. It is more challenging to anticipate the stock prices of a certain company in a specific market since the stock market's prediction is not linear (Aldhyani and Alzahrani 2022).

Technical assessment and basic evaluation have historically been each of them most typical often used to evaluate the stock exchanges data. Since fundamental analysis is predicated on the idea of intrinsic worth, in order to establish the current price, data of both types are used. This strategy long-term embraces the Emit seems to imply there may be any inefficiency in the near run. However, technical assessment makes advantage of previous analytics to spot trends and predict eventual shifts in stock prices (Ayala et al 2021). It could be challenging to anticipate the cost of stocks. Many stock market ideas have

existed and evolved throughout the years. Whether they try to describe how markets work or ask whether it's feasible to exceed the market. According to the Efficient Market Hypothesis (EMH), at any given moment, every detail concerning a stock is included into its market price company, is one of the most popular and fiercely debated hypotheses put out by Fama (1970). The stock is suitably valued if everything happens priced (Shah et al 2019). Deep learning and machine learning methods may aid traders and investors in making judgments in programs that forecast the stock price. These methods seek to automatically identify and recognize connections amid enormous amounts of data. These methods of efficiently self-learning and can deal with forecasting price changes to enhance trading tactics. Numerous methods for predicting changes in stocks have been improved in recent years (Nabipou et al 2020).

Ghosh et al (2019) presented for predicting future returns in financial markets. The endeavour is particularly difficult because of how unpredictable, erratic, and nonlinear the financial market moves are. A three-stage strategy is suggested for completing this challenging undertaking. Kamalov et al (2020) investigated a hitherto understudied problem: utilizing machine learning algorithms to forecast substantial changes in stock price based on past changes. The efficiency of analysers using neural networks in the relevant context is of special interest to us. Singh et al (2019) focused on illustrating various machine learning techniques that have been used to create prediction predicts and valuation predictions for machines that utilize support vectors, among other stock exchanges, deep learning, random forests, boosted decision trees, ensemble methods, and a few hybrid techniques. By offering an updated systematic evaluation of the stock market forecasting methods, including their categorization, characterisation, and comparison, this work seeks to close this gap (Bustos and Pomares-Quimbaya 2020). Shahi et al (2020) evaluated the relevance applying emotional reactions to economic information when predicting the stock markets comparing the results of an averaged examination long short-term memory (LSTM) and gated recurrent unit (GRU) for stock market forecasting under the identical settings. The cooperative deep-learning architecture that we presented is the subject of this comparative research. Lu and Ma (2020) two fresh machine learning models built around hybrid decision trees are suggested to provide more precise predictions of short-term water quality. Extreme gradient boosting (XGBoost) and random forest (RF) are the two blended variables' base designs, and they both add an advanced data denoising approach called complete ensemble empirical mode decomposition with adaptive noise (CEEMDAN). Chen et al (2021) offered a unique approach for predicting stock trends using a graph convolutional feature-based convolutional neural network (GC-CNN) model, which considers both stock market and company-specific information. The DL algorithm is used in this paper's big data analytics approach to forecast the SPDR S&P 500 ETF's daily stock market return direction. The complete dataset was then run through a DL algorithm, such as the MultiDepth NeuroNetwork (MD-NN) technique, to forecast the daily trajectory of the index of shares results in future years.

The following is the paper's key contributions:

1. A whole chain based on students' multi-source daily behaviour data; EPGO-ANN is suggested for the prediction of academic achievement. It can automatically extract characteristics without depending on specialized knowledge.
2. By combining ANN with an embedding layer, the time-series characteristics of each kind of behaviour data are effectively recovered.
3. ANN is used to find the correlation characteristics between different sorts of behaviours.
4. The trials are performed using a sizable actual data set, and the results demonstrate that our suggested technique works better than the conventional DL methods.

The remainder of the document is structured as follows: In section 2, the research methodology and techniques used to collect and evaluate the data are described along with recommendations for future research based on the findings. Before presenting the research results concisely and systematically, analysing and explaining them considering the study aims or objectives, we go through the Discussion and results in section 3 first. Section 4 provides an overview of the Study's main elements, as well as its relevance and contributions, potential ramifications for practice or policy, and potential future study areas.

2. Materials and Methods

2.1. Data collection and selection

The selection of relevant data for prediction is part of the data collecting process. The information used in the suggested technique was gathered from reliable sources. The historical S&P 500 ETF data used in the proposed approach was gathered from yahoo.finance.com. It is S&P 500 Index stock daily statistics. The result represents the stock's value on the specified time start of the day (open), its highest price throughout the day (high), its lowest price during the day (low), and its price at the end of the day (close) are the characteristics utilized as indicators. Results are the closing price of the stock the next day. The dataset spans the period from November 2008 and November 7, 2019. It has 2770 records in total. The neural network is trained with 1939 data, and it is tested using 831 records.

2.2. Data normalization

The most important problem for prediction is the quality of the data. Pre-processing the data is crucial because it may improve prediction accuracy even if the data contains missing values and mismatched samples. The data used in the suggested technique includes information on 2770 trade days. The process of dividing values from data across zero and one and one is known as normalization. The normalizing approach also has the benefit of uniformly scaling the data values, which equalizes their relative importance. The suggested technique employs min-max normalization. The approach known as min-max normalization transforms all values between the ranges of 0 and 1 linearly.

2.3. Prediction algorithm

2.3.1. MultiDepth NeuroNetwork (MD-NN)

The MultiDepth NeuroNetwork is the most widely used form of neural network of all the ones that have been created for data analysis uses recognition of patterns especially categorization. Fig. 1 depicts such a multidepth neural network. In Fig. 1, W_j, j = 1, 2..., j, signifies the jth neuron in the hidden layer with j neurons; Ok, k = 1, 2..., K, means the kth neuron in the output layer; and G_i, i = 1, 2..., I, represents the ith output vector (layer) neural element comprising i components (neurons). Each neuron in the connections between the two neighbouring layers has weights that have been experimentally adjusted. For instance, the weight between the ith the j th neuronal in the concealed layer and the ith cell in the data input layer is shown by the symbol 〖X〗_il. Multilayer feed-forward neural networks with processes with a logarithmic threshold may accurately mimic any function if there are enough hidden neurons. Depending on how complicated the neural networks are, there may be any number of hidden layers. Typically, a boundary value of 10 is used to distinguish DNNs from shallow neural networks. In other words, feed-forward neural networks are DNNS if they include more than 10 hidden layers; otherwise, shallow neural networks are mentioned. Standard feed-forward ANNs frequently employ the back propagation learning algorithm, which is based on an iterative procedure wherein weights are placed of the connections exist various layers are repeatedly about the layer that is output via the layers that are hidden, and finally to the first buried layer, the adjustment is made reverse, in order to minimize the mean squared error (MSE), which measures the discrepancy between the predicted class and the true class. The conventional back propagation learning is still often employed to train recently generated DNNs, even though additional advanced learning there are currently built methods. throughout the years for certain purposes.

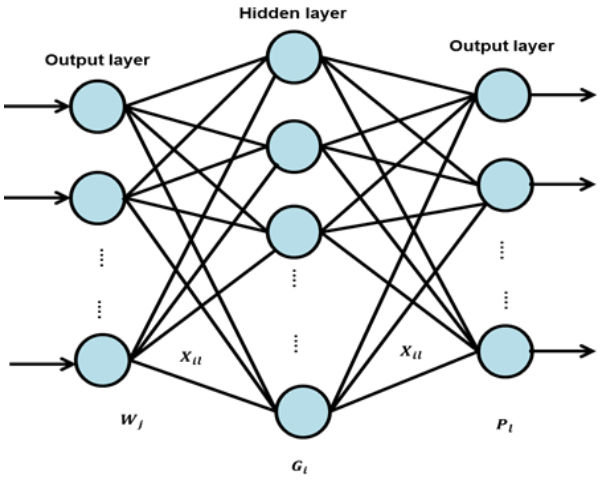

Figure 1 Topology of a multilayer feed-forward neural network used for classification.

3. Results

3.1. Error rate

In machine learning, the error rate is often used as a measure of the performance of a predictive model. It indicates how well the model generalizes to new, unseen data. Better performance is typically indicated by lower error rates because the model is operating more accurately. The cross-validations technique is used to calculate the error rate %. The number of errors is determined to be a proportion of 0.045. Three methods of machine learning are used in our design to forecast the upcoming price of stocks, including KNN, XG BOOST, RNN and MD-NN. The error rate % is used to determine the optimum methods. The best method for more precisely calculating a predictive model's test failure is cross-validation of the prediction error's deviation from the mean is known as RMSE. The distinction in the result actual and the desired output is measured by error in prediction. Figure 2 and table1 demonstrates the proposed and existing method. The modest result decreases the error rate.

Table 1 Numerical outcomes of error rate.

Methods	Error Rate (%)			
KNN	1.99	XG BOOST	RNN	MD-NN [Proposed]
XG BOOST	0.089	65.3	33.6	85.3
RNN	0.068	48.2	61.5	76.5

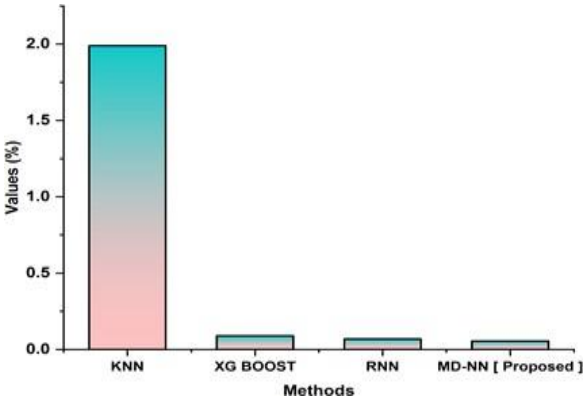

Figure 2 Error rate.

3.2. Actual and predicted price

The result graph showing the actual pricing as compared to what was anticipated. Within the graph, the blue line indicates the expected values, while the red line displays the stock's actual cost. L-fold verification is used to optimize this variable. technique to decrease the mistake and to calculate the mistake rate %. At last, using this method, a 1.98 percent error rate is calculated. Figure 3 and table 2 demonstrates the proposed and existing method. It is concluded that the proposed MD-NN features a 3% increase in efficiency for actual and predicted prices.

Table 2 Numerical outcomes of Actual and predicted price.

Methods	Actual and Predicted Price (%)			
KNN	86	XG BOOST	RNN	MD-NN [Proposed]
XG BOOST	75	55.5	66.2	98.2
RNN	69	38.7	43.4	85.6

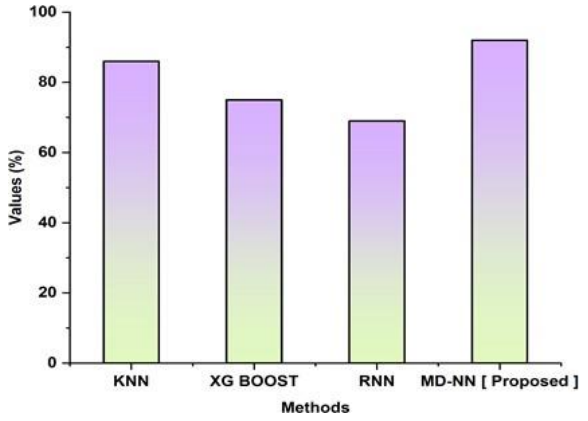

Figure 3 Actual and predicted price.

3.3. Accuracy and precision

Accuracy is a commonly used performance metric that measures the correctness of predictions or classifications made by a model. It is described as the proportion of appropriately predicted cases relative to all instances in a dataset. Accuracy is typically expressed as a percentage. Precision, or the percentage of true positive predictions among all positive predictions made by the model, is a measurement of how accurately a model or algorithm makes positive predictions. To put it another way, precision is the percentage of real positives out of all the occurrences the model correctly identified as positive.

$$Precision = \frac{|\{relevant\ documents\} \cap \{retrieved\ documents\}|}{|\{retrieved\ documents\}|} \quad (1)$$

Figure 4 and Table 3 demonstrates the proposed and existing method. The proposed MD-NN is better than existing method.

Table 3 Numerical outcomes of Accuracy and precision.

Methods	Accuracy Precision (%)			
	KNN	XG BOOST	RNN	MD-NN [Proposed]
1	26.7	55.5	66.2	98.2
2	38.5	38.7	43.4	85.6

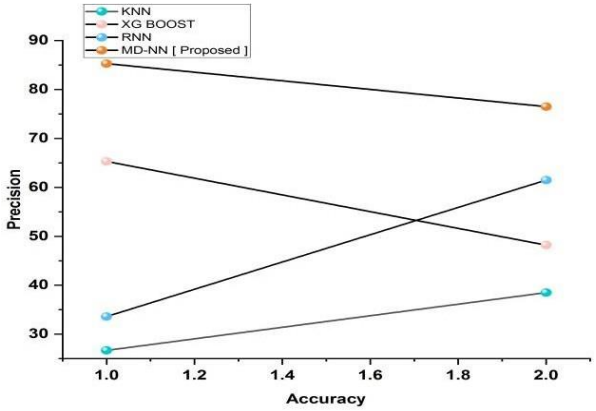

Figure 4 Accuracy and precision.

3.4. Recall and F1 Score

It is also referred to as sensitivity and represents the percentage of relevant documents that were found compared to all relevant instances. It is the percentage of pertinent instances that have been located out of all pertinent cases and documentation. 99.98% of the recall was successful.

$$Recall = \frac{|\{relevant\ documents\} \cap \{retrieved\ documents\}|}{|\{retrieved\ documents\}|} \quad (2)$$

It is a measurement of the test's accuracy and is also referred to as the F-measure. It includes both recall and precision. The estimated harmonic average of Precision and Recall is the F1 score.

$$F_1 = 2 \times \frac{Precision \times Recall}{Precision + Recall} \quad (3)$$

Figure 5 and table 4 demonstrates the proposed and existing method. The suggested (MD-NN) technique outperforms the current one.

Table 4 Numerical outcomes of Recall and F1 Score.

Methods	Recall F1 Score (%)			
	KNN	XG BOOST	RNN	MD-NN [Proposed]
1	77.8	55.5	66.2	98.2
2	68.9	38.7	43.4	85.6

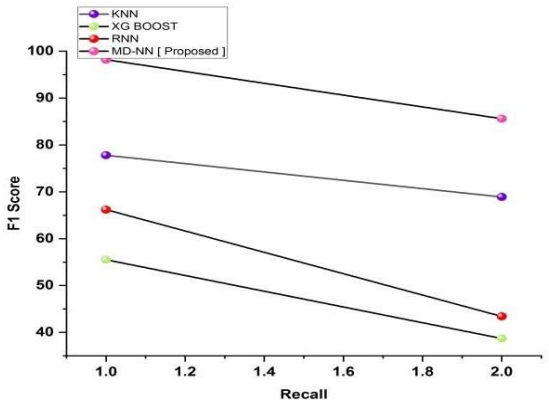

Figure 5 Recall and F1 Score.

4. Conclusions

The proposed system using MD-NN is discovered to be more reliable than the current SVR algorithm in forecasting daily returns on the stock market. The technique aided businesses in making more money while directing traders' market investments. To anticipate returns on stocks, a method like Principal Component Analysis, or PCA, or Deep Neural Network (DNN) has been further refined. The results highlight how important it is to compare the suggested approach's error rate, accuracy and precision, recall and f1score to cutting-edge methods. By combining several classifiers and feature selection techniques, we want to assess the classifier's selecting scheme in future work.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Revolutionizing network management with an AI-driven intrusion detection system

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Abstract The creation of methods and models that can learn and make predictions or judgments based on such learning is artificial intelligence (AI). By combining an AI-driven intrusion detection system (IDS) with the BAT optimization method and a Deep Convolutional Neural Network (DCNN), we provide a revolutionary strategy to the revolutionize network management. Utilizing the advantages of deep learning and BAT optimization, the goal is to increase the efficiency of intrusion detection in the network management. Here, the classification effectiveness of the DCNN is increased by using the BAT optimization strategy. The suggested framework combines a DCNN model, which is excellent in pattern data collection, pre-processing by using normalization, and prediction tasks, with the BAT Optimized with Deep Convolutional Neural Network (BATO-DCNN) method, recognized for its capacity to identify optimum solutions in the challenging search spaces. The suggested method effectively tunes the DCNN using BAT optimization, leading to the better convergence and accuracy. The results of the research show that the recommended methodology performs better than traditional approaches in terms of accuracy, precision, F1-score, and recall measures. The results of this study support the current research in the area of network security and open the door for improved network management systems.

Keywords: AI, IDS, revolution, network management, DCNN, BAT optimization

1. Introduction

The process of changing how businesses manage their networks by deploying new technologies, strategies, and procedures that enhance performance, security, and efficiency is referred to as revolutionizing network management. Advanced tools like AI-driven intrusion detection systems and other cutting-edge techniques may be used in the study. Organizations may increase network visibility, see possible threats and vulnerabilities, and take proactive measures to resolve them before they become major issues by using technologies and solutions. They may also increase overall network dependability, decrease downtime, and optimize network performance. Network management must be revolutionized by integrating new technology as well as new management procedures and strategies that meet the demands of contemporary businesses. The entails putting agile approaches into practice to enhance cooperation and hasten the development and deployment of network infrastructure as well as employing data-driven insights to make strategic network management choices (Wahab et al 2022). Another new method of managing networks is called "network function virtualization," which includes replacing physical network devices with virtualized versions of those devices that operate on standard hardware. As virtualized services may be swiftly installed and expanded as necessary, the study can aid in cost reduction and increase scalability (Nazir and Khan 2021).

Organizations may revolutionize network administration and achieve major gains in performance, security, and dependability by using cutting-edge technology and fresh ideas. The creation of methods and models for AI entails teaching them to learn from data and basing their predictions or choices on that teaching (Kumar et al 2022). Using big datasets to train methods to find patterns and make predictions is one of the main uses of artificial intelligence. Deep learning, which includes training neural networks to learn intricate data representations, is another crucial field of AI. Deep learning has excelled in several areas, including voice recognition and computer vision, where it has produced state-of-the-art results on several benchmark challenges (Rahman and Hossain 2022). Figure 1 illustrates that Securing AI systems with IDS is an important aspect of ensuring the safety and integrity of AI applications. IDS can help detect and prevent unauthorized access, attacks, or malicious activities that may compromise the AI system.

AI may be used in the healthcare industry, for instance, to analyze medical pictures and assist clinicians in providing more precise diagnoses. AI may be used in finance to spot fraud and make wiser investment choices. AI may be used in transportation to improve traffic flow and lessen congestion. But AI also brings up significant moral and societal dilemmas, such as the loss of jobs, privacy difficulties, and prejudice in methods. It will be critical to address the challenges and make

sure that AI is used in ways that benefit society as a whole as it develops and becomes more interwoven into our everyday lives. It has been determined that the Internet of Things (IoT) is a crucial study area for the current and next decade. The Industrial Internet of Things (IIoT) and the Internet of Medical Things (IoMT) are IoT applications that have been incorporated into industries and health sectors to benefit consumers. The IIoT revolution is rapidly expanding, leading to significant financial advantages and automation. However, the IoMT has also expanded to become a multimillion-dollar sector (Foroughi et al 2023). The open and ubiquitous nature of the IoMT ecosystem makes it a potential target for numerous new cyber threats and assaults even while it offers substantial advantages. The devices are a top target for many threat actors who may conduct anomalous actions against them due to their high level of connection and ongoing data exchange (Singh 2023).

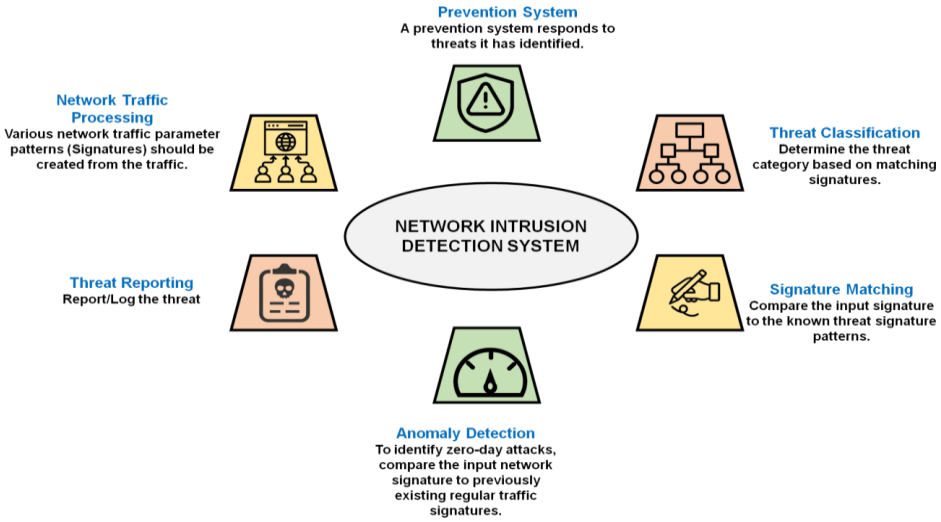

Figure 1 Secure AI with Intrusion Detection System.

Each of the fields has developed along distinct, independent paths. Enterprise risk management, which aims to foresee revenue shocks and surprises for the focus firm, was mostly developed in the financial services sector. The IT integration industry served as the foundation for the development of cyber security, and businesses and governments all over the globe have used its toolkit. Each of the fields has developed its own set of theoretical precepts, a unique group of specialized practitioners, and a hierarchy of best practices (Sodhro et al 2020). Monitoring network traffic to spot any malicious activity or unauthorized access attempts are known as network intrusion detection. Identifying symptoms of intrusion or unusual behavior entails the examination of network packets, logs, and other data sources. Network intrusion detection systems often use AI methods to automate detection procedures and boost precision. The taxonomy of network intrusion detection is shown below, along with a few AI applications for each category: Known attackers' signatures or established patterns are used in signature-based detection (Füller et al 2022). By automating the formation and updating of signatures based on observed network traffic, AI approaches may improve signature-based detection. The goal of anomaly-based detection is to locate variations from typical network behavior. To identify any deviations or anomalies that would point to a possible intrusion, AI systems can learn the typical patterns of network traffic. Based on pre-established rules or heuristics, misuse detection entails recognizing well-known attack patterns or harmful behaviors. By learning from previous attack data and modifying the rules appropriately, AI may help to increase the accuracy of abuse detection. To take advantage of their advantages and minimize their disadvantages, hybrid approaches incorporate several detection techniques, such as anomaly-based and signature-based detection.

To combine and refine the methods for greater accuracy, AI methods may be used. Another advantage of adopting AI-driven intrusion detection systems in network management is the real-time reaction. The systems can react to threats automatically, which cuts down on the amount of time it takes to contain and lessen the effects of an incursion (Bhadra et al 2023). Here are some examples of how real-time reaction may be enabled using AI: AI driven intrusion detection systems may automate the incident response procedure, allowing a real-time reaction to threats that are discovered. When a possible danger is identified, the system may immediately raise an alarm and launch a reaction, such as quarantining a compromised device, banning access to a certain IP address, or starting an incident response plan. The amount of time needed for manual intervention is reduced, as is the potential effect of an assault. AI-driven solutions can assist security teams' decisions, enabling them to respond to threats in real-time.

The system can give contextual information about the discovered threat, including the nature, severity, and possible effect, by analyzing network data and using AI methods. Security teams may use the information to choose the best course of action and how to focus their efforts. Security teams may conduct proactive investigations into possible threats thanks to AI driven intrusion detection systems' assistance in threat-hunting efforts. The system may provide warnings or reports that

indicate possible dangers by examining network traffic patterns and spotting unusual activity. The study makes it possible for security professionals to look into the problem immediately and take the necessary measures. Real-time reactions to attacks may be made possible by cloud-based AI-driven solutions since they provide a centralized and scalable platform for handling security occurrences. The system can handle massive amounts of data and analyze risks in real time by using cloud-based resources, allowing quick and efficient incident response. Real-time reaction to new threats is made possible by AI-driven intrusion detection systems' ability to learn and adapt to new threats and attack methodologies. To keep one step ahead of attackers, the system may upgrade its models and detection capabilities by continually analyzing network traffic and adding fresh data. Because of its flexibility, the intrusion detection system can stay successful even as attackers develop their techniques (Zarie and Chevittithara 2022).

Organizations may improve network security capabilities by integrating AI-driven intrusion detection with the ground-breaking BAT Optimized with Deep Convolutional Neural Network (BATO-DCNN) method. The intrusion detection system gains special benefits and characteristics from the BATO-DCNN method. (Gupta and Sandhu 2021) suggested a first step in putting forward and talking about the idea of Activity-Centric Access Control (ACAC) for a connected and smart environment. Examination of the idea of activity in relation to distributed but linked systems that are collaborative, we emphasize the many parties involved as well as the essential factors to take into account when choosing an activity management strategy. The paper describes a fundamental process for producing activity control expressions that may be employed with different smart objects in the system. The paper's main goals are to demonstrate the need of an activity-centric approach to access control in connected smart devices and to promote discussion about the suggested future research agenda (Wolsey 2022) reviewed an in-depth examination of the most recent research in the area is provided together with an explanation of the cutting-edge AI methods utilized in malware detection and prevention. The methods under investigation include Deep Learning, Bio-Inspired Computing, and Shallow Learning. They are applied to a range of platforms, including cloud, Android, and the Internet of Things (IoT). The poll also discusses how quickly fraudsters are using AI to build ever-more sophisticated malware and take advantage of the AI defenses against it.

Modi et al (2019) examined the supply chain's inventory levels were decreased, yet the wait times for currently available products were drastically cut while availability improved to over 100%. The wholesalers' and retailers' inventory turns more than quadrupled, and their profitability dramatically rose. During the Great Recession, the comprehensive strategy enabled the business to more than quadruple its earnings and strengthen its cash flow. Carpenter (2020) extracted the defending and conserving outdated business models, banks must embrace technology-driven advances, smash down obstacles to change, and disrupt themselves digitally to remain relevant and competitive. The article explains how banks may use AI and machine learning to overcome these obstacles and undergo a dramatic transformation to succeed in the customer experience age. Ponnusamy et al (2022) determined the development of communication technologies has had a significant impact on healthcare. With the use of communication technology, a patient may be remotely monitored in real-time to identify illness symptoms and health metrics at a reasonable cost. These communication tools also make it feasible to monitor community health, which frees up time and allows us to assist more people. Evans et al (2022) preferred Reliable communication is ensured via AI-based communication, which is essential in the healthcare sector. Self-diagnosis is made possible in the healthcare industry by AI and the Internet of Things (IoT) via wireless body area networks (WBANs), which make use of wearable sensor devices. Goralski and Tan (2020) evaluated the wearable WBAN is a difficult one since it exposes the human body to waves. With the aid of a mobile application and specialized communication protocols, mHealth is another technology that makes it possible to access healthcare services whenever and wherever one chooses. Mir (2023) augmented and virtual reality enables accurate diagnosis and more precise surgery utilizing real-time digital visual assistance. For each of such technologies, specialized wireless communication is necessary. Thus, the chapter aimed to tackle issues with IoT-based healthcare, mHealth healthcare, body area networks, and augmented and virtual reality as well as methodologies, communication protocols, and applications. Alsarhan et al (2021) determined numerous computational benefits of the Support Vector Machine (SVM) structure including particular direction at a limited sample and indifference of method complexity to sample size. In the Vehicular Ad hoc Networks (VANET), intrusion detection is a non-convex combinatorial problem. The accuracy value of the SVM classifier is thus improved using three intelligence optimization strategies. The traffic should subsequently be processed, producing sizable 2-class and multi-class datasets. Medjek ET AK (2021) examined study choose a collection of important attributes for each assault, and we train several classifiers with this set to create the IDS. Random forest (RF) was proven by 5-fold cross-validation trials. Kshirsagar and Kumar (2022) determined the testing on the dataset reveals that J48's proposed Naive Bayes (NB) technique, which uses 24 characteristics, has a detection rate of 99.9909%.

Here are some possible significant contributions that a paper on transforming network administration with an AI-driven intrusion detection system may concentrate on:

- The design and development of an innovative AI-driven intrusion detection system specialized for network management may be discussed in the article. The recommended method, BATO-DCNN, is used to identify and address network breaches.

- The system's capacity to conduct real-time network traffic monitoring and provide warnings or notifications for shady behavior or prospective intrusions may be highlighted in the report. This may highlight the significance of prompt identification and mitigation of security risks.

The rest of the text is organized as follows: Section 2 provides suggestions for further study based on the results along with a description of the research methodology and strategies utilized to gather and analyze the data. We first go through the Discussion and findings in section 3 before succinctly and methodically presenting the research outcomes, analyzing and interpreting them in light of the study goals or objectives. The Study's key components are summarized in Section 4, along with the study's relevance and contributions, possible implications for practice or policy, and prospective future research fields.

2. Materials and Methods

Depending on the precise area of study and the kind of research being done, experimental methods might differ greatly. However, research may provide a broad foundation for an experimentation method that is often used in scientific research, as seen in Figure 2.

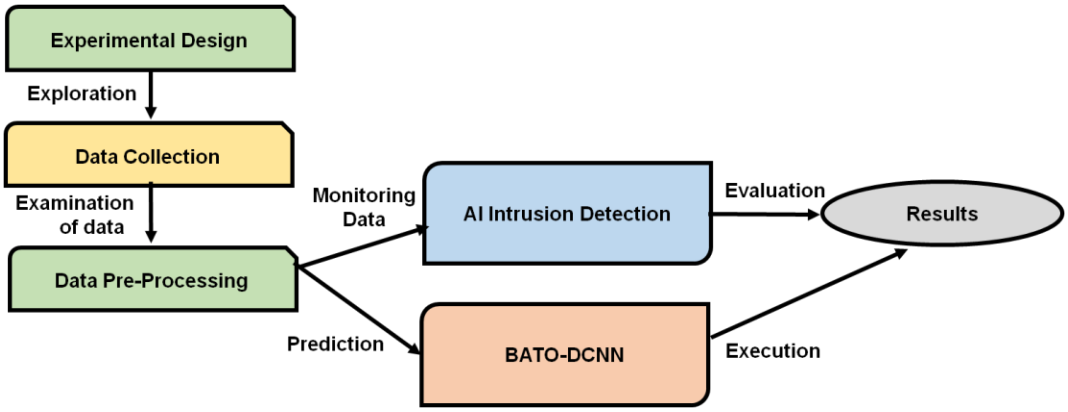

Figure 2 Flow diagram of Experimental Design.

2.1. Data Collection

Three datasets are employed in this study: one for training and testing the proposed model, in which data are taken from a university campus; and the CICIDS2017; and two additional datasets for performance assessment. In this study, a brand-new dataset is produced for the method training and first testing (Mendonça et al 2021). The statistics include both assaults and lawful traffic. The new dataset was gathered in the server room and eight installed subnets (Dep1 to Dep8) of a university campus' common Local area network (LAN) network configuration. Different operating systems, including Microsoft Windows 7, Windows 8.1, and Windows 10, as well as the Linux Ubuntu distribution, are used by each department. The server room uses a variety of Microsoft Windows servers, including those from 2012 and 2016. Dataset1 refers to the dataset created on the university campus, and Dataset2 refers to the scenario involving a medium-sized corporation. Table 1 provides a quick overview of the features of the key public datasets. When our datasets are compared to their, the development of the datasets may be seen, particularly in the case of zero-day attacks, when no prior information about the assault is available and only traffic patterns point to an ongoing attack. The bulk of datasets also lack an important attribute that modern devices like IoTs have today: new device characteristics. On the other hand, our datasets have more current frequent assaults and more realistic features. The proposed system was evaluated with the CICIDS2017 dataset used in. The CICIDS2017 dataset, which simulates actual real-world data, contains typical and harmless attacks including Distributed Denial of Service (DDoS), Infiltration, Brute Force, and Web assaults. 25 users' abstract behavior based on the Hyper Text Transfer Protocol (HTTP), Hypertext Transfer Protocol Secure (HTTPS), File Transfer Protocol (FTP), Secure Shell Protocol (SSH), and email protocols was created for this dataset.

Table 1 A brief examination of the key public datasets' properties.

Dataset	Network traffic	IoT traces	Zero-day	Year
DARPA 98	No	No	No	1998
KDDCUP 99	No	No	No	1999
ADFA 13	Yes	No	Yes	2013
CICIDS 2017	Yes	No	Yes	2017
Dataset 1	Yes	No	Yes	2020
Dataset 2	Yes	Yes	Yes	2020

2.2. Data pre-processing by using Z-score normalization

Z-score normalization, also known as zero-mean normalization, normalizes each input feature vector by determining the mean (M) and standard deviation (SD) of each feature over a training dataset and dividing it by the dataset size. Equation 1 computes the average and standard deviation for every characteristic. The general formula states the change is necessary.

$$n' = \frac{(n-\mu)}{\sigma} \qquad (1)$$

The stated property's M and SD are and, respectively. Before training can start, all the properties of the data set are z-score normalized. The M and SD of each characteristic must be noted once training data has been collected to be used as algorithmic weights.

2.3. Revolutionizing network management based on AI

The addition of AI to IDS has the potential to dramatically improve the capacity to identify and address security threats, which has the potential to revolutionize network management. Utilizing cutting-edge tools and techniques to improve the effectiveness, adaptability, and security of network operations constitutes revolutionizing network management. Significant improvements in threat detection accuracy, real-time monitoring, proactive response, and adaptive security are brought about by the use of AI in intrusion detection systems. Organizations may improve their cyber security posture, reduce risks, and protect the integrity and availability of their network infrastructure by redefining network management using AI-powered intrusion detection. Network management may be revolutionized by using AI for intrusion detection, allowing more proactive, precise, and effective detection and response to security threats. As a result, network security is increased, downtime is decreased, and general network administration procedures are improved.

Organizations must revolutionize network management if they want to remain competitive in the current fast-paced digital environment. They may boost network performance, increase security, and generate more corporate value by adopting new technologies, strategies, and procedures. Utilizing cutting-edge tools and creative strategies, revolutionizing network management enhances the effectiveness, security, and dependability of computer networks. There are various methods to do this, including A crucial part of network administration is automation since it may assist manage complicated networks with less time and effort. Network managers may concentrate on more strategic efforts and boost network performance by automating rote operations like configuration changes and software upgrades. A new method of managing networks that separates the control and data planes of the network is called software-defined networking. As a result, the network may be centrally managed and configured, increasing flexibility and lowering complexity. In general, AI classification tasks are often carried out utilizing a variety of methods, such as BATO-DCNN. AI-driven intrusion is discovered using the revolutionary BATO-DCNN network management system.

2.4. BAT Optimized with Deep Convolutional Neural Network (BATO-DCNN)

In the realm of intrusion detection systems, the particular pairing of BAT optimized with DCNN may not be universally accepted. Combining the two elements (BAT optimization and DCNN), we can suggest a notion where BAT optimization is included in the deep convolutional neural network methods to increase the network's performance and attention optimization. This integration may include modifying the attention optimization inside the convolutional layers or integrating binary attention modules at various DCNN levels. The idea is to provide the network the ability to selectively concentrate on key details or areas of the input data while efficiently removing noise or unimportant data. The network may be better able to identify minor patterns or abnormalities linked to network intrusions as a consequence, producing more precise findings for intrusion detection. It's crucial to remember that the precise implementation details, network design, and training methods would need rigorous study, testing, and validation. Depending on the individual dataset, the kind of intrusion detection challenge, and the computing resources available, the suggested concept's efficacy would vary. It is possible to improve attention optimization and the effectiveness of intrusion detection systems by combining BAT with a deep convolutional neural network. We may explore a possible idea based on these elements: However, additional study and development would be required to demonstrate the viability and usefulness of this exact combination in the context of network intrusion detection.

2.4.1. BAT Optimization method

Usually, AI is not linked to the BAT Optimisation method. Instead, it uses an optimization approach that was inspired by bats' echolocation techniques. The BAT method may, however, benefit from the addition of AI strategies to improve performance. The study may take into account the following methods to include AI in the BAT method:

- *Initialization using AI:* The study may create an initial population of bats that is more likely to include viable solutions using AI approaches like neural networks or genetic methods as opposed to randomly initializing the population of bats.

- *Adaptive parameters:* Fuzzy logic and reinforcement learning are AI approaches that may be used to dynamically modify the method parameters, such as the bats' volume and heart rate, depending on the effectiveness and properties of the optimization problem.
- *Hybridization with AI methods:* The BAT method may be used in conjunction with other AI methods such as genetic methods, particle swarm optimization, or ant colony optimization. By combining the advantages of the two techniques, this hybridization may increase searchability and convergence speed. It's crucial to keep in mind that integrating AI methods into the BAT method is still a research topic and may call for modification and experimentation depending on the particular issue domain. The kind of optimization challenge and the AI approaches used will determine how well the integration works.

2.4.2. Deep Convolutional Neural Network (DCNN)

A particular kind of artificial neural network called a DCNN which is made for analyzing visual input, such as pictures or movies. It is a potent method that has transformed computer vision and excelled in a wide range of applications, such as picture classification, object recognition, image segmentation, and more. The structure of the visual cortex in the human brain is a major source of inspiration for DCNNs. They are made up of many layers, including pooling, convolutional, and fully linked layers. Together, these layers process raw pixel data to extract and learn hierarchical representations of visual information. Here is a quick rundown of the essential elements and processes of typical DCNN methods:

- *Convolutional Layers:* The input data is subjected to convolutional procedures at these layers. In a convolution, local features are extracted from the input picture by swiping a series of filters or kernels over it. Every filter develops the ability to recognize certain patterns, such as edges, corners, or textures. As the network's depth rises, the convolutional layers provide the network with the ability to gather spatial data and extract more complicated characteristics.
- *Pooling Layers:* To downsample the feature maps and keep important properties while doing so, pooling layers are often added after the convolutional layers. Max pooling, which chooses the highest value inside a pooling zone, is the most used pooling procedure. Translation invariance is attained and the computational cost of the following layers is decreased by pooling.
- *Activation Functions:* Following each convolutional layer, element-wise non-linear activation functions, such as ReLU (Rectified Linear Unit), are applied to the feature maps. The network is given non-linearities through activation functions, which enables the network to learn intricate linkages and improve model expressiveness.
- *Fully Connected Layers:* Fully linked layers are often used after the DCNN design. These layers function similarly to conventional neural networks in that they link every neuron in one layer to every neuron in the next. After the study has gathered all global dependencies, they generate the outcome, such as the class probabilities for image classification.
- *Training:* The back propagation method and huge labeled datasets are used to train DCNNs. Backpropagation includes employing optimization methods like stochastic gradient descent (SGD) or its variations to feed training samples forward through the network, calculate the loss or error, and then propagate the error backward to update the network's weights. Because of their deep design, DCNNs are excellent at visual tasks because they can learn and extract important information from pictures in a hierarchical way. They can collect both low-level and high-level visual information because they automatically identify relevant characteristics from raw pixel data. They work effectively for complicated visual recognition tasks because they can learn hierarchical representations.

3. Results

3.1. Evaluation of the performance of the BATO-DCNN method by comparing existing and proposed method *of AI*

According to the observation of Figures 3, 4, 5, and 6, the four-evaluation metrics of prediction performance based on current and proposed techniques of BATO-DCNN are particularly evident in the macro recall meter. Though there are wide variations in F1-score, precision, accuracy, and recall, there aren't many variations in the outcomes of predictions.

3.1.1. Accuracy

An important parameter to evaluate the dependability and efficiency of the system is how reliably the AI-driven intrusion detection system employing BATO-CNN detects possible security breaches. The system's accuracy would be measured by how well it could identify both legitimate network traffic and hostile activity. It considers both accurate positive and accurate negative forecasts, as well as accurate positive and accurate negative predictions that were not accurate. A system with more accuracy may identify intrusions with greater precision, reducing the number of false positives and false negatives, as illustrated in Equation 2. Organizations may improve network security, reduce risks, and react quickly to possible attacks by revolutionizing network management with an AI-driven strategy and attaining high accuracy rates, protecting their important assets and data.

$$\text{Accuracy} = \frac{\text{TP+TN}}{\text{TP+TN+FP+FN}} \quad (2)$$

Figure 3 displays the accuracy of the proposed and current methods. The accuracy level is often expressed as a fraction of the total. The possibility for faulty estimations may be seen in both the current method and the proposed one. Both systems are aware of this risk. However, compared to 25% for SVM, 28% for RF, and 38% for NB, the recommended approach BATO-DCNN has a 42% accuracy rate. As a result, the suggested method has the highest accuracy rate. The precision of the suggested method is shown in Table 2.

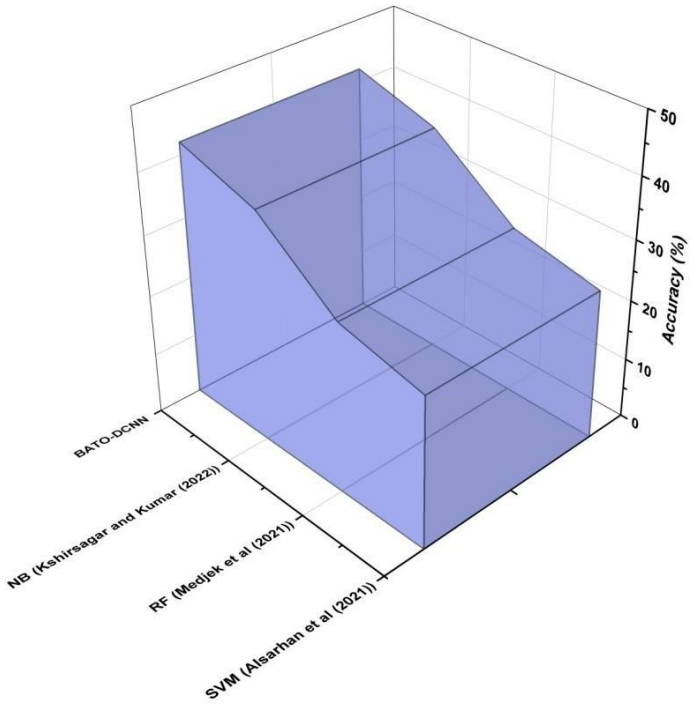

Figure 3 Comparison of accuracy of existing and proposed method.

Table 2 Numerical outcomes of the accuracy of existing and proposed method.

Methods	Accuracy (%)
SVM (Alsarhan et al 2021)	25
RF (Medjek et al 2021)	28
NB (Kshirsagar and Kumar 2022)	38
BATO-DCNN [Proposed]	42

3.1.2. Precision

Precision is a performance indicator used to assess how well a system can spot instances of intrusions or assaults. It focuses especially on the percentage of genuine positive predictions that is, accurately recognized intrusions—among all positive predictions provided by the system, including both true positives and false positives. In equation 3, a high accuracy value shows that the system has a low rate of false positives, indicating that it is successful in accurately recognizing real incursions while minimizing false alarms. A low accuracy score, on the other hand, indicates that the system may generate a high proportion of false positives, which might result in pointless alarms and could increase the strain on network managers. Achieving a high accuracy rate is essential when transforming network management with AI-driven intrusion detection systems since it lowers the number of false positives and increases the system's overall dependability and efficiency.

$$\text{precision} = \frac{\text{TP}}{\text{TP+FP}} \quad (3)$$

Figure 4 displays the Precision of the proposed and current methods. The accuracy level is often expressed as a fraction of the total. The possibility for faulty estimations may be seen in both the current method and the proposed one. Both systems are aware of this risk. Both systems are aware of this risk. In contrast, the recommended method BATO-DCNN has a 48% Precision rate, whilst SVM, RF, and NB each have 27%, 32%, and 43%, respectively. As a result, the suggested method has the highest Precision rate. The Precision of the suggested method is shown in Table 3.

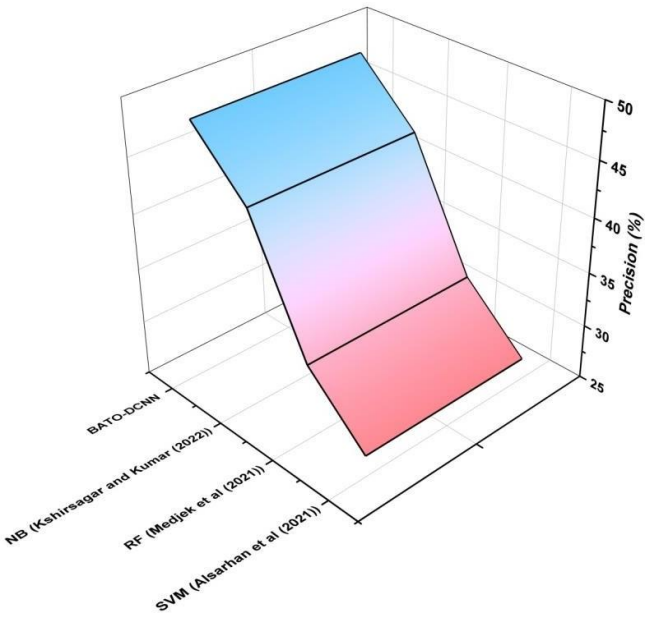

Figure 4 Comparison of precision of existing and proposed method.

Table 3 Numerical outcomes of precision of existing and proposed method

Methods	Precision (%)
SVM (Alsarhan et al 2021)	27
RF (Medjek et al 2021)	32
NB (Kshirsagar and Kumar 2022)	43
BATO-DCNN [Proposed]	48

3.1.3. Recall

Recall, often referred to as sensitivity or true positive rate, is a performance indicator that assesses how well a system can distinguish between instances of intrusions or assaults from all other genuine positive instances that are present in the network. With a low incidence of false negatives, a system with a high recall value is likely to be successful in detecting the majority of network intrusions, as indicated in Equation 4. This is essential to ensure that the system doesn't ignore or miss any possible risks. A low recall value, on the other hand, indicates that the system may have a high proportion of false negatives and that it may miss a significant fraction of true incursions. Attacks that go undetected, possible security lapses, and weakened network integrity may all result from this. Achieving a high recall rate is crucial when implementing AI-driven intrusion detection systems to revolutionize network management because it guarantees that the system can accurately identify as many network intrusions as possible, reducing the risk of threats going undetected and enhancing the network's overall security posture.

$$\text{Recall} = \frac{\text{FN}}{\text{FN+TP}} \qquad (4)$$

Figure 5 depicts the recall of the suggested and current techniques. Recall levels are often expressed as a fraction of the whole sample. The possibility for faulty estimations may be seen in both the current method and the proposed one. Both systems are aware of this risk. Both systems are aware of this risk. However, the recommended method, BATO-DCNN, has a 49% Recall rate, while SVM, RF, and NB only achieve 34%, 38%, and 45% Recall rates, respectively. As a result, the suggested method has the highest Precision rate. The recall of the suggested technique is shown in Table 4.

Table 4 Numerical Outcomes of Recall of existing and proposed method.

Methods	Recall (%)
SVM (Alsarhan et al 2021)	34
RF (Medjek et al 2021)	38
NB (Kshirsagar and Kumar 2022)	45
BATO-DCNN [Proposed]	49

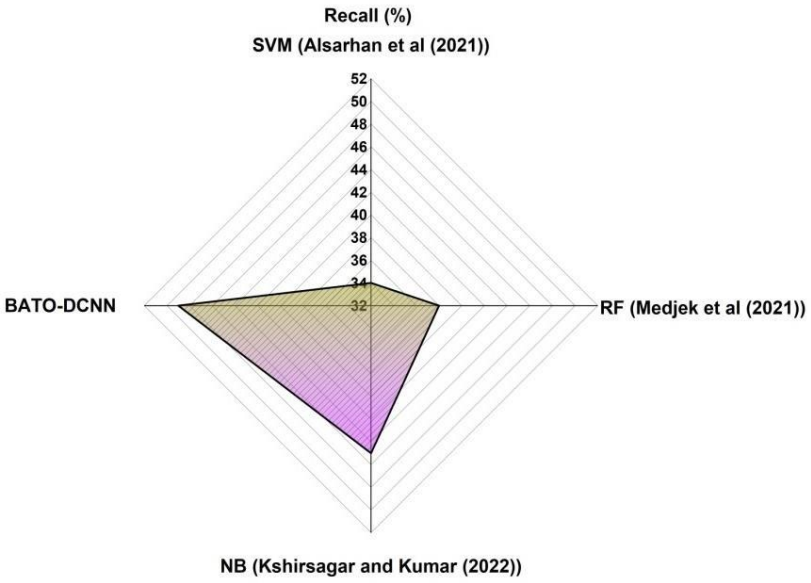

Figure 5 Comparison of recall of existing and proposed method.

3.1.4. F1-score

A performance statistic called the F1-score combines recall and accuracy into one number. By taking into account both false positives and false negatives, it offers a fair assessment of the system's capacity to accurately recognize both positive and negative cases. The F1-score offers a thorough assessment of the system's performance by taking into account both accuracy and recall, balancing the trade-off between minimizing false positives and false negatives as stated in equation 5. It captures the system's capacity to precisely identify and categorize intrusions while minimizing both false alarms and undiscovered threats, making it a valuable statistic for evaluating the overall success of the AI-driven intrusion detection system in revolutionizing network management.

$$\mathrm{F1-score} = \frac{(\mathrm{precision})\times(\mathrm{recall})\times 2}{\mathrm{precision}+\mathrm{recall}} \qquad (5)$$

Figure 6 displays the F1-Score for the proposed and current methods. Levels of the F1-Score are often expressed as a fraction of the total. The possibility for faulty estimations may be seen in both the current method and the proposed one. Both systems are aware of this risk. Both systems are aware of this risk. However, compared to 22% for SVM, 18% for RF, and 15% for NB, the recommended approach BATO-DCNN has a 45% F1-score rate. As a result, the suggested method has the highest Precision rate. The F1-Score for the suggested approach is shown in Table 5.

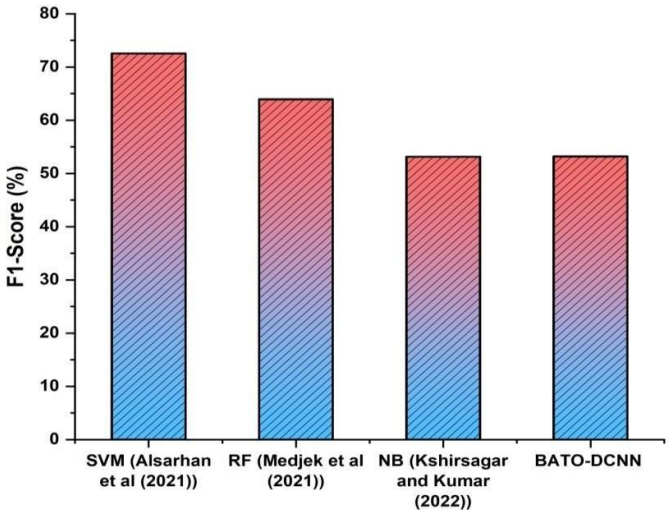

Figure 6 Comparison of F1-score of existing and proposed method.

Table 5 Numerical outcomes of F1-score of existing and proposed method.

Methods	F1-Score (%)
SVM (Alsarhan et al 2021)	22
RF (Medjek et al 2021)	18
NB (Kshirsagar and Kumar 2022)	15
BATO-DCNN [Proposed]	45

4. Conclusions

Network management and overall security might be revolutionized by the use of an AI-driven intrusion detection system that blends deep convolutional neural networks (CNNs) with the BAT mechanism optimized. The following are the main takeaways: Using deep CNNs in combination with BATO-DCNN, BAT integration allows for very accurate and precise identification of possible threats in network traffic. By enabling speedy detection and response to intrusions, these improved detection capabilities lower the likelihood of successful assaults. Real-time reaction capabilities are enabled by the AI-driven intrusion detection system using BAT optimized with deep CNNs. Threats may be quickly identified, and notified, and automatic measures like blocking malicious traffic, isolating compromised devices, or initiating incident response processes can be started. This decreases the amount of time needed for manual intervention and lessens the possibility of an incursion. By selecting and focusing on pertinent characteristics, the optimized BAT mechanism in the intrusion detection system maximizes resource use. By increasing efficiency, the system is better able to manage heavy network traffic. By upgrading its models and detecting methods, the AI-driven intrusion detection system continually learns and responds to new threats. To adapt to changing attack methods and enhance its overall threat detection skills, it may analyze past data. Network management integration: The deep CNN-optimized BAT-driven AI-driven intrusion detection solution effortlessly integrates into network management procedures to improve overall network security. The system offers a holistic approach to threat identification and response, maximizing the effectiveness of network management, when used in concert with other network management tools and procedures. Organizations may dramatically improve their network security, efficiently handle possible breaches, and defend against emerging cyber threats by using the power of AI-driven intrusion detection. We conclude that the combination of BAT with deep CNNs, a sophisticated protection system that can detect threats in real-time and take necessary responses is produced. Deep CNNs and the optimized BAT mechanism combined with AI-driven intrusion detection enable enhanced threat detection, real-time response capabilities, resource efficiency, and flexibility to evolving threats. By increasing security controls, boosting incident response, and defending networks against emerging cyber threats, this integration revolutionizes network management.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Predictive maintenance of planetary gearboxes using FFT and machine learning technique

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Abstract Planetary gearboxes are widely used in manufacturing processes, and non-destructive assessment is becoming increasingly important for monitoring their state. We outlined a fine-tuned random decision tree (FT-RDT) in this study for classifying and fault-finding the gearbox via signals generated by vibrations. This approach concentrates on the identification of worn gears, consequently distinct classes—healthy gears, ringed gears containing damaged tooth faces, and planetary gears featuring damaged tooth faces—were established. Each of the categories consists of 150 specimens, divided into two separate sets of 50 specimens for the testing data and 100 specimens for the data used for training. The Fast Fourier Transform (FFT) was used to convert the temporal signals to frequencies. The next step was to gather 24 statistical characteristics from frequency data. The retrieved characteristic was fed into the fault classification procedure (FT-RDT). Combining these methods yields rates of classification accuracy across train and test data of 92.75% and 91.50%, demonstrating the excellent reliability and capability of the problem identification solution that is created.

Keywords: planetary gearbox, manufacturing process, maintenance, fault detection, FFT, FT-RDT

1. Introduction

The efficient operation and longevity of industrial machines now depend heavily on predictive maintenance. It has an important role in the upkeep of planetary gears, for example. To transfer torque and power between rotating components, these gearboxes are frequently utilized in a variety of industries, including the aerospace, automotive, and manufacturing sectors. Planetary gearboxes are however subject to wear, deterioration, and collapse over time because of their complexity and the high stress environment in which they function. A potent method for forecasting and preventing gearbox breakdowns has emerged in response to this difficulty, combining Fast Fourier Transform (FFT) research with machine learning approaches (Schwendemann et al 2021). A mathematical procedure called FFT analysis is used to convert a signal from the time domain to the frequency domain. FFT is used to analyze the vibration signals produced by planetary gearboxes during operation in the context of predictive maintenance (Theissler et al 2021). The presence of aberrant vibrations, variations in the frequency of the gear mesh, and the appearance of faults or flaws are only a few of the important details that vibration signals provide about the state of the gearbox. It is feasible to pinpoint particular frequency components connected to various gearbox states and problems by using FFT to these data (Ran et al 2019). The initial phase of performing predictive maintenance with FFT is to gather data on vibration from the planetary gearbox while it is operating normally. A gearbox housing-mounted accelerometer or other vibrating sensor is often used to get this data. A frequency spectrum representing the various vibrational components contained in the data is produced by processing the gathered signals using FFT. It is possible to examine the spectrum to locate certain frequency peaks connected to gear meshing, bearing issues, or other irregularities (Sohaib et al 2021). However, manually examining the frequency spectrum can be difficult and time-consuming, particularly in intricate industrial systems. Machine learning methods are useful in this situation. It is possible to train machine learning algorithms to automatically examine the frequency spectrum and spot trends or anomalies that point to gearbox problems or deterioration (Saini and Dhami 2022). These algorithms are capable of learning from labeled data in which the vibration signals correspond to well-known gearbox breakdowns or situations.

Mushtaq et al (2021) described the advancements in rotating bearing defect diagnostics, a key element of rotatory machines. Over the previous ten years are thoroughly reviewed in this study. A framework for data-driven defect diagnosis includes data collecting, feature extraction and learning, and decision-making using shallow and deep learning algorithms. This review study has explored several signal processing methods, traditional machine learning strategies, and deep learning algorithms for diagnosing bearing faults. Koukoura et al (2019) stated gearbox failures are a major factor in the operation and maintenance expenses of wind turbines, particularly offshore where logistics for replacements are more difficult. Therefore, it is crucial to identify developing gearbox issues before they turn into catastrophic breakdowns. Typically, accelerometers

mounted on the surface of wind turbine gearboxes are used to detect vibrations and monitor gearbox condition. Vrba et al (2021) suggested a completely automated method for diagnosing gearbox faults that doesn't need to be familiar with the particulars of the load or gearbox structure. Evaluation of the prediction error of an adaptive filter serves as the foundation for the suggested method. A support-vector machine is used to classify the condition of the gearbox after further processing the standard deviation of the acquired prediction error. Cross-validation tests were performed on the suggested approach and two other standard techniques using a public dataset divided into 1760 test samples. The proposed method's accuracy was superior to that of the standard techniques in all categories. Krishnaveni et al (2021) stated through signal processing, the motor vibrations can be used to diagnose and forecast faults. Through a data signal, motor vibrations can be used to diagnose and predict faults. described the information from the engine's vibration is collected using three separate sensors, including temperature, MEMS, and vibration. Predictive maintenance of machinery using multi-source sensing data from the Internet of Things (IoT) combined with AI and big data processing technologies can significantly increase the serviceable life of the machinery while lowering the cost of labor when determining mechanical faults, making this a highly relevant research area. The models and fusion methods for multi-source sensing data are examined and addressed in this work. Manarikkal et al (2021) explained in a wide range of industries, condition monitoring of machines is acknowledged as an efficient technique for performing maintenance. A planetary gearbox is an essential part of aircraft, wind turbines, hybrid cars, and other devices. Because of their size and interlocking parts, planetary gearboxes are complex in nature. Due to the challenge of reliably extracting faults from raw vibration signals, planetary gearbox condition tracking and fault detection are difficult. Amin et al (2020) includes a theoretical and experimental investigation into the use of vibration signals for fault identification in robotic gearboxes under cyclostationary and noncyclostationary situations. The existing research concentrates on estimating the robot's health while it is operating, paying little attention to any problematic parts. This article proposes a unique data-driven strategy for asset health and exhibits the diagnosis of individual element degradation of a robotics gearboxes throughout a robotic cycle using domain knowledge. Shifat et al (2020) stated As machines operate under more complex and varied situations nowadays, predictive maintenance has grown to be a significant problem in system health monitoring. A good maintenance plan can increase system yield and significantly lower production and maintenance costs in addition to reducing the danger of a catastrophic breakdown. The failure diagnosis of a permanent magnet brushless DC (BLDC) motor utilizing vibration signals is presented in detail in this work.

The machine learning model may be trained to correctly identify and predict the condition of the gearbox's health by taking pertinent features from the frequency spectrum and applying them to the labeled data (Carroll et al 2019). The reliability and performance of planetary gears can be improved through predictive maintenance using FFT and machine learning approaches. FFT makes use of the strength of vibration analysis to obtain useful frequency-domain features that record gearbox health data. Maintenance staff can use machine learning algorithms that have been trained on this data to accurately diagnose issues and anticipate probable failures. The advantages of predictive maintenance, such as decreased delay, improved maintenance scheduling, and enhanced equipment performance, make it a worthwhile investment for sectors that rely on planetary gearboxes despite hurdles in data collecting and model building (Suawa et al 2022).

2. Materials and methods

2.1. FTT

Wavelets, the Fast Fourier Transform (FFT), and the Short Time Fourier Transform (STFT) are examples of advanced non-parametric techniques that have been taken into consideration for signal processing in recent studies. The majority of instruments for noisy and vibration-acoustic analysis use a Fast Fourier Transform (FFT), which is a specific case of the generalized Discrete Fourier Transform. It changes how the vibration signal is represented in the time domain to how it is represented in the frequency domain. To convert vibration signals from the time domain to the frequency domain in this investigation, the FFT signal processing method was used. One sample from each class examined in this study is shown in Figure 1 and 2, respectively, along with the time signal. The MATLAB software used an FFT signal processor to examine each velocity data, and 24 statistical and vibration characteristics, including the minimum, maximum, range, average, standard deviation, and others, were then retrieved. To identify and categorize faults, the chosen attributes were fed into a finely adjusted random DT classifier.

2.2. Fine-tuned Random decision tree (FT-RDT)

The main characteristic of this algorithm requires less specialized knowledge, but the cost of computation goes up. The threshold values and selected attributes are picked at random when dividing the datasets. The DT algorithm may, in the most extreme scenario, be independent of training samples, and parameters may be used to modify the degree of unpredictability.

FT-RDT has undergone some upgrades to increase its effectiveness and accuracy. Such as follows:

The algorithm produced imbalanced trees, which were discovered. In other words, when one branch of training samples prematurely develops leaf nodes, while the remaining branches do not match the impurity requirements. In order to address

the issue, the tree balance component was introduced while determining the relevant division evaluation, considerably reducing the likelihood that the aforementioned scenario would arise. There will be numerous single datasets when there are many samples in the experiment and the node impurity threshold is 0. This issue will significantly reduce efficiency, and that isn't necessary. Therefore, in this experiment, the node impurity was adjusted to 0.1. The randomized DTs used samples to create and validate the trees rather than dividing the samples into samples for training and test samples. The samples in the study were separated at random into three equal groups in order to increase the objectivity and legitimacy of the classification accuracy. In accordance with the algorithm's formulation, the algorithm made the independence of the trees by randomly selecting bands from the image. However, there were only four bands in the photograph, which is insufficient to ensure the tree's full growth. As a result, classification covered all of the bands. Algorithm 1 shows the FT-RDT.

Algorithm 1

1. Input: Training dataset contains labels that match the features (X).
2. Choose hyper parameters:
    - Tree count (n_estimators)
    - Number of features to take into account at each split (max_features)
    - Maximum depth for each tree (max_depth)
    - Minimum number of samples needed to separate an internal node (min_samples_split)
    - A leaf node must have a minimum amount of samples (min_samples_leaf).
    - Various other pertinent hyperparameters unique to your implementation.
3. For every tree (n_estimators), repeat:
    a. Sample data: To construct a fresh training set, choose at random a portion of the training data with replacement.
    b. Establish a DT:
        - Create a new, empty tree.
        - Pick a subset of features (max_features) at random for each node to take into account for splitting.
        - A suitable criterion (such as Gini impurity or entropy) should be used to determine the best split point for the features that have been chosen.
        - Depending on the chosen split point, divide the node into child nodes.
        - Repeat the first two steps for every child node iteratively until a stopping requirement (such as the maximum depth or minimum number of samples) is satisfied.
    c. Keep a record of each DT you make by storing it.
4. Multiple DTs combined with Random Forest as output.
5. New data should be run through each DT in the Random Forest to generate predictions. The predictions should then be combined (for example, via majority voting for classification or average for regression).

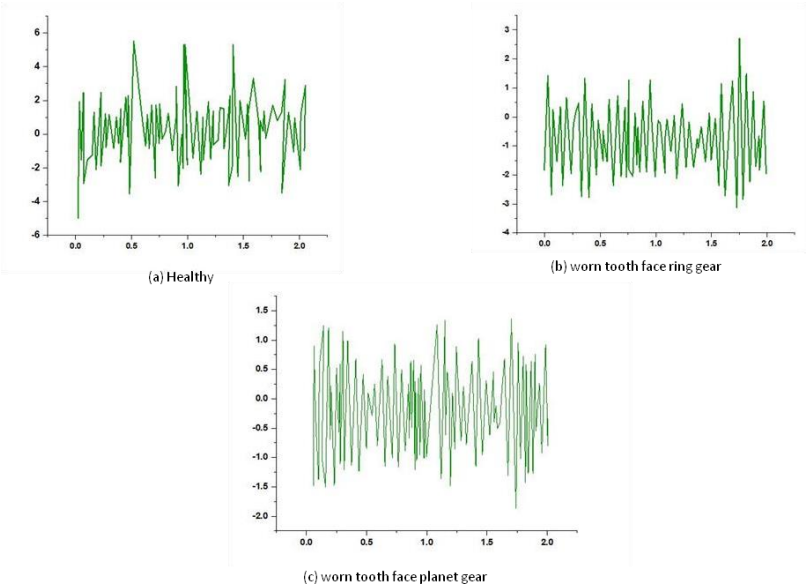

Figure 1 Time signal.

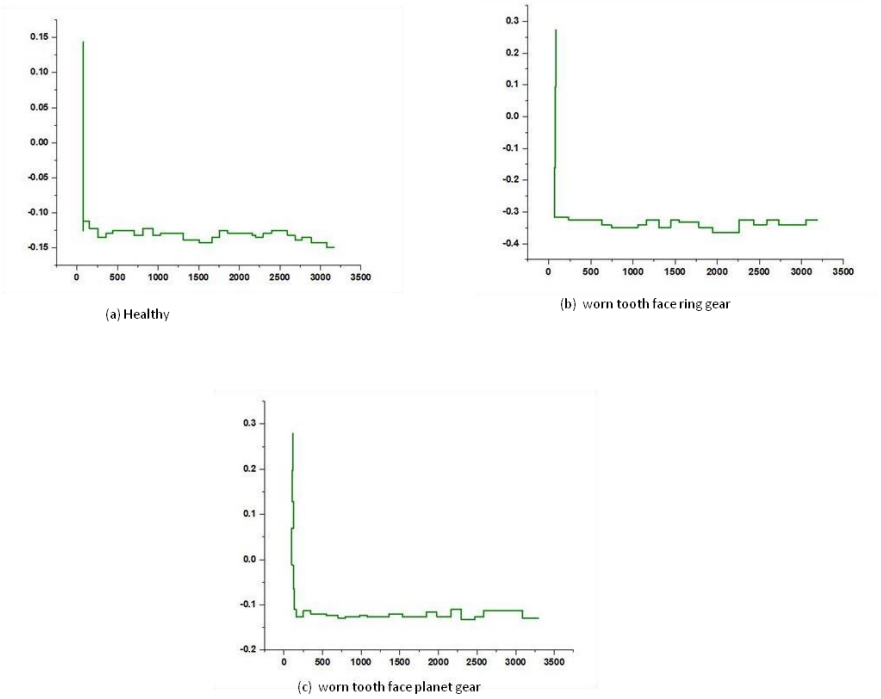

Figure 2 Frequency signal.

3. Result and discussion

The final driving and electromotor for this project were first mounted on a test bed that was constructed for the purpose. Utilizing a connection power transmission, the 3KW electromotor provided power to the gearbox. An inverter regulated the speed of the electromotor that powered the final drive's input shaft at 200 revolutions per minute.

Accuracy in the context of predictive maintenance of a planetary gearbox refers to the accuracy and dependability of forecasts or evaluations made regarding the condition of the gearbox or future failures. It gauges how well the gearbox's current state can be reliably identified as well as how well the predictive maintenance system can forecast its future performance. The accuracy results are shown in figure 3. It reveals that our suggested method (FT-RDT) has high accuracy (92.75%) than existing work like SVM (77.25%), DT (82.15%), RF (85.35%).

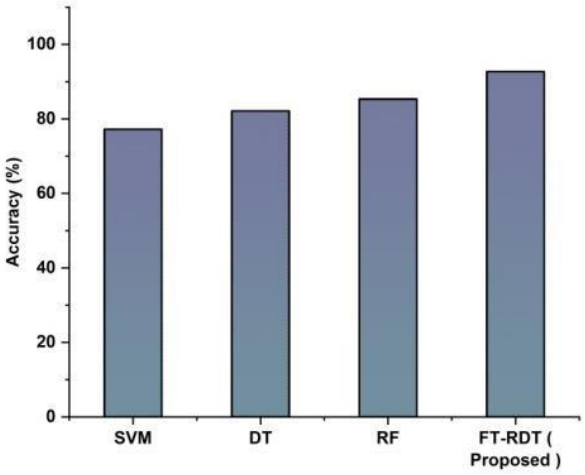

Figure 3 Accuracy result.

Precision in the context of planetary gearbox predictive maintenance refers to the accuracy and dependability of the successful forecasts generated by a predictive maintenance system. Out of all the gearboxes that were projected to be defective, it calculates the percentage of faulty or deteriorating gearboxes that were correctly recognized. Figure 4 depicts the precision result. This demonstrates that our suggested technique, FT-RDT has a better performance (90.75%) than existing work in predictive maintenance of planetary gearboxes.

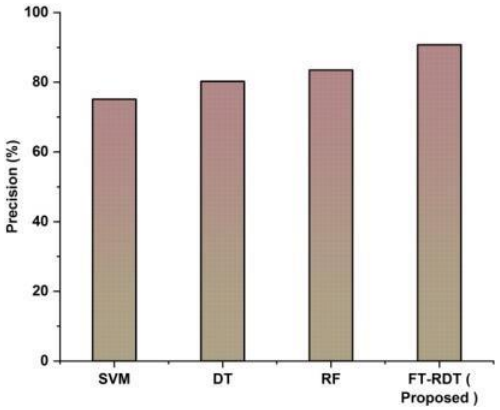

Figure 4 Precision result.

Recall refers to the capacity of a predictive maintenance system to accurately identify all the defective or deteriorating gearboxes out of the total number of gearboxes that actually require maintenance or repair in the context of a planetary gearbox. It assesses the system's capacity to identify every affirmative case (faulty gearboxes) without omitting any, or to avoid false negatives. Figure 5 shows the results of the computation. This demonstrates that our suggested methodology, FT-RDT, requires less time (90.25%) when compared to the methods already in use, SVM (78.50%), DT (80.25%), and RF(83.15). This shows that the strategy we proposed will be effective.

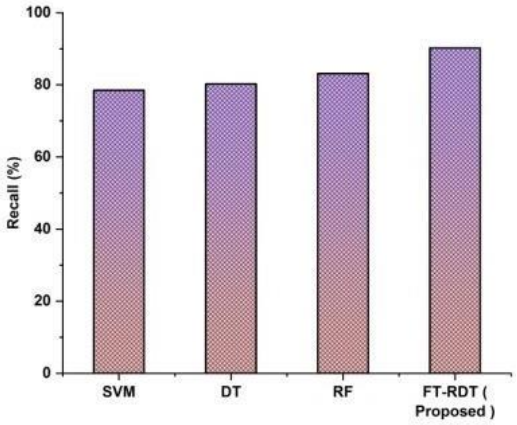

Figure 5 Recall result.

In the context of predictive maintenance of a planetary gearbox, the F1 score is a combined evaluation metric that takes into account both precision and recall to provide a balanced measure of the predictive model's performance. The F1 score combines the benefits of both measurements by taking the harmonic mean of precision and recall. We have examined the F1-Score's outcome. Figure 6 demonstrates that our suggested methodology's (FT-RDT) performance measure (87.25) is superior to the existing in use techniques, SVM (76.50%), DT (80.50%), and RF (81.15%).

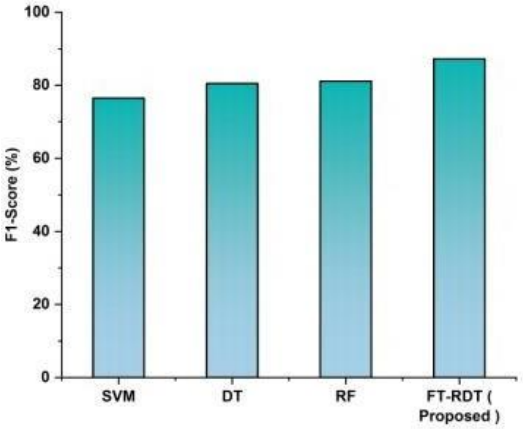

Figure 6 F1-Score result.

Three classes were established for classification in this study. Each class comprises 150 samples, which are divided into two groups: 50 samples for testing data and 100 samples for training the SVM classifier. The training and test data for all 24 characteristics were used in this work. For training and test data, the LS-SVM's performance across all features was 92.75% and 91.50%, respectively. This precision demonstrates the capability and value of the system that is being provided for the planetary gearbox fault diagnosis and categorisation.

4. Conclusions

In many industries, predictive maintenance is now essential to maximizing the dependability and productivity of equipment. The early identification of faults and prompt maintenance are essential in the case of planetary gearboxes, which are frequently found in heavy machinery and industrial equipment. Consequently, costly failures and downtime are reduced. A powerful solution for planetary gearbox predictive maintenance may be found here by combining the Fast Fourier Transform (FFT) and machine learning techniques. An analogous frequency-domain signal is produced by converting a time-domain signal using a mathematical process known as the FFT. It is feasible to recognize particular fault signatures connected with gear problems, such as pitting, chipping, and misalignment, by studying the frequency spectrum of a gearbox's vibration signal. These fault signs appear in the frequency spectrum as discrete peaks or shifts. These fault-related features can be extracted from the vibration data using the FFT, allowing for the early identification of gear problems. The defect identification and classification procedure are automatically carried out by machine learning algorithms, which enhance the FFT. A machine learning model can learn to recognize patterns and detect the existence of particular flaws by being trained with labelled vibration data from healthy and defective gearboxes. This makes it possible to create a predictive maintenance system that, using real-time vibration data, can reliably forecast impending gearbox breakdowns. There are a few standard steps that the FFT and machine learning predictive maintenance method normally takes. First, sensors are used to gather the vibration data coming from the planetary gearbox. Then, these signals are pre-processed to get rid of artifacts and noise that can reduce the precision of defect identification. The pre-processed signals are then subjected to the FFT in order to produce the frequency spectrum.

To extract pertinent elements, such as peak amplitudes and frequencies, which capture the fault signatures, the frequency spectrum is examined. Once the features have been extracted, a machine learning model uses them as inputs. The model is trained using labelled data, where the labels denote whether particular gearbox faults are present or absent. Depending on the complexity of the task and the data at hand, a variety of machine learning techniques, such as DT, SVM, or neural networks, might be used. The model gains the ability to link the retrieved characteristics with the associated defect labels during training. After training, the model can be put to use in a system for real-time monitoring, where it continuously assesses the vibration data coming in from the planetary gearbox. The model can identify the existence of problems and categorize them appropriately by comparing the retrieved features from the real-time data with the learned patterns. A potent method for planetary gearbox predictive maintenance is presented by the combination of FFT and machine learning approaches. Real-time vibration data can be used to reliably detect and categorize gearbox issues by combining the frequency analysis skills of FFT and the pattern recognition capabilities of machine learning. In addition to reducing downtime and repair costs, this proactive maintenance approach enhances the planetary gearboxes' performance, dependability, and longevity. In order to ensure the efficient operation of machinery and equipment, the combination of FFT and machine learning approaches will become more and more important as industries continue to adopt predictive maintenance.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

The African origin of public policy, programme and project monitoring and evaluation (M&E) practices

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Abstract The literature has robust contestation about the origin of public policy, programme and project monitoring and evaluation (M&E). Cloete (2016) argues that public policy, programme and project M&E originated in Europe and America and was introduced in Africa by colonisers who divided the African continent among themselves in the early 1880s. Cloete (2016) does not explain why there was no public policy, programme or project M&E in Africa or any other non-western part of the world before the arrival of western colonisers. Mouton (2010) also argues that M&E was introduced in Africa by international development organisations and financial organisations in the 1980s. According to Mouton (2010), these western development organisations and financial institutions introduced M&E to the African continent as a condition for accessing foreign aid and as a funding requirement for the projects these institutions were funding. Neither Mouton (2010) nor Cloete (2016) accounts for ample literature which demonstrates that M&E practices existed in Africa (and in China) thousands of years before the arrival of the international development organisation and international financial organisations in these parts of the world. This paper uses the Secondary Data Analysis (Archival Study) approach to provide a systematic and chronological analysis of the available literature to trace the genesis of public policy, programme and project M&E as a practice. The findings in this paper indicate that M&E could potentially have become a practice in African countries such as Egypt and Asian countries such as China long before it was a practice in the U.S. and European countries. However, evidence suggests that academics and practitioners in the U.S. and European countries could have compiled the first recorded theoretical academic content about M&E models and approaches currently being used to train people who want to take up a career or profession in M&E.

Keywords: M&E, public policy, programme evaluation, project, evaluation

1. Introduction

It is often argued that to understand an academic topic's origin or historical background, one must trace its research and publication history (Auriacombe 2013). Therefore, according to Auriacombe (2013), one must investigate the historical background of evaluation research to understand better what public policy, program, and project evaluation are all about. There are some essential truths to Auriacombe's (2013) argument. Still, this author does not account for the fact that some ancient civilizations did not write down their history. Instead, they used oral history to pass the information from one generation to another. Researching the historical background of evaluation practices (or as a discipline and field of study) in Ancient Africa is difficult because knowledge was mainly transferred from one generation to the other through oral history. Therefore, while developed countries' history is well kept in books, articles, etc., the fact that most literature is from Western countries risks giving us a skewed account, heavily biased toward Western countries. The difficulty in finding written records about how M&E was practiced in Ancient Africa is further complicated because colonizers have stolen these records and have hidden them in different museums in their countries. This paper will show that the Palermo Stone, the only credible ancient description of M&E practice in ancient Egypt, is kept in Palermo, Sicily, Italy. If there are written records about M&E practices in ancient Africa, there are safely hidden in private home libraries and are inaccessible to modern researchers.

The following paragraphs discuss the different stages in the history of public policy, program, and project M&E as a practice to determine its origin or genesis, as promised in the opening paragraphs of this paper. But, before doing so, the paper starts with the conceptual analysis of concepts related to the topic of the research and will provide a detailed analysis of the following:

2. Conceptual and contextual analysis

One must first establish a working definition for the essential concepts to study the genesis of public policy, programmes and projects monitoring and evaluation (M&E) practices. Basheka and Byamugisha (2015) state that the term practice implies that the field or an area of work attracts enough people to work in it on a regular basis. As Basheka and

Byamugisha (2015) continue to argue, the fact that M&E practitioners are currently found in many government departments, civil society organisations (CSOs), private and public consultancy organisations, and academia means that M&E is now a fully-fledged practice.

For the analysis in this paper, the concept "Genesis" comes from Ancient Greek "γένεσις" or genesis", which means "the origin or coming into being of something, source, beginning, nativity, generation, production," meaning "origin", "in the beginning" (Merriam-webster. 2022). The English concept "Genesis" is like a Latin word derived from the Greek "gignesthai" which means "to be born," and can refer to the origin or beginning of anything from a heavenly body to an idea" (Merriam-webster 2022). Therefore, while the focus of this paper is on M&E as a practice [due to the limited space in this paper and time], the genesis of public policy, programme and project M&E means its "originem", i.e., origin/s, root/s, foundation/s beginning/s, source/s, where it rises, the place where it began, where it sprang into being (Vocabulary.com 2022) as a practice.

The other central concept in this paper is monitoring (M). Monitoring is the routine tracking and regular collection of data about programs and projects' activities (USAID 2022). However, while monitoring is integral to the evaluation, the two concepts are different. According to The American Evaluation Association (AEA 2017), evaluation (E) involves using the information and data collected through monitoring to do proper SWOT analysis (strengths, weaknesses, opportunities, and threats) of policies, programs, and projects being implemented; as well as the people, products, and organisations that are implementing them to improve their efficiency and effectiveness. Evaluation can lead to continuing interventions if they are on the right track to success. Introducing improvements to the initiatives if they can succeed with little adjustments or corrections or discarding them if they have no chance and trying to salvage them is a waste of time and resources.

Kibeyi (2019) argues that M&E are integral part of the policy, programme and project cycles from conception, through to planning, implementation, termination, and beyond. In contrast, evaluation is "a systematic and intentional process to measure the progress, short-term and long-term results (output and outcomes), and impact of a project" monitoring focuses on capturing and storing data regarding activities and progress daily. In other words, evaluation goes beyond just checking the project's timely completion within the budget Uwizeyimana (2020). When evaluation is conducted before the implementation starts it is called diagnostic evaluation, when it is conducted during the implementation or execution process, it is called formative evaluation, and when it is conducted after the implementation has been completed it is called summative evaluation (Bakewell et al 2008). Irrespective of when evaluation is performed, its objective is always to improve current and future management decisions. To assess the extent of change and the causal link between the status quo before the implementation starts and the observed change at the time evaluation is conducted, M&E may produce one or a combination of the following comparisons:

a) Comparisons of data collected over time or time series analysis (i.e., tracking one or more indicators over a long time to see how they change. This type of data usually comes from the service providers' records. Still, it may also come from "focus group discussions and community surveys, random sample surveys of intended beneficiaries or other techniques" (Kibeyi 2019).
b) Comparisons over space/areas (i.e., two or more different areas) called cross-sectional analysis. Making comparisons over geographical space or areas requires comparing one population group with another (Kibeyi 2019). This type of evaluation may include comparing one area that has received the intervention with another that did not receive the same intervention. The second area is used for control (with no intervention) to determine the difference between the two areas (i.e., the real impact of the intervention).
c) Counterfactual comparisons which answer questions like "what would have happened to this target community if no project or program intervention was implemented? In addition, it also answers questions like what could have happened if the programme or project had been designed and implemented differently in the same area (Kibeyi 2019).

3. Theoretical analysis

The purpose of public policy, programme and project M&E is to determine a change (i.e., output, outcome and impact) and the causal link between the observed change and the implemented policy, programme and project intervention. The theory of change (ToC) is often used to explain these changes and causal relationships. A ToC represents the normative, structural and operational mental models underlying the success or failure of government's intervention (Uwizeyimana 2020). According to the USAID (Uwizeyimana 2020), a well-formulated ToC must achieve the following objectives:

- "To identify all the internal and external conditions necessary and sufficient to achieve a desired goal (i.e., desired change or output, outcomes or impact) starting from the situation before the implementation as the baseline.
- Clarifying the causal relationship i.e., how and why the interventions are expected to cause the desired changes.
- Explaining the sequence in which the events leading to change should occur in order to cause the desired changes.
- Answering the "why" questions (i.e., the rationales) behind this sequence of changes (Woodrow and Oatley 2013).

- Identifying other public and private interventions and conditions (both internal and external, local and international) that must happen and cause the desired changes.
- To recognise where there might be gaps in the environmental analysis and how to close them or minimise their effect.
- To know which indicators to monitor when monitoring progress.

In summary, Uwizeyimana (2019) and Uwizeyimana (2021) argue that a ToC explains why following a partucular course of action will lead to the desired change in the prevailing context. This can be summarised in the following (Woodrow and Oatley 2013) statement:

> "If we do X actions…, then Y (output, outcomes, and impact) will happen because Z (conditions)… are in place" (Woodrow and Oatley 2013), in Uwizeyimana (2019) and Uwizeyimana (2021).

According to Masuku and Ijeoma (2015), “modernist scholars argued that “the evolution M&E started in the western countries”. However, many scholars such as Shadish (Cook and Leviton 1991; Kusek and Rist 2008; Stockman 2011; UNESCO 2016; Matsiliza 2019) tend to disagree and argue that “M&E is not a new concept in Africa”. and They argue that it has “existed in the form of traditional governance during the Stone Age” (Masuku and Ijeoma 2015). As Masuku and Ijeoma (2015) put it “it is so unfortunate that the current literature on M&E has, for a very long time, “overlooked the evolution from the Stone Age context”.

The following paragraphs trace the different stages in the development of M&E as a practice to determine its origin or genesis.

4. M&E practices in the animal kingdoms - Since the beginning of life on Earth

Literature suggests that the practice of evaluation was naturally done by animals such as apes (chimpanzees, chimps, monkeys, gorillas, orangutangs etc.) measuring the depth of a river or a pond to find out how deep it is before crossing the river or diving. Evaluation as an animal's instinct survival mechanism to avoid drowning was behind this practice in the animal kingdoms. The following picture (Figure 1) shows "Mego the Orangutan" using "a long, staff-like stick to measure the depth of the river to find out whether the river was too deep to cross. (Finnis 2014) argues that "Mego the Orangutan was rescued by the Nyaru Menteng Rescue and Rehabilitation Centre in Central Kalimantan, Indonesia. A few days after the Orangutan was released into the wild in 2014, saw him at the bank of the Joloi River holding a long branch of a tree (Finnis 2014). According to the eyewitness in the park, as stated by Finnis (2014) the Orangutan slowly inserted it into the water to measure the depth and only made his way in, after realising it was safe to cross". But unluckily, things did not go well with Mego as he latter lost grip of the branch and hopelessly watched it float away. After realising that it would be dangerous to continue the journey across the river without it, the clever animal decided to turn back to the shore of the river (Finnis 2014).

It can be argued that Mego the Orangutan's act of using a stick to measure the depth of a river is almost equivalent to collecting the data and/or information, its decision to wade in the river after concluding that it was not too deep, and its ability to decide to turn back to safety after losing the branch (i.e., a measuring instrument) because it deemed it to be dangerous to cross the river, without it meets the basic and minimum analytical requirements of modern M&E practices.

Evaluation implies the ability to systematically analyse the information and make appropriate judgement or decisions, or recommendations to yourself and others (Uwizeyimana 2020). Evaluation requires the evaluator to make decisions or choices, to “estimate, judge, defend, criticise, and justify" (Bloom et al 1956; Huitt 2011).

The fact that animal practiced evaluation as a natural survival instinct and the fact that "men" evolved from the apes suggest that evaluation could have been practiced since the beginning of people perhaps also as an instinct for human survival. The apes, and especially orangutans share 98 per cent of human's DNA, explains "their remarkable similarity to us" and why they are adaptable and innovative like humans (McEntee, in Finnis 2014).

Figure 1 Mego the Orangutan testing the waters to checks the depth of the river with a stick before crossing. Source: https://www.dailymail.co.uk/news/article-2746844/Don-t-depth-Incredible-pictures-orangutan-using-stick-check-river-safe-cross.html.

Accessed on: 21 October 2022.

5. M&E in Ancient human kingdoms and societies

Appraising or examining a phenomenon's relative significance is a natural and intrinsic part of every human being. Accordingly, (Shadish 1991) use the example of someone in the pre-historic era trying to “roast meat to see if it can taste better than raw meat. Knowingly or unknowingly, such ancestors of ours were conducting evaluation and their findings of such evaluation processes are still beneficial to people in modern societies accross the globe. In addition, "someone who, in the pre-historic era, ventured into discovering “whether certain fungi, leaves, roots, plants,insects, birds, animals, and sea and air creatures, were edible or not, or if the work could be carried out by using one particular type of tool than with another, that person was conducting evaluation (Stockman 2011). Hence the history of human existence is filled with difficulties and challenges they must overcome to survive, many forms of evaluation practices were conducted by human ancestors in the pre-historic era. The time for such discoveries is not recorded anywhere in the history books because humans in the pre-historic era had not started documenting their history. Still, no one can deny that these were life-changing evaluations and that such evaluation practices have had and continue to have real effects on the lives of people living today and those who will live in the future. Therefore, one has to look at the times and places where human beings lived first in the pre-historic era to determine the origin of evaluation practices (Stockman 2011).

The most available scientific discovery shows that the human evolution stared as early as 300,000 years ago as demonstrated by "The 300,000-year-old bones and stone tools" of Homo sapiens ever found" (Yong 2017). The earliest fossilised remains of Homo sapiens (or primate species) include bones and the stone tools which were recently discovered in a place called Jebel Irhoud "around 62 miles west of Marrakesh, the capital city of Morocco" (Yong 2017). These remains are believed to belong to the "Homo sapiens, members of a nascent ape species that had spread across Africa” around 315,000 years ago (Yong 2017). Before the Moroccan discovery, the oldest known fossilised remains of Homo sapiens were the two focils discovered in Ethiopia which are estimated to be between 160,000 and 195,000 years old (Yong 2017). The two discoveries of the earliest Homo sapiens ever found confirms modern scientific research which shows that Africa is the "Cradle of Humankind" (Yong 2017). Hence the identification of the problem, and alternative options to solve them, is dated back to the early stage of human evolution, and the earliest fossilised remains of Homo sapiens were recently discovered in two African countries (Morroco and Ethiopia), the one can safely argue that the earliest M& practices were initiated by Ancient African communities.

5.1. Government monitoring and evaluation in ancient times

According to UNESCO (2016), public policy, programme and project monitoring practices have been an integral part of the education process in most developped and developing countries over the last few decades. As UNESCO (2016) states "practices, such as school attendance registers have been part and parcel of the schools’ performance management strategies for many years. Furthermore, "basic education data, such as the number of schools in a particula geographic location, the number of students enrolled in schools and the number of teachers in a particular geographical area or school have been part of national education statistics for many years (UNESCO 2016). In fact, all developed countries, such as the U.S. and other western Europe countries, have well-established M&E systems. According to UNESCO (2016), even less developed countries, such as Bangladesh, Sri Lanka, Kenya, Uganda and Tanzania, have had simple public policy, programme and project monitoring tools since early 1990.

The above argument support UNESCO’s argument that governments monitoring and evaluating their performance is not new Kusek and Rist (2008). The thought and influence of M&E were recorded in ancient human kingdoms about 5000 years ago. This is "when ancient governments and officials would take note of the performance of their livestock and grain sales, the quality as well as the balancing of the financial books" (Matsiliza 2019). According to Matsiliza (2019), although in those earlier days, M&E might not have been "as prominent and advanced as it is today, the modern principles of ensuring quality and assessing results are much applicable in modern-day governance and policy-making". This M&E process which "assisted in planning ahead for sales and satisfaction and means of improvement in future instances" in ancient kingdoms, is "the same code which is being followed for present-day M&E" (Matsiliza 2019). Matsiliza (2019) argument confirms Kusek & Rist (2008) argument, which acknowledges that governments' M&E of their own performance is not new. Literature suggests that monitoring and evaluation were regularly practised when the Egyptian Pharos built the Pyramid of Giza. The Great Pyramids of Egypt were constructed in about 2630 BC (Meredith 2014). That was 1630 years before Stonehenge (erected in England estimated 2000 B.C.) and 2000 years before Mexican Sun Pyramid built1500 B.C.), and over 5000 BC before the first western travellers (led by Vasco Da Gama in1498) arrived in Africa (Meredith 2014). There was a specialist in performing the important task (i.e., M&E) to ensure that the Pyramids met certain specific structural and engineering criteria and their alignment with celestial planets and stars, but also to ensure the completion of the work on time. The scientific details care taken by the people who built the Pyramids of Giza etc., and the astronomic characteristics suggest that these people were far advanced in all scientific fields by about 3000 BC. This is, for example, the view held by (Haughey 2014), who argues that

"the history of M&E can be traced back to Egypt in 2570 B.C." and that it was practiced "during the construction of the Great Pyramid of Giza". As Haughey (2014) puts it:

"The Egyptians built the pPyramid'shistorical records, which portray that they were managers for each pyramid cycle to oversee their work to completion. Some degree of planning, execution and control was adopted to manage this project". Therefore, even though the term M&E was not coined at that time, "there was a monitoring and evaluation level in this". Therefore, as Haughey (2014) concludes, "based on this historical evidence", M&E of projects and project management are not new concepts.

There is a consensus among authors such as (Kusek and Rist 2008; Clayton 2012, Meredith 2014; Birasa 2019) that "The Pharaohs built the pyramids with exceptional precision, and that such work would not have been possible without exceptionally skills managers dedicated to overseeing (i.e., monitoring and evaluation) the work for each face of the Great Pyramid. The fact that the pyramids were completed in a specific time and according to the plan suggests there were managers and leaders behind who were monitoring and evaluating the progress of the building projects when the Pharaohs built the great pyramids of Giza in 2750BC (Haughey 2014).

5.2. The Palermo Stone and the Nilometer as the oldest M&E writings and instruments in Ancient Egypt

One of the oldest written pieces of evidence to demonstrate that the Ancient Egyptians were far advanced in terms of M&E during the Early Dynastic Period the Ancient Egyptians is the "Palermo Stone". Schäfer (1902) states that "the Palermo stone are a "set of several pieces of a large black basalt slab", which are "written in hieroglyphics (i.e., an Ancient pictorial writing) on both sides"). More importantly, regarding the discussion in this article, the Palermo Stones contain the information about how the Nile River was monitored in Ancient Egypt (from around 3200 to 2350 BC) (Schirò 2021). During the 700 years period, "the height of the Nile was recorded as 6 cubits and 1 palm (about 3.217 m or 10 ft 6.7 in)" (Clagett 1999). As correctly indicated by Schäfer 1902:

Written in Ancient Egyptian Hieroglyphs, "the Palermo stone has short, year-by-year accounts of major events that took place during the reign of different pharaos. These events are mostly ceremonies, festivals and rituals" and are writen in the shape of a palm branch. The bottom of each register records the Nile heights. In Schäfer's (1902) own words:

The Nile heights are in ancient Egyptian units of lengths:

	ḏbꜣ	*finger*	0.74 inch
	šzp	*palm*	4 fingers
	mḥ	*cubit*	7 palms

The strokes stand for multiples of the signs. For example, *mḥ 2 ḏbꜣ 2,* means 2 cubits and 2 fingers. This converts to 2x7x4+2 fingers = 58 fingers = 42.92 inches.

Schäfer (1902). The Palermo Stone (Palermo Museo Archeologico).

The following is an example of the Palermo Stone (Figure 2) discussed in the above section.

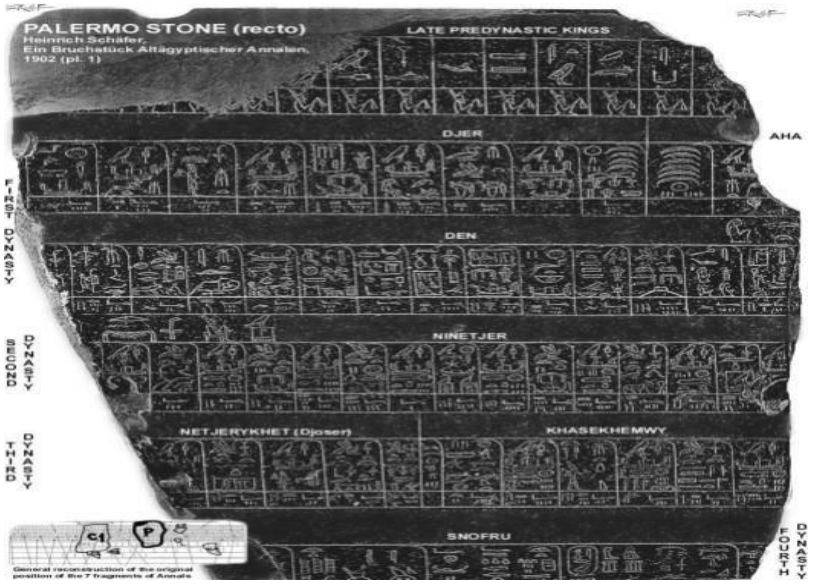

Figure 2 The Palermo Stone (Palermo Museo Archeologico. (Source: http://xoomer.virgilio.it/francescoraf/hesyra/palermo.jpg; and also

http://www.catchpenny.org/thoth/Palermo/index.htm (Accessed on: June 1, 2023).

In addition to the Palermo Stone, there is evidence that the Nilometter was the oldest known M&E in Ancient Egypt.

6. The Nilometer is the oldest known M&E in Ancient Egypt (>5200 ago)

There is overwhelming evidence to demonstrate that the Ancient Egyptians used one of the very sophisticated scientific measuring instruments known as the Nilometer to monitor, record and evaluate the Nile River's seasonal variations and their impact on flood and harvest (Kiprop 2018). Archeologic evidence suggests that Nilometers originated in Pharaonic times (i.e., from 3200 BC until 332 BC when the country fell under the Macedonian conquerors). The fact that the Nilometer was used to measure water levels as early as 5200 years ago suggests that nilometers are the oldest known monitoring and evaluation instruments (Figure 3).

The analysis of this information helped the people in charge of monitoring and evaluating the Nile River. The priests' and pharaohs' (and later, Roman or Arab leaders) ability to record data (daily) and to analyse the data to predict whether the harvest was going to be good or whether there was going to be famine (Mortel 2022) is like current monitoring and evaluation practices in areas of public policies, programmes and project implementation. The skill of predicting nature (quality and levels of the) floods also played a significant administrative and political role in Ancient Egypt civilisations because the quality of the Nile River floods determined the levels of tax paid by citizens in the region in that given year (Mortel 2022). For example, the average inundation suggested an excellent harvest and therefore more taxes to be collected during that annual agricultural cycle, a below average inundation would result in famine and less tax collection. An unusually above-average inundation was catastrophic as it meant that most cultivated land and crops would be washed away (Mortel 2022). The above-average inundation would usually lead to massive destruction of a large portion of the nation's infrastructure constructed along the floodplain and less tax collection. Trend analysis of historical records about the Nile River flooding cycles indicates that "one out of four years on average (or about 28%) between 622 and 999 CE, experienced flooding that did not meet the people's expectations over the same period of about 102 of the years" (Fagan 2010).

Figure 3 The Nilometer used by Ancient Egyptians to monitor the Nile River flood level (Source: Mortel 2022).

In fact, ancient Egypt was not the only non-western country with advanced M&E practices in the pre-historic era. Several authors such as (Mouton, 2010; Shadish and Luellen 2011; Alkin and King 2016; Kabeyi, 2019) have traced the origins of M&E back to 2200 B.C. in China, where evaluations were conducted on employees. Shadish et al (1991) assert that the idea of planned social evaluation may be traced back to personnel selection in China around 2200 B.C. In addition, "China started initiatives like program assessment in the public health and education sectors in the eighteenth century" (Alkin 2012).

7. Literature is very scant on the M&E practices between 2200 BC and 202 BC

However, the Great Wall construction in China in 202 B.C. marked another historical event that influenced project management. The Qin Dynasty or Ch'in dynasty, which gave its name to China (founded by Qin Shi Huang, who became the First Emperor of Qin and lasted from 221 to 206 BC), is credited for establishing a system in which the labour force was organised into three major groups: criminals, soldiers and ordinary people. The Qin dynasty commanded these groups. This system, established by the Qin dynasty, led to an emergency of organising, controlling and centralising command structure in the project execution and monitoring and evaluation practices. The centralised command and control structure in these ancient Chinese times ensured proper work planning was done (i.e., executed) and completed on time. Ensuring that projects met their objectives when completed required adequate monitoring and evaluation of these projects.

In addition, there is not enough literature on what happened between the 202BC and the 15th Century. However, a close analysis of the literature shows that some African indigenous people had practices which included some M&E practices like what is done today. Such examples include the tradition of Imihigo in ancient Rwanda. It is unclear when Imihigo practices were introduced in Rwanda, but such practices can be traced back to the 15th Century. (Scher 2010) asserts that Rwanda's Imihigo is rooted in the country's pre-colonial cultural practice. During the feudal system era, especially during king

Mutara Rwabugiri reign (approximately 1853/1860- 1895), warriors would publicly vow kill the enemy of the king or conquering neighbouring kingdoms on behalf of the king or doing some other acts deemed to require exceptional courage. Once the person who made the vow delivered his promise, he was given a reward (Kugororerwa), which ranged from cows, the king's daughter for marriage, being made ruler of a region or a combination of these rewards. Once he failed to deliver on the vow, he was either killed or humiliated in a public ceremony.

The practice of Imihigo since the 15th Century confirms Potter and Kruger (2001) argument that the activities resembling modern/current projects, programme and policy evaluation had existed for many centuries before the advent of "modern" programme and policy evaluation in the 1960s. The Imihigo practices, which were part of Rwanda's tradition before the arrival of Germans (1895-1919), and Belgian colonisers (1923-1961) (Kayibanda 1962, Uwizeyimana 2020), show that M&E was part of Rwanda's cultural practices and cultures. The post-1994 Rwandan government re-launched the course of Imihigo in 2006 (Scher 2010). Modern Performance Contracts (imihigos) involves the signing of performance contracts between the President Paul Kagame and leaders at district and local government levels of government (Murasi and Auriacombe 2022).

According to Klingebiel (2019), the signing of the Imihigos between the President and mayors at the district level act as a policy management tool designed to ensure the implementation of national policies at the district level. As in the olden days of traditional Rwanda, current leaders who succeed in achieving their Imihigo targets are publicly rewarded, while the ones who fail to deliver on their Imihigo face public humiliation and may get dismissed from their jobs Casley and Kumar (1987).

8. Public policy, programmes, and projects M&E practices from 1700 to date

According to Rossi and Freeman (1993) and Babbie and Mouton (2001), policy, programme, and project evaluation-like activities although different from Results-Based M&E, Kusek and Rist (2008) were evident in the fields of education and public health in the 18th Century. However, the following are just a few examples demonstrating that evaluation practices have existed in almost all government endeavours and have gone through different stages of development and perfection to become what they are today since the 1790s.

Table 1 Development process of M&E as a practice.

Era	Age	Description

1	**Age of Reform/ Measurement (1792-1900).**	The Age of reform (1792-1900), also known as the "Age of Measurement", is said to be the first generation of modern evaluation. During this first generation of contemporary evaluation, evaluation mainly focused on "measurement" and favoured statistics and surveys. This era was also characterized by performance measurement in schools (Beywl and Gullickson 2022). The U.K. seems to have been at the forefront of educational evaluation practices and methodological development during this era. Literature suggests that it is in that quantitative marks were first used in Britain to assess the performance of students' assignments in 1792 (Hogan 2007). Professor William Farish (1759–1837), is credited for having been the first person to use quantitative mark allocation to exam questions so that he can measure individual university students' examination performance in 1792. However, while Prof William Farish's use of written examination and quantitative marking is said to be the earliest known official usage of evaluation in education, this does not mean that students' assessment was first done in the U.K. Fahim and Zoair (2016) analysis of the "Education systems and practices in Ancient Egypt before the end of the Graeco-Roman period" shows that practical exams, written exams, and oral exams were used the main assessment methods to determine whether the students have acquired the necessary skills in the different educational fields and subjects. According to Fahim and Zoair (2016) analysis of the education level, its objectives, teaching, and learning, as well as its assessment methods during the Graeco-Roman era (i.e., 332 BC-395 AD) (i.e., 100 years period after the Persian rule over Egypt, 395 AD-495AD)"; shows that systematic teaching and systematic evaluation or assessment of student's academic performance was being practised. According to Fahim and Zoair (2016), during the Graeco-Roman Period, all Egyptian children, including immigrants such as the Jewish Moses in the Bible, had to gain different kinds of scientific knowledge to be considered well educated and ready to perform their societal roles. In fact, as Fahim and Zoair (2016) put it, "The Hellenistic education systems and processes, inherited by current generations from the ancient Egyptian and Athenian models, has kept its manners with less to no fundamental changes. In fact, it is often argued that the only small modifications which occurred in teaching and assessment methods occurred during the Roman Period. Otherwise, the influence of the Egyptian educational model was more than that of the Roman model. If one takes into account Fahim and Zoair (2016) argument, it becomes clear that the use of quantitative marks introduced in 1792 by William Farish (1759–1837) to assess the performance of British students' assignments (Hogan 2007) was not a new assessment method, but most likely a revised assessment method of the methods that might have been in use in Ancient Egypt many millennia before William Farish's (1759–1837) said invention. Therefore, while the Age of Reform (1792-1900) or "Age of Measurement" evaluation was primarily

		developed and practiced in the context of education in the U.K. and probably in the U.S. in the 18th Century (Beywl and Gullickson 2022), evaluation practices during this era were heavily inspired by other disciplines (such as agronomy which used "rigorous experiments in plant cultivation" (Rossi 2004), and the monitoring and evaluation of the Nile River flooding seasons which have been practised many millennia in Ancient Egypt as already mentioned in previous sections of this article.
2	**19th Century:**	The 19th Century seems to have been dominated by two countries, namely the US and the UK. In these two countries M&E evaluation studies were undertaken commissions appointed by governments to measure the success or failure of government's initiatives in critical areas such as the educational, law and health sectors. At that time, the U.S. government appointed many "Presidential Commissions" to conduct large-scale evaluations, examine evidence and judge various programmes, including agriculture, to which agricultural practice yielded the most significant crops. The studies conducted in the early 1900s by the American government are often regarded as the first government-driven evaluation study (Chellimsky 2006). In 1815, the U.S. by the Army Ordnance Development developed evaluation regulations, which are recorded as the first formal evaluation activities (Rossie et al 2004). School performance evaluation was popularised in 1845, when it was formalised for the first time at Boston University, U.S. (Rossie et al 2004).
3	**1917: The Gantt chart by Henry Gantt (1861-1919):**	1917 was characterised by development of project management tools such as the Gantt Chart, which facilitated M&E practices. Created by Henry Gantt (1861-1919), the Gantt chart is widely used in project planning, implementation management and evaluation (Haughey, 2014). M&E practices benefited from the development of the Gantt Chart as it became a tool for monitoring the progress of programmes and project activities (Kabeyi 2019).
4	**Age of Efficiency and Testing (1900–1930):**	During the 1900–1930 period, scientific management was centered on observation, quantitative measurement and analysis, and efficiency and effectiveness. The 1930s also saw a significant change in the public administration sphere when the American government allocated between $40 and $50 million for evaluation research in Agriculture, education etc., by the American government.
5	**Tylerian Age (1930-1945):**	The Tylerian Age (1930-1945) era, or the post-World War II period (1939-1945), was the catalyst for spreading western evaluation practices to developing countries, especially those that depended on foreign aid. Western donor agencies and global financial agencies especially the IMF and the World Bank consider evaluation an essential programme management tool. M&E became conditional for providing financial (and material) aid to aid-dependent countries. As a result, evaluation "began to emerge both at the country level and in the U.N. system in the early 1950s (Mouton 2010). This period is called the Tylerian Age (1930-1945) because Ralph W. Tyler (1902-1994), and his colleagues championed the importance of evaluating government programmes to find out whether they have accomplished their stated objectives (Mouton 2010). The work of Ralph Tyler and his colleagues was "the catalyst in establishing evaluation as a "distinct field" (Potter and Kruger 2001). The need for monitoring and evaluation of public policies and programmes resulted from the Great Depression of the 1930s, which caused many western governments to increase their budget spending on social and economic programmes to assist with the recovery of their economies. There was a need for objective-based tests to ensure the effectiveness of these government social programmes in solving the socio-economic problems facing many western citizens during and after the Great Depression of the 1930s. Ralph W. Tyler's (1994) influence was mostly felt in the field of testing and measuring the performance of education programmes and school curriculum. He is credited for transforming the idea of testing and measurement into a global concept that is now called evaluation (Education Encyclopaedia 2022). The (1930-1945) was also characterised by Longitudinal systematic study (education, U.S.): For example, in 1941 Ralph Tyler presented the result of an eight-year investigation of an educational objective and the measurement of their impact. Some consider Ralph Tyler to be the catalyst of a process that led to the establishment of evaluation as a distinct field or practice and study (Alkin and Christie 2004).
6	**The Age of Innocence (1946-1957)**	During the Age of Innocence (1946-1957) period, Americans mentally moved past World War II and the Great Depression (1930s) and started making monitoring and evaluation part of the government policies and programmes. During the Period (1956/7), M&E greatly benefited from the development of the Critical Path Method (CPM).

9. Conclusion and recommendations: what does the above historical review tell us about the origin of M&E as a practice?

The objective of this paper was to use the Secondary Data Analysis (Archival Study) approach to provide a systematic and chronological analysis of the available literature to trace the genesis of public policy, programme and project M&E practices. The study suggests that M&E was practised many years ago in the animal and ancient human kingdoms. The findings also indicate that "to appraise, examine or simply evaluate the relative significance of a phenomenon is part of the human natural and intrinsic phenomena. This finding suggests that M&E is as old as humankind. Thus, one must find out where the earliest human beings have been found to know the origin of M&E practices. Archaeological and historical records show that the earliest Homo sapiens ever seen are on the African continent. This suggests that the oldest M&E practices used by humans, such as roasting meat to find out whether it tests better, or the use of a stick by human ancestors, such as Homo Sapiens, to measure and assess the depth of a river to avoid drowning could have originated from Africa. This finding is also

supported by the literature, which shows that M&E practices, such as systematic evaluation of crops, have been recorded bout 5000 BC in ancient Egypt. This is the time Ancient Egyptians built the Pyramids of Giza. Old records such as the Palermo Stone show that the Pharaohs who built the pyramids kept records, especially on the Parlemo Stones, showing that there were managers for each face of the Great Pyramid. These managers were responsible for overseeing (i.e., monitoring and evaluating) the work to completion. While the literature reviewed also show that M&E was commonly practised in Ancient China as social evaluation with government staff selection in China early as 2200 B.C.; the fact that the Palermo Stones contain information about how the Nile River was monitored in Ancient Egypt (from around 3200 to 2350 BC, approximately (>5200 ago), is further proof that M&E practices originated from the Ancient African people who inhabited the northern part of Africa during this era.

In addition, while there is not enough literature on what happened between the 202BC and the 15th Century, a close analysis of the literature shows that some African indigenous people had traditional M&E practices, such as the tradition of Imihigo in ancient Rwanda back in the 15th Century. These traditional M&E practices included some M&E practices similar to what is done today. Furthermore, while ancient M&E practices in the ancient animal and human kingdoms are necessarily different from modern (or current) M&E practices, it can be safely concluded that current public policy, programmes, and projects M&E practices that have existed since the early 1700 have their roots in M&E practices that existed for many millennia ago. For example, many people roast meat on the fire the same way, and the early humans roasted it for the first time for the same reasons. The fact that practices similar to programme evaluation were evident in education and public health in the 18th Century further proves that M&E practices are not new.

However, the analysis in this paper shows that Ancient M&E practices went through many stages of development, refinements and perfection from the Age of Reform/Measurement (1792-1900) to become Results-Based M&E, or Evidence-Based Evaluation (EBE) in the 20th and 21st centuries, the evidence presented in this paper demonstrates that the genesis of public policy, programme and project M&E practices is routed in Ancient African traditions.

Ethical considerations

Not applicable.

Conflict of Interest

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Literature review of the relationship between E-procurement and cost reduction

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Abstract The purpose of this desktop study was to examine the efficacy of e-government technologies and the obstacles to their efficient use. The researchers assessed how well e-government affected service delivery, how it might result in cost savings and the advantages and difficulties of adopting and using it. The study also looked at the advantages of using e-government to investigate this. E-efficiency in providing services was demonstrated by greater citizen involvement and interaction with the local government, increased openness and accountability, and cost savings. The study revealed that the use of e-government improves traditional methods of conducting business and providing services while also enabling access to information and services online, reducing the need for rework, increasing transparency and accountability, and encouraging citizen participation. The ineffective use of e-government in local authorities was hampered by a lack of funding, inadequate enabling infrastructure, low ICT literacy levels, and the digital divide, among other factors. It was evidenced in this study, that e-procurement leads to cost savings, thus it affects cost reduction strategies positively. Thus, e-procurement reduces inventory costs.

Keywords: E-procurement, cost reduction, service delivery, local government

1. Background of the Study

In this modern-day digitalised world, the traditional tendering approach is increasingly becoming outdated and irrelevant. Procurement operations need to be handled by digital platforms that streamlines the procurement process, thereby enhancing the speed of decision making and delivery, thus creating opportunities to generate value and save resources. The demand for paperless business processes by the government and private companies in Zimbabwe has seen the emergence and development of many commercial e-tendering.

2. Literature Review

The study comprises a theoretical framework of theories which justify the existence of the problem statement, particularly e tender systems and the effectiveness of procurement decision systems. It then proceeds through a conceptual framework which maps out the overall investigation, to accurately review the relationship between two variables in the study. The last section of the review is that of conceptualizing the evidence already propagated on weaknesses of manual tendering, evidence that justify the adopting of e-tendering to curb the weaknesses of the former and lastly, to examine evidence on challenges in adoption of e-tendering systems in procurement decision making as well as evidence on recommendations already in suggestion.

3. What relationship exist between e-procurement and cost reduction?

According to a 2007 study by Adrienne Selko, the cost of turning requisitions into orders was reduced by 62 percent because of e-procurement. E-procurement has enhanced cost reductions and helps streamline internal processes while increasing supplier relationships, according to a 2012 study by Aberdeen. E-procurement helps you save money by avoiding duplicative purchases, taking advantage of volume discounts, and avoiding expenses related to paper-based systems (for example, the cost of stamps to mail your paperwork).

3.1. Relationship between e-procurement and service delivery

Better service delivery to residents is one of the goals of electronic governance. Such an approach can help the government streamline its procedures, connect all the stakeholders, and lower operating and administrative costs, all with the overarching goal of increasing service delivery. E-government technology can improve service delivery by introducing

methods for citizens and governments to communicate effectively with one another. E-government has had a big impact on public administration, changing the environment in which it operates, bringing in new concepts and methods, and changing the relative weightings and relationships between its numerous systems. In a descriptive research typology, (Chukwuemeka et al 2018) and (Ibikunle et al 2019) found a strong correlation between e-government and service delivery. This is due to how much less time is wasted, there are less delays and mistakes made by employees when doing their jobs and providing services thanks to ICT.

According to (Chadwick 2016), e-government technologies promote effective governance processes, expand public access to information, and improve government accountability to the people. Government-to-Government (G2G), Government-to-Employees (G2E), Government-to-Business (G2B), and Government-to-Citizens (G2C) are the four main e-government service delivery interactions that apply to local authorities, according to (Ahmad 2019) and (Sharma 2017). These interactions are discussed below.

3.2. Government –to Government (G2G)

Refers to the electronic correspondence between government departments, offices, and agencies that is based on a government database (Sharma 2017). Solinthone and (Rumyantseva 2016) claim that G2G services occur on both a local and international level. The usage of online communication and collaboration, which enables the exchange of databases and resources, improves process efficiency. This program intends to speed up government procedures by lowering the cost of providing services and enhancing internal operations within the public sector. It helps with resource management, including how human and financial resources are used, monitored, and evaluated.

It could also be used in a way that enhances the government's capacity to create and implement the plans and policies required to successfully carry out its obligations. For instance, a G2G connection will be possible by ICT between the KCC and the Ministry of Local Government, Public Works, and National Housing.

3.3. Government-to-Citizens (G2C)

This kind of service includes any efforts carried out by the government or its agencies that are intended for the general population. (Amuche 2019) asserts that the deployment of electronic government improves the delivery of high-quality services. Citizens are given the chance to participate in governmental processes and help shape policies that affect them through the use of ICTs; this is sometimes referred to as enhancing democracy or participation. Since it enables appropriate citizen-government participation, G2C is sometimes considered as the primary goal of e-government. On the one hand, this boosts the accessibility and availability of public services while also improving their quality. Thanks to this choice-based system, citizens can select when, from where, and how to connect with the government. Government information and services are easily accessible to the public at all times and from anywhere. In a descriptive study, (Gatobu and Muthini 2021) claim that the government-to-citizen model has had a significant and progressive impact on service delivery, leading to increased customer satisfaction. The vast majority of government services should be delivered online as a result of the implementation of e-government.

The transformation drive of public service delivery has made the most significant progress in the following areas, among others: e-procurement, e-invoicing, e-payment, e-licensing, e-archiving, e-tendering, e-taxation, e-democracy, e-submission, e-compliance, e-assessment, e-participation, e-health, and online company registration Web portals can be used by the government to disseminate information, for example by making downloadable forms available online and hosting public training courses there.

3.4. Government-to-Business (G2B)

G2B is a relationship between businesses and the government where government agencies provide services and information to a business via government portals, according to (Suri and Sushill 2019). Through G2B, businesses and governments may communicate.

Various services are transferred between government and business in G2B transactions (Solinthone and Rumyantseva 2016). As a result, the business sector is able to contribute to the development of policies and stay informed about information from the government, such as memos, policies, rules, and regulations.

This model states that some instances of interactions between the government and business include projects, purchases, taxes, bids, electronic auctions, and the delivery of business-focused services online. This project also aims to improve and streamline interactions between the government and the commercial sector. In addition to these, it also covers regulation, procurement from, general services to, and digitization.

3.5. Government-to-Employees (G2E)

The government, which is by far the largest employer, needs to engage with its employees on a daily basis just like any other enterprise. Employees and the company have a mutually beneficial relationship. One instance of G2E engagement is

the online information sharing between the KCC and its employees via websites and intranets. A G2E system deployment for improved government services, according to (Mapano and Caballero 2018), demonstrates equality and equity to employees of local government units in terms of workload distribution and the provision of rewards and recognition. Government to employee services boost efficiency, accountability, and service quality in addition to managing internal communication more effectively (Rao 2017).

4. Effectiveness of e-government systems

4.1. Access to online information and online services

ICT has a huge impact on access and equity in public services because it offers a mode of access that is substantially more affordable than the conventional face-to-face technique. As a result of this influence, ICT has been utilized for the good of the public in numerous nations. Simple tasks could be easy to do if one has internet access to government information. The public benefits from easy access to the most recent information available without having to spend a lot of time or effort getting it, and it is practical and economical for enterprises. E-government streamlines processes and makes it easier for organizations in the public sector to access government information. Therefore, the ultimate goal of e-government is to offer residents a larger choice of public services in an efficient and cost-effective manner. Online service delivery reduces the need to repeat the same action, which would otherwise waste resources and limits the faults that come with manual service supply.

The efficiency of online service delivery benefits local governments. (Aritonang 2017) asserts that e-government strengthens and improves service delivery. According to Visser and Twinomurinzi, the adoption of e-government as a tool for service delivery will undoubtedly aid in the enhancement of government services. E-government systems are used by the local government to transmit information and provide services online. Additionally, it makes it possible for everyone in the nation to have equal access to information via the internet and websites. Bryman asserts that the implementation of an e-governance system enhances service delivery. Citizens in various regions of the nation can access council services from anywhere and at any time by using an e-governance system.

4.2. Improved traditional methods of transacting and service delivery

Traditional paper-based methods make way to the use of information technology when technology is employed to supply services. The results of a study by Obi, Uzor, and Chukwurah (2020) show that e-government has facilitated service delivery, which is evident in the ways and manner in which the traditional methods have been transformed as government staff are trained to easily use electronic tools provided in order to effectively and efficiently serve the public in the best possible paradigms, causing a positive increase in the quality of service delivery. E-government refers to the use of the internet as a platform for financial transactions, communication, and service delivery with the general public, the private sector, and other governmental entities. (Obi 2020) assert that the transformation of traditional methods shows how easier service delivery has become thanks to e-government. The Internet, mobile computing, and wide area networks are some examples of these technologies (Ngonzi and Sewchurran 2019). Local governments have access to online banking for financial transactions, e-billing for calculating monthly ratepayer invoices, and the ability to email and SMS ratepayers. In addition to Ecocash, ratepayers can pay their bills online through internet banking. Customers can go to the local government's website.

4.3. Improved relationship between local authority and citizens promoting citizen participation

A local government and its residents can engage more effectively thanks to an e-governance system, claim (Gatobu and Muthini 2021). Interactions between local governments can be facilitated and improved by the establishment of an e-governance system. Employee commitment and emphasis on service quality are made possible by e-government. It offers an interactive website for information transmission and receipt, convenient service, and time-saving facilities (Akpan 2020). Because the council will be able to respond to its citizens' needs more promptly, this can boost citizen trust and enhance relations. By offering services every day of the week instead of only during the council's regular business hours, it also saves time. E-government, in Saugata's opinion, helps individuals by enhancing their access to municipal data and enabling them to interact and participate. According to (Aritonang 2017), the advantages of e-government include increased citizen participation, improved accessibility, and higher-quality services. By providing easy and improved access to local government information and the ability to quickly interact and participate in the governance process, the effective implementation of e-governance systems in local governments and the sharing of information with various stakeholders results in citizen empowerment. Even in the processes used to create the budget, citizens and other business actors will be able to participate.

4.4. Greater transparency and accountability of the local government

E-government helps the local government by increasing transparency and accountability, claims (Belanger 2017). The public's access to, understanding of, and utilization of government information are all included in the concept of

transparency. As such, transparency requires a populace that can obtain, understand, and use information provided by the government (Marufu and Manenji 2016). This may imply that public authorities must uphold their specific obligations, such as procurement procedures and tendering, in a transparent manner.

Increased transparency and accountability in local government operations and interactions with citizens and stakeholders are also facilitated by the use of e-government systems in local authority processes. A lot of transparency in a local authority's operations to the public is provided by the sharing of information like council audited financial reports to the public online for review and processes being accessible to the public. Accountability is the capacity to outline what happened, provide an explanation for decisions and actions, and support those decisions and actions. ICT in local governments increases accountability by educating stakeholders and giving them daily access to the most recent information. Stakeholders include the federal government, municipal governments, civil society, and citizens. In order for stakeholders to confirm and concur with the council, local governments are expected to provide financial statements online, through websites, prior to publication. Since people will be aware of what the local governments are planning, this will increase effectiveness and stakeholder input and develop a sense of ownership. The use of internet-based techniques to involve citizens in the policy-making process serves as an example of government accountability and openness (Silonthone and Rumyantseva 2016).

5. Differences between manual tendering and e-tendering?

5.1. Manual Tendering

When using a manual procurement process, electronic commerce activities are not being carried out as swiftly and cheaply as anticipated. (De Boer et al 2002) hinted that the manual method is also prone to data loss, managerial override, and collusion because it depends on human contact and paperwork. Steward accountability and transparency have deteriorated as a result of manual processes, which promotes corruption. Stakeholder engagement has also very low (Ruikar 2002).

6. Which e-tender solutions have been presented to date?

E-Procurement encompasses a vast array of web-based techniques and software tools that businesses use for contract management, contract awarding, and other processes that span the entire process of purchasing the resources they need. According to (Anumba 2002), (Ruikar 2002), and (ITCBP 2003), e-tendering is included in e-procurement, suggesting that it also employs virtual operating procedures.

According to (De Boer et al. 2002), there are many different types of procurement, including e-tendering, e-reversing, e-auctioning, Web-based ERP, e-MRO (Maintenance, Repair and Operating), and e-informing. E-tendering was characterized as the web-enabled automation of a Request for Proposal (RFP)-style tender advertisement, automated bid receipt, and automated analysis, comparison, and supplier selection. E-tendering is a tool and enabler for business that entails using electronic technologies to automate and expedite an organization's procurement operations.

6.1. Umucyo System

This is an outstanding electronic portal that houses the tender advertisement and notification of accepted tenders as part of Rwanda's e-tendering solution. Although the system provides an online marketplace where suppliers can sign up and submit bids, it does not automatically evaluate tenders, which is important for improving openness and accountability throughout the entire procurement process. The system lacks evaluation methods for making decisions, such as e-auction system's price ranking of bids or extra supplier advantages such critical route analysis.

6.2. GeBIZ

A system created in Singapore's public sector to automate the government's and its suppliers' purchasing decisions. Although the system allows suppliers to register for bidding and selects the best offer based on the lowest price, additional quantitative and qualitative factors like the net price, time of delivery, or product quality are still not integrated. Furthermore, it does not establish a central repository where suppliers might constantly login and communicate with the state. It does not include a blacklist file or a thorough ranking or scoring system for bids.

6.3. EPIQ

EPIQ stands for Electronic Procurement Information Center (EPIC), a web-based paradigm for purchasing with improved document management connected to the application for the procurement process. All supplier data, fulfillment records, and any further supporting documentation are all recorded by the system. Registered users can also read, upload, print, and fax procurement papers via the system. In essence, the system is deficient in the integration of essential

procurement procedures, such as evaluation, ranking score, and integration with the purchasing department as the need's initiator. It is missing features like the Five Star Suppliers and the Blacklist File (FSS).

6.4. Tender Tiger

Tender Tiger promotes a business's goods and services, and it has a sizable, regular audience of about 10,000 buyers from the public and private sectors who use it to publish tenders and find Suppliers. As a result, the system works as a global network that links suppliers and buyers. But because the systems are not personalized, they do not include unique procurement procedures like automated evaluation and selection, blacklisting, and contract awarding. The systems also don't have automated negotiation processes.

7. Challenges to effective use of e-government systems as a way of enhancing service delivery

While there are many obstacles to using and implementing e-government initiatives in developing countries, the severity of these obstacles varies depending on the situation (Mustafa et al 2020). These issues can be grouped into the following categories:

7.1. Infrastructure

Numerous studies have found that underdeveloped countries lack the infrastructure needed to properly deploy e-government projects (Baheer et al 2020; Hanum et al 2020; Kanaan et al 2019). One of the important e-government enablers that a government needs to prioritize is ICT infrastructure. Due to problems including low fixed line telecommunications penetration and limited electricity, e-government is not widely used in the nation. According to a report by (Samboma 2019), local governments confront the following difficulties: insufficient network connectivity, inadequate IT infrastructure, unreliable access to telecoms and the internet, and low internet adoption. The process of transforming, storing, and distributing data that has significant value and is required for delivering e-government services uses the ICT infrastructure as a tool. According to (Gisemba and Iravo 2016) research, technology is by far the most important factor influencing how well e-government platforms offer services. This situation has left a service gap in e-government. Third, it can negatively impact the performance of e-government systems, making it difficult for users to receive higher quality services. Inadequate infrastructure hinders the delivery of e-government services by acting as barriers to government agencies providing e-services. Second, it reduces demand for e-government services by preventing people from accessing e-government services.

7.2. Digital divide

The "digital divide" is causing service gaps in developing nations, particularly when it comes to the utilization of e-government services. Internet users have a competitive advantage over those without it (Alabdallat, 2020). The "digital divide," which refers to the lack of or restricted access to electronic services and computer equipment among citizens due to economic factors, a lack of skills, and the location of inhabitants, is seen as a major barrier to the implementation and use of e-government (Alabdallat 2020; Chipeta 2018; Idoughi and Abdelhakim, 2018; Twizeyimana and Andersson, 2019). As a result, only those with access to the required technology and the ability to use e-services can accept and use e-government. People who lack access to ICTs and the necessary ICT skills are unable to use e-services, which prevents them from benefiting from e-government initiatives carried out in their service areas (Haider et al 2015; Twizeyimana and Andersson 2019; Verkijika and De Wet 2018).

7.3. Funding

Because "any e-government program requires funds to launch and sustain e-government projects," finance is essential for a successful e-government implementation (Apleni and Smuts 2020). With a few notable exceptions, most underdeveloped countries have difficulty funding their e-government initiatives. According to (Aritonang 2017), a lack of funding prevents the successful implementation and use of e-government. In order to build the necessary infrastructure, increase needed capacity, and offer the necessary training, financial resources are crucial and key factors. Governments want to build e-government, yet often lack the resources to make ideas a reality. This results in a funding problem (Fasheyitan 2019; Ziba and Kang 2020). As a result, most e-government initiatives receive the majority of their revenue from donations, especially in countries in Africa. When e-government implementation is dependent on donor funds, it typically leads to unsustainable funding when the funding is withdrawn, which hinders implementation progress (Khadaroo et al 2019).

7.4. Resistance and Lack of user awareness

According to several studies, resistance to change poses one of the biggest obstacles to the efficient use of e-government technologies. Some people think that an organization may be threatened by e-government. The major reason why employees are frustrated and afraid is because they believe the new system will have a detrimental impact on their ability to stay employed or to keep their position. Lack of user awareness and low ICT literacy levels substantially impair the

efficacy of e-government systems in the delivery of services by local governments. According to (Kanyemba 2017), residents' poor literacy levels continue to have a detrimental impact on how well they use e-government platforms.

(Lawan 2020) noted how the utilization of e-government is significantly impacted by ICT illiteracy. According to Hayat, a lack of user understanding can prevent ICT from being used effectively in the public sector. If the vast majority of intended users are unaware of these apps, nobody will utilize them, and the e-government systems become obsolete. For instance, citizens will continue to seek information and services from personnel at government offices if they are not familiar with a local authority's website.

7.5. Research Gap

The use of ICT in information processing has been shown to edify the entire procurement process, making it more effective, secure, transparent, and responsible, as noted by (the B&C Watch, 2001), (Georgieva 2017), and (Piera et al 2014). The main objective of procurement automation, according to (NSW Government, 2003), (Raventoand Zolezzi 2015), Kajewski and Weippert and other sources, is to promote efficiency, openness, and accountability (2004). Despite the many advantages of the previous manual procurement system and the outdated ideas, it is still debatable whether these systems effectively integrate all the procurement procedures necessary in the contemporary business environment. Automatic tender assessments, such as bidder ranking and scoring, blacklisting, automated selection, and contract awarding, are missing from the earlier systems. Few academics, with a primary emphasis on security considerations, were able to generalize the predicted outcomes of a modern procurement campaign. A single repository that enables genuine suppliers to gradually login and update their business profiles was absent from the bulk of earlier systems. Furthermore, existing systems lack the capacity to include negotiating procedures as well as the full supply chain of a company. The researchers want to take advantage of these shortcomings in order to make a thorough real-time proposal to problems with procurement in state institutions.

8. Conclusion

Despite the advent of e-government many years ago, local authorities continue to struggle as a result of employee reluctance to change. Limited time and finance availability, as well as resistance were obstacles to the study's completion. The ineffective use of e-government in local authorities was hampered by a lack of funding, inadequate enabling infrastructure, low ICT literacy levels, and the digital divide, among other factors.

9. Recommendations

- Computer literacy should be made a requirement for all public employees and civil servants at all levels of government, including municipal, state, and federal, by the government enacting ICT laws. The policy should also include initiatives to educate public employees about ICT and computer literacy.
- Government should provide subsidies to help local governments build e-government systems when they don't have enough money.

Ethical considerations

The study was permitted by Midlands State University

Conflict of Interest

The authors declare that they have no conflict of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

The impacts of E-Procurement on cost reduction: A case of Gweru city council

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Abstract Many businesses choose to employ information technology to develop and improve their operations. The improvement of public services has also benefited from the usage of information technology. Such efficient information technology in the commercial, public, and private sectors can have good effects in addition to introducing hazards and new vulnerabilities in a fully autonomous system. The purpose of this study was to examine the efficacy of e-government technologies and the obstacles to their efficient use. The study adopted a quantitative research approach and data were collected using questionnaires. The use of e-government has been shown to improve traditional methods of conducting business and providing services while also enabling access to information and services online, reducing the need for rework, increasing transparency and accountability, and encouraging citizen participation. The ineffective use of e-government in local authorities was hampered by a lack of funding, inadequate enabling infrastructure, low ICT literacy levels, and the digital divide, among other factors. In conclusion, e-government and improved service delivery have a positive link, as indicated by the Pearson correlation coefficient of 81,9 percent that was found between the two variables in the research problem.

Keywords: E-Procurement, Cost Reduction, service delivery, local government

1. Introduction

The manual procurement approach has historically been shown to be ineffective at completing and achieving procurement goals in the allotted times and budgets. The tendering decision cycle, from the submission of bids by suppliers to the internal processes of grading, selecting, and approving the best provider to deal with, is handled more slowly by the manual approach. Transparency, accountability, and consistency are further lacking in the manual tendering procedure. To effectively provide excellent service delivery, organizations and nations must stay up to date on all advances brought about by new developing technologies, globalization, population expansion, and modernization. The focus of this study was therefore to investigate the ability and extent to which e-tender evaluation systems can lead to value addition, through reduction in costs and effective cost management.

2. Background of the Study

According to IFRS 3, a business is defined as an arrangement with inputs, transformations, and outputs. Therefore, each business arrangement needs inputs to convert itself, and these are purchased at a certain cost. The traditional tendering system typically relied heavily on paperwork, routine phone calls to suppliers for updates, etc. to manage the procurement function and ensure that the client received the necessary goods and services from one location to another within the agreed-upon time frame and quantity. Therefore, the previous tendering system's main objective was to simply buy inputs at the right time, the right price, and the appropriate amount.

More specifically as stipulated by the Procurement Act (Chapter 22:14), there are five stages in Zimbabwe's Public procurement process and these include the preparation stage, the advertisement stage, the bid evaluation stage, the awarding and contracting stage. The first stage, the planning stage involves activities such as determining the choice of procurement to use, preparation of solicitation documents, deciding the type of contract to engage and lastly preparation of bidding documents. Stage number two of advertising involves publication of procurement opportunities in line with section 8 and 10 of Procurement Regulation (2002), activities including gazetting and publishing in local newspapers, preparation and dispatch of letters for Special Formal Tender in line with the regulations and issuance of bidding documents. Moving to stage three of bid evaluation, the entity procurement team and board sit down physically, to evaluate bids in line with section 8 and 10 of the Procurement Regulations, as well as section 15 to 20 of that same act. According to the act, bid evaluation

entails opening bids and entering into possible negotiations with the bidders. Stage 4 of public procurement Act does not have many processes as it is just the stage where an approved bidder is chosen and contacted with a contract offer. Specifically, the stage entails approving the bidder, actually offering the contract of engagement, debriefing and allowing room for any appeals against the choice of award.

The last stage of the Procurement Process, Stage 5 is just an ongoing continuous management practise where performance obligations are defined and communicated with the contracted supplier. Orders are defined, performance is rendered, evaluated, payment is delivered, and room is given for settling disputes and offering resolutions. As evidenced, not only is such traditional procurement system time consuming, but is notably prone to several disruptions from various factors due to its lack of visibility and consistency. Handling the procurement system as a short-term task rather than an integral aspect of business operations tends to cause most State bodies to miss out on the merits of a strategic and systematic tendering approach such as an electronic tender system (Alassim and Alfayad 2017). In this modern-day digitalised world, the traditional tendering approach is increasingly becoming outdated and irrelevant. Procurement operations need to be handled by digital platforms that streamlines the procurement process, thereby enhancing the speed of decision making and delivery, thus creating opportunities to generate value and save resources. The demand for paperless business processes by the government and private companies in Zimbabwe has seen the emergence and development of many commercial e-tendering systems. Gweru city council appears to be one authority that can benefit from the adoption of an E-tender evaluation system in several ways. The City of Gweru Council appears to be one of the most visionary councils in Zimbabwe when judging from a mere look at the entities vision, mission and core values.

The council's vision is prominently to be a sustainable city of choice by 2030. This vision translates into a mission of consistent provision of quality services to the council's stakeholders, residents and clients. More interestingly, the core values seem to be cohesive and strategically aligned with the city`s vision and mission. Amongst these core values, the council states that it endeavors to be customer oriented, to resemble professionalism at its apex, to be fair, transparent and accountable in its dealings. Essentially, the city council has an e-government platform which offers e-tendering services, although the system is primitively used. The system enables suppliers to create an account and profile themselves, yet they can also download application and be able to print and submit the application forms as hardcopy. That is, the entity does not fully optimise the use of e-procurement.

3. Research Question

Is there a correlation between an e-procurement system and inventory cost reduction?

4. Literature Review

4.1. Relationship between e-procurement and service delivery

Better service delivery to residents is one of the goals of electronic governance. Such an approach can help the government streamline its procedures, connect all the stakeholders, and lower operating and administrative costs, all with the overarching goal of increasing service delivery. E-government technology can improve service delivery by introducing methods for citizens and governments to communicate effectively with one another (Alassim and Alfayad, 2017). E-government has had a big impact on public administration, changing the environment in which it operates, bringing in new concepts and methods, and changing the relative weightings and relationships between its numerous systems. In a descriptive research typology, Chukwuemeka et al (2017) and Ibikunle et al (2019) found a strong correlation between e-government and service delivery. This is due to how much less time is wasted, there are less delays and mistakes made by employees when doing their jobs and providing services thanks to ICT. According to Chadwick (2016), e-government technologies promote effective governance processes, expand public access to information, and improve government accountability to the people. Government-to-Government (G2G), Government-to-Employees (G2E), Government-to-Business (G2B), and Government-to-Citizens (G2C) are the four main e-government service delivery interactions that apply to local authorities, according to Ahmad et al (2019) and Sharma (2017). These interactions are discussed below.

4.2. Government –to Government (G2G)

Refers to the electronic correspondence between government departments, offices, and agencies that is based on a government database (Sharma 2017; Akpan et al 2020). Solinthone and Rumyantseva (2016) claim that G2G services occur on both a local and international level. The usage of online communication and collaboration, which enables the exchange of databases and resources, improves process efficiency. This program intends to speed up government procedures by lowering the cost of providing services and enhancing internal operations within the public sector. It helps with resource management, including how human and financial resources are used, monitored, and evaluated. It could also be used in a way that enhances the government's capacity to create and implement the plans and policies required to successfully carry out its

obligations. For instance, a G2G connection will be possible by ICT between the KCC and the Ministry of Local Government, Public Works, and National Housing.

4.3. Government-to-Citizens (G2C)

This kind of service includes any efforts carried out by the government or its agencies that are intended for the general population. Amuche (2019) asserts that the deployment of electronic government improves the delivery of high-quality services. Citizens are given the chance to participate in governmental processes and help shape policies that affect them through the use of ICTs; this is sometimes referred to as enhancing democracy or participation. Since it enables appropriate citizen-government participation, G2C is sometimes considered as the primary goal of e-government. On the one hand, this boosts the accessibility and availability of public services while also improving their quality. Thanks to this choice-based system, citizens can select when, from where, and how to connect with the government. Government information and services are easily accessible to the public at all times and from anywhere. In a descriptive study, Gatobu and Muthini (2021) claim that the government-to-citizen model has had a significant and progressive impact on service delivery, leading to increased customer satisfaction. The vast majority of government services should be delivered online as a result of the implementation of e-government.

The transformation drive of public service delivery has made the most significant progress in the following areas, among others: e-procurement, e-invoicing, e-payment, e-licensing, e-archiving, e-tendering, e-taxation, e-democracy, e-submission, e-compliance, e-assessment, e-participation, e-health, and online company registration (Akhtar, 2016). Web portals can be used by the government to disseminate information, for example by making downloadable forms available online and hosting public training courses there.

4.4. Government-to-Business (G2B)

G2B is a relationship between businesses and the government where government agencies provide services and information to a business via government portals, according to Suri and Sushill (2017). Through G2B, businesses and governments may communicate.

Various services are transferred between government and business in G2B transactions Solinthone and Rumyantseva (2016). As a result, the business sector is able to contribute to the development of policies and stay informed about information from the government, such as memos, policies, rules, and regulations. This model states that some instances of interactions between the government and business include projects, purchases, taxes, bids, electronic auctions, and the delivery of business-focused services online. This project also aims to improve and streamline interactions between the government and the commercial sector. In addition to these, it also covers regulation, procurement from, general services to, and digitization.

4.5. Government-to-Employees (G2E)

The government, which is by far the largest employer, needs to engage with its employees on a daily basis just like any other enterprise. Employees and the company have a mutually beneficial relationship. One instance of G2E engagement is the online information sharing between the KCC and its employees via websites and intranets. A G2E system deployment for improved government services, according to Mapano and Caballero (2018), demonstrates equality and equity to employees of local government units in terms of workload distribution and the provision of rewards and recognition. Government to employee services boost efficiency, accountability, and service quality in addition to managing internal communication more effectively (Rao 2017; Ajibade et al 2017; Alabdallat 2020).

4.6. Research Method

In quantitative design, variables including sample size, types of to be collected data, sampling and recruitment strategies, data collection techniques, data management and analysis methodologies, and others are regularly described.

Table 1 Target Population and Sample.

Population	Total	Sample Size	Sample (%)
Procurement Board	8	4	50%
Procurement Committee	9	9	100%
Other Procurement Dept members	6	6	100%
Purchasing Dept	6	6	100%
Accounts Dept	8	6	75%
IT Dept	6	4	66,6%
Total	**45**	**35**	**78%**

To evaluate the relationship between computer assisted audit methods and the type, scope, and timeliness of audit operations, the quantitative technique was used in this study. In Robson's opinion, quantitative research is appropriate,

particularly when examining the link between variables (2002). Cooper and Schindler (2006) assert that since the participant replies are sorted, categorized, and converted to numbers for statistical analysis, this procedure shouldn't affect the study's findings. Survey research has been shown to be extremely dependable (Babbie 2004).

5. Results

5.1. Descriptive analysis

The mean is a descriptive statistic that examines the average of a given dataset. The researchers made use of the Likert Scale responses and coded them in IBM SPSS. However, the researchers first grouped the responses into two groups under the variables. One set of questions sought to investigate the presence of an e-procurement system and the subsequent level of understanding and usage. The next batch of questions was on the respondents' opinions concerning how an e-procurement system affects operations and costs associated with inventories. Such grouping enabled the researcher to compute the mean values for the independent variable and the dependent variable. Table 2 below illustrates the mean values for e-procurement and cost reduction.

Table 2 Mean Analysis.

Descriptive Statistics			
	Mean	**Std. Deviation**	**N**
Cost_Reduction_mean	4.1229	.82848	35
E_procurement_mean	3.9357	1.06257	35

Table 2 is illustrating the mean for e-procurement and cost reduction. As coded by the likert scale, 5 is strongly agree, 4 is agree and 3 is uncertain. Thus, the mean for cost reduction is 4.1229 implying that most of the respondents were above simply agreeing that cost reduction is enhanced through e-procurement. The mean for e-procurement is slightly lower because a significant portion of the respondents possess little to no knowledge of e-government and the entity and government invest little funds on awareness and motivational campaigns. Table 3 below further illustrates the Pearson coefficient of correlation.

Table 3 Pearson Correlation analysis.

		Cost_Reduction_mean	**E_procurement_mean**
Pearson Correlation	Cost_Reduction_mean	1.000	.635
	E_procurement_mean	.635	1.000
Sig. (1-tailed)	Cost_Reduction_mean	.	.000
	E_procurement_mean	.000	.
N	Cost_Reduction_mean	35	35
	E_procurement_mean	35	35

As illustrated by the Table 4, the coefficient of correlation between the two variables is 63.5%, implying that 65,7% of the variations in the dependent variable can be explained by the independent variable.

Table 4 Regression Summary.

Model Summary[b]				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	0.635[a]	0.403	0.385	0.64997

a. Predictors: (Constant), E_procurement_mean
b. Dependent Variable: Cost_Reduction_mean

The table above summarizes the regression output as computed through IBM SPSS. The table illustrated the R, R square and Adjusted R square. R-squared (R2) is a statistical measure that depicts the percentage of variance for a dependent variable in a regression model that is explained by one or more independent variables. The R square computed is 0.403, implying that 40.3 % of the variations are explained by the model. An adjusted R square of 38,5% was also obtained from the analysis. Essentially, a high value of the R square resembles goodness for fit. The sample's estimation of the population parameter is measured using standard error statistics. When an effect size statistic is unavailable, it is especially crucial to estimate an interval for the population parameter using the standard error. The standard error estimate to the model was 65%.

5.2. Excel Analysis

Gweru city council, being involved in the provision of services to Gweru local residents requires materials to inject in its operations and production of services and products. This section of an excel analysis attempts to demonstrate how an e-procurement system can lead to cost reduction. As evidenced in the previous chapters, an e-procurement system can house

a negotiation algorithm where only applicants accepting room for discount negotiations can submit tender offers. The supplier would be able to agree to the asking discounts, whereas they can also specify the quantity of discount they are willing to offer to win the contract. Such a negotiation algorithm can be integrated with the economic order quantity model so that inventory costs can be minimized. This section follows an experimental approach, although it is still guided by general norms.

The city council annually requires 10 000 units of material x which is used to purify water. The council issues tenders to invite suppliers, through the online portal. Suppliers are able to apply online and view headlines. The table 5 summarizes costs associated with material x.

Table 5 Cost Structure.

	Unit Cost	Measurement
Annual Demand		**10 0000**
Holding cost	0.05	per unit
Ordering Cost	2	per order
Purchase cost	1.25	per unit

5.3. Economic Order Quantity Formulae

$$EOQ = \sqrt{\frac{2(Annual\ Demand * Cost\ per\ Order)}{Annual\ holding\ cost\ per\ unit}}$$

Given the above formulae and table, the EOQ for material X to the City Council, using information on table 4.5.4 is notably 894.43 units. A price negotiation algorithm may be inserted as follows:

Negotiation algorithm
<1000 = 0% discount
>1000<2000 = 15%,
>2000 = 33% discount

With the negotiation algorithm, new inventory costs may be computed as follows (Table 6):

Table 6 Inventory costs.

	Scenario 1	Scenario 2	Scenario 3
		15%	33%
Order Quantity	1000	1500	2500
Number of Orders (Annual Demand/order quantity)	10	7	4
Total Ordering Cost (number of orders * cost per order)	$20.00	$13.33	$ 8.00
Purchase cost (Purchase Price * AD * (100% - discount)	$12500	$10625	$8375
Warehousing Cost (0.2 * AV units)	$100	$150	$250
Total Inventory Cost	**$ 12,620.00**	**$ 10,788.33**	**$ 8,633.00**

Based on computations provided above, the optimum order which reduces costs is 2500 units, giving total inventory costs of $8,633. Despite the fact that its below the EOQ, it's the advisable order as it leads to significant cost reduction, since the EOQ is below the region that qualifies for discounts. Such mechanisms can be incorporated within e-procurement to better interact with suppliers. The table below summarizes the impact of a e-procurement on inventory costs.

The Figure 1 is demonstrating that a negotiation algorithm can significantly reduce inventory costs, through lowering the purchase cost and order cost. However, careful analysis would be needed to compare the benefit in cost saving and the extra storage costs accruing from large and less frequent orders.

It was evidenced in this study, that e-procurement leads to cost savings, thus it affects cost reduction strategies positively. Thus, e-procurement reduces inventory costs.

E-efficiency in providing services was demonstrated by greater citizen involvement and interaction with the local government, increased openness and accountability, and cost savings.

The use of e-government has been shown to improve traditional methods of conducting business and providing services while also enabling access to information and services online, reducing the need for rework, increasing transparency and accountability, and encouraging citizen participation. However, the study's primary objective was to examine the efficacy of e-government technologies and the obstacles to their efficient use. The ineffective use of e-government in local authorities was hampered by a lack of funding, inadequate enabling infrastructure, low ICT literacy levels, and the digital divide, among other factors.

E-procurement and cost reduction in state entities are positively correlated, according to the research performed in Chapter 4's findings. Excel and IBM calculations produced a R square of 67 percent. The level of variability within the researcher's model is explained by the adjusted R Square value, which was 65,8 percent. The medians for e-government

adoption and service delivery were 3.8767 and 4.2217, respectively, showing that the distribution of responses gathered using the research tools was not low or ambiguous as indicated by the Likert scale. The respondents' low engagement and awareness of e-government contributed to the slightly low mean for e-government. In conclusion, e-government and improved service delivery have a positive link, as indicated by the Pearson correlation coefficient of 81,9 percent that was found between the two variables in the research problem.

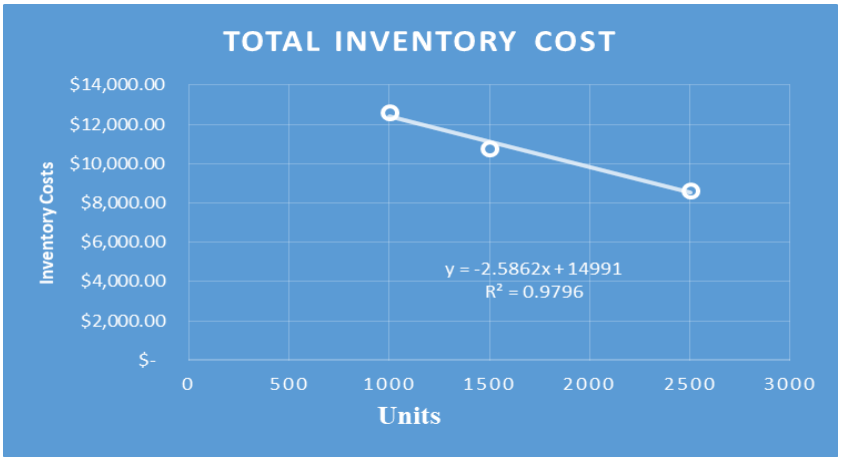

Figure 1 Regression through Scatter. (Source: Secondary and Primary Data).

5.4. Major Findings

The use of e-government has been shown to improve traditional methods of conducting business and providing services while also enabling access to information and services online, reducing the need for rework, increasing transparency and accountability, and encouraging citizen participation. However, the study's primary objective is to examine the efficacy of e-government technologies and the obstacles to their efficient use. The ineffective use of e-government in local authorities was hampered by a lack of funding, inadequate enabling infrastructure, low ICT literacy levels, and the digital divide, among other factors.

6. Conclusion

Despite the advent of e-government many years ago, local authorities continue to struggle because of employee reluctance to change. The use of e-government has been shown to improve traditional methods of conducting business and providing services while also enabling access to information and services online, reducing the need for rework, increasing transparency and accountability, and encouraging citizen participation. The ineffective use of e-government in local authorities was hampered by a lack of funding, inadequate enabling infrastructure, low ICT literacy levels, and the digital divide, among other factors.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Coastal Zones and its legal management in State of Gujarat, India

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Abstract India is one of the major coastal nations in the world it has 7516.6 km. The 5422.6 km. The mainland coastline and 2094 km of island territories. The Coastal Governance is based on accordance with central and state legislation, rule, notification, guidelines issued by the competent authorities from time to time. The Coastal Regulation Zone rules and notifications are prepared by Union Environment Ministry under section 3 of the Environment Protection Act, 1986 and it's implemented by the State Coastal Management Authorities (SCMA) of the particular coastal state. The Government revised the 1991 CRZ rules and come up with CRZ 2011 even in CRZ 2011 were unable to make satisfactory provisions related to the Coastal Development and Coastal Communities. For looking at the issue related to CRZ the Government of India appointed former secretary Dr Shailesh Nayak of the Ministry of Earth Sciences formed a committee in 2014, Shailesh Nayak Committee submitted its report to the MoEF in 2015. The 6 Member Committee as per the recommendation of the committee new CRZ rules were come in to picture in the year 2018 based on the Shailesh Nayak Committee dealing with the issue of Sustainable Development based on scientific principles and global warming, hazards, coastal and marine hazard. This research paper is an analysis of various laws and regulations governing and coastal management in state of Gujarat, India.

Keywords: coastal development, coastal regulation, coastal notifications, coastal authorities

1. Introduction

The legal management of coastal zone in Gujarat and the authorities responsible to implement the laws. The increased pressure on environment due to urbanization, overpopulation and industrial activities is constantly demanding attention for conservation of environment and associated wildlife and resources. Gujarat has 1600 KM long coastline which makes it the state with longest coastline. It has two Gulfs, the Gulf of Kachchh and the Gulf of Khambhat, and the coastline of Gujarat is loaded with mudflats, mangroves, coral reefs, saltpans, ports which makes it rich in resources and scenic beauty but also demands high level of regulation of activities in the CRZ, Coastal Regulation Zone. The present laws which apply to Gujarat are the Coastal Zone Regulation notifications of 1991, 2011, 2018 and the Dandi eco-sensitive zone notification, 2010. The chapter analysis the monitoring bodies and their powers, functions and activities carried out by them for legal management of coastal zone in Gujarat.

The first Coastal Regulation Zone notification was issued in 1991, to resolves, various ambiguities regulations that came into existence in the year 1911. Even though the CRZ was in operation the need for a proper coastal zone management plan was felt significant provisions to realize and resolve the various issue raised by the stakeholders related to coastal management and Development. The Government of India has established a committee under the chairmanship of Shailesh Nayak. The committee submitted his reports in 2015. As per the recommendation of the committee, the coastal zone has been divided into four categories and subcategories the incorporation of the Shailesh Nayak Committee Reports on the CRZ regulations came in years 2018 and it's notified in the year 2019.

Noronha and Ligia (2004), Due to multiple notifications, rules and regulations for the governance of the coastal area in the State of Gujarat of defined CRZ's 500 meters from the coastal zone. How these notifications are implemented and fulfilling the development requirement at coastal management plan of coastal zone given under the Coastal Regulation Zone 1991, 2011 the Coastal Regulation Zone, 2018 and Dandi notification 2010. In the State of Gujarat, the Gujarat Coastal Zone Management Authority (2023) are looking into the holistic implementation of the CRZ's regulations with other competent authorities in particular area of the coastal zone. There is a need of research how the CRZ's notifications are applicable and fulfilling the objects of the various regulations.

Pinak (2011) assessment and classification of the coastal regulation zone, the article assesses various coastal regulation zones in Bhavnagar district of Gujarat by preparing maps. The objective of the article is to show how the "GIS software and high-resolution satellite data (Remote Sensing) can be used to form land use and land cover maps and a digital elevation model for Gujarat (explain)". Author aims to establish that the maps generating for this research purpose are

helpful in giving effect to the coastal zone management plan. Author discusses the fact that Bhavnagar district has many infrastructure and development plants salt related industries, ports along with that it is home to various marine species, sea grass, mangroves and has critically eco-sensitive coastal environment. By using techniques like satellite imagery, photogrammetry, remote sensing, image interpretation the author has identified land use/land cover regions in CRZ.

Author with help of tables, maps and photos have identified the coastal areas in Bhavnagar district as industry, saltpan, agricultural land, forest, manmade forest, mangrove forest, waste land, sandy area, river & estuary, marshy land etc. The data so gathered is represented by using bar-graphs and the land use/ land cover is expressed and classified as part CRZ-I, II, III and IV areas. Author reaches the conclusion that CRZ-I has the highest area of all the CRZs. It has rivers, wastelands, mangroves etc. CRZ-II covers least area of all the CRZs and is constituted of facilities like roads, water supply etc. CRZ-III occupies 2nd highest areas of all the CRZs and CRZ-IV consists of small islands and area not covered under other CRZs.

Burak et al (2004) CRZ-I is the most important category of all the CRZs as it has most no. of ecologically sensitive areas. Author is of the opinion that the visual output that has been generated by the maps can help in better utilization of coastal resources and reducing environmental harm to the ecosystem. Author emphasises that the maps made using ArcGIS can be updated by monitoring developmental and environmental activities in the CRZs.

The technique for assessing CRZ in Bhavnagar is remote sensing and satellite imagery which produces geographical data. The article doesn't discuss the CRZ and its management on state level hence the research area is restricted to one district solely and leaves out important costal zones of Gujarat like Dandi and Surat. Although author uses science and technology to improve the implementation of CRZ notifications in Bhavnagar district, it is disconnected with the applicable laws, regulatory framework and CRZ rules and notifications that needs implementation of laws on grassroot level.

Manju Menon et al (2023) CZMAs AND Coastal Environments, this research analysed the regulation of CZMAs (Coastal zone management authorities) in coastal regulation zones of India and how the authorities have engaged with local communities living in coastal areas. It includes extensive empirical research based on primary sets of data.

The authors have interviewed about 30 members from CZMA and reviewed the relevant judgments of NGT. The research work highlights issues faced by the authorities like difficulty in using the maps of coastal zone management plans. It also analysed how CZMA works in different states and states that only 2 states focus on conservation of coastal zones whereas other states' CZMAs end up devoting majority of the meeting's time in approving a plan, therefore the research work highlights a gap that exists between monitoring and enforcement.

In later part of the research, the authors suggest six reforms for improving management by authorities like providing clarity on powers of central and state CZMAs, inclusion of local communities for coastal management plans, focusing on health of coast, giving powers to the district level coastal committee established under CRZ notification to enforce the decisions of CZMA. Lastly, the authors discuss the question of law and empowerment of coastlines of India under the light of participation and principle of inclusivity.

Cigdem Ciftci et al (2010) Authors recommends that the key to master the implementation of rules for coastal management is transparency and access to information like recording meetings, maintaining databases, updating the websites regarding CZMAs meetings, court's orders and other information. The research works concludes that most of the state CZMAs don't provide for a public interface platform where people belonging to local communities can file their grievances hence it suggests for opening community call centres and interactive websites where their grievances can be settled.

The research work is empirical study of CZMAs and its regulation in various coastal states of India however it doesn't dwell deep in specific areas of the states where the coastal environment has been declared 'eco-sensitive' or 'fragile'. The coastal areas in Gujarat varies due to change in demography, environmental and cultural significance, the present research work doesn't cover the empirical study based in areas like Surat, Dandi (Navsari district) of Gujarat. Since the research work was published in year 2015, it doesn't cover the impact of 2018 CRZ notification on state of Gujarat.

Sushmita Purohit and Till Markus (2013) India's coastal regulation zone, the article analysed the laws in action for regulating coastlines in India under the light of marine environmental law and the developments after 2011 CRZ notification. It discusses the anthropogenic pressure on the marine environment due to human activities like urbanization, increase in population, oil-refineries and ports. It also highlights the conflicts between smaller and traditional fishermen and the industrial fishing due to competing interests in limited marine area. It discusses the positive development from the year 1991 to 2011 and suggests the reforms for better implementation CRZ notifications. It presses the issue of compliance of rules regarding CRZ and submits that the 1991 notification lacked the spirit of strong implementation, thus it advocates for increasing comprehensiveness in laying down rights and duties of the persons in the CRZ notification and the enforceability by the court of law. The article advocates protection of rights of traditional coastal and fishing communities amidst industrial development and also giving these communities exclusive rights to manage the coastal eco-systems. The article concludes that 2011 notification imbibes provisions for good legislative coastal management practice but its regulatory framework is such that it harbours many exception clauses that defeats the conservation and sustainable goals related to the coastal areas therefore carefully drafted laws are required for the governance of coastal areas in India.

2. 'Coastal Zone' and Coastal Zone Regulation Notification 1991

The 'Costal Zone' under the CRZ notification of 1991 is defined as the area 500 meters the landward side from the HTL (High tide line) and the land between LTL (Low tide line) and HTL. High Tide Line being the line upto which highest high tide reaches in Spring Season. The image below shows the lines of high tide and low tide from where the 'Coastal Zone' is calculated.

The coastal areas are classified in four major zones i.e., CRZ-I, CRZ-II, CRZ-III and CRZ-IV. The development activities take place in the area 500 metres landward side from HTL and no development is allowed in the area between LTL and HTL except discharging treated effluents in sea, pipelines facilities for oil, gas and facilities for carrying sea water for cooling purposes. This area falls under CRZ-I and is deemed as ecologically sensitive area because it harbours wildlife, mangroves, breeding grounds for marine life etc. and includes reserve forests, national parks etc. The second category of 'coastal zone' under 1991 notification is CRZ-II which majorly forms the already developed areas laying close to the sea-shore. It consists of infrastructures like drainage facility, roads, sewage pipes, water pipes. The third category consists of both developed and non-developed areas which neither falls in CRZ-I nor in CRZ-II and which are comparatively lesser disturbed areas falling and includes areas falling in rural regions. The fourth and last category of coastal zone is the coastal stretches of Andaman & Nicobar, Lakshadweep and other islands which are not covered under CRZ-I, CRZ-II or CRZ-III. Legal Management of 'Coastal Zone' in State of Gujarat under 1991 Notification:Ministry of Environment & Forests, under "section 3(1) and section 3(2)(v) of the Environment Protection Act, 1986, which empowers the central government to take steps to ensure protection of environment, the Ministry of Environment and Forests passed the Notification in February, 1991. The Notification regulated various activities in Coastal Regulation Zone and defined CRZ. The objective of the notification was to restrict activities related to industries and processes in CRZ area.

2.1. The Gujarat Town Planning and Urban Development Act, 1976

It is the Local Town Planning Regulation Act for development of towns in Gujarat. The appropriate authority under this act is an Area Development Authority or the Urban Development Authority. An Area Development Authority includes Chairman appointed by Gujarat state government, a Chief town planner, four members from local authority of the development area, head of the panchayat of the district, two officials as appointed by Gujarat state government, an individual who is non-official and possesses practical experience and special knowledge on Town Planning, a member secretary who shall be chief executive authority of the Area Development Authority.

Controller & Auditor General of India (2013) The Urban Development Authority includes almost same members as in Area Development Authority and additionally includes the Public Health Chief Engineer and the Municipal Commissioner of the Municipal Corporation.

Under the 1991 notification, the construction of buildings on the landward side of the roads are regulated under this act. These authorities prepare and execute the development plans of towns and local areas as directed by Gujarat state government by carrying out surveys, levying security fees for surveying documents, hold/manage/dispose property, entering into contracts and agreements with local authorities, individuals or organizations and carry out development works of the areas and towns in Gujarat.

2.2. Existing FSI/FAR Norms in Gujarat

Under the CRZ 1991 notification, the construction of buildings on the landward side is regulated by the FSI/FAR norms. The Floor space index, FSI or the Floor area ratio, FAR is the ratio of the area covered by all the floors constructed on the plot to the actual area of the plot. The Value of FSI changes with city type, building type and other features. In Gujarat the FSI is regulated by the Town Planning and Valuation Department which works under the Urban Development and Urban Housing Department of Government of Gujarat.

2.3. Gujarat Water Resources Development Corporation, 1975

The GWRDC corporation was created to carry out management of ground water in Gujarat and perform functions like investigating, exploring and recharging the ground water. The organization set up is located in Gandhinagar and it performs its functions under Narmada Water Supply & Water Resources Department of Gujarat government. The major functions performed by GWRDC includes drilling for water in all terrains, analysing water and soil samples, constructing recharge dams etc.

2.4. Gujarat Water Supply & Sewerage Board (GWSSB), 1979

The GWSSB board is responsible for regulating and developing the water and sewage facilities in Gujarat. It functions to supply drinking water, install hand pumps in rural areas and finance schemes for proper discharge of sewage. It also prepares the draft state plans for water supply and sewage disposal. Under the CRZ notification, 1991 the Ground Water

present in between the Coastal zone falling within 200 metre-500 metre can only be tapped in concurrence with regulations established by GWSSB.

2.5. Gujarat Pollution Control Board (GPCB), 1974

The 1991 Notifications directs that emission of noise, treated effluents, solid wastes from the construction site in the coastal zone shall be in concurrence with the rules established by the state pollution control board.

CPCB (2001) the office in Gandhinagar, GPCB has 27 regional offices in Gujarat for prevention and pollution control. The functions of the board have majorly remained regulatory in nature but the effectiveness of the board has grown many folds over the years. The major functions of the board are to enforce following laws in State of Gujarat:

- "The Water (Prevention and Control of Pollution) Act, 1974
- The Air (Prevention and Control of Pollution) Act, 1981.
- The Environment Protection Act, 1986
- The Hazardous and other Waste (Management and Trans boundary Movement) Rules, 2016
- The Coastal Zone Regulation-Declaration Notification, 1991 etc" .

2.6. Tourism Department (Ministry of Tourism, Gujarat)

The 1991 Notification says that for construction of hotels or beach resorts, in the coastal zone for purpose of temporary stay by tourists, prior approval of the Tourism Department of respective State shall be sought. The Gujarat Tourism Department is responsible for drafting and enabling the tourism policies in the state of Gujarat. It is also the nodal body for regulating tourism projects, encouraging investments, conducting trade fairs, road shows and international events in State of Gujarat.

3. CRZ' Notification, 2011/2015 and Coastal Zone

The 'Coastal Zone' under the CRZ notification of 2011 is defined as the "land between LTL (Low tide line) and HTL, area 500 meters landward side from the HTL (High tide line), HTL to 100 meters landward in case of tidal influenced water bodies connected to the sea, area between hazard line and 500 metres from the HTL on landward from the sea and 100 metres in case of tidal influenced water bodies and Sea area till 12 nautical miles from LTL and in case of tidal influenced water bodies, from one side of the bank to another". The Figure 1 shows the HTL, LTL, CRZ Line for calculating the 'coastal zone' under 2011 notification.

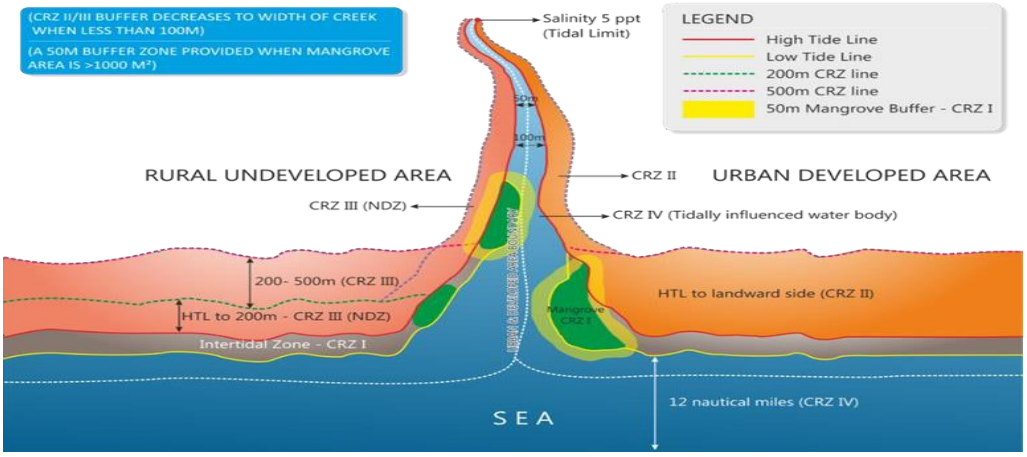

Figure 1 Coastal Management as per the Coastal Zone Regulation . NCSCM – National Centre for Sustainable Coastal Management, Ministry of Environment, Forest and Climate Change. Government of India. Sources: https://ncscm.res.in/.

Under the notification, the area has been divided in four major zones along with CVCA (Critically vulnerable coastal areas). The first three categories of coastal zone in the 2011 notification are similar to the first three categories in 1991 notification. However, the fourth category, CRZ-IV under the (CRZ notification 2011) introduces new areas to be covered under coastal regulation zone which were not there in notification of 1991. CRZ-IV comprises of "the water area of the sea from LTL to 12 nautical miles seawards. It also includes the water area of tidal influences water bodies (like river, estuaries etc.), this area starts from the opening of the water body in the sea till the influence of the tide which is measured as five parts per thousand in the year's driest season".

Along with the authorities mentioned in the CRZ Notification, 1991, there were some other authorities introduced in the CRZ Notification, 2011 for the legal management of Coastal Zone. In addition to the above-mentioned authorities, it includes:

3.1. Gujarat Coastal Zone Management Authority (GCZMA 2016)

The Authority was established by Ministry of forest and environment in 2016 after the 2011 notification was circulated by the central government. With its head office in Gandhinagar, it has power to protect the coastal environment and curb the pollution in coastal zone in Gujarat. GCZMA is responsible for monitoring and enforcing the provisions of the CRZ notification, preparing Coastal Regulation Zone Maps in Gujarat, training, advocating and conducting research. It is the central authority in state of Gujarat to deal with issues related to coastal zone regulation and the associated environment. "Its function is to identify ecologically sensitive areas in coastal zone and draft management plans for conservation of such areas". It is the central authority for preparing Coastal Zone Management Plan, CZMP. The authority overlooks the activities and functioning of District Coastal Zone Monitoring Committees. "It is under a mandate to present its report at least once every six months before the National Coastal Zone Management Authority and the Ministry of Environment and Forests"

3.2. District Level Committees

The forest and environment department of Gujarat Government in 2013 constituted district level committees for assisting GCZMA in coastal regulation zones. It consists of district magistrate/collector, chief Nagar Palika officer, fisheries officer, forest officer, port officer etc.

The functions of the district level committee are to monitor and implement the CRZ Notification of 2011, take up complaints regarding violations of CRZ provisions, submit report on action taken to GCZMA, control the pollution in coastal regions of Gujarat, identify ecologically sensitive areas and report them to GCZMA and improve coastal environment. It shall send monthly reports to various departments of government of Gujarat. The committee has been endowed with the power to take suo motu cognizance of the case and send the case to concerned state authority for legal action, such legal action may be taken against any individual, organization. Any appeal if lies against an order passed by the district level committee is heard by the forest and environment department of Gujarat and chairman of GCZMA.

3.3. National Centre for sustainable coastal management

Ministry of environment, forest and climate change established NCSCM in 2011 for policy advice, conservation, protection and management of coastal regions. It reinforces Integrated Coastal Zone Management, the national coastal zone management scheme by providing scientific knowledge, communities and relevant institutions. Under the 2011 notification, the demarcation of HTL and LTL needs to be done by the recommendations of NCSCM. The major function of the NCSCM is to conduct environmental impact assessment of coastal regions and associated marine life and biology, water quality, preparing ICZM plan.

4. CRZ's Notification, 2018 and Coastal Zone in state of Gujarat

The 'Costal Zone' under the CRZ notification of 2018 is defined as "the area 500 meters landward side from the HTL (High tide line), the land between LTL (Low tide line) and HTL, area from HTL to 50 meters landward or width of the creek whichever is lesser in case of tidal influenced water bodies connected to the sea and sea area till 12 nautical miles from LTL and in case of tidal influenced water bodies, from one side of the bank to another". The Figure 2 shows the 'Coastal Zone' as defined under the 2018 CRZ Notification.

Figure 2 Coastal Regulation Zone Notification 2018. Source: https://www.downtoearth.org.in/coverage/governance/coastal-regulation-zone-notification-what-development-are-we-clearing-our-coasts-for-63061

The classification of coastal zone under 2018 notification is done in four major categories which are further sub-divided in various categories. The first category is CRZ-I which is further divided in two sub-categories, CRZ-I A and CRZ-I B.

CRZ-I comprises of environmentally most critical area. CRZ-I A constitute the areas same as CRZ-I under 2011/15 notification. "CRZ-I B constitutes the intertidal zone I.e., the area between HTL and LTL" .

Second category is CRZ-II which includes the developed land area close to the shore line. This includes areas where 50% of the total plots have been built-up and have been provided with facilities like roads, drainage, sewage and water supply. The third category is "CRZ-III, which is made of undisturbed land areas. It is majorly No Development Zone (NDZ) and is further divided in three categories. CRZ-III A includes the areas which is densely populated with population density of 2161 per square K.M. as per 2011 census". CRZ-III B constitutes area which has population density lesser than 2161 per square K.M. and 200 metres landward from the HTL and this area shall be NDZ. "Fourth category is CRZ-IV and is divided in two sub-categories. CRZ-IV A includes the water area and sea bed from LTL seaward up to 12 nautical miles, CRZ-IV B includes the water and bed area along the width of the tidal influenced water body and the area starts from the opening of the water body in the sea till the influence of the tide which is measured as five parts per thousand in the year's driest season".

Surat City Development Plan (2013) Legal Management of 'Coastal Zone' in State of Gujarat under CRZ Notification, 2018: The authorities responsible for legal management of coastal zone as mentioned under 2018 Notification are same as the authorities mentioned under the CRZ Notification 2011. Hence the major difference in the CRZ Notification 2011 and 2018 is the 'Classification of Coastal Zone' and the 'Permissible and prohibited activities' in various coastal regulation zones. The powers and functions of the governing bodies are same as provided under the 2011 Notification.

5. Dandi Eco-Sensitive Zone Notification, 2010: 'Coastal Zone' in State of Gujarat

The 'Costal Zone' under the Dandi Notification, 2010 is defined as the area of 20,000 hectares covering Dandi and three adjacent villages Samapor, Matwad, Onjal in Gujarat as the Eco-sensitive zone. There is no further classification of coastal zones under this notification. Implementation of CRZ's authorities under the applicable laws 'Coastal Zone' in State of Gujarat under Dandi eco-sensitive zone notification, 2010.

5.1. Monitoring Committee

Under the Dandi Notification, 2010 the Central government constituted a committee for monitoring and ensuring the application of the provisions of the notification in coastal zone. The composition of the monitoring committee is of not more than 10 members and shall include members from Dandi memorial committee, a member from Ministry of Environment and Forests (Gujarat), Gujarat ecological commission, two representatives from NGO active in field of environmental law, the collector of Dandi village etc. The major functions of the monitoring committee are related to environment impact assessment. "It has power to file complaint under section 19 of environment (protection) act, 1986 if any offence is committed under the said act. An appeal against the decision of the monitoring committee lies with Ministry of Environment and Forest, Government of India".

5.2. The Local Authorities

Under this notification the Local authorities of the coastal zone are directed to draw schemes and plans for drainage, collection and treatment facility for treated and untreated effluent, providing plan for segregation of solid waste into biodegradable and non-biodegradable categories. The recycling of the waste needs to be done through composting or vermiculture or disposed in environmentally acceptable way.

5.3. Municipal Solid Waste Management (MSWM)

The state of Gujarat has initiated a drive for solid and liquid waste management covering more than 38% of the state's population (as per 2001 census). The drive is based on the concept of 'Reuse of Waste'. The recycled products are used in such a way that the solid recycled products are used as fertilizers by farmers for agriculture purpose and the recycled liquid water is used for irrigating farm lands. Hence the MSWM project creates infrastructure like processing facilities, produces compost and sells it directly to the farmers who use it as a substitute of chemical loaded fertilizers.

6. Conclusions

There are ample authorities and management plans in action for regulation of Coastal Zone but their existence doesn't completely eradicate the problem of environment degradation due to developmental activities. Even in the ecologically sensitive zone the general construction activities like laying of oil and gas pipelines, sewage facilities are permissible which causes harm to marine life more than often in Gujarat due to oil spills.

Although the four notifications govern the individuals and organization carrying out activities in the CRZ but the penalty imposed for violation of law is either not mentioned or is very less. The nature of these notifications is more regulatory in nature and they weaken when it comes to incriminating the offender. Lastly, the improvement in the technology to monitor the Marine ecosystem like coral reefs, mangroves will help authorities declare the required areas as eco-sensitive zones and protect the vulnerable species.

As per applicable laws for coastal governances and authorities established under the various notification. The organization, department from the central and state authorities for concerning the protections Coastal Zone and the rights of the coastal communities.

- Need of the Coastal Zone Management Plan as per the 2018 Coastal Regulation Zone notification a per present situation the Coastal Zone Management Plan which is applicable in the various coastal zone in state of Gujarat.
- The authority is part of coastal governance need to understand the coastal communities' issue and challenges which includes the occupation rights as well as.
- The best coastal management dealing the protection and coastal sustainability in state of Gujarat.
- The focal things must be the coastal development without compromission the environmental aspects of the marine coastal.
- Coastal communities need to aware the coastal development plan and coastal activities.
- The implementation of the various notification needs to assessment of the policies and practices in various coastal area in state of Gujarat.

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Ethical considerations

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Declaration of interest

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

The dynamic causality model on foreign institutional investments and nifty indices

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Abstract Post LPG, the Foreign Institutional Investors (FIIs) Investments, has created a massive impression on the Indian Equity market as well as the Indian economy, contributing toward several financial reforms of the Indian Government, RBI and SEBI, to a major extent, dancing to the tune of, the various Indian and other global economic crisis, to name a few, the US subprime crisis, demonetization in India and the Covid '19 pandemic lockdown. The recent Covid-19 pandemic triggered fears of global recession due to which, the foreign investors started sculling back to pull out from the equity markets in India, a total net outflow of Rs. 1,12,189 crore (Rs.59,377.1 crore syphoned out from equities and Rs.52,811 crore from the debt segment) the highest withdrawal ever, in March 2020 by the FPIs, had a worst impact on the Indian Equity Market to the extent of a enormous drop of 1203 points of BSE Sensex and the broader NSE Nifty Index tanked 344 points in March 2020. This negative economic effect has prompted to analyze the impact of the FIIs Investments not only on the India's major Index, i.e., Nifty but also its selected sectoral indices. The impact of FII investments has been specifically analyzed on both bidirectional and uni-directional relationship applying Granger causality model, considered more appropriate and have chosen the VAR framework for suitable outcome of the results of this study.

Keywords: granger causality, VAR framework, ADF, FIIs investments, uni-directional relationship, Johansen's Cointegration Model

1. Background of the Study

FIIs had impacted the Indian equity market as well as the Indian economy to a larger extent since 1992, when India opened up its liberalization process in the early 1990s, subsequently infusing profound changes in the Indian economy, followed by FPIs (foreign portfolio investments), FDIs (foreign direct investments), globalization, deregulation, etc. The pumping in of FIIs (foreign institutional investors) in the Indian equity market plays a predominant role today. For many reasons, India has been a preferred destination for foreign institutional investors to drive their funds in various sectors, inducing economic growth and, simultaneously, the reversal of private capital inflows. Clear instances are evident, showcasing how Indian Equity Scrips respond following the tune of FII inflows. This trend has been observed since the global crisis 2008, extending to the recent impact of COVID-19. The study analyzed the FII influence in the Indian equity scratches on various sectors for a period from January 2008 to March 2020, embracing all fifty sectoral indices along with the primary index to gauge the impact of FIIs in the Indian equity market and to find the causal effect of FIIs in the Indian economy by applying the Granger causality model with a suitable VAR framework.

The FDI inflows for the year ending in 1991 were US$ 97 mn, and the corresponding amount for the year ending in 2004 was US$ 4,674.9 mn. The equivalent FII inflows were US$ 6 mn and US$ 11.37 bn, respectively. The significant increase in FDI and FII in India is due to the responsive political environment, substantial improvement in the capital market's adeptness, and investors' safety. At the end of March 2010, the foreign exchange reserves, a total net cumulative investment by FII, amounted to Rs. 388311 crores against Rs. 35840.80 cr. as of March 2020. The financial sector reforms initiated by SEBI and RBI over the last two decades have augmented the magnitude of the FII inflows in India. The critical policy reforms have tremendously encouraged FDI and FII inflows. Hence, the study on the FII inflow's impact on understanding the causal effect and relationship between Nifty and its sectoral indices requires the hour to be analyzed from the global crisis year 2008 to the recent COVID '19 pandemic effect.

The primary research of our study is to understand the causal relationship between investments by foreign institutional investors in the Indian equity market and index movements with particular reference to Nifty and other selected sectoral indices of the National Stock Exchange (NSE). To achieve this objective, we have used the data relating to the daily index movements and daily net investments by foreign institutional investments in the Indian equity scripts for the study period,

relevantly applied from the 2008 uptrend market to the post-COVID cycle in 2020. The reason behind the period selection is that during this period, the Indian equity market experienced three bull and four bear phases, and the market experienced historical events such as the subprime crisis-triggered economic meltdown, demonetization, introduction of GST, and the pandemic event COVID-19. The data were collected from the official websites of NSE, RBI, and SEBI to maintain accuracy and reliability.

2. Objectives of the Study

The objectives proposed for this study are primarily to verify the long-run association between FII investments and the index movements of Nifty and its selected sectoral indices, then to test whether a bidirectional or unidirectional relationship exists between the series chosen for the study and to observe the dynamic relationship between foreign institutional investor investments with Nifty and its selected sectoral indices, concluding to find that FIIs influenced the Indian equity market indices.

3. Literature Review

The dawn of FIIs has benefitted all investors through a broader range of instruments with capricious degrees of liquidity, risk, and returns. Hence, SEBI policies have also been tuned to promote further FII investments. FIIs, in the Indian context, are said to have been instrumental in encouraging market efficiency (Chopra,1995). Any increase in foreign shareholdings eventually enhances the firm's performance, and it is found that there is an alliance between the promoter's holding of the company's shares and the company's asset turnover ratio (Sarkar and Sarkar, 2002). Rangarajan (2000) suggests that foreign portfolio investments will naturally help stock markets, widening investors' bases and incidentally driving local authorities to enhance the trading system. According to Stanley Morgan (2002), FIIs have played a crucial role in the accumulation of India's forex reserves, which has steered many effective economic reforms in India. Followed by the FIIs, as imperative investors, have been contributing to the country's economic growth despite the sluggishness of domestic sentiments that has revealed a correlation between foreign inflow's impact on Indian stock market returns, which is considerably high during the bear period that weakens with strengthening equity prices due to increased participation of other players.

Gordon and Gupta (2003) observed the causal relationship between FII net inflows and stock market returns of the BSE and NSE. Agarwal et al (2005) observed that foreign investors preferred companies with superior corporate governance. Bandopadhyay (2005) has identified that portfolio capital has helped many developing economies to mitigate their balance of payments deficit and to maintain liquidity in the financial markets. Battacharya and Rao (2005) found an effect of FII holdings on the agency costs of publicly traded companies, and the results showed that FIIs had been effective observants in reducing agency fees. Li (2005) observes that foreign investors choose foreign direct investment (FDI) rather than indirect portfolio investment in the case of poor corporate governance. Chakrabarty (2006) argued that FII inflows and outflows should be regarded as an integrated policy package for all capital receipts, considering their proactive role in the overall macroeconomic structure instead of being delineated in isolation. The two-way causality of FII behavior on par with the performance of the Indian stock market from Jan 2007 to June 2007 concludes that financial liberalization has increased efficiency in the Indian equity market.

Analyzing the market return and volatility changes due to FIIs, (Anand Bansal and Pasricha, 2009) found that the volatility significantly reduced, although the market returns did not change. Ritika Sinha (2011) observes that the net purchase of Rs 97,955.40 crore ($21.42 bn) is the highest-ever investment by overseas firms in any single year in India and that FIIs are the key drivers of the Indian equity market. However, it eventually reflects on the uneasiness of the volatility in the inflows and outflows of foreign institutional investments and its effect on the different sectors of the economy. The overwhelming increase in the volumes of foreign institutional investment (FII) inflows has led to apprehensions regarding the volatility of these inflows, relating to a threat of capital flight, impacting the stock markets and influencing changes in the regulatory regimes to have attempted to analyze the impact of FIIs on the economic growth of the Indian economy.

4. Analytical Discussions

The Granger causality test has been employed in the VAR framework to achieve the objectives. Since this test is a lag sensitivity test, efforts to identify the right lag length should be applied while executing the GC test. For the proper lag length selection, it is crucial to employ the appropriate VAR specification, namely, the unrestricted VAR model or the vector error correction model. The unrestricted VAR model may be used when the selected variables do not possess a long-run association between them. On the contrary, if the chosen variables have a long-run association among them, then it is prudent to use the vector error correction model while choosing the right lag length. Determining the long-run association between the selected variables becomes necessary to choose the precise VAR. Johansen's cointegration test is conducted to understand the long-run association between the investments of foreign institutional investors in the Indian equity market related to index movements, viz. Nifty and its other selected sectoral indices of NSE, and for the practical application of Johansen's cointegration test, it requires the data in such a manner that it should be nonstationary in nature as it is, i.e., in 'At Level'. It should possess the data quality to be stationary 'at First difference'. Hence, to validate this, the augmented Dickey-Fuller test (ADF test) was

applied by using the data of daily index movements and daily net investments of foreign institutional investors in the Indian equity market for the period selected for the study. Thus, our analytical work was constructed in a four-stage process. First, we applied the augmented Dickey-Fuller test to confirm the nonstationarity-like data selected 'at level' and subsequently stationary 'at first difference' required to execute the cointegration test followed by the Johansen cointegration test to verify the long-run association between the selected variables to choose the VAR specifications prudently. Then, we tested for lag length using the VAR specification to identify the correct lag length and finally applied the Granger causality test to examine the dynamic relationship between the investments of foreign institutional investors in the Indian equity market congruent with the Nifty index and its other selected sectoral indices of NSE movements.

As mentioned, the augmented Dickey-Fuller (ADF) test was conducted to understand the stationary status of the data selected for the study at the level and the first difference for all three test equations (intercept, trend & intercept, and none) and the results obtained are displayed in Table 1.

Table 1 Test for stationary – ADF test on fifty & specific selected sectoral indices with FII inflows.

Particulars		Intercept			Trend and Intercept			None		
		T statistic value	Test critical value	P value	T statistic value	Test critical value	P value	T statistic value	Test critical value	P value
Nifty	At Level	-1.493266	-2.862302	0.5371	-2.168414	-3.411301	0.5065	-0.049003	-1.940929	0.6665
	I st difference	-13.15554	-2.862302	0.0000	-13.13161	-3.411301	0.0000	-13.15312	-1.940929	0.0000
FII	At Level	-0.752141	-2.862301	0.8315	0.279852	-3.411299	0.9985	-0.282848	-1.940929	0.5843
	I st difference	-12.81311	-2.862301	0.0000	-12.86816	-3.411299	0.0000	-12.81639	-1.940929	0.0000
Auto	At Level	-1.194639	-2.862300	0.6790	1.191203	-3.411297	1.0000	-0.131134	-1.940929	0.6385
	I st difference	-50.45763	-2.862300	0.0001	-50.51236	-3.411297	0.0000	-50.46243	-1.940929	0.0001
Bank	At Level	-1.567622	-2.862302	0.4991	-2.285808	-3.411301	0.4411	-0.473944	-1.940929	0.5105
	I st difference	-11.10098	-2.862302	0.0000	-11.08028	-3.411301	0.0000	-11.10786	-1.940929	0.0000
Financial Services	At Level	-1.583309	-2.862302	0.4910	-2.724588	-3.411301	0.2265	-0.425924	-1.940929	0.5298
	I st difference	-10.34796	-2.862302	0.0000	-10.29777	-3.411301	0.0000	-10.35342	-1.940929	0.0000
FMCG	At Level	1.045884	-2.862299	0.7387	-2.575165	-3.411296	0.2919	0.836845	-1.940929	0.8916
	I st difference	-53.65716	-2.862300	0.0001	-53.65399	-3.411297	0.0000	-53.62796	-1.940929	0.0001
IT	At Level	-1.182046	-2.862299	0.6844	-2.036533	-3.411296	0.5804	0.436288	-1.940929	0.8080
	I st difference	-56.26471	-2.862300	0.0001	-54.26088	-3.411297	0.0000	-54.25655	-1.940929	0.0001
Pharma	At Level	-1.381608	-2.862300	0.5929	-0.269272	-3.411297	0.9915	-0.007417	-1.940929	0.6802
	I st difference	-51.35826	-2.862300	0.0001	-51.39175	-3.411297	0.0000	-51.36059	-1.940929	0.0001
PSU Bank	At Level	-2.192573	-2.862300	0.2092	-2.178341	-3.411297	0.5010	-1.016059	-1.940929	0.2788
	I st difference	-50.57594	-2.862300	0.0001	-50.57596	-3.411297	0.0000	-50.57876	-1.940929	0.0001
PVT Bank	At Level	-1.494501	-2.862302	0.5365	-1.793830	-3.411301	0.7078	-0.557734	-1.940929	0.4758
	I st difference	-9.943487	-2.862302	0.0000	-9.927145	-3.411301	0.0000	-9.954331	-1.940929	0.0000
Realty	At Level	-5.828407	-2.862302	0.4329	-5.570428	-3.411301	0.7286	-4.331565	-1.940929	0.4991
	I st difference	-17.76623	-2.862302	0.0000	-17.84947	-3.411301	0.0000	-17.70688	-1.940929	0.0000

The condition to reject the null hypothesis framed as "Data selected are nonstationary in nature" is that the absolute values of the calculated T statistic value should be greater than the corresponding test critical value, and the probability values should be less than 0.05. The estimated absolute T statistic values for all the selected series during all the test equations at 'At Level' are less than the corresponding calculated absolute test critical values, and the p values are greater than 0.05. Hence, the null hypothesis is accepted, concluding that the selected series are nonstationary at the 'at level'. However, in contrast to this situation, the calculated absolute T statistic values for all the chosen series during all the test equations 'at first difference' are more significant than the corresponding calculated absolute test critical values, and the p values are less than 0.05; hence, the null hypothesis is rejected and proves that the selected series are stationary 'at first difference'. Since the data chosen are nonstationary 'at level' and stationary 'at first difference,' as needed, we have proceeded to test Johansen's cointegration to check the long-run association between the investments of foreign institutional investors in the Indian equity market and the index movements of Nifty and other selected sectoral indices of the NSE, and the results are exhibited in Table 2. The existence of a long-run association between the variables will be accepted only when the calculated trace and max-eigen values are greater than the corresponding calculated critical values, provided that the p values are less than 0.05. It is found that the said conditions are fulfilled for the series between investments of FIIs and the Nifty index, between FIIs and the Bank index, between FIIs and the PSU Bank Index, between FIIs and Private Bank index, and between the FIIs and the Realty index and hence confirmed that the selected series have long-run association among each of them during the study period. Therefore, applying a vector error correction model to determine the lag length is judicious. However, contrary to the mentioned condition, it is found that the calculated trace and max eigenvalues are less than the corresponding calculated critical values. The p values are greater than 0.05 in the case of series between FIIs and the Auto index, between FIIs and the financial services index, between FIIs and the FMCG index, between FIIs and the IT index and between FIIs and the Pharma index, confirming that there is no long-run association between these series; hence, the unrestricted VAR model should be used for the lag selection process.

Since the lag selection requires the correct VAR specification, whether to use the unrestricted VAR model or the vector error correction model, the findings of the Johansen cointegration test are used to differentiate the series that requires using the unrestricted VAR model and the series that demands the usage of the vector error correction model.

Table 2 Cointegration Test between FII and the selected indices.

Indices	Test	Trace statistics	Critical Value	Probability	Max- Eigen Statistics	Critical Value	Probability
FII &Nifty	None	16.305071	15.49471	0.6595	15.614572	14.26460	**0.0030**
	Atmost1	4.690499	3.841466	0.4060	4.690499	3.841466	**0.0040**
FII & Auto	None	6.983981	15.49471	0.5797	6.585983	14.26460	0.5392
	Atmost1	0.397998	3.841466	0.5281	0.397998	3.841466	0.5281
FII & Bank	None	16.466031	15.49471	0.0404	15.725704	14.26460	**0.0486**
	Atmost1	4.740327	3.841466	0.0389	4.740327	3.841466	**0.0389**
FII & Financial Services	None	7.595116	15.49471	0.5097	6.656265	14.26460	0.5306
	Atmost1	0.938851	3.841466	0.3326	0.938851	3.841466	0.3326
FII & FMCG	None	3.751562	15.49471	0.9218	3.515238	14.26460	0.9066
	Atmost1	0.246324	3.841466	0.6197	0.246324	3.841466	0.6197
FII & IT	None	4.005476	15.49471	0.9031	3.757127	14.26460	0.8840
	Atmost1	0.248348	3.841466	0.6182	0.248348	3.841466	0.6182
FII & Pharma	None	13.28202	15.49471	0.1049	12.92830	14.26460	0.0804
	Atmost1	0.353719	3.841466	0.5520	0.353719	3.841466	0.5520
FII & PSU Bank	None	27.07843	15.49471	0.0006	26.44380	14.26460	**0.0004**
	Atmost1	4.634628	3.841466	0.0042	4.634628	3.841466	**0.0042**
FII & PVT Bank	None	17.58357	15.49471	0.0409	16.552052	14.26460	**0.0434**
	Atmost1	4.031520	3.841466	0.0098	4.031520	3.841466	**0.0098**
FII & Realty	None	18.16820	15.49471	0.0009	17.24586	14.26460	**0.0008**
	Atmost1	3.922338	3.841466	0.0033	3.922338	3.841466	**0.0033**

Hence, the VAR specification basic model determines the correct lag order by selecting the perfect VAR type. The findings of the Johansen cointegration test are used to choose the ideal VAR type, and by applying the various lag orders, we choose the correct lag length to be used in the Granger causality test to determine the dynamic relationship between the variables selected for the study. The Akaike information criterion (AIC) and Schwarz information criterion (SIC) help choose the correct lag order. Using the perfect VAR specification and the lag order ranging from 1 to 6, the AIC and SIC values are calculated for all the selected series and shown in Table 3.

Table 3 Test for Lag Selection.

Indices	Lag 1		Lag2		Lag 3		Lag 4		Lag 5		Lag 6	
	AIC	SC	AIC	SC	AIC	SC	AIC	SC	AIC	SC	AIC	SC
Nifty	28.30745	28.32738	28.26028	28.28819	28.23491	28.27981	28.22718	28.27507	**28.22245**	**28.27433**	28.21503	28.27491
Auto	28.45900	28.47095	28.27374	28.29367	28.22800	28.25592	28.20197	28.23786	**28.19380**	**28.23768**	28.19527	28.24316
Bank	30.38170	30.40164	30.33703	30.36494	30.31002	30.34591	30.30203	30.33592	30.29880	30.31068	**30.29471**	**30.30459**
Fin Service	28.81538	28.82733	28.63107	28.65101	28.58567	28.61358	28.55943	28.59533	**28.53132**	**28.59520**	28.54569	28.59757
FMCG	30.27770	30.28965	30.09864	30.11857	30.05423	30.08214	**30.02109**	**30.06399**	30.02293	30.06682	30.02762	30.06950
IT	29.25001	29.26197	29.06994	29.08988	29.02211	29.05003	28.99738	29.03928	28.99273	29.03662	**28.98633**	**29.03421**
Pharma	28.75973	28.77169	28.57597	28.59591	28.53022	28.55814	28.50451	28.54040	**28.49996**	**28.53385**	28.49749	28.54937
PSU Bank	27.75274	27.77267	27.71100	27.73891	**27.68092**	**27.72282**	27.68191	27.72580	27.68226	27.73315	27.69853	27.73841
Pvt Bank	29.08967	29.10960	29.04447	29.07239	29.01546	29.05136	**29.00665**	**29.05054**	29.00721	29.05709	29.00863	29.06151
Realty	24.54391	24.56384	24.49661	24.52453	24.46591	24.50181	24.44263	24.48951	24.43571	24.48760	**24.42596**	**24.48584**

The basic rule for choosing the correct lag length is that the lag order with the lowest AIC and SIC values is the best fit to apply as the lag strength in the Granger causality test. The correct lag length was chosen for all the selected series, and the Granger causality test was applied to the series selected for the study. The results obtained using the Granger causality test are shown in Table 4. The decision rule to reject the null hypothesis is that the calculated F statistic value should be significant at 5 percent. The calculated probability value should be less than 0.05. It is found that both the null hypotheses - “Nifty does not Granger cause FIIs” and “FIIs do not Granger cause Nifty” are rejected while finding the dynamic relationship between investments by FIIs and Nifty. We noted a bidirectional relationship between the investments by FIIs and Nifty. The same scenario prevails in the case of the relationship between FIIs and the Auto index, between FIIs and the Bank index, between FIIs and the Financial services index, and between FIIs and the Private Bank index. However, the situation is different when the remaining indices are concerned. Only a unidirectional relationship is found between the investments by FIIs and the indices, such as FMCG, IT, Pharma, PSU bank, and Realty indices. The accepted null hypotheses are that a) the FMCG index does not Granger cause FIIs, b) the IT index does not Granger cause FIIs, c) the Pharma index does not Granger cause FIIs, d) FIIs do not Granger cause the PSU Bank index and e) the Realty index does not Granger cause FIIs. This indicates that except in the case of

the PSU bank index, in all other indices, unidirectional relationships exist and confirm that Granger is caused or influenced by FII investments.

Table 4 Granger causality relationship between FII and specific selected sectoral indices.

Index	Null Hypothesis	No. of Lag	F -Statistic	Probability	Result
Nifty	Major Index not to Granger cause on FIIs	5	6.60183	4.E-06	Rejected
	FIIs not to Granger cause Major index	5	3.11979	0.0082	Rejected
Auto	Auto index not to Granger cause on FIIs	5	4.80721	0.0002	Rejected
	FIIs not to Granger cause on Auto index	5	4.25726	0.0007	Rejected
Bank	Auto index not to Granger cause on FIIs	6	5.81216	5.E-06	Rejected
	FIIs not to Granger cause on Auto index	6	3.38715	0.0025	Rejected
Financial Service	Financial Service index not to Granger cause on FIIs	5	5.33164	7.E-05	Rejected
	FII does not Granger cause Financial Service Index	5	6.98382	2.E-06	Rejected
FMCG	FMCG index not to Granger cause on FIIs	4	1.33237	0.2554	Accepted
	FIIs not to Granger cause on FMCG index	4	4.20136	0.0021	Rejected
IT	IT index not to Granger cause on FIIs	6	1.40338	0.2093	Accepted
	FIIs not to Granger cause on IT index	6	3.44033	0.0022	Rejected
Pharma	Pharma index not to Granger cause on FIIs	5	1.37539	0.2303	Accepted
	FIIs not to Granger cause on Pharma index	5	3.99209	0.0013	Rejected
PSU Bank	PSU Bank index not to Granger cause on FIIs	3	6.71614	0.0002	Rejected
	FIIs not to Granger cause on the PSU Bank index	3	2.02956	0.1076	Accepted
PVT Bank	PVT Bank index does not Granger cause FII	4	8,23460	1.E-06	Rejected
	FIIs do not Granger cause PVT Bank index	4	6.86333	2.E-05	Rejected
Realty	Realty index not to Granger cause on FIIs	6	1.43429	0.1974	Accepted
	FIIs not to Granger cause on the Realty index	6	2.34541	0.0291	Rejected

5. Concluding Remarks and Scope for Further Research

This paper addresses whether money inflows by investing institutions from abroad toward the Indian equity market have any influence on index movements. Using the Granger causality test in the VAR framework, efforts were made to find effective results. The findings of our study revealed that a bidirectional relationship exists between the investments of foreign institutional investors and the Nifty Index as well as with sectoral indices such as the Auto index, Bank index, Financial services index, and Private Bank index. However, the other sectoral indices, usually termed defensive sectors in the Indian equity market, such as the FMCG index, IT index, Pharma index, PSU bank index, and Realty index, have shown only a unidirectional relationship with the selected variable. However, it is interesting to note that all the sectoral indices and Nifty are invariably influenced by foreign institutional investments except the PSU bank index. We found that the investments by FIIs Granger cause the respective indices and Nifty except for the PSU bank index. All these indices have been dancing to the tune of institutional investors' investments from abroad. Therefore, we conclude that the money infused by investing institutions from abroad significantly influences the movements of the Indian equity market. We suggest that retail investors consider the investment pattern of foreign institutional investors before making any significant investments in the Indian equity market against the flow of foreign institutional investors. We also feel that a study of this kind with a shorter study duration, particularly concerning any particular event, such as COVID-19 or demonetization, will deliver much more exact findings, and we place our request on financial practitioners and researchers to pursue their forthcoming research in this unexplored area of study.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Fintech innovations in E-payments: Privacy and security in cybercrime threats

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Abstract The digitalization challenges in the e-commerce world provide ample opportunities and advantages for the corporates, financial institutions and the consumers but also have posed several threats in the form of financial thefts and cyber frauds. The Fintech innovations have brought in effective solutions for many fraud detections and poised to have a controlled safety and security systems in handling the financial and other commercial transactions, most specifically in the fund transfers and other payment processes in the Electronic Payments Systems (EPS) in the current era. Absence of security culture is vulnerable to incur heavy and unaffordable costs to the service provider's organization pertaining to financial frauds, cybercrime threats, identity larceny, illegal procedures, loss of consumer confidence, etc. Hence, in today's robust e-commerce scenario the vitality of Fintech Innovative solutions, Security enabled systems, ensuring Safety and Privacy of Information of the customers are of prominence. This research study analyses the Fintech Innovative solutions, on the security, safety and privacy of customer's information on effective Electronic Payment Systems (EPS) and the legal safety assurance on cybercrimes.

Keywords: fintech innovations, perceived safety, perceived privacy, EPS protection and usage, cybercrime safety applications

1. Introduction

The challenges in digitalization and consumer behavior pose the need for exploring new and innovative technologies for creating robust electronic platforms either for the purpose of complying or for competing. Payments' security is becoming more imperative due to increasing card fraud losses and data breaches that result in direct and indirect losses for the affected financial institutions. Security controls employed in electronic payment systems are expected to be more vigorous and may frustrate users in payment handling applications. Security systems are more than an add-on requirement; they need to be implemented as a culture both as a mindset and as a mode of operation across organizations to mitigate financial fraud. The absence of security culture leads to uncertainty and ultimately results in security incidents that are vulnerable to heavy and unaffordable costs. Any innovations have to be initiated in a secured environment rather than an unsecured innovative system. Hence, failure to secure sensitive information by organizations can cause severe damage to the service provider's organization pertaining to financial deceptions, identity larceny, illegal policy procedures, loss of consumer confidence, etc. In today's robust e-commerce scenario, the vitality of fintech innovative solutions, security enabled systems, and ensuring the safety and privacy of information of customers are prominent.

2. Literature Review

Lee et al. (2001) stated that the extensive use of telecomm networks and the increase in commercialization in the current dynamic e-commerce world have provided innumerable advantages over the traditional system for financial transactions with regard to speed, openness, anonymity and global accessibility, improving the individual user's quality of life. Boosting the popularity of electronic payments ultimately enhanced the competitive edge of companies that have adopted technology innovations to maintain enhanced business relationships due to secured EPS (Vladimir Zwass 1996). Ensuring that these systems are effectively applied across Turkish and US university students across countries (Lightner et al., 2002).
The edifice of electronic commerce (EC) is EPS, and with its increase in volumes of EC, EPS has become increasingly vital for businesses and individual users (Linck et al., 2006) has stated that for any advanced electronic commerce utilizing businesses, EPS is considered the most crucial determinant for its success and sustenance. In the scenario of EPS advancements in the past decade, security and privacy issues are of predominant concern and continue (Shon and Swatman 1998). Security is the 'set of procedures, mechanisms and computer programming, authenticating the sources of information and to guarantee the

reliability of the data, to abstain leading to a hardship of economic data resources' (Tsiakis and Sthephanides 2005), whereas privacy is 'the form of confidence held on the business partners based on the reliability and integrity' vital in transactional relationships, especially those involving high risk, specifically in online transactions (Liao and Chen 2011; Reicheld and Schefter 2000). Internet connectivity allows hackers to connect to countless other computers and transmit information, messages, and data, which unfortunately also allows these cyber criminals to communicate with other criminals and with their victims, a threat to malicious stealing of data (Smitha and Ammar 2012).

3. Vitality of Fintech Innovations and Security

In the present technological advancements, both innovation and security are equally vital. It is a known fact that our own smartphones have been exposed to the greatest privacy risk. In this context, an increasing number of businesses need to deploy EPS in all their commercial transactions to meet increasing demands and, due to government pressures, to depend on a speedy and secured EPS for their clients/customers. All effective applications and prudent implementation processes of the EPS to the dismal resulted in several hacking crimes causing financial losses for the companies. The stringent fraud detection processes resulting from the Fintech procedures culminate as the solution provider for effective EPS implementation. Emerging developments in technology hamper the growth of the m-payments industry as the market becomes fragmented (Lim 2008).

4. Safety and Privacy issues in EPS

The individual user's quality of life has improved to a larger extent due to the popularity of fintech innovations, thereby enhancing the competitive edge of the companies that have adopted at the right time. Although businesses have thrived due to innovative fintech advancements and improved EPS applications, the safety, security and privacy issues of the information shared electronically are still a matter of concern, preventing integrity and trust in the companies implementing their business processes. This trust, safety and privacy issue has been a challenge preventing individuals from engaging in e-commerce transactions and fund transmittances. Informed consent is an important human value that integrates online interactions wherein just-in-time interventions are employed to meet their goals (Friedman et al., 2002). Hence, the economic growth of the country and the business growth of companies demands additional safety and privacy of information in fintech innovations for effective and efficient EPS implementations of companies for viable and trustworthy EPS usage from the customers' viewpoint.

5. Cybersecurity applications and protecting laws

The primary stakes of cybersecurity against cyber threats in need are as follows:

- Network security solutions are designed to identify and block cyber-attacks, especially in financial transactions.
- Cloud Security: the digital transformation era to incorporate cloud-based tools and services as a part of the business infrastructure.
- Endpoint Security: high need to protect devices such as workstations and servers from malicious cyberattacks
- IoT Security: securing Internet devices and the networks they're connected to from threats and breaches by protecting, identifying, and monitoring risks
- Application Security: developing, adding, and testing security features within applications to prevent security vulnerabilities against threats such as unauthorized access and modification.
- Zero Trust: a security framework requiring all users, whether in or outside the organization's network, to be authenticated, authorized, and continuously validated for security configuration

Therefore, perceived security was found to be an essential variable in understanding consumer behavior and trust in e-payments (Chellappa and Pavlov 2002).

6. Objectives of the study

- To comprehend the antecedents of the perceived safety and privacy issues on EPS and cyber threat protective usage
- Examining the privacy and security challenges to eliminating financial fraud through fintech procedures in the EPS from an individual user's viewpoint
- Identify individual user's personal experience of Electronic Payment Systems (EPS) and cybercrime protection.

7. Statement of the problem

The innovative inclusions of electronic payment systems (EPS) have improved individual users' quality of life in terms of speed, accuracy, security, privacy and ease of payments for online fund transactions. The outcomes of innovative technology with privacy and security using EPS have been a long-term debate, and finding solutions to resolve these issues continues to be a challenge. The study analyses the impact on the privacy and security risk in the process of eliminating financial frauds

ensuring secured EPS. Data collected from 296 sample respondents indicate that both perceived safety and privacy have a significant influence on EPS innovation and usage. Trust and confidence models are used interchangeably, whether supportive or skeptical (Earle 2009).

Electronic commerce has amplified the competitive internet markets overpowering traditional markets due to several novel EPS brands, such as pay pals, credit cards, debit cards, prepaid wallets, electronic cheques or e-payments, an imperative requirement to execute electronic fund transfers and other e-commerce transactions. Hence, there is a need for advanced protections to address security, privacy and trust issues through secured EPS and cybercrime protection.

8. Research Design

The lack of perceived security and privacy issues certainly erodes the willingness and trust to use EPS by individual users (Linck et al 2006; Mukherjee and Nath 2003). The conceptual model has been developed and tested based on the determinants of the study, such as the fund transaction process, FinTech application procedures, security-linked applications and the detection of fraud processes that affect perceived safety and perceived privacy in the output of effective EPS protection and usage (Figure 1).

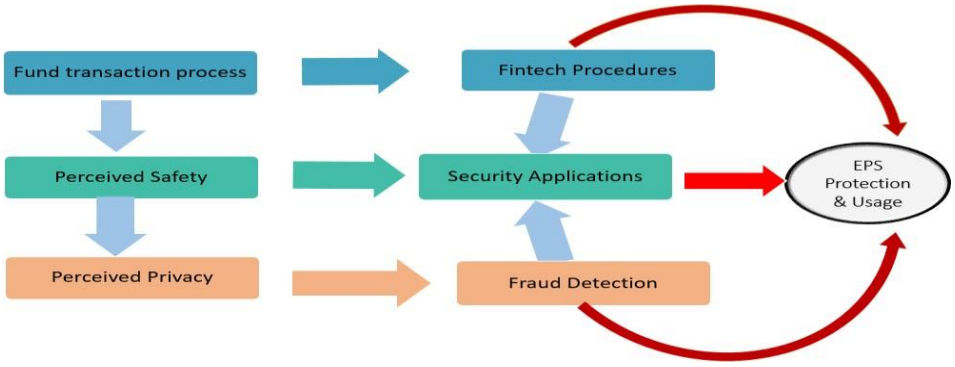

Figure 1 Conceived model on perceived security and privacy issues in EPS protective usage.

9. Hypotheses Tested

H_1: The fund transaction process has a substantial effect on the perceived safety and perceived privacy in EPS protection and usage.
H_2: Fintech procedures have a major effect on the perceived safety and perceived privacy in EPS protection and usage.
H_3: Security applications have a substantial effect on the perceived safety and perceived privacy in EPS protection and usage.
H_4: The detection of fraud in cybercrime has a substantial effect on the perceived safety and perceived privacy in EPS protection and usage.
H_5: Perceived safety has a substantial influence on EPS protection and usage.
H_6: Perceived privacy has a substantial influence on EPS protection and usage.

10. Analytical discussions

10.1 The composite reliability (CR) and Cronbach's alpha are tested for the selected determinants of EPS

From Table 1, the average variance, composite reliability and Cronbach's alpha were captured from the data analysis. According to Hair, Anderson & Black (2007), values above 0.50 are acceptable for the average variance. Since all the values of average variance are larger than 0.5, convergent validity is present for all the variables. The composite reliability (CR) of each variable accepts values above 0.70. The composite reliability (CR) and Cronbach's alpha, as shown in Table 1, have values greater than the suggested cutoff value of 0.70, indicating that the reliability of all variables is acceptable.

Table 1 Cronbach's alpha on the determinants of EPS.

Indicator	Trans Process	Fintech Procedure	Security Appli.	Fraud detection	Perc. Safety	Perc. Privacy	EPS usage
Cronbach's Alpha (α)	0.85	0.88	0.92	0.89	0.90	0.85	0.92
Aver Var	0.56	0.64	0.68	0.72	0.66	0.69	0.82
CR	0.85	0.87	0.92	0.89	0.90	0.86	0.92

10.2 Structural equation model analysis of the EPS

The structural equation model was then applied to represent the hypothesis generated to test the goodness of fit (Figure 2).

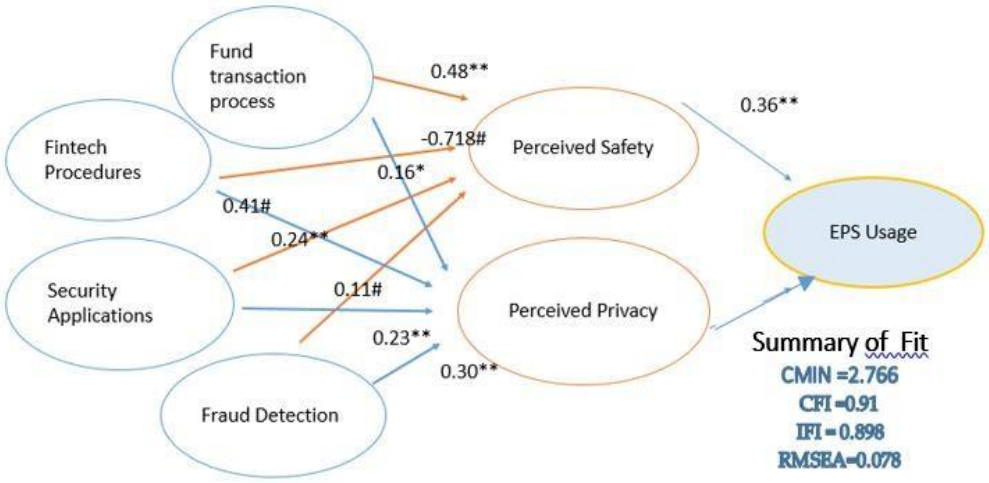

Figure 2 SEM Analysis of the Variables.

10.3 Model Fit Analytical Results

The CFA (Confirmatory Factor Analysis) indicates a good fit of the measures (x2=988.60, df=2.612; CFI=.907; IFI=0.91 & RMSEA=0.075), and all the values met the threshold requirements. The measures of the varimax eigenvalues that show values greater than one are accepted, and the results exhibit discriminant validity. Subsequently, the structural equation model was tested to assess the inclusive goodness of model fit. The results indicate that the model fits the data and is within the thresholds (x2=1069.015, p<.001, CMIN=2.766; CFI=0.91; IFI=0.898; RMSEA=0.078).

11. Findings

The perceived safety and privacy of EPS users provides a deeper understanding of all the constructs developed and shows that these two major constructs have a positive and significant effect on EPS usage. When the underlying constructs impacting the two major variables assure security and convincing, they are more willing to adopt EPS fund transfers and transactions. The results have also shown that the fintech procedures applied have been a strong determinant of both perceived safety and privacy factors, with an increasing number of users trusting the EPS systems simultaneously contributing to the growth of businesses.

Consumers increasingly engaging EPS increase the success rate of businesses but are influenced by perceived safety and perceived privacy. Understanding the implications of the influencing factors determines the enhanced use of EPS. This insists on delivering maximum possible fraud detection in the application of Fintech procedures and the adequacy and reliability of security applications for protection in the fund transfer process. EPS ensures the safety of the individual user's personal details (name identity, contact number, address of communication, credit card details, and bank account details), which are kept secure enough, and the fund transfers are speedy, easy, reliable, trustworthy and safe.

The results have shown that cybercrime fraud detection and protection are prominent determinants of fund transfer trust and security. It is essential for the companies to have a close monitoring system and stringent surveillance on any dissatisfaction of the consumers in the EPS handling systems. Stringent cyber threat laws enforced strictly shall be the ultimate solution.

12. Conclusions

The present study has initiated a research model to test the validity of the pertinent determinants identified for the study, which are perceived safety and perceived privacy affecting the use of the EPS systems administered by the companies. The results of the study have been authenticated through the data analysis and findings that the 'Fund transfer process' relies on the novel 'Fintech procedures' ensuring 'fraud prevention' and 'secured applications' impacting the primary determinants, i.e., perceived safety and privacy, toward the success rate of EPS usage.

The study observes a noteworthy relationship between fintech procedures and perceived safety and privacy in e-payment system usage because consumers need not focus on the complexity and time-consuming fintech procedures; they only give importance to convenience and protective EPS usage. Although the findings cannot be generalized to a larger population, the study has effectively brought out the results of the two predictor variables (perceived safety and privacy) relating to the use of EPS in business transactions, most specifically protection against cybercrime threats. Ultimately, the question arises as to which is more important, whether innovation or security and safety systems, and the solution that emanates from the success of any innovation is based on the safety and security of the systems usage. Web-driven electronic

commerce is redefined by the dynamics of Internet and fintech innovative solutions, necessitating a look forward to the role of EPS as a pragmatic upgrade to safety, security and privacy systems.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Robo-advisory an intrinsic convergence of ai in enhancing investment returns – An empirical analysis

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Abstract The vigor of Robo-advisory is anchored along with AI (Artificial Intelligence) to expedite, synthesize and synchronize the requisite information, an enabler in the progression of upscaling and facilitating financial intelligence and advice, to the xennials and the millennials, on their investment patterns. Innumerable times the investors usually behave irrationally in their investment decisions on selecting financial instruments, schemes or in trading, generally termed as behavioral biases. The prime target for Robo-platforms are the Millennials and the Xennials, due to affordability, 24/7 accessibility and utmost transparency with zero or nil investment bias, through a fusion model (of Robo-plus -Human) or a hybrid strategy, that can help to invigorate the investor's investment goals. Henceforth this analytical study pertains to apply the advanced TAM (Technology Acceptance Model) on some of the significant variables such as the Perceived Usefulness, Perceived Trust, Perceived Security and the most inevitable demographic variables of the investors, administering the Structural Equation Model, that has confirmed, much remarkable user interface and the competences of AI has played a predominant role in structuring better ease- of- usage, trust and security among the investors on utilizing the Robo-Advisory Services.

Keywords: artificial intelligence (AI), robo-advisory, investment goals, financial decisions, millenials

1. Introduction

The dynamic element of robo-advisory services is artificial intelligence (AI), without any doubt. AI, demonstrated by machines, perceives, synthesizes and infers information similar to or better than human intelligence. This intelligence factor of AI enables higher investment returns through upscaling and integrating financial advice in robo-advisory services, playing a powerful role in providing financial insights with potential and positive outcomes. "Robo-advisors working on complex algorithms that have the capability to address complex investment needs of an investor" (Fisch et al., 2019). "There are two types of Robo-advisors: pure play Robo advisors and hybrid models that operate with or without an extra fee. As they are working on algorithms, Robo platforms can avoid conflicts of interest and investment biases that could occur with a human investment advisor, who might push for investment instruments that pays higher incentives for him" Fisch. Robos came to existence a decade ago, and the first two brands that introduced robo-advisory platforms were Wealth front and Betterment.

Today, Robos are a fast-growing investment advisory platform across the globe, but they still command a very small share of investment in the advisory market. In 2016, robo-advisory platforms had an AUM of $126 billion out of $69 trillion in the US. The surprising factor is that most recent studies have shown that 55% of investors still have limited or no knowledge about robo-advisory platforms. In 2017, the Securities and Exchange Commission included Robo Advisor in its "examination purview" as per the PwC report (2017). Robo advisors are regulated, i.e., Robots should register as investment advisors and as stock brokers if needed. Today, most of the robo-advisory platforms use improved algorithms that can accurately deliver investment solutions tailored according to the needs of people as required and can manage complex investment needs. It helps an investor to design his portfolio, invest as per his investment goals and retire better with the assistance of Robo-platforms. Advanced Robos use complex algorithms that use the data provided by clients to create and manage their portfolio based on the investment goals of the clients.

Robo advisors take the information from clients through an online questionnaire and use AI-based algorithms to recommend asset allocation that best fits the customer's investment goals, risk appetite and investment horizon. "Post creating the portfolio, Robo advisors manages the portfolio by doing the periodic rebalancing, executing trades, performing tax-loss harvesting and other services that can help its clients" (Lilly et al 2022).

2. Conniving with Nudges

Robo advisors are suitable for investors who are comfortable using digital platforms with minimal or no human interference. “The gray area is, does a Robo-advisor improve outcomes?” Indeed, investment advice does pay off, says Hammond 3 Studies show that investors who seek professional investment help by putting their money in target-date funds have seen that their median CAGR moves up by 3 percent.

The fundamental drawback of Robo-advisor is that there is no human touch and emotional angle, which is very important to some investors, and in Robo, you are just conversing to a computer, and “computers output is solely depended on the information that you input” (Sironi 2016). Even if the algorithm is super intelligent, it may not necessarily understand and draw out all information that is relevant to an investor’s investment goals and financial situation, most of the studies that have been done on the efficiency of the platforms. The performance of Robotics is still in the gray area when the market is highly volatile and the investor’s needs are highly complex.

3. Literature Review

The SWFI describes robo-advisory as a kind of financial advice for providing AI-based management of the portfolio with nearly zero human interaction and that has characteristically used algorithms and formulas (SWFI 2015). Accordingly, (Investopedia 2017) defined robo-advisory as digital platforms for providing algorithm-driven and automated financial planning services with no supervision of humans. The Wall Street journal, in its research, stated that with minimum balance and low management fees, robo-advisory is a boon to middle-class investors that enables them to access wealth management services. The RA market of the Asian Pacific has been expected to depict promising growth among various regions and forms a continuous attempt to develop innovative and cost-effective automated economic advisory services. The RA market in this region is expected to be predominantly driven by India, Japan and China through the forecasting period. This is due to the enormous customer base associated with increased disposable income. As per (Tokic 2018), a robo-advisor enabled the handling of the complex investment needs of a prospective investor due to the complex algorithms on which robo-advisors work. (Fein 2015) clearly narrates in this study about the success rate of the investment decisions the Robo platforms can offer to an investor, as all new Robo platforms are working on complex algorithms. Belanche et al. (2019) state that with advanced algorithms, Robo-advisors can now play a critical role in investment success and revolutionize the investment market. According to (Clarke Demo 2020), the success of Robo-advisors depends solely on two things: AI capabilities that can address complex investment needs and the user friendliness of platforms.

4. Structural Framework of the study

The structural framework of the study revolves around the provision of investment advice to the seeking investors, both millennials and retired individuals, for the purpose of enhancing their returns, which is both cost effective and reliable, facilitated through robo-advisors that are articulated with artificial intelligence.

4.1. Framework of Robo-Advisory on TAM

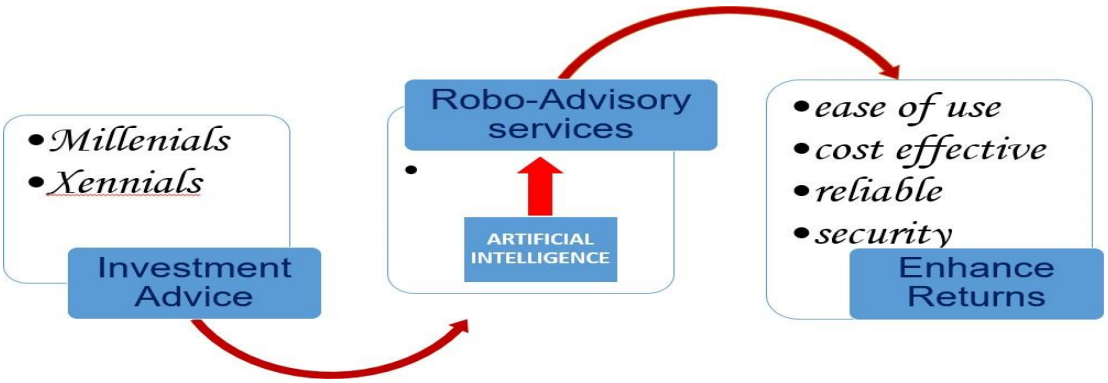

Figure 1 Structural Framework of Robo-Advisory on TAM.

4.2. Investment Advice

According to the Research papers millennials are going to be the prime target for Robo-advisory platforms, due to the low fund management fees and transparency of platforms (Abraham et al., 2019) presented that the predominant reason for the Robo Advisory’s popularity among the millennials is because of the efficiency of the individual investors to take sole responsibility of their own investments and the millennials feel that the advices received are free from biases. Furthermore, as

millennials start their investment journey, the low level of investible income does not meet the minimum investment criteria set by wealth management firms; hence, millennials cannot access a wealth manager most of the time (Cedrell and Issa 2018).

4.3. AI and TAM in the Usage of Robo-advisors

According to (Francesco D'Acunto et al 2018), the robo-advisory is transparent as they work on AI. Meanwhile, the interaction between the clients and human advisors can be influenced by the interests of the advisor, whereas Robo-Advisor purely works on the inputs that an investor has given to the platforms and on the inbuilt algorithms. Hakla (2019) says that Robo-Advisor has the AI ability to make active investment decisions by replacing human involvement in active decision making, which makes this platform free from investment biases.

4.4. Process of Outcome

Rising awareness among customers for adopting automated financial advice for the purpose of investing and saving is the main and key concept for the demand for RA services in the upcoming years, as per the reports of Asian market witnesses. In India, the robo-advisory market is still at a very emerging but promising stage, and we need to create many positive perceptions about the platform and build trust for mass adoption (Ankita et al., 2020). According to (Fein 2016), RAs provide investment advice and discrete management services without the involvement of humans but with the help of algorithms followed by the allocation of asset models.

5. Research Design

A causal research design is applied to explore the effect of selected variables on investment returns. The respondents were customers seeking investment advice, mostly millennials and retired individuals. The data were collected from the Ernakulum district of Kerala state. The convenience sampling method is used to determine the client's behavior toward its technological acceptance (TAM).

The TAM had nine variables, and the data collected were tested to prove the validity and reliability of the tool used. Cronbach's alpha of all the variables was above 0.8, and structural equation modeling (SEM) using partial least squares was used to predict the effect of independent variables on behavioral intention.

The hypotheses framed for the study were as follows:

H_{1a}. Perceived usefulness has a significant positive effect on consumer attitudes toward intention-to-use robo-advisory

H_{1b}. attitude has a positive effect on the intention to use robo-advisory

H_{1c}. perceived ease-of-use has a positive effect on consumer attitudes toward intention-to-use robo-advisory

H_{1d}. perceived ease of use has a significant positive effect on consumer perceived usefulness of the intention to use of robo-advisory

H_{1e}. The perceived usefulness of financial robo-advisors has a positive effect on the intention to use them.

H_2: Personal innovativeness in information technology has a direct relationship with the intention to use robo-advisory among investors.

H_3: Perceived trust has a positive relation with the intention to use robo-advisory devices among millennials.

H_{04}: There is no significant difference in age on the perceived uncertainty of investors' intention to use RAs based on the extension of **the** TAM.

H_{05}: There is no significant difference in the effect of gender on the perceived uncertainty of investors' intention to use RAs based on the extension of **the** TAM.

6. Analytical Observations

The primary data were collected from the investors on their utilization of robo-advisory services for investment advice instead of relying upon human suggestions and information about the selection of stocks and other capital market-related queries in the process of investors' wealth creation. Relevant statistical tools applied to test the relationship and impact of the variables chosen under the study.

6.1. Relationship of perceived ease of use of RA toward gender

The Levine test for equality of variances was used to test the association between gender and the perceived ease of use of RA based on TAM.

Ho: There is no significant difference in the effect of gender on the perceived ease of use of investors' intention to use RAs based on the extension of the TAM.

From the analysis given in Table 1, it is clear that the gender of the respondents has a significant effect on the perceived ease of use (t value=2.053, p=0.041< 0.05). There is a significant difference in the genderwise perception of the robo-advisory scheme.

Table 1 Investor intention to use RAs based on the TAM.

		Lexeue's Test for Equality of Variances		t test for Equality of Means						
		F	Sig.	t	df	Sig.(2-tailed)	Mean Diff	Std Error Diff	95% Difference Interval of the Difference	
									Lower	Upper
PEU	Equal Variances assumed	sv	210	2053	502	_041	12008	~.05848	~.23497	~.00518
	Equal Variances not assumed			2.054	501.953	.040	12008	~.05848	~.23497	_.00522

6.2. Influence of age on perceived security

Evaluation of the influence of age on the perceived security of investors' intention to use RAs based on the extension of the TAM

Ho: There is no significant difference in age on the perceived security of investors' intention to use RAs based on the extension of the TAM.

Table 2 Effect of age on perceived security.

Association between Age and Perceived security					
	Sum of squares	df	Mean Square	F	Sig.
Between Groups	034	2	_017	_069	_933
Within Groups	121.798	501	_243		
Total	121.832	503			

The influence of the age category of the respondents on perceived security is evaluated using ANOVA, and the results show that the age of the respondents does not play any significant role in perceived security or its effect on the intention to use robo-advisory schemes (p value=0.933>0.05).

6.3. Structural Equation Model Analytical Views

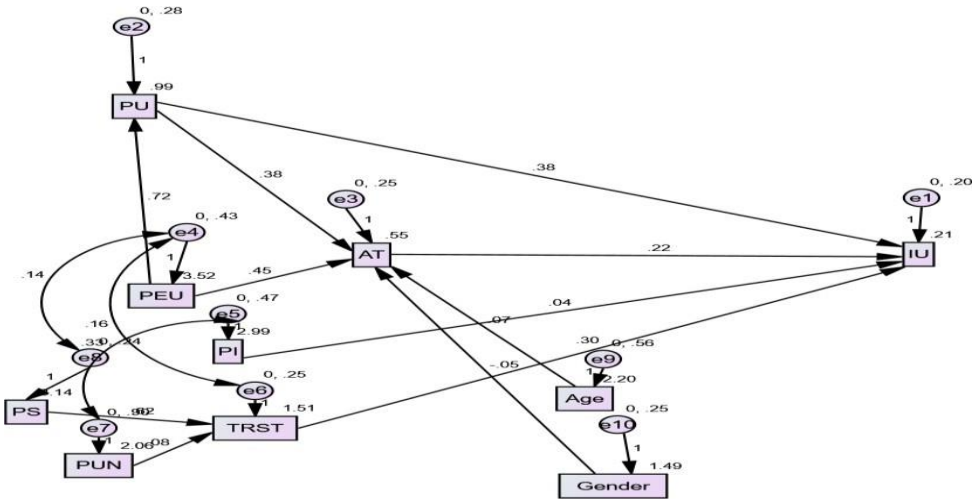

Figure 2 Structural equation model of the study.

6.3.1. Model Fit Indices for the Factors Influencing the Intention to use Robo-Advisory Services

Table 3 Model Fit Assessment of Factors influencing Robo-Advisory.

Factors	Actual Value	Recommended Value
RMS	0.072	<0.08
GFI	0.901	>0.90
AGFA	0.822	>0.80
NFI	0.924	>0.90
TLI	0.934	>0.90
CFI	0.912	>0.90
RMR	0.035	<1
IF	0.935	>0.90

The fit indices shown in Table 3 for the proposed conceptual model indicate that the model is a good fit for the given data, with GFI=0.901, AGFI=0.822, NFI=0.924, TLI=0.934, CFI=.912, RMR=0.035, and IFI=.0.935, and the measures conclude that all the factors analyzed influence robo-advisory services.

7. Findings and Conclusion

The peculiar characteristic of Robo-Advisory is that it obtains information from its clients with regard to their financial situations, their investment horizon, the investor's risk appetite and up the ante of their anticipated returns; hence, the data are processed with the aid of intricate built-in algorithms to achieve preeminent investment instruments harmonized based on their investment goals. Many studies on investor biases have observed that at times, investors behave irrationally more often while making decisions on investments, they show certain biases based on their past experiences, and these behavioral biases need to be avoided (Amudha and Muthukamu 2018). Such errors are proven to be very expensive in most situations; hence, we need dependable Robo-platforms that evolve from a technological standpoint and can handle complex investment needs even in volatile market conditions.

The findings of the study confirm that robo-advisors, along with TAM, exhibit a positive outcome. With advanced AI capabilities, robo-advisors can play a predominant role in the future and can truly help investors manage their investment with minimal advisory costs. AI-enabled robo-advisors benefit customers exclusively for those who have to start their investment journey, precisely for millennials. Enhanced user interfaces and AI capabilities have played a major role in building ease-of-use and conviction among investors in the adoption of Robo-advisors. Genderwise perceptions of Robo-advisory platforms are totally different from our study, which could be due to differences in the awareness level, and Robo-advisory platforms can be targeted to across investors, as age has the least implication in the perception and adoption of Robo-advisory platforms.

Millennials are going to be the leading targets for Robo-platforms due to their easy affordability, 24/7 accessibility and complete transparency with no investment bias, and as an investor ascends in their investment journey, a mix or hybrid structure (Robo + Human) is substantially helpful to reach their investment needs.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

Role of multilevel governance in the prevention of air pollution in Delhi, NCR

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Abstract This study examines the role of multilevel governance in the prevention of air pollution in Delhi, NCR. The research utilises both primary and secondary data sources to assess the perception and opinion of respondents on various issues related to air pollution. Hypothesis testing is employed to analyse the data, and the findings indicate that less than 50% of respondents feel that there is any conflict of interest between agencies or governments in the implementation of schemes or programs to combat air pollution. Additionally, it is found that more than 50% of respondents believe that the formulation of one apex body for policy formulation, rather than multiple bodies, would be more effective in controlling air pollution. However, 50% of respondents believe that there is a lack of political will or coordination among stakeholders in controlling air pollution, and multilevel governing bodies are seen as a bottleneck. Based on these findings, it is recommended that a centralised authority be established to deal with air pollution-related issues and that more efforts be made to increase public awareness about air pollution. The analytical approach used in this research highlights the importance of hypothesis testing in making inferences about populations based on sample data. Future research could also look into how well different multilevel governance strategies work in different situations. It could also look into the role of citizen engagement and participation in making policies and programmes to stop air pollution. Also, research could look at the possible effects on the economy and society of using multilevel governance approaches to stop air pollution.

Keywords: air pollution, multilevel governance, Delhi NCR, stakeholders, conflict of interest

1. Meaning of Air Pollution

When chemicals that are bad for the environment, the temperature, or human health are released into the air, we call that 'air pollution.' Gases (such as ammonia, CO, SO2, methane, nitrous oxides, and chlorofluorocarbons), organic and inorganic particles, and living compounds are all contributors to air pollution. Air pollution has the potential to hurt not only people (through illnesses, allergens, and even mortality), but also other creatures, vegetation, and the natural or constructed environment. Pollution in the environment can be caused by either human actions or natural occurrences. Several respiratory illnesses, cardiovascular disorders, chronic obstructive pulmonary disease, asthma, and lung cancer have been linked to air pollution. Poor air quality has far-reaching impacts on human health, particularly affecting the lung and circulatory systems. One's response to air pollution is conditional on factors such as the nature of the contaminant, the extent to which one is subjected to it, one's current health, and one's hereditary make-up (Daniel 2014). In its 2008 study, World's Worst Polluted Places, the Blacksmith Institute identified indoor air pollution and bad metropolitan air quality as two of the world's worst hazardous pollution issues. Annual fatalities attributable to outdoor air pollution are estimated to range from 2.1 (Raquel et al 2013) to 4.21 million (Lelieveld et al 2019). Air pollution is the biggest natural health danger in the globe, responsible for the premature mortality of approximately 7 million people annually (Reed 2016).

2. Meaning of Multilevel Governance

Furthermore, multilevel governance of air pollution acknowledges that the issue is complex and multifaceted and needs to be approached holistically. It entails the creation of laws and policies that account for the various pollutant sources, types, and sectors, as well as the various air-polluting industries, businesses, and agricultural practises (Joyeeta Gupta 2008).

Additionally, a sustained commitment to research and development is needed to find new technologies and approaches for reducing air pollution in order for multilevel governance of air pollution to be effective. One of the challenges of multilevel governance of air pollution is making sure that different levels of government and other stakeholders work together. This includes making systems for tracking progress and finding places to improve, as well as forming partnerships and collaborations between different sectors and stakeholders to share knowledge and resources. This can be especially difficult in areas with multiple legal systems, as is the case with Delhi's National Capital Region, which is split up into several

states and union territories. To deal with this problem, the Graded Response Action Plan (GRAP) was put in place in Delhi-NCR. This plan provides a framework for coordination and collaboration between different stakeholders at different levels of government (Joyeeta Gupta 2008).

With multilevel governance of air pollution, it is also hard to make sure that rules and policies are followed. This means that effective monitoring and reporting systems must be set up, and the community and civil society must be involved in making sure that laws and policies are followed. The effectiveness of air quality management programmes can be hampered by a lack of enforcement and compliance with regulations, which can also erode stakeholders' confidence in the process.

The success of multilevel governance of air pollution is also affected by the availability of resources and the building of skills at different levels of government and among stakeholders. This entails allocating adequate financial resources for the implementation of air quality management programmes as well as educating and empowering stakeholders to successfully implement and keep track of laws and regulations (Joyeeta Gupta 2008).

In general, multilevel governance of air pollution is a complicated and changing process that needs the participation and coordination of different levels of government and stakeholders. Effective policies and rules need to be made, communication channels need to be set up that are open and accountable, communities and civil society need to be involved, laws need to be enforced and followed, there needs to be enough money and resources, and people's skills need to be built up. Air pollution problems around the world can be fixed in a fair and long-lasting way with the help of multilevel governance.

3. Literature Review

Delhi has been an epicentre of air pollution in India; multiple studies have proved the same in the last few decades. In a comparative study of six northern cities of India it was observed that Delhi had a maximum PM10 load (Yadav et al 2020)

The idea of polycentric governance can serve as a foundation for the theoretical framework for multi-level governance of air pollution in Delhi NCR. The complexity of environmental issues and the need for multiple actors and institutions to work together and coordinate their efforts to address them are both acknowledged by polycentric governance (Elinor Ostrom 2010). This would entail collaboration and coordination between various governmental levels, civil society organizations, and commercial entities in the case of air pollution in Delhi NCR.

The national government can establish broad policies and regulatory frameworks to direct the efforts of various states and cities to combat air pollution. As an illustration, the National Clean Air Programme (NCAP) offers a thorough framework for lowering air pollution throughout the nation (Ministry of Environment, Forest & Climate Change, Government of India National Clean Air Program 2019). At the state level, Delhi, Haryana, and Uttar Pradesh's governments can create policies and strategies that are region-specific to reduce air pollution, taking into account regional sources of pollution and elements that worsen air quality.

The theoretical framework for multi-level governance of air pollution in Delhi NCR can also be based on the idea of environmental federalism in addition to polycentric governance. The division of environmental duties and authority among various governmental spheres, including the federal government, state governments, and local governments, is referred to as environmental federalism (David and Aidan 2017) The central government of India is in charge of setting national policies and standards, and the state governments are in charge of putting those policies and standards into practise at the local level (Verma et al 2018).

A lack of coordination and cooperation between the various levels of government as well as conflicting policies and strategies can occasionally result from this division of duties. This is especially true in the case of Delhi NCR's air pollution, where various states have different emission standards and regulations and there is a lack of coordination in addressing transboundary pollution. A balance between centralised policies and decentralised implementation, as well as cooperation and coordination between various levels of government, are therefore necessary for effective multi-level governance of air pollution in Delhi NCR (Verma et al 2018).

The idea of the ‘tragedy of the commons’ is another theoretical framework that can be used to address multilevel governance of air pollution in Delhi NCR. This is referring to a scenario in which selfish behaviour by individual actors can cause a shared resource, like the air we breathe, to degrade (Hardin 1968) Individual actors, such as businesses and car owners, may put their own interests ahead of public health and environmental sustainability in the case of air pollution in Delhi NCR, which worsens the region's air quality.

The multi-level governance of air pollution in Delhi NCR must include incentives for individual actors to adopt more environmentally friendly practises and technologies in order to overcome this challenge. This may involve measures like emissions trading, financial assistance for greener technologies, and sanctions for non-compliance. A more equitable and sustainable approach to air pollution governance in Delhi NCR is achievable by addressing the ‘tragedy of the commons’ through efficient policy interventions.

4. Research Gap

Even though there have been a lot of studies on the causes and effects of air pollution on plants and animals, the role of government and administration in solving this problem has not been studied well. Even though the government has taken steps to reduce air pollution, there is still a need for multilevel governance (Silva et al 2013) to improve the way these steps are carried out to make sure they work in the long run. Also, all interested parties, including the community, need to be involved (Silva et al 2013). Therefore, a critical review of the progress of the steps taken to address air pollution is needed, particularly with respect to coordination between central and local governments after implementation as well as analysing the operational problems and bottlenecks faced by citizens and implementing agencies. This will help achieve a sustainable environment in the end.

5. Research Objectives

1) To study the existing preventive actions taken to control air pollution and participation from multilevel governance point of view.
2) To analyse the role of Government and other organizations and their mutual coordination in improving the pollution index.
3) To propose effective suggestions to control the air pollutants concentration in the environment with multilevel governance.

Hypothesis:

1) H0: There is absence of proper coordination with multilevel governance for implementing policies to control air pollution.

Data Analysis:

Table 1 shows the frequency and percentage distribution of stakeholders in a survey or study. The survey appears to have asked participants to identify their type of stakeholder in environmental issues.

Table 1 Type of Stake Holder.

	Frequency	Percent	Valid Percent	Cumulative Percent
Government Official National	4	12.90	12.90	12.90
Government Official Local	13	41.94	41.94	54.84
Academic/Scientific Expert	0	00.00	00.00	54.84
Environmental NGO	14	45.16	45.16	100.00
Other	0	00.00	00.00	100.00
Total	31	100.00	100.00	

Figure 1 depicts that out of 31 respondents, 4 (12.9%) identified as Government Official National, 13 (41.9%) identified as Government Official Local, 14 (45.2%) identified as Environmental NGO, and none identified as Academic/Scientific Expert or Other.

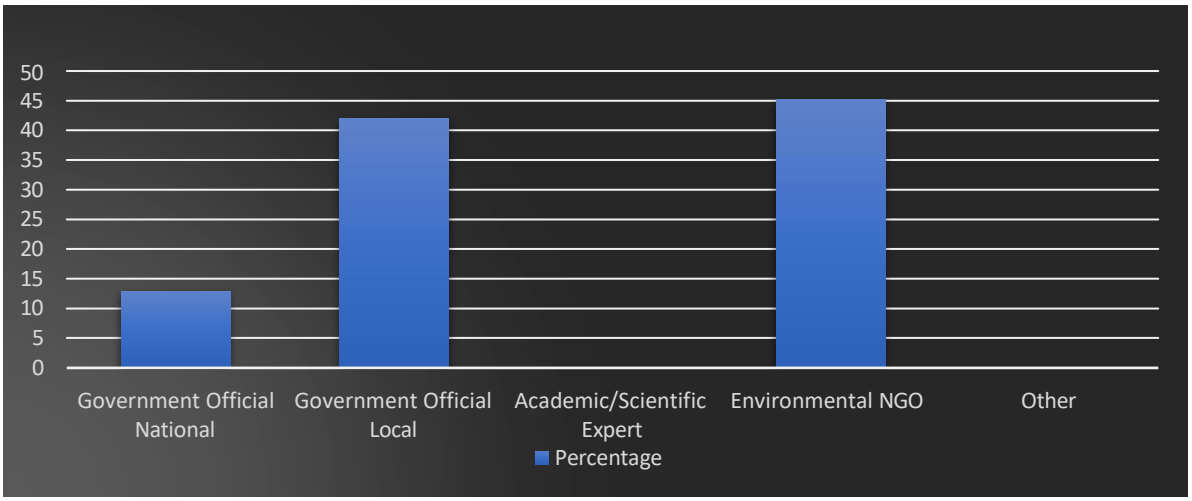

Figure 1 Type of Stake Holder.Source: Primary Data.

The cumulative percentage column shows that 54.8% of the respondents identified as Government Official Local and 100% of the respondents identified as either Government Official Local or Environmental NGO.

Overall, the table suggests that the majority of the respondents are either government officials at the local level or members of environmental NGOs. ''The absence of responses from academic/scientific experts or other types of stakeholders may limit the representativeness of the sample, and caution should be exercised in generalizing the findings to the larger population of stakeholders in environmental issues (Table 2).

Figure 2 depicts that out of the 31 respondents, 17 (54.84%) answered 'Yes' to the question of whether the current steps taken by governments/agencies/stakeholders cover all the relevant air quality concerns (Table 2). This suggests that they believe the current actions being taken are adequate to address air quality concerns.

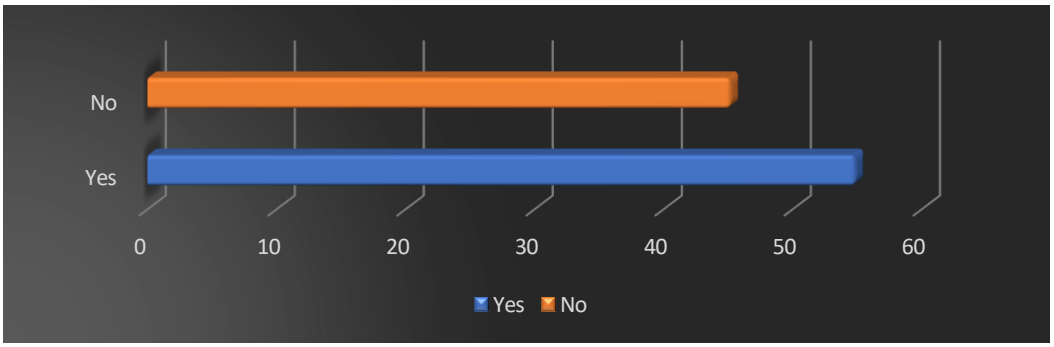

Figure 2 Does current steps taken by governments/ agencies/ stake holders covers all the relevant air quality concerns? Source: Primary Data.

On the other hand, 14 respondents (45.16%) answered 'No,' indicating that they do not think the current steps taken are enough to cover all relevant air quality concerns (Table 3). This suggests that there may be a perception among some respondents that more needs to be done to address air pollution.

Table 2 Does current steps taken by governments/ agencies/ stake holders covers all the relevant air quality concerns.

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	17	54.84	54.84	54.84
No	14	45.16	45.16	100.0
Total	31	100.0	100.0	

Table 3 shows the responses of the participants to the question 'Do you think the plans presented by the Government to prevent air pollution are sufficient?' A total of 31 people responded to the question, and their responses are displayed in the table. Figure 3 shows that out of the 31 participants, 13 (41.94%) responded 'Yes', indicating that they believe that the plans presented by the Government to prevent air pollution are sufficient. "On the other hand, 18 (58.06%) participants responded 'No', indicating that they do not think that the plans presented by the Government to prevent air pollution are sufficient.''

Table 3 Do you think the plans presented by the Government to prevent air pollution are sufficient.

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	13	41.94	41.94	41.94
No	18	58.06	58.06	100.0
Total	31	100.0	100.0	

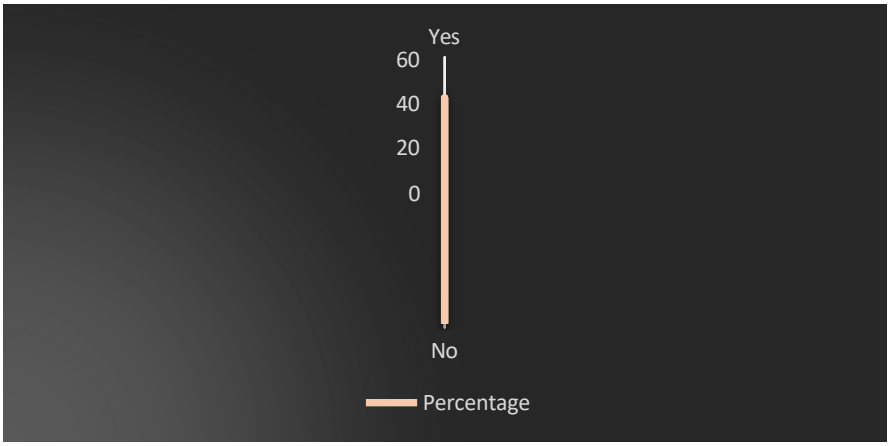

Figure 3 Do you think the plans presented by the Government to prevent air pollution are sufficient. Source: Primary Data

It is important to note that this table only displays the frequency and percentage of responses and does not provide any information on the reasons behind the participants' responses or their level of knowledge about the Government's plans to prevent air pollution.

Out of the total 31 respondents, 32.26% i.e., 10 respondents feel that there is a conflict of interest between agencies/governments in implementation of schemes/programs in combating air pollution, while 67.74% i.e. 21 respondents do not feel so. This question aimed to assess whether the respondents perceive any conflicts of interest between the agencies/governments involved in the implementation of schemes/programs to control air pollution, as shown in Figure 4 and Table 4. It can be inferred that a significant proportion of the respondents perceive some conflict of interest, which might impact the effectiveness of the implementation of these programs. Further analysis and investigation may be required to identify the specific areas of conflict and address them to ensure the successful implementation of the schemes/programs.

Table 4 Do you feel that there is any conflict of interest between agencies/ governments in the implementation of schemes/ programs in combating air pollution.

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	10	32.26	32.26	32.26
No	21	67.74	67.74	100.0
Total	31	100.0	100.0	

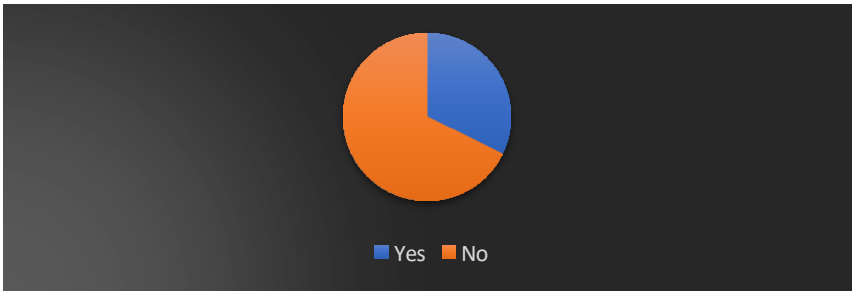

Figure 4 There is any conflict of interest between agencies/ governments in implementation of schemes/ programs in combating air pollution. Source: Primary Data.

Table 5 presents the frequency and percentage distribution of responses to the question 'Was there ever any ambiguity while receiving instructions from more than one governing body?' among the survey participants.

Out of 31 participants, 7 (22.58%) responded 'Yes', indicating that they have experienced ambiguity while receiving instructions from more than one governing body, as shown in Figure 5. On the other hand, 24 (77.42%) participants responded 'No', indicating that they have not experienced such ambiguity.

Table 5 Was there ever any ambiguity while receiving instructions from more than one governing body.

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	7	22.58	22.58	22.58
No	24	77.42	77.42	100
Total	31	100.0	100.0	

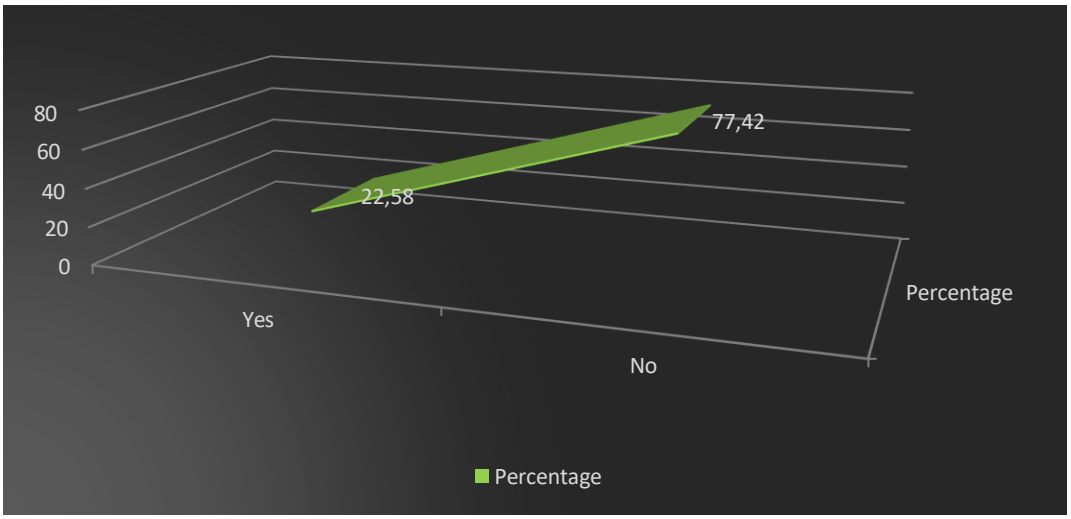

Figure 5 Was there ever any ambiguity while receiving instructions from more than one governing body. Source: Primary Data

The majority of respondents (87.10%) agreed that having an apex body for policy formulation to curb air pollution in Delhi NCR would be more effective than the current multiple bodies working on the issue. Table 6 and Figure 6 suggests that there is a need for a more streamlined and coordinated approach towards addressing air pollution in the region. Such an approach could potentially lead to more efficient and effective implementation of policies and initiatives, as well as better coordination among various stakeholders involved in the process. However, it is important to note that the creation of an apex body alone may not be sufficient, and it would need to be accompanied by other measures such as adequate funding, political will, and stakeholder engagement to ensure its success.

Table 6 There are multiple bodies working for formulating and implementing various steps to curb air pollution in Delhi NCR. Do you think the formulation of one apex body for policy formulation rather than these multiple bodies will be more effective.

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	27	87.10	87.10	87.10
No	4	12.90	12.90	100
Total	31	100.0	100.0	

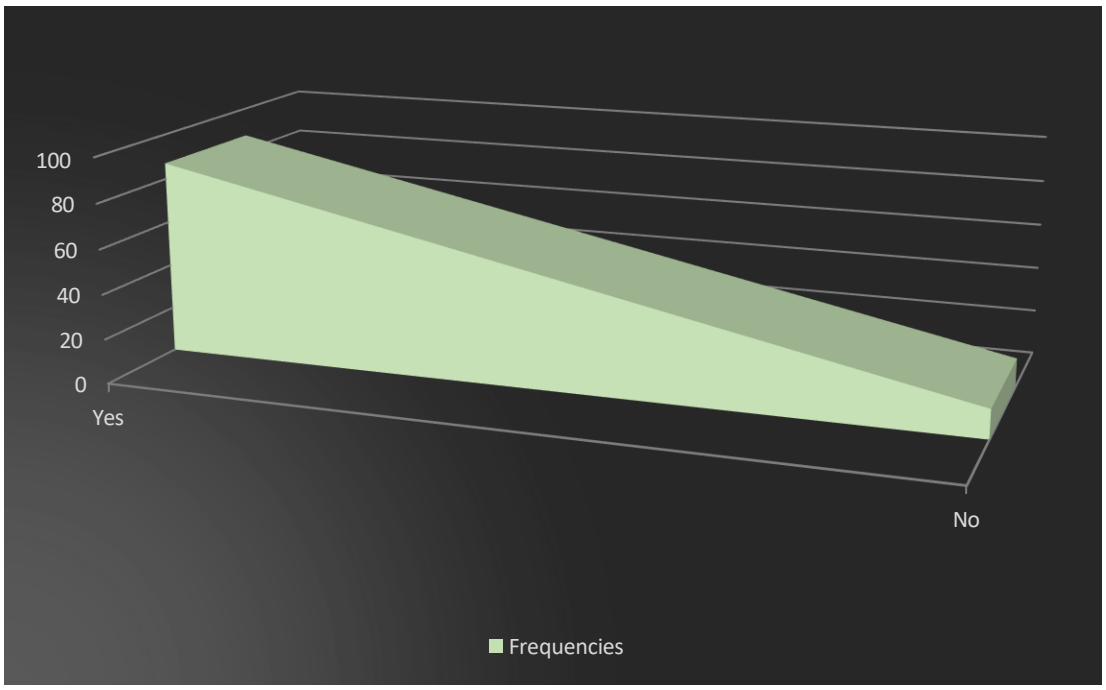

Figure 6 There are multiple bodies working for formulating and implementing various steps to curb air pollution in Delhi NCR. Do you think the formulation of one apex body for policy formulation rather than these multiple bodies will be more effective. Source: Primary Data

This survey question is asking the respondents for their opinion on the reasons for the challenges faced in controlling air pollution in Delhi NCR. The respondents were given two options to choose from: lack of political will or lack of coordination among stakeholders.

Table 7 and Figure 7 depict 45.16% of the respondents felt that there is a lack of political will in controlling air pollution in Delhi NCR, while 54.84% of the respondents felt that there is no lack of political will. On the other hand, 54.84% of the respondents felt that there is a lack of coordination among stakeholders in controlling air pollution, while 45.16% of the respondents felt that there is no lack of coordination among stakeholders.

These results indicate that the majority of the respondents perceive a lack of coordination among stakeholders as a challenge in controlling air pollution in Delhi NCR, while a significant minority perceive a lack of political will as a challenge. It is important to note that this is based on the perception of the respondents and may not necessarily reflect the actual situation.

Table 7 In your opinion, is there a lack of political will or lack of coordination among stakeholders in controlling air pollution.

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	14	45.16	45.16	45.16
No	17	54.84	54.84	100.00
Total	31	100.00	100.00	

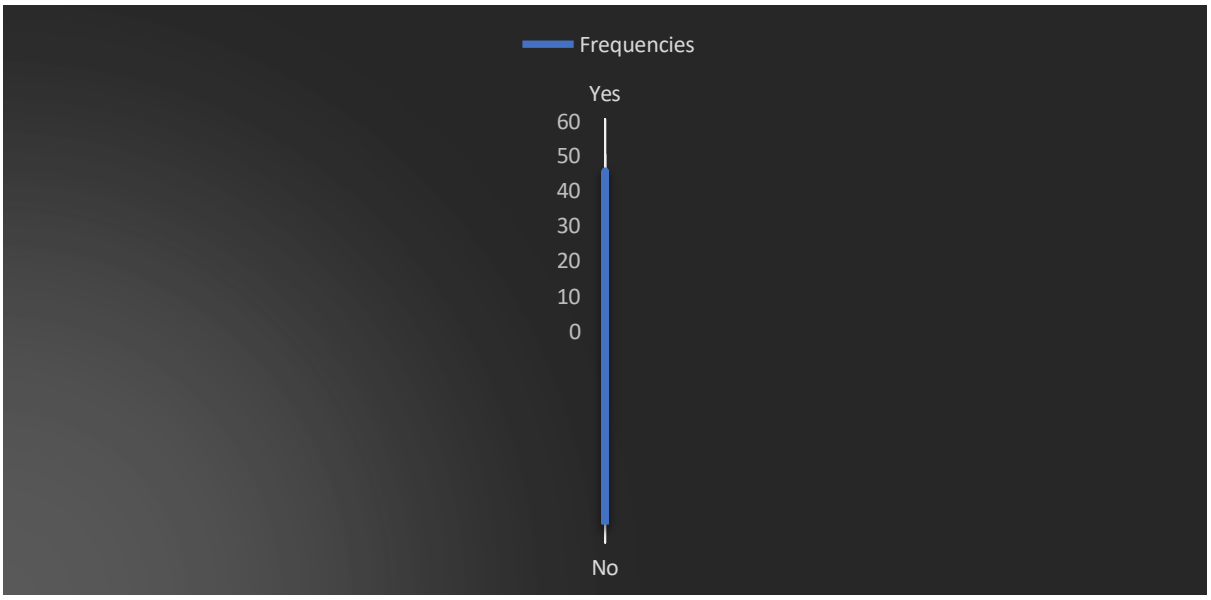

Figure 7 In your opinion, is there a lack of political will or lack of coordination among stakeholders in controlling air pollution. Source: Primary Data

Based on the responses, 54.84% of the respondents believe that the presence of multiple governing bodies in dealing with air pollution is a bottleneck. This could mean that they perceive the existence of multiple bodies to be a hindrance in effective policy-making and implementation. On the other hand, 45.16% of the respondents think that having multiple governing bodies is helpful, as shown in Table 8 and Figure 8. This could mean that they believe that each body has its unique strengths and expertise that contribute to the fight against air pollution. It's worth noting that the respondents' opinions may be based on their personal experiences and observations of the actions taken by the governing bodies.

Table 8 In your opinion, multilevel governing bodies in dealing with air pollution is.

	Frequency	Percent	Valid Percent	Cumulative Percent
Bottleneck	17	54.84	54.84	54.84
Helpful	14	45.16	45.16	100.00
Total	31	100.00	100.00	

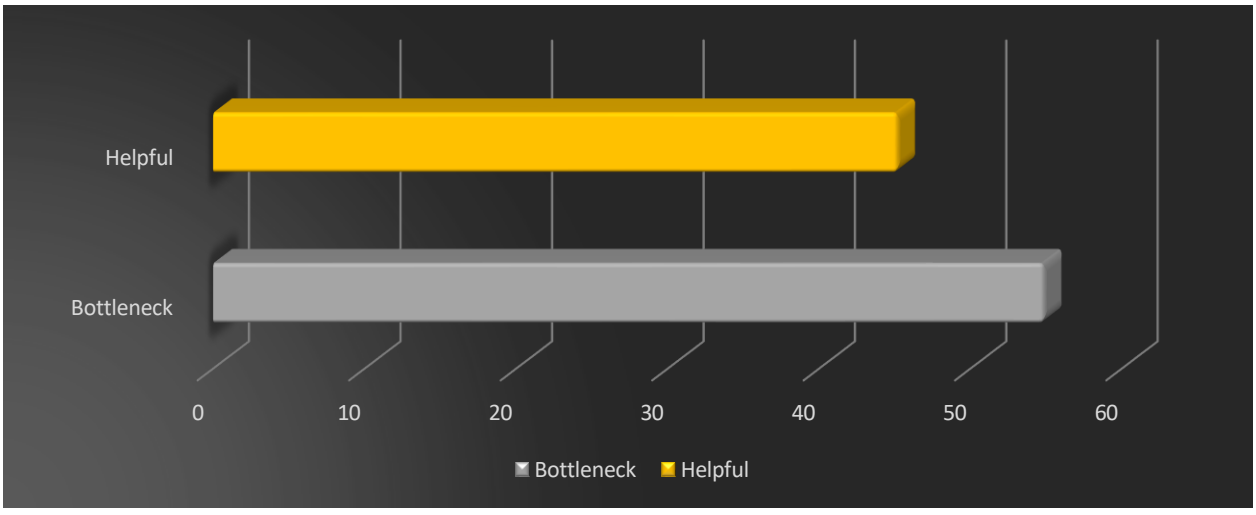

Figure 8 In your opinion multilevel governing bodies in dealing air pollution is. Source: Primary Data

Hypothesis Testing:

In this hypothesis test, the null hypothesis (H0) states that 50% of respondents feel that there is a conflict of interest between agencies/ governments in implementation of schemes/ programs in combating air pollution. The alternative hypothesis (H1) states that less than 50% of respondents feel that there is a conflict of interest.

The significance level is set at 0.05 and the test statistic is calculated to be 1.975. To determine whether to accept or reject the null hypothesis, we compare the test statistic to the critical value from the standard normal distribution Table 9.

Since this is a left-tailed test (the alternative hypothesis is less than), we compare the test statistic to the critical value at the 5% level of significance in the left tail of the standard normal distribution Table 9, which is 1.645.

The test statistic of 1.975 is greater than the critical value of 1.645, indicating that it falls in the rejection region. Therefore, we reject the null hypothesis and accept the alternative hypothesis. This means that less than 50% of respondents feel that there is a conflict of interest between agencies/governments in implementation of schemes/programs in combating air pollution.

Table 9 Do you feel that there is any conflict of interest between agencies/Governments in the implementation of schemes/programs in combating air pollution.

H_0	P = .50, 50% of respondents feel that there is any conflict of interest between agencies/ governments in implementation of schemes/ programs in combating air pollution.
H_1	P < .50, Less than 50% of respondents feel that there is any conflict of interest between agencies/ governments in implementation of schemes/ programs in combating air pollution.
Significance Level	.05
Z Value	1.975
Table Value	1.645 (left tail)
Compare	Z Value > Table Value, H_0 Rejected, H_1 Accepted.
Conclusion	It is proved that less than 50% of respondents feel that there is any conflict of interest between agencies/ governments in implementation of schemes/ programs in combating air pollution.

6. Findings

The findings of the hypothesis testing conducted in this study indicate that:

- Less than 50% of respondents feel that there is any conflict of interest between agencies or governments in the implementation of schemes or programs to combat air pollution.
- Less than half of the people who answered say that there is any confusion when getting orders from more than one governing body.
- More than 50% of respondents think that the formulation of one apex body for policy formulation rather than multiple bodies will be more effective.
- 50% of respondents think that there is a lack of political will or coordination among stakeholders in controlling air pollution.
- 50% of respondents perceive multilevel governing bodies dealing with air pollution as a bottleneck.

7. Recommendation

Based on the findings of this study, several recommendations can be made to improve the multilevel governance system in preventing air pollution in Delhi, NCR:

1. Establishment of one apex body for policy formulation: More than 50% of respondents felt that the formulation of one apex body for policy formulation rather than multiple bodies would be more effective. Therefore, the government should consider establishing a single agency responsible for the development and implementation of air pollution policies.
2. Increase in budget allocation: More than 50% of respondents felt that the budget allocated by the government is not sufficient to control air pollution in the Delhi-NCR region. Therefore, the government should consider increasing the budget allocation to improve the implementation of air pollution control measures.
3. Improvement in coordination and political will: 50% of respondents believed that there was a lack of coordination and political will among stakeholders in controlling air pollution. Therefore, the government should focus on improving coordination and political will among all stakeholders, including government agencies, non-governmental organisations, and citizens.
4. Awareness campaigns: Half of the people who answered the survey thought that citizens don't know enough about the different kinds of air pollution, how it affects people, and what policies are in place to stop it. So, the government should run campaigns to teach people about how air pollution affects them and what they can do to stop it.
5. Conducting further research: This study has provided insights into the perceptions of stakeholders regarding multilevel governance in preventing air pollution in Delhi, NCR. However, there is scope for further research to investigate the effectiveness of current policies and programmes, and to identify new measures to control air pollution in the region.

8. Conclusion

In conclusion, the recommendations made in this study can help improve the multilevel governance system for preventing air pollution in Delhi NCR. It is essential that the government takes necessary steps to implement these recommendations to reduce air pollution levels and ensure a healthier environment for the citizens of Delhi NCR.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

The difference in the skills employment, job training satisfaction and job engagement by training duration among NDTS Apprentices in Southern region of Malaysia

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Abstract Globalization, technological advancements, and changes in work organization have increased the demand for skilled employment in many countries. In the absence of skills, employers are less likely to be able to find employment and are more likely to face skills-related unemployment, which decreases their competitiveness. In order to address the challenge of promoting skilled employability, the National Dual Training System (NDTS) apprenticeship training programme is an essential component. This enhances the ability of employees to find employment opportunities and earn income with the help of their skills. The development of skilled employability is one of the most effective strategies for ensuring a successful transition to the workforce and the access to career-oriented employment. Furthermore, the NDTS provides employees with the skills, knowledge, competencies, and attitudes necessary to find employment and to survive in an unstable economic environment. The performance of an employee is also related to the level of job satisfaction along with the skills of the employee. It has been demonstrated that satisfied employees perform better, resulting in a higher productivity level in the organization. Also, employees must be provided with necessary job training to ensure they develop the necessary skills to fulfill the requirements of their respective roles as well as prepare themselves for employment in specialized fields. The existence of training opportunities is likely to lead to employees remaining satisfied with an organization for a longer period of time. The improvement of employee engagement and workplace excellence can also be observed in this regard. As part of this study, the focus will be on identifying how the duration of the NDTS apprenticeship training program affects the employment of skilled employees. This will affect the satisfaction of job training, and the engagement of employees on the job.

Keywords: skilled workers, CO-E, skill employment, SR-U, NDTS

1. Introduction

A significant feature of the National Dual Training System (NDTS) is that it combines three key aims: improving individual capability and capacity to regulate themselves, promoting equality of opportunity and participation in society, and developing human resources (Pilz and Wiemann 2021; Liguori and Winkler 2020). NDTS is distinguished from other skills training programmes in that trainers are required to incorporate both human and social values as well as learning and methodology skills when teaching or facilitating technical subjects. Today's competitive environment requires employees to have access to this added value component of NDTS. In conjunction with structured learning on the job, this training programme will enable the employee to receive relevant and portable skills that are applicable to the labour market, indirectly combating Malaysia's growing skills underemployment (Clarke 2018; Affouneh et al 2020)

Skills underemployment has increased dramatically in several developed countries, including Malaysia, since the global economic crisis began. Even though Malaysia's labour market is recovering, high skills unemployment continues to present a serious problem (Nga et al 2021; Shahirah Mokthar et al 2019). The current workflow system does not balance different products and services adequately, which should be addressed at the job design stage. Insufficient protocols, practices, and standards for performing a particular task or activity in the workplace are largely responsible, which do not match the employer's objectives and adversely affect work design. Poor design limits opportunities to develop a variety of skills and abilities and to experience a variety of learning situations (Hakanen et al 2018). Employee dissatisfaction, increased turnover and lack of engagement are all the results of this interference with the employee's career interest and fulfilment. Employee dissatisfaction, disengagement, and demotivation are the results of poor work design (Islam et al 2019).

Furthermore, employees were unable to acquire and apply new knowledge, adapt to changes in technology and organizational structure. The organization may not retain talented employees. Low employee productivity and stress can lead to psychological issues like high blood pressure, heart disease, psychological strain, burnout, depression, anxiety, irritability, and poor concentration (Rosmala et al 2019). Therefore, NDTS is shaping an industry-driven, skilled workforce that can export in-demand technology based on values. It fosters innovation, economic growth, and community well-being through this diverse talent program. Through this program, employees can acquire the knowledge, skills, and attitudes necessary in order to succeed in a globalized world (Abd Samad et al 2018). Ultimately, training programs must be structured within an ideal duration in order to be effective and highly effective. As a matter of fact, it is not about the duration of training, but rather about the value an employee gain from it. Ideally, training should be tailored to solve a specific problem and fit within the employee's schedule in order to maximize that time (Cascio 2019; Ali 2020).

For greater relevance, the objective of the study is to identify how the duration of NDTS apprenticeship programmes affects skills employment, as well as job training satisfaction, and job engagement, to enrich the research purpose. By implementing NDTS training programs, organizations can achieve a variety of benefits, including increased employee motivation, engagement, and satisfaction. In addition, organizations can achieve increased profit margins. An organization must maximize the impact of such initiatives when they impact it (Basilaia et al 2020) In view of the NDTS' sustainability and inclusivity; it is formulated in such a way as to facilitate economic recovery from skill underemployment. In order to prepare a skilled workforce that can meet the challenges of a rapidly changing future job landscape, this program aims to recover, rebuild, and reform skill-related underemployment among employees. It is therefore important to emphasize that the duration of training is an important determinant of its success (Crawford et al 2020, Martin 2020). However, there is no one-size-fits-all level of employment when it comes to training duration; a few factors can offer valuable insight. In regards to young employees, the findings of the study will benefit society since the NDTS apprenticeship program plays a crucial role in improving the skills of the work force. It will inspire employees to gain meaningful employment and build long-term careers by enriching their knowledge, skills, and attitudes. In doing so, they can support themselves and their families, thereby helping to make our nation and community more sustainable.

2. Conceptual Framework

The conceptual framework for this research is shown in Figure 1, and it describes the different instrument variables adopted for this research. The research model in this study is an adaption of the “The Work Design Questionnaire (WDQ)” which was developed by Morgeson, F.E in 2006 consists of four (4) core job design and the nature of work to determine skill employment, “Job Training Satisfaction (JTS)” which was developed by Steven (Schmidt 2004) consists of two (2) facet scales to assess employee attitudes about aspects of the job and aspects of job training and plus with “Job Engagement (JE)” scale which was developed by Bruce Louis Rich in 2010 consists of three (3) core constructs linking job demands and resources to promote involvement and performance.

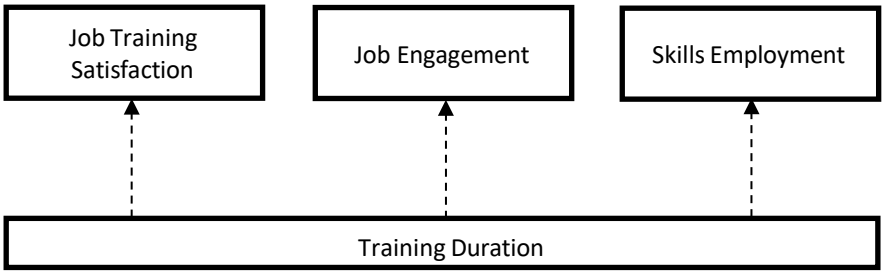

Figure 1 Conceptual Framework.

3. Methodology

Survey methods were used in this study to investigate the current situation, which is the most appropriate method to quantify current attitudes or practices at a certain point in time. The use of numerical data to explain the research questions was highly appropriate for this study. It is in individuals' attitudes, beliefs, and opinions that they determine how they perceive problems, while their practices reflect their actions (Braun et al 2021). In addition to assessing community needs, the design can also assess community involvement and planning. Although survey research has numerous disadvantages, it is an effective data collection method since it can collect valid data from a variety of populations, dispersed populations, anonymous populations, and the quality of data collected is always beyond control (Carey 2020).

In this study, a quantitative research approach was used to determine whether variables differed by training duration. An instrument survey questionnaire can be used in this approach to collect specific numerical data that can be analysed statistically in order to explain phenomena. The research questions and variables were clearly defined in advance of data collection, with a greater tendency for it to be fixed and deductive. Data collected was accurate and did not require a great

deal of analysis prior to drawing conclusions. A relationship could be established between the independent and dependent variables.

In this study, all NDTS apprentices enrolled in the Southern region of Malaysia for years 2022 and 2023 are included in the population. There were three (3) subcategories of training certification among the population in this study, which were classified according to their level: Malaysian Skills Certificate (SKM) Levels 1, 2, and 3 as well as three (3) active course codes of NDTS programmes listed on the Standard Registry according to the Malaysian Standard Industrial Classification (MSIC), including C, G, and S. An analysis of cumulative NDTS registration data by state was used to determine the number of NDTS apprentices in the southern region of Malaysia. The NDTS is a skill certification program operated by the Department of Skills Development (DSD) recognized by Malaysian industry. In similar manner to academic qualifications, apprenticeship programs provide apprentices with an exciting career path and a chance for personal growth.

A multistage simple random sampling design was used to select the DSD region, certification levels, and active course codes. This sample represents the entire sample population that is interested in participating in this study. The sample size was sufficient in order to make confident judgments about the findings, including 20 percent to reduce the probability of questionnaires being returned. The sample proportion was estimated by adding the success rate within a sample and the sample size. Lastly, determine the sample proportion based on the number of successes to the sample size.

A questionnaire was used to conduct this study. In order to improve feedback accuracy, a thorough questionnaire preparation process was followed as well as an analysis and conclusion were drawn from the collected data. This instrument was divided into four sections, A, B, C, and D. The demographic information in Section A is the personal information of the respondents. Section B is Work Design Questionnaire (WDQ) to analyse skill employment, Section C is Job Training Satisfaction (JTS) and Section D is Job Engagement (JE). The questionnaire's sections B, C, and Dare scored on a four-point Likert scale.

3.1. Instruments

In this study, the Work Design Questionnaire (WDQ) was adapted to reflect the Industrial Revolution 4.0 in order to determine skill employment. It was based on a questionnaire published by (Morgeson and Humphrey in 2006) The questionnaire contains four dimensions, namely Task Characteristics, Knowledge Characteristics, Social Characteristics, and Work Context (Morgeson and Humphrey 2006) The WDQ has been subjected to a variety of arguments, comparative analyses, and classifications, ultimately resulting in 18 categories of work characteristics, which are subdivided into three higher-order categories: motivation, social, and contextual characteristics of the work environment (Mat Nawi et al 2020). The WDQ was an effective tool for measuring each of these three factors in a comprehensive and integrated manner. It was necessary to bridge the gap between tasks and characteristics, despite practitioners having limited work characteristics (Madrid et al 2020). The internal consistency reliability of the WDQ scale averages 0.87, while its convergent validity averages 0.74 factor loadings (Morgeson and Humphrey 2006).

The Job Training Satisfaction (JTS) questionnaire was developed by Steven (Schmidt 2004). Employee satisfaction with training is impacted by a variety of factors, including opportunities and rewards, supervision, fringe benefits, operational rules and procedures, co-workers, the nature of the work performed, organizational support for training, feelings about training, and employee satisfaction with training (Schmidt 2004). Job Training Satisfaction Index measures the attitudes, beliefs, and overall job satisfaction of employees. In addition to the variety of training components, employees reported increased satisfaction with their job training. It measures employee satisfaction as well as formal or planned training activities undertaken by an organization (Huang 2020). Training employees in the workplace directly or indirectly contributes to productivity and job satisfaction (Ensour et al 2018). In general, the JTS reliability coefficients range from 0.61 to 0.90. The Cronbach's alphas for both job training and job satisfaction are 0.83 and 0.89, respectively (Schmidt 2004).

Job Engagement (JE) scale was adapted from Bruce Louis Rich's publication in 2010. The scale measured the level of physical, emotional, and cognitive engagement in the workforce (Rich et al 2010). A maximum level of employee engagement, as defined by the JE scale, is the investment of employees' physical, emotional, and cognitive resources in the performance of their duties simultaneously and holistically (Kahn 1990). There was a higher degree of precision in the JE as well as a better theoretical foundation. Various theories of motivation, work design, and role performance have been used to conceptualize job engagement (Nguyen and Pham 2020). A high internal reliability index of 0.89 was found for the Job Engagement Scale, also referred to as Rich Engagement Scale, based on the findings of Bruce Louis Rich. There was also good convergent validity demonstrated by the Job Engagement Scale, with an alpha coefficient exceeding 0.70 (Rich et al 2010).

3.2. Data Collection

The first step in this process was to apply for permission to conduct research in the respective NDTS apprenticeship training centres in collaboration with the Department of Skills Development (DSD). It is mandatory to obtain this permission in order to conduct the study in accordance with the rules and regulations of the DSD and NDTS training centre. A Google form with questions was created and emailed to DSD for NDTS apprentices to complete. A one-month period was provided

to respondents for completing the questionnaire and submitting their answers. In accordance with established procedures, all data collected will be analysed. Analyses of the finalized data were conducted for the purpose of interpretation of the study.

3.3. Data Analysis

The study's findings report will be based on the analysis of test results and feedback from respondents. SPSS version 26 was used to analyse the data from this study. Tables were used to present all results. A descriptive and inferential analysis of the research findings was used to describe the answers to research objectives, questions, and hypotheses.

4. Results

A summary of the statistics for skills employment, job training satisfaction, and job engagement has been calculated. Skills employment observations had an average of 3.17 (*SD* = 0.25, Min = 2.31, Max = 3.73). The observations for job training satisfaction had an average of 2.96 (*SD* = 0.55, Min = 2.00, Max = 3.80). Job engagement observations had an average of 3.30 (*SD* = 0.36, Min = 2.33, Max = 4.00). The standard deviation for all three variables is less than 1/3rd of the mean. According to the study, most respondents were satisfied with the level of skill employment, job training satisfaction and job engagement afforded by the NDTS apprenticeship training programme. The levels of skills employment, job training satisfaction and job engagement are based on the levels of mean score range provided in Table 1. This is adopted from Education Policy Planning and Research Division under Ministry of Education based on 2006 (Ibrahim & Don 2014).

Table 1 Summary Statistics Table for Interval and Ratio Variables.

Variable	*M*	*SD*	Min	Max
Sills Employment	3.17	0.25	2.31	3.73
Job Training Satisfaction	2.96	0.55	2.00	3.80
Job Engagement	3.30	0.36	2.33	4.00

A) Research Question 1**:** Is there a statistically significant difference in the skills employment by the training duration?
Null Hypothesis (H_0): There is not a statistically significant difference in the skills employment by the training duration**.**
Alternative Hypothesis (H_1): There is a statistically significant difference in the skills employment by the training duration.

A two-tailed independent samples *t*-test was conducted to examine whether the mean of skills employment was significantly different between the Less than 6 months and 6 to 12 months categories of training duration. The result of the two-tailed independent samples *t*-test was significant based on an alpha value of 0.05, $t(75) = 2.22$, $p = 0.03$, indicating the null hypothesis can be rejected. This finding suggests the mean of skills employment was significantly different between the less than 6 months and 6 to 12 months categories of training duration. The results are presented in Table 2.

Table 2 Two-Tailed Independent Samples t-Test for Skills Employment by Training Duration.

Variable	Less than 6 months			6 to 12 months			*t*	*p*	*d*
	M	*SD*	*n*	*M*	*SD*	*n*			
Skills Employment	3.23	0.27	41	3.10	0.22	36	2.22	0.03	0.51

Note. N = 77. Degrees of Freedom for the *t*-statistic = 75. *d* represents Cohen's *d.* Lower Limit = 0.01, Mean Difference = 0.13, Upper Limit = 0.24.

B) **Research Question 1:** Is there a statistically significant difference in the job training satisfaction by the training duration?
Null Hypothesis (H_0): There is not a statistically significant difference in the job training satisfaction by the training duration**.**
Alternative Hypothesis (H_1): There is a statistically significant difference in the job training satisfaction by the training duration.

The result of the two-tailed independent samples *t*-test was not significant based on an alpha value of 0.05, $t(75) = -0.68$, $p = 0.50$, indicating the null hypothesis cannot be rejected. This finding suggests the mean of job training satisfaction was not significantly different between the less than 6 months and 6 to 12 months categories of training duration. The results are presented in Table 3.

Table 3 Two-Tailed Independent Samples t-Test for Job Training Satisfaction by Training Duration.

Variable	Less than 6 months			6 to 12 months			*t*	*p*	*d*
	M	*SD*	*n*	*M*	*SD*	*n*			
Job Training Satisfaction	2.92	0.54	41	3.01	0.56	36	-0.68	0.50	0.16

Note. N = 77. Degrees of Freedom for the *t*-statistic = 75. *d* represents Cohen's *d.* Lower Limit = -0.34, Mean Difference =-0.09, Upper Limit = 0.16.

C) **Research Question 1:** Is there a statistically significant difference in the job engagement by the training duration?
Null Hypothesis (H_0): There is not a statistically significant difference in the job engagement by the training duration.
Alternative Hypothesis (H_1): There is a statistically significant difference in the job engagement by the training duration.

The result of the two-tailed independent samples *t*-test was significant based on an alpha value of 0.05, $t(75) = 4.00$, $p < 0.01$, indicating the null hypothesis can be rejected. This finding suggests the mean of job engagement was significantly different between the less than 6 months and 6 to 12 months categories of training duration. The results are presented in Table 4.

Table 4 Two-Tailed Independent Samples t-Test for Job Engagement by Training Duration.

Variable	Less than 6 months			6 to 12 months			*t*	*p*	*d*
	M	*SD*	*n*	*M*	*SD*	*n*			
Job Engagement	3.44	0.35	41	3.14	0.29	36	4.00	< 0.01	0.92

Note. N = 77. Degrees of Freedom for the *t*-statistic = 75. *d* represents Cohen's *d*. Lower Limit = 0.15, Mean Difference = 0.30, Upper Limit = 0.45.

5. Discussion

An empirical study is being conducted to determine whether training duration is associated with differences in skills employment, job training satisfaction and job engagement in the southern region of Malaysia. According to the study's rationale, training duration should be engaging and meaningful for all employees in order to ensure that they are continuously learning, growing, and improving. The length of the training must be determined by considering what is necessary to assist employees in developing a particular knowledge or skill set. Prior to training, it is necessary to determine how much time is required while maintaining a high level of quality. But then there is no point in striving for the optimal training duration. It would be more beneficial to ask employees what should be included to maximize the value of the training program. In other words, it is seeking meaningful information that is presented in an engaging manner without containing any unnecessary information. There is no magical or scientific formula for determining how long a training program should last in order to be most effective. On the basis of the respondents' perception, the categories of duration of training had a significant impact on the degree of core skill employment and job engagement. Indeed, the length of a training program has a direct effect on both the skills of the trainees and the prospect of employment as well as their satisfaction and engagement in the program. It is more difficult for employees to learn from practice-based learning processes (such as skills training) than those that do not, since they must be repeated until they are capable of learning on their own. A tolerable range of pressure speeds up learning in a way that is highly motivating rather than threatening, so that training can be completed in a timely manner. In situations where training duration becomes monotonous and threatening, learning becomes nearly impossible.

The optimal training duration will depend both on the intensity of the session and the degree of commitment and interest of the employee. Employees typically select a training field that can be accomplished in less than six months. According to this survey, most respondents opt for short-term training over long-term training. The shorter, the better. Employees seek to improve their skills in order to achieve a better and more pleasant job without devoting to extensive training sessions. Long training periods can easily cause employees to lose interest and enthusiasm in repeated duties. Many professions can be entered without much training. However, the salary and job satisfaction levels are comparable to those in need of extensive training. It is extremely encouraged to participate in a short-term job training programme in an emerging field.

In a short period of time, an employee may be qualified for a rewarding new position. lucrative employment is made possible through short job training. Regardless of their interests, employees can gain knowledge in a short training programme. Short programmes can assist employees specialise more or learn in new manners. They can also make use of them to get a greater understanding of a different field of skills employment in which they are interested. Whatever the case, short training programmes are a form of freedom that raises employee satisfaction and engagement. Although employees may have knowledge in a particular profession, their organisation is now focused on a sector that includes several other disciplines. Employees will always feel competent in their field of professional growth after a short training programme. Nevertheless, the short training programme can sometimes hinder employees from learning all the required skills.

Conversely, considering the findings, the duration of training had no major impact on employee satisfaction. It involves improving employee attitudes, acquiring knowledge, skill development, and self-efficacy. Likewise, the duration of training is only a general guideline and a measure of skill development and maintenance for long-term transfer as well as to promote greater engagement. Whereas employee satisfaction refers to a degree of contentment with their job that goes beyond their normal responsibilities. While the duration of training is one of the criteria used to make job training more effective, accessible, and convenient in order to extend opportunities, it is important that training effectiveness gives opportunities for employees to learn and increase their skills and knowledge. In addition, the efficacy of the training is essential for creating valuable training programme materials that will increase satisfaction with job in the long run. Greater

employee performance and satisfaction, better team morale, higher return on investment (ROI), and support in retaining and attracting talented employees are all benefits of more effective training.

6. Conclusion

The effectiveness of a skills employment and job engagement can be significantly impacted by the duration of the training programmer. However, the training program's quality and contents have a significant influence on how satisfied employees are at work. Determining an employee's interest in a subject is always extremely important since it will greatly affect the degree of attention, they can provide to a training session. The duration of the training programmer is an element to consider, but the organization must spend time studying the demands of its employees. The importance of the skills, knowledge, and attitude that employees need to develop in order to succeed in their professional careers should be factored into the training strategy's relevance and interest level. With this, the organisation can study, taking in mind the level of participation, the ideal duration of the training package. However, the ideal length of a training programme can be one with a shorter training period and higher production quality. The training objective or purpose can get neglected if the training period is too long. Focusing on quality over quantity will help to guarantee that employees get the most out of it possible and will also boost their spirits, engagement, and satisfaction.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

An evaluation of the relationship between company performance and executive pay of telecommunications companies listed on the Johannesburg stock exchange in South Africa

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Abstract South Africa has experienced difficult trade conditions over recent years. South Africa's real Gross Domestic Product growth rate from 2016 to 2021 has grown at less than 1.5%. This current economic condition makes it difficult for company executives to increase revenue, thereby increasing share price. This study aimed to evaluate the relationship between company performance and executive pay of telecommunications companies listed on the Johannesburg Stock Exchange in South Africa. The study adopted a quantitative research approach to gather and analyse published information from selected Johannesburg Stock Exchange-listed telecommunications companies in South Africa.

Keywords: company performance, executive pay, Johannesburg stock exchange, listed companies, telecommunications companies

1. Introduction

South Africa has experienced difficult trade conditions over recent years. As a result, South Africa's Gross Domestic Product (GDP) growth rate from 2016 to 2021 has grown at less than 1.5% (O'Neill 2021). A lower GDP rate indicates a decrease in the number of consumer spending and thus, a decline in company revenue (Plecher 2019). This current economic condition makes it difficult for company executives to increase revenue, resulting in failure to increase the share price (Picincu 2020).

In South Africa, the compensation of an executive director has generated debate, especially in light of the rising wealth disparity (Seligson 2019). Companies in the telecommunications industry are not new to these contentious executive remuneration arrangements, notwithstanding the data campaign (Seligson 2019). The country's highest paid telecommunications firms are those in South Africa. These conclusions come from a study on employee compensation at the biggest telecoms and information technology (IT) firms in South Africa (Writer 2020). Additionally, South Africa's communications businesses pay their Chief Executive Officers (CEO) 20–70 times more than the typical employee salary, although workers in the industry aren't making too little money either (Writer 2015).

The whole amount of compensation or perks paid to a director must be disclosed in yearly financial statements, according to Section 30 of the South African Companies Act 71 of 2008. Additionally, the King IV Report on corporate governance in South Africa offered suggested guidelines for behaviour for the boards and directors of organisations that are listed on the Johannesburg Stock Exchange (JSE) as well as other organisations, including state-owned businesses. Owners might use pay regulations to align their interests with those of directors by pressuring managers to take decisions that maximise shareholder return (Correia et al 2014).

South Africa's telecommunications sector is expanding at a record rate. As users seek faster service and a better network, a huge number of connected devices are producing more data than ever before (Picincu 2020). World-class (IT) and telecom firms have emerged from South Africa, including MTN, Vodacom, Dimension Data, Naspers, and Altron. However, as there is a high volume of traffic in telecommunications networks, it is difficult for service providers to meet client demand (Picincu 2020). The current issue is that dependable income sources like landline phone services are no longer producing as much cash as they formerly did (Picincu 2020). For telecommunications businesses, there has never been a better moment to invest in new services that can boost their revenue (Skinner 2018).

The South African telecommunications sector faces the challenges of increasing value, revenue, and profits due to reduced data prices (Johannesburg Stock Exchange 2021). Despite these challenges, South African telecommunications sector executives are highly remunerated (Writer 2020). This suggests that there may be irregularities in the remuneration of

executives in the telecommunication sector. The South African multinational mobile telecommunications executives' remuneration appears misaligned with company performance and shareholder interests (Tarrant 2017).

Share price analysis is part of the firm performance in this study; share price was not a performance criterion for the company in earlier studies. Most studies (Bussin and Modau 2015; Scholtz and Smit 2012) only took into account short-term aspects of a company's success, such as revenue and Earnings before Interest, Taxes, Depreciation, and Amortisation (EBITDA), Return on Equity (ROE), Return on Assets (ROA), and EBITDA. This study is unique from other studies as it discusses short-term and medium-term elements such as share price and asset turnover. Similarly, this study focuses on smaller to medium-sized companies and large companies within the telecommunications sector. Zietsman (2020) indicated that companies whose market capitalisation is below R1 billion are categorised as having a small market cap. On the other hand, a medium market capitalisation is between R1 billion and R10 billion, while a large market capitalisation is above R10 billion. Market capitalisation is the total issued shares of a publicly traded entity multiplied by the market price per share (Zietsman, 2020). Table 1 presents the gaps identified in the literature.

Table 1 Different studies and gaps in research.

Author	Country	Finding
Abdullah and Wan (2013)	Malaysia	Executive director compensation is based on a company's size and growth rather than ROA.
Scholtz & Smit (2013)	South Africa	Executive director compensation and the performance indicators of turnover and total assets were shown to be closely related.
Meyer and de Wet (2013)	South Africa	Economic Value Added (EVA), Return on Assets (ROA), and Return on Equity (ROE) performance indicators and executive director compensation were found to be significantly correlated.
Bussin and Modau (2015)	South Africa	The majority of profit-generating businesses base CEO compensation on profit.
Bussin and Modau (2015)	South Africa	The guaranteed cost-to-company of CEOs and financial performance (Du Pont model) have very little to no correlation.
Geiler and Renneboog (2016)	United Kingdom	Their study discovered that firms that pay their executives partly with stock options pay lower dividends and total executive remuneration.
Akram (2018)	German	It was discovered that CEOs play a significant influence in developing and putting into practise company policies, including decisions about their own compensation, investments, and capital-related matters.
Harvey et al. (2020)	United Kingdom	Despite signs of a lax control environment, executive salary transparency is considered as a solution to corporate governance problems.

The remainder of the study is organised as follows after this introduction: first, the literature pertinent to this subject is examined, and the theoretical framework is given. The research technique and a discussion of the findings are next covered, after which the problem statement and the study objectives are reviewed. The study's shortcomings and recommendations for further research were presented at the end.

1.1. Problem statement and objectives of the study

It has become evident that there has been a general discomfort globally regarding the excessive remuneration of executives. In addition, there has been an increasing threat of shareholders rejecting executive pay reports and remuneration policies, as the shareholders are of the view that executive pay is not aligned with company performance. According to (McLeod 2020), the JSE-listed technology companies' annual analysis of the telecoms sector's share price performance reveals that the sector's shares underperformed in 2019. However, it was shown that South Africa had the highest salaries for IT and telecom executives (Writer 2020).

The disclosure of the total remuneration or benefits paid to a director shown on the financial statements as required in Section 30 (5) of the South African Companies Act of 2008 has enabled stakeholders to evaluate, analyse, and criticise what is paid to executives. These mandatory disclosures have resulted in a statistical analysis done by Broadband Trusted Tech, which found that telecommunication executives in South Africa are among the most generously paid (Writer 2020). However, MTN shareholders are not happy with the executive pay policies (Crotty 2021). Therefore, this study determines whether these remunerations align with company performance in the JSE-listed telecommunications companies.

This executive remuneration public discomfort has been enabled by the director's remuneration disclosures as required by King IV (IoDSA 2016). The remuneration committee should issue a remuneration report to explain the company's remuneration philosophy and how it has been implemented (IoDSA 2016). This, in turn, empowers all stakeholders to evaluate and voice their concerns if remuneration policies are not company performance-based (IoDSA 2016).

The study aimed to evaluate the relationship between executive pay and company performance in the JSE-listed telecommunications sector.

The executive compensation is examined in relation to asset turnover, EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortisation), ROA (Return on Asset), and share price. This will make it easier to determine whether there is a general or erratic correlation between executive pay and firm performance in the JSE-listed telecom sector.

1.2. Literature review on aligning executive pay and company performance in the JSE-listed telecommunications sector

Executive compensation has been a sensitive issue for a long time. In Rodgers (1933) the Supreme Court ruled that overall compensation needs to be reasonable in proportion to the value of services rendered. Executive compensation is still debated (Eklund & Stern, 2021).

According to a prior court decision in South Africa, a bonus payment that is unrelated to the value of the services provided is a gift, and no one has the authority to give away corporate property (Cooley, 2009). According to the understanding and interpretation of this court decision, every bonus that is given out should be based on performance, as this adds value to the business. The legal authority to investigate the executive compensation of publicly traded firms was effectively established by this court judgement (Cooley, 2009). In addition to adding to the body of knowledge on director compensation, the court cases paved the way for the King Code to develop a framework for executive salary disclosures (IoDSA 2009). This is one of the reasons why the King III Code and King IV Code were both improved in 2016 (IoDSA 2016).

Eklund and Stern (2021) encourage JSE-listed corporations to adopt just CEO pay plans and better align their pay practises with the King IV standards. The rules advise firms listed on the JSE to reveal their annual report compensation policy and how it is being implemented, as well as specifics on the pay components assigned to each executive (Eklund & Stern, 2021). The implementation of the compensation strategy and the establishment and administration of compensation plans that support the company's value generation should be governed by the remuneration policy (Eklund & Stern, 2021).

This is so because CEO compensation is frequently in the news during times of global crisis. Bebchuk et al. (2010) discovered that the top-five executive teams at Bear Stearns and Lehman Brothers cashed out significant amounts of performance-based compensation during the 2008 financial crisis. They had the opportunity to cash out substantial amounts of bonus pay from 2000 to 2008 prior to the collapse of the companies, and they also made sizable profits through the sale of shares (Bebchuk et al 2010). These cash bonuses and payouts were sizable enough to make up for the losses CEOs endured following the collapse of the 2008 financial crisis.

Ten years after the financial crisis, the coronavirus disease of 2019 (COVID-19), which led to firms withholding dividends, caused another global crisis. As a result, the South African stock markets crashed, wiping off billions of Rands in market value (Buthelezi, 2020). As share prices fell and their wealth shrank, shareholders felt the pain as CEOs continued to get bonuses. So that the pain of the crisis is not only felt by the shareholders, boards of directors are urged to reconsider executive compensation (Buthelezi, 2020).

Additionally, the COVID-19 pandemic has increased public awareness of executive compensation (Mans-Kemp, 2021). If executive remuneration is not clearly connected to long-term financial and non-financial performance measures, stakeholders are criticising JSE-listed companies more (Mans-Kemp, 2021). Therefore, in order to avert future crises, legislators and regulators must take into account both the future realignment of CEO pay incentives and the role that executive pay incentives played in the financial crisis. The executive remuneration system has been the subject of increased discussion since COVID-19 (Eklund & Stern, 2021). The King IV guidelines recommend that JSE-listed companies disclose their annual report remuneration policy and implementation, as well as specifics of pay components allocated to the individual executive, even though doing so is encouraged and will help JSE-listed companies better align their pay practises with the King IV guidelines (Mans-Kemp, 2021; Eklund & Stern, 2021).

2. Research Methodology

This study used a quantitative methodology to collect data in order to tackle its research issue. The population of this study consists of South African telecoms businesses that are listed on the JSE. Given that telecoms is the sector driving revenue from the digital transformation, the telecommunications sector was chosen because of the firms' predicted sales growth, which may be used as a proxy for company size in relation to total executive director salary.

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2.1. Sample frame

The study employed a census or total sampling method in selecting all JSE-listed companies in the telecommunications sector in South Africa. This means the financial statements of the six JSE-listed telecommunication companies under study were analysed (Johannesburg Stock Exchange 2021). This sampling method is consistent with what (Kirsten and Du Toit 2018) applied in their study of the consumer goods and service sector regarding the relationship between remuneration and financial performance of JSE-listed companies. This study was conducted in 2021 and the sample period includes reporting periods from 2016 to 2020; this resulted in studying the results of the six companies, each with five years' worth of published annual reports.

2.2. Data collection

The Identification of Requirements for Enterprise Social Software (IRESS 2016) was used to acquire company financial information. According to (IRESS 2016), Africa's top supplier of financial data feeds and analysis tools. Two of South Africa's leading providers of financial data, McGregor BFA and I-Net Bridge came together to establish IRESS. They are responsible for publishing annual financial statements of all companies listed in any stock market. These financial statements are readily

available to the public (IRESS 2016), and permission is not required to access them. Thus, anyone can download these financials and make their own analysis. However, this study followed the right ethical considerations processes to obtain the financial statements from IRESS.

2.3. Data analysis

To see if there is a correlation, the compensation of directors was regressed over various corporate performance measures. According to Kendall (1955), a statistical indicator of the link between two variables is a correlation. According to Kendall (1955), the measure performs best when employed with variables that are connected linearly.

Indicating how strongly two variables are related to one another is a number called the correlation coefficient. The coefficient, which ranges from -1 to 1, can be understood as follows: a perfect positive correlation (1) shows that the variables tend to move in the same direction (i.e., when one variable increases, the other variable also increases), whereas no correlation (zero) indicates that the variables do not have a relationship with one another (Kendall, 1955). A complete negative correlation (-1), on the other hand, shows that the variables tend to move in opposite directions (when one variable rises, the other falls). The correlation coefficient measures how comparable two sets of data that pertain to the same group of objects are to one another (Kendall, 1955).

The correlation coefficient between the data from the sampled companies' annual financial statements and other sources was used to analyse executive pay and company performance from 2014 to 2020:

3. Results and discussion

This section presents the results and discussion of the study.

3.1. Data extraction

Table 2 below show's an analysis of executive pay and company performance from 2014 to 2020 of the six JSE-listed telecommunications companies. This represents data and analysis extracted from Company A's published financial statements from 2014 to 2020.

Table 2 Extracted data of Company A.

Year	Share Price (year-end)	Executive Remuneration	EBITDA	Return on Assets	Asset Turnover
2014	225	9 975 000	37 955 000	0,17	4,07
2015	190	9 947 000	33 436 000	0,15	1,82
2016	151	6 396 000	23 596 000	0,10	1,98
2017	135	7 323 944	29 064 000	0,99	2,09
2018	100	10 525 590	30 114 000	0,97	2,42
2019	90	12 174 736	25 689 000	0,05	1,20
2020	90	9 775 140	27 386 000	-0,04	1,59

Extract of financial statements of company a from 2014-2020.

Table 2 shows that in the published financial statements of Company A, executive remuneration has increased from R9 million to R12 million (from 2014 until 2019) and hereafter decreased in 2020 to R9 million. In contrast, share price decreased from R2,25 to R0,90, EBITDA decreased from R37 million to R27 million, and ROA decreased from 17% to -4%. This decrease signifies that the revenue is not increasing substantively to cover the company's expenditure. It also means that the company's financial performance is decreasing, and the expectation is that it should negatively affect executive pay, but this is not the case at Company A.

Table 3 presents data extracted from the published financial statements of Company B from 2014-2020.

Table 3 shows that in the published financial statements of Company B, 2020 executive remuneration has increased from R7 million to R19 million (from 2014 until 2020). In contrast, share price increased from R2.1 to R4.85, EBITDA increased from R17 million to R178 million, and ROA increased from 4% to 9%. However, asset turnover decreased from 76% to 48%. This implies that company B's financial performance has continuously improved; thus, it is expected that the executives will be rewarded for the value they have added to the company.

Extract of financial statements of company B from 2014-2020.

Table 4 represents data extracted from Company C's published financial statements from 2014-2020.

Table 4 shows that in the published financial statements of Company C, the 2020 executive remuneration has increased from R149 million to R266 million (from 2014 until 2020). In contrast, share price decreased from R221 to R61, EBITDA decreased from R73 million to R63 million, and ROA decreased from 23% to 12%. However, asset turnover increased from 0,9 to 0.76. The cause of this poor performance is that revenue increases are not substantive to cover the increasing expenses of Company C. In turn, this is expected to impact the director's remuneration negatively.

Table 3 Extracted data of Company B.

Year	Share Price	Executive Remuneration	EBITDA	Return on Assets	Asset Turnover
2014	85	7 491 091	17 964 000	0,04	0,76
2015	210	5 491 576	15 933 000	0,04	0,75
2016	515	6 115 214	33 000 000	0,07	0,74
2017	850	6 267 264	53 000 000	0,08	0,77
2018	870	11 290 087	129 000 000	0,10	0,50
2019	790	15 514 570	134 000 000	0,08	0,43
2020	485	19 663 667	178 000 000	0,09	0,48

Table 4 Company C extracted data.

Year	Share Price in cents (year-end)	Executive Remuneration R'000	EBITDA R'000	Return on Assets	Asset Turnover
2014	22 141	149 513	73 191	0,23	0,90
2 015	13 289	177 230	59125	0,11	0,67
2016	12 617	205 176	40 751	-0,02	0,78
2017	13 660	197 630	46 955	0,02	0,73
2018	8 900	242 426	49 056	0,08	0,73
2019	8 249	292 220	64 821	0,08	0,67
2020	6 112	266 948	63 311	0,12	0,76

Extract of financial statements of company C from 2014-2020.

Table 5 shows that in the published financial statements of Company D, the 2019 executive remuneration has slightly increased from R1,4 million to R1,7 million (from 2014 until 2019) the table is up until 2019 as financial statements of Company D were not yet published at the time the study was conducted. In contrast, the company's performance decreased; thus, the share price decreased from R0,9 to R0,75, EBIDTA slightly increased from R7,3 million to R7,5 million, and ROA decreased from 12% to 6%. However, asset turnover improved from 4,5 to 5,6. The decrease results from the revenue not increasing substantively to cover the increasing expenses of Company D. Thus, it is expected that the executive remuneration will be negatively affected due to the company's poor performance.

Table 5 Company D extracted data.

Year	Share Price	Executive Remuneration	EBITDA	Return on Assets	Asset Turnover
2014	90	1 425 297	7 304 298	0,12	4,5764
2015	138	1 463 396	7 082 668	0,13	4,4915
2016	120	1 463 396	6 675 955	0,08	4,0635
2017	75	1 474 401	12 131 309	0,08	4,0016
2018	89	1 354 069	12 627 720	0,13	4,8023
2019	75	1 720 000	7 545 289	0,06	5,6999

Extract of financial statements of company D from 2014-2019.

Table 6 represents data extracted from the published financial statements of Company E from 2014-2020.

Table 6 shows that in the published financial statements of Company E, the 2020 executive remuneration of Company E has increased from R20 million to R76 million (from 2014 until 2020). In contrast, the share price decreased from R129 to R114, and EBITDA increased from R27 million to R37 million. However, ROA decreased from 36% to 12%, and asset turnover decreased from 199% to 64. This is expected to affect executive remuneration negatively. However, this may not be the case as executive remuneration has continuously improved (see Table 6), which implies that executives will be generously rewarded despite the company's financial performance deteriorating.

Table 6 Company E extracted data.

Year	Share Price	Executive Remuneration	EBITDA R'000	Return on Assets	Asset Turnover
2014	129,99	20 522 698	27 314	0,36	1,99
2015	132,69	17 180 116	26 905	0,27	1,68
2016	160,53	30 257 225	29 808	0,25	1,57
2017	152,00	33 013 393	31 085	0,25	1,56
2018	153,07	88 713 781	34 241	0,12	0,66
2019	111,43	43 446 398	35 161	0,10	0,59
2020	114,13	76 473 765	37 610	0,12	0,64

Extract of financial statements of Company E from 2014-2020.

Table 7 represents data extracted from the published statements of Company F from 2014 to 2021.

Table 7 Company F extracted data.

Year	Share Price	Executive Remuneration	EBITDA R million	Return on Assets	Asset Turnover
2014	33,48	17 723 944	7 798	0,13	1,03
2015	78,81	39 750 006	8 978	0,11	1,06
2016	57,57	23 967 494	8 776	0,07	1,11
2017	75.03	39 389 843	10 875	0,11	1,20
2018	52,94	25 342 212	10 422	0,08	1,09
2019	72,92	22 709 690	10 581	0,07	1,10
2020	20,53	27 247 132	9 534	0,01	0,96
2021	42,36	48 771 970	11 703	0,05	0,90

Source: Extract of financial statements of Company F from 2014-2020.

Table 7 shows that in the published financial statements of Company F. Company F published its 2021 financial statement hence, the inclusion in this study. The 2020 executive remuneration has increased from R17 million to R48 million (from 2014 to 2021). In contrast, the share price increased from R33 to R42, and EBITDA increased from R7 million to R11 million. However, ROA decreased from 13% to 5%, and asset turnover decreased from 103% to 90%. Thus, it is expected that this will positively affect executive remuneration.

3.2 Relationship between company performance and executive remuneration

To determine whether there is a relationship between the share price of the telecoms firm and the total executive director's compensation, the Pearson correlation test formula was utilised. According to (Schober et al. 2018) the correlation analysis aids in determining the relationship between variables. as two variables are correlated, the magnitude of one variable changes as the other changes. According to (Schober et al 2018), they either travel in the same direction (positive correlation) or the opposite direction. A Pearson product-moment correlation is a common way to define a linear relationship between two continuous variables when the term "correlation" is used.

The scale for correlation coefficients runs from -1 to +1, with 0 denoting that there is no relationship between the two variables. As the coefficient becomes closer to an absolute value of 1, the relationship becomes stronger when it resembles a straight line (Pearson correlation) or a continuously rising or falling curve (Spearman correlation) (Good 2009). Tables 8 through 13 below will give the findings from the examined telecoms firms so that you can see if there is a correlation between business performance and executive pay.

Table 8 Company A's executive remuneration correlation.

	Share Price	Executive Remuneration	EBITDA	Return on Assets	Asset Turnover
Share Price		-0,24	0,74	-0,16	0,72
EBITDA	0,74	0,26	1,00		
Return on Assets	-0,16	-0,20	0,09	1,00	
Asset Turnover	0,72	-0,09	0,78	0,16	1,00

Source: Author's own compilation

Table 8 above shows that there is no relation between share price and executive remuneration (-0.24), a weak correlation between EBITDA and executive remuneration (0.26), no correlation between ROA and executive remuneration (-0.20), and no correlation between asset turnover and executive remuneration (-0.09). Based on the above, there is evidence that the executive remuneration of Company A is not performance-based in relation to the share price. This is in line with a prior study by (Bussin and Modau 2015) that found no connection between executive remuneration and firm performance. (Abdullah and Wan 2013) further affirm that the size and development of a company, rather than financial success measures, are the only factors that affect senior directors' compensation.

Table 9 Company B's executive remuneration correlation.

	Share Price	Executive Remuneration	EBITDA	Return on Assets	Asset Turnover
Share Price	0,28	0,28			
EBITDA	0,54	0,94			
Return on Assets	0,84	0,60	0,81		
Asset Turnover	-0,49	-0,90	-0,93	-0,64	1,00

Source: Author's own compilation.

Table 9 above shows a weak relation as shown by the correlation value of (0.28) between share price and executive remuneration, a strong relationship by the correlation value of (0.94) between EBITDA and executive remuneration, a strong

relationship as shown by the correlation value of (0.60) between ROA and executive remuneration, an inverse relationship as shown by the correlation value (-0.90) between asset turnover and executive remuneration. Therefore, based on the above results, the executive remuneration of Company B is performance-based in relation to share price, EBITDA, and ROA. The only exception was asset turnover, as no relationship exists.

Table 10 Company C's executive remuneration correlation.

	Share Price	Executive Remuneration	EBITDA	Return on Assets	Asset Turnover
Share Price	-0,87	-0,87			
EBITDA	0,48	-0,15	1		
Return on Assets	0,66	-0,42	0,9	1	
Asset Turnover	0,84	-0,63	0,28	0,52	1

Source: Author's own compilation.

Table 10 shows an inverse strong relation (-0,87) between share price and executive remuneration of Company C, no relationship by the correlation value of (-0,15) between EBITDA and executive remuneration, no relationship as shown by the correlation value of (-0.42) between ROA and executive remuneration, and an inverse relationship as shown by the correlation value (-0, 63) between asset turnover and executive remuneration. Moreover, it is evident from the above that the executive remuneration of Company C is also not performance-based in relation to share price, EBITDA, ROA, and asset turnover as no relationship exists between these performance indicators and executive remuneration.

Table 11 Company D's executive remuneration correlation.

	Share Price	Executive Remuneration	EBITDA	Return on Assets	Asset Turnover
Share Price	-0,30	-0,30			
EBITDA	-0,53	-0,39	1,00		
Return on Assets	0,39	-0,79	0,21	1,00	
Asset Turnover	-0,37	0,66	-0,15	-0,20	1

Source: Author's own compilation

Table 11 above shows an inverse weak relation as shown by the correlation value of (-0,30), between share price and executive remuneration of Company D, an inverse relationship by the correlation value of (-0,39) between EBITDA and executive remuneration, a strong inverse relationship as shown by the correlation value of (-0, 79) between ROA and executive remuneration have, and a positive relationship as shown by the correlation value (0, 66) between asset turnover and executive remuneration. Moreover, it is evident from the above that the executive remuneration of Company D is not performance-based in relation to share price, EBITDA, ROA, and asset turnover as no relationship exists between these performance indicators and executive remuneration.

Table 12 Company E's executive remuneration correlation.

	Share Price	Executive Remuneration	EBITDA	Return on Assets	Asset Turnover
Share Price	1	0,15			
EBITDA	-0,42	0,74	1,00		
Return on Assets	0,36	-0,85	-0,88	1,00	
Asset Turnover	0,41	-0,87	-0,90	0,99	1

Source: Author's own compilation.

Table 12 above shows that there is a weak relation as shown by the correlation value of (0,15) between share price and executive remuneration of Company E, a strong relationship by the correlation value of (0,74) between EBITDA and executive remuneration, a strong inverse relationship as shown by the correlation value of (-0, 85) between ROA and executive remuneration, and a strong inverse relationship as shown by the correlation value (-0, 87) between asset turnover and executive remuneration. This suggests that the executive remuneration of Company E is performance-based in relation to share price and EBITDA. However, there appears to be a strong inverse relationship between executive remuneration, ROA, and asset turnover. Executive remuneration increases continuously, but ROA and asset turnover continuously decrease. This shows that asset turnover and ROA have no relationship with executive remuneration. (Callan and Thomas 2014) attest to this as they indicated that executive pay remained relatively high regardless of the company's performance.

Table 13 above shows that there is a correlation (0, 26) between share price and executive remuneration of Company F, a strong relationship by the correlation value of (0, 63) between EBITDA and executive remuneration, a weak inverse relationship as shown by the correlation value of (-0, 10) between ROA and executive remuneration, and an inverse relationship as shown by the correlation value (-0, 24) between asset turnover and executive remuneration. The above results show that

Company F's executive remuneration is performance-based as there is a correlation between share price and EBITDA in relation to executive remuneration.

Table 13 Company F's executive remuneration correlation.

	Share Price	Executive Remuneration	EBITDA	Return on Assets	Asset Turnover
Share Price					
Executive Remuneration	0,26	0,26			
EBITDA	0,21	0,63	1		
Return on Assets	0,52	-0,1	-0,33	1	
Asset Turnover	0,72	-0,24	-0,06	0,58	1

Source: Author's own compilation.

4. Conclusions

The King IV remuneration guidance and responsibility states that the governing body is responsible for the overall sight of the remuneration policies. It actively implements this oversight by the delegation of its powers to a remuneration committee. According to the composition and structure of the committee, the majority of the members of the compensation committee must be non-executive and independent. The committee's chairperson should be a non-executive director who is also independent. The board chair shouldn't chair the committee, but she or he is allowed to be a member.
The governing body should put into place remuneration rules that are equitable, responsible, and transparent for the organization with the help of the remuneration committee. The following objectives should be addressed by every organization's remuneration strategy, according to King IV's guidelines for remuneration policy:

- Use of remuneration performance appraisals that support positive outcomes to the economic and social environment that a company operates in, as well as all other capitals that organisations employ or affect.
- Ensuring that executive compensation is fair and responsible in relation to the overall employee compensation in the organisation.
- The implementation of shareholders' voting regarding remuneration policies and executive pay and a report on how matters raised during the voting for approval of remuneration policies are being addressed and attended to, which should also be published on the financial statements.

In light of this, the researchers discovered that CEO compensation was reported on the annual financial statements for every company. Base salary, bonuses, variable compensation, including short- and long-term incentives, payments on termination of employment or office, retention and restraint payments, financial and non-financial benefits, and share options were among the remuneration's components. However, it appears that for some businesses, CEO compensation is correlated with financial performance measures like share price and EBITDA. This demonstrates that the executive pay of the telecommunications sector, which is listed on the JSE, is not significantly correlated with the company's financial performance. The financial performance of the company and CEO compensation have a poor correlation. This offers the chance to make sure that executive pay performance agreements are based in large part on financial performance indicators by board compensation committees.

The study found that company performance has a significant relationship with executive remuneration. However, for some Johannesburg Stock Exchange-listed telecommunication companies, their executive remuneration was not aligned with their company performance.

The study contributes to the existing knowledge of telecommunications companies and executive pay. Practical implications and recommendations for future studies were provided.

5. Limitations and Suggestions for Future Research

The JSE telecoms listed businesses were the main subject of this investigation. To further understand the connection between CEO pay and business performance, research in different sectors should be done. In addition, company performance was only confined to financial performance indicators, which are standard accounting calculations, and non-financial indicators such as competitive position and market conditions. Strategic goal achievements were not considered as they are not relevant in today's competitive market environment.

There were no interviews or questionnaires conducted with the executive directors of the selected telecommunication JSE-listed companies. Getting a meeting with these directors would be almost impossible due to their busy schedules, making the study never-ending. In addition, no interviews were conducted with the remuneration committees of the subject companies as some of the committee members were working outside South Africa. Moreover, there were no individual performance contracts between the executives and the subject companies as this was private and personal information that

companies were unwilling to share on their systems. It is suggested that future research should focus on analysing the relationship.

Ethical considerations

Not applicable.

Declaration of interest

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Navigating the Present and Future: Contemporary Issues and Challenges in Management

An empirical study of television commercials of FMCG among rural consumers of Odisha

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Abstract The purpose of this desktop study was to examine the efficacy of e-government technologies and the obstacles to their efficient use. The researchers assessed how well e-government affected service delivery, how it might result in cost savings and the advantages and difficulties of adopting and using it. The study also looked at the advantages of using e-government to investigate this. E-efficiency in providing services was demonstrated by greater citizen involvement and interaction with the local government, increased openness and accountability, and cost savings. The study revealed that the use of e-government improves traditional methods of conducting business and providing services while also enabling access to information and services online, reducing the need for rework, increasing transparency and accountability, and encouraging citizen participation. The ineffective use of e-government in local authorities was hampered by a lack of funding, inadequate enabling infrastructure, low ICT literacy levels, and the digital divide, among other factors. It was evidenced in this study, that e-procurement leads to cost savings, thus it affects cost reduction strategies positively. Thus, e-procurement reduces inventory costs.

Keywords: E-procurement, cost reduction, service delivery, local government

1. Introduction

One of the most inclusive and all-encompassing terms is marketing. It is regarded as philosophy, information, and direction for achieving company objectives. Marketing has a particular function in the administration of companies and industries. The conventional marketing system has been replaced by numerous innovative tools and strategies (Cotte and 2004). Modern strategies must be taken into consideration to accomplish fundamental goals. Consumer happiness is crucial and can support a company's continued operation (Rajkumar and Kannan 2014). The company enterprise should conduct its operations in a way that respects and pleases its customers. Advertising, distribution, and selling are all part of the creative marketing practices sector (Rayenda et al 2018).

India is an agrarian country where "nearly 75% of the total population lives in rural areas". Rural area marketing compromises approximately 30 percent of our country's income. The marketing of various products identifies and serves the needs of consumers in rural areas. Modern facilities have not yet reached too few of the villages located in remote areas. Rural consumers are currently considered an untapped opportunity for marketing sciences.

The primary income source is agriculture or allied for rural people. Many companies hesitated to enter the rural market because of its unstructured nature. In rural areas, the poor purchasing power of people, fragile demand patterns, and seasonal nature make marketing more challenging (Chandok 2005). Looking at the changing scenario a day, the government has many initiatives of regulated markets to facilitate proper marketing of farm produce in rural areas (Nicosia 1966). Rural marketing is a two–way process where the supply of goods occurs from rural to urban and vice versa for manufacturing and consumption purposes Beatty and Talpade (1994).

Various products under fast-moving mainly generate their awareness through advertisements. Consumer goods mainly generate awareness through advertisements such as soaps, detergents, cosmetics, agricultural inputs, and consumer durables such as two-wheelers, television sets, and electrical appliances. The urban-to-rural supply of materials occurs (Erto and Vanacore 2002). Agricultural products are mainly rural to urban flows, but many rural products are sold within rural areas for consumption.

2. Background

Fast-moving consumer goods are also commonly known in short as FMCG products. These goods are sold quickly at low cost because of their high consumer demand. FMCG products, such as fruits, vegetables, meat, and dairy, have a short shelf life and are perishable (Atkin 1978). The turnover rates of prepacked goods are high. Different holidays and seasons greatly influence the sales ratio. Hindustan Unilever Limited, Godrej Consumer Product Limited, Dabur India Limited, Procter

and Gamble, Colgate-Palmolive India Hygiene and Health Care Limited, Nestle India Limited, Marico, Niram Ltd., Britannia India Limited, and Cadbury India Limited are some of the well-known FMCG companies that are covered in this study.

Television commercials are a popular instrument in the marketing communication process to sell or promote a new commodity or service. A marketer keeps a close eye on the particular deliverable message. Any product may be promoted through various channels, including radio, television, web, print, in-store, novelties, and celebrity endorsements. The phrase "advanced advertising" describes a new data-driven advertising tactic that relies heavily on tools and data.

3 Literature review

Ravi (2011) stated that T.V. commercials have incredible potential as a powerful device for showcasing services and products in industrialized and nonindustrialized countries. Due to the increased cost of commercials in T.V., it is treated as an expenditure rather than an investment in developing countries. The demeanor toward promoting is changing quickly with enhancement and dynamism. It is seen that advertising according to product expectations and opportunities has become an operational component. Hence, advertising is accepted as a supportive service for wider growth.

Chette et al (2018), in the article titled "Impact of Socioeconomic Factors on Purchase Decision of Health Insurance: An Analysis", analyzed the influence of socioeconomic factors on choosing a health insurance company. The study found that age, gender, income, and marital status have an impact; on the other hand, sum assured, premium, occupation, H.I. cover, and H.I. type have no relationship in selecting health insurance companies. Either public or private. These factors were generally taken, but comparisons between rural and urban consumers and products offered by public and private insurers were not explained.

Dash (2013), in the article "A Buyer vs. Seller Perspective of 7Ps in Post Liberalization Indian Life Insurance Sector", researched the perspectives of many stakeholders, including clients, agents, and executives of both public and private life insurance. He analyzed consumer purchasing patterns for marketing and servicing insurance policies using the 7Ps of services marketing. A total of 207 life insurance executives and 405 life insurance policyholders were questioned about this. It was concluded that "location" and "people's behavior" were strongly connected with insurance policy purchases by clients.

Nithya (2013) studied the purpose of defeating their fiercest rivals and generating profit; they studied the fast-moving consumer goods sector and sought to comprehend television advertising methods. The majority of FMCG companies want to gain a sizable market share. You must engage them and persuade them to buy if you want it to happen. Numerous goods are produced each day utilizing original and inventive ideas. However, it is important to tell the public about the new products adequately. It can only be accomplished through advertising. Advertising by itself will not substantially impact a consumer's thinking. Through innovative forms of advertising that incorporate smart technology and a sound plan, consumers are led to believe something strongly and persistently.

Sivanesan (2014) identified that "advertisements greatly impact the buying behavior of rural and urban customers". It was observed that before purchasing a product, customers make a concrete decision after collecting relevant product information. Hence, advertisements are helpful in spreading knowledge among consumers. It was found that social and personal factors more influence consumers' buying behavior. It was observed that other people's views are another factor influencing consumers to purchase any item. As stated, "advertisement plays a crucial role in the buying behavior of rural and urban consumers in the Kanyakumari district of Tamil Nadu".

Priya and Bhatia (2014) studied "unconventional media and its impact on the buying behavior of rural consumers". They also studied "the challenges of communication in rural Uttar Pradesh and highlighted the importance of nonconventional media in rural markets". It is also seen that the launch of new products or relaunching old products in unconventional media are effective through advertisements. In the case of FMCG products, hype can propel sales volume if a good distribution system backs a strong advertising campaign. The paper elucidates "the shortcomings of conventional media by highlighting some national advertisement campaigns which corporate giants carried out to communicate with the target audience in rural markets". Marketers must understand rural areas' social, cultural, demographic, and economic challenges for effective communication and promotion.

Maheshwari and Brindha (2015) stated that advertising is a tool that helps disseminate product information and create awareness. Television advertisements have a massive impact on marketing fast-moving consumer goods (FMCG). The significant yearly reports were addressed, and some encouraging reviews were gathered. Marketing professionals highlighted the importance of T.V. commercials compared to other media advertisements.

4. Problem statement

The FMCG industry is the fourth-largest sector of the Indian economy. Therefore, FMCG marketers should learn why their sales decline in rural markets. The most crucial factor in boosting sales is advertising. By analyzing the following crucial scenarios, this study seeks to determine the kind of advertisements and techniques rural customers expect and the types of marketing that will be successful for FMCG in the rural market.

1) The types of commercials that are accessible for the rural FMCG market,

2) Types of T.V. commercials and strategies to be used for successful marketing in rural areas in Odisha,
3) The information content expected in FMCG commercials by rural consumers.

There was a requirement for the FMCG study. The Indian economy depends heavily on rural markets, and to boost the country's economic standing, marketers must concentrate their marketing efforts there. In rural areas, FMCGs sell swiftly and with little risk. Therefore, it offers a fantastic opportunity to boost the nation's economic standing.

5. Objectives of the study

1. To understand how T.V. commercials for FMCG influence rural consumers in remote markets.
2. To comprehend what kinds of T.V. advertising is effective at increasing FMCG sales in rural markets.
3. To learn what kind of information rural consumers want about FMCG products.

6. Methodology and coverage

In this study, primary data were gathered through questionnaires and scheduled interviews. Secondary information was gathered from various websites, periodicals, and books. Using a convenient sampling technique, 275 consumers were selected in different rural areas of Odisha with distribution in various districts and demographics from July to October 2022. Simple tables and graphs with the Garrett ranking technique were used to analyze the primary data. The chi-square hypothesis test was used for nonparametric data analysis, and ANOVA was used to test the effect of independent variables on dependent variables.

The current study aims to find the awareness and likelihood of various advertisements for particular FMCGs in rural markets. Only a few tactics and advertising strategies are effective based on several ways to advertise products to consumers. The study was carried out in rural Odisha. The major goal of this study was to determine the techniques and components of advertising that would increase FMCG sales in rural markets.

The findings and conclusions of this study can help the FMCG industry understand the value of FMCG advertising and the expectations of rural consumers for FMCG products. Additionally, through their marketing, FMCG companies can comprehend the issues that rural consumers experience. Therefore, FMCG marketers can correct their errors to meet the needs of rural consumers.

7. Findings and interpretations

Following this study, it can be seen from Table 1 that there were 275 respondents, 68% of whom were male, 34% of whom were in the 25–35 age range, 35% of whom had only completed elementary school, 31% of whom were employed in agriculture and farming, and 234 of whom had heard of FMCG through advertisements. Among them, 41% are aware of FMCG through radio advertisements, and 79% enjoy advertisements due to the usage of local lingo.

Table 1 Demographic details of the consumer.

Question Type	Attributes	No of responses	Percentage (%)
Gender	Male	187	68
	Female	88	32
Age	Below 25 Years	93	34
	26 - 35 Years	55	20
	36 - 45 Years	50	18
	Above 45 Years	77	28
Education qualification	Under matric	96	35
	Matric pass	44	16
	Under graduate	60	22
	Post graduate	38	14
	Professional	37	13
Occupation	Farmer	85	31
	Pvt Job	77	28
	Govt. Job	22	8
	Unemployed	58	21
	Others	33	12

Of the 275 respondents, 72% are familiar with P&G, 69% are familiar with HUL FMCG products, and 87% regularly buy personal care items. All respondents anticipate that FMCG commercials will accurately represent FMCG products, their prices and locations, their manufacture dates and expiration dates, their directions for use, any potential adverse effects, their ingredients, terms and conditions, etc. Approximately 65% of respondents reported having issues due to the lack of product information in the T.V. commercials.

The factors rural customers anticipate from FMCG Tv commercials are displayed in the Table 2. With a mean score of 56.771 and a total score of 15612, clarity in commercials came out at the top. Conclusion: Ads that are clear and easy to understand are chosen above those that are visually appealing.

Table 2 Preference distribution of the consumers.

Question Type	Attributes	No of responses	Percentage (%)
Sources of awareness	Advertisement	152	65
	WoM	23	10
	Shop owner	30	13
	Friends and relatives	12	5
	Sales representative	5	2
	Others	12	5
Recall FMCG companies	HUL	187	68
	P and G	198	72
	Dabur India Limited	113	37
	Godrej	55	20
	Hygiene and Healthcare Ltd	50	18
	Colgate - Palmolive	177	58
	Nestle India Limited	96	35
	Marico	77	28
	Nirma Limited	60	22
	Britannia India Limited	189	69
	Cadbury India Limited		23
Types of advertisement seen	Print media	50	18
	TV	113	41
	Radio	38	14
	Outdoor advertisement	27	10
	In store advertisements	28	10
	Push Messages	11	4
	Others	8	3
Factors likes in the advertisements	Clarity of advertisement	41	15
	Real fact in advertisement	107	39
	Regional language	126	46
	Celebrity involvement	11	4
	Duration of advertisement	5	2
Rural consumers expectations	True statement	184	67
	Product price	198	72
	Expiry details	189	69
	Usuage of product	151	55
	Side effects	60	22
	Disclosure of T and C	77	28
	Content of the product	33	12
	Others	11	4
Problems faced due to advertisement	Untrue statement	74	27
	Production and Expiry details	14	5
	Clarity on pricing	58	21
	Terms and conditions	33	12
	Promotional details	63	28
	Others	19	7

Using the Garrette Ranking Technique to comprehend the variables involved in FMCG commercials (Table 3).

Table 3: Ranking of various factors.

Factors	Total score	Mean score	Rank
Type of advertisement	14912	45.64	5
Content of advertisement	15568	56.78	2
Details of product	15148	47.18	4
Slogan and Dialogs	14288	32.16	6
Strategies for attractive advertisement	13009	13.57	7
Clarity in advertisement	15612	59.33	1
Level of true statements	15292	53.28	3

Testing of Hypothesis Chi-Square Test ($\chi 2$)

H1: There is no correlation between the buyer's age and the sort of FMCG they frequently purchase.
H2: There is no correlation between gender and the frequently bought FMCG type.
H3: There is no correlation between educational background and the type of FMCG that is frequently bought.
H4: There is no connection between occupation and the type of FMCG that is frequently bought.

Since 16.919 is more than the calculated value, the null hypothesis H01 is significant at the 5% significance level. Therefore, the null hypothesis is accepted, and the estimated value of 7.815 is exceeded by 7.815 according to H02 at a 5% significance level (Table 4).

Table 4 Hypothesis significance test.

Hypothesis	Calculated value	Table value	D.F.	Level of Significance
H1	5.0108	16.919	9	Significant
H2	0.3375	7.815	3	Significant
H3	8.1916	19.681	11	Significant
H4	11.758	19.681	11	Significant

Source: Primary Data.

The ANOVA table indicated the numerous insignificant sources of awareness because the estimated F-ratio of 1.1402 is less than the table values of 3.83 between rows, and 2.255 is less than the table values of 3.88 (Table 5).

Table 5 Distribution of ANOVA data.

Sources	Sum of Square	d.f	Mean of Sums	F Distribution	P value
rows	4633.72	3	1544.65	1.1402	3.83
coloums	9143.56	3	3055.33	2.255	3.88
r x c	12203.77	9	1359.81		
Total	25998.69	15			

8. Conclusions

The success of marketing also depends on T.V. commercials. The FMCG sales ratio also relies upon television commercials. The study attempted to determine the kind of promotion or T.V. commercials that help FMCG organizations build a better sales environment. Additionally, the problems the rural consumers face and the subtitles they expect in the FMCG TV Commercials. Hence, attempts were made by FMCG companies in advertisements to retain and motivate rural consumers. This will increase sales, which will increase turnover.

Ethical considerations

Not applicable.

Declaration of interest

The authors declare no conflicts of interest.

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