

भारत दूरसंचार



# JOURNAL OF COMMUNICATIONS FINANCE

Volume I, Issue I  
**2024**

National Communications Academy- Finance (NCA-F)  
Near Metro Pillar No. 152, Opposite SSB,  
Mehrauli Gurugram Road, New Delhi-110047

*Journal of  
Communications  
Finance*

**NCA-F**

**2024**



## About National Communications Academy- Finance

The National Communications Academy–Finance (NCA-F), formerly known as NICF, is a premier Central Training Institute (CTI) under the Department of Telecommunications (DoT), Ministry of Communications (MoC). Located on a 53-acre campus in Delhi NCR, it is equipped with modern infrastructure, including a 220-room hostel, sports facilities, computer labs, and a well-stocked library. NCA-F trained 2,682 officers last year, leading to 28,504 training man-days. As part of Mission Karmayogi, it has published 42 courses on the iGOT platform, with over 130,000 learners enrolling and more than 112,000 completing the courses.

NCA-F is the designated cadre training institute for the Indian Posts and Telecommunications Accounts and Finance Service (IP&TAFS) and provides training for civil servants in the Ministry of Communications. It conducts a 2-year Induction Training program for IP&TAFS Group ‘A’ probationers, combining classroom learning, on-the-job training, and field visits. Additionally, it runs Mid-Career Training programs and Induction Training for AAOs and JAs, serving the capacity-building needs of approximately 4,000 Group-B and C personnel across the DoT, DoP, and MoC.

The Academy collaborates with international organizations like ITU, NLSIU, IIMs, IITs, and IISc to offer capacity-building programs and joint research on topics such as Telecom Manufacturing, IPR Policy, Spectrum Economics, and 6G Standards. NCA-F also organizes workshops, seminars, and webinars for MoC employees and provides demand-based training on Corporate and Project Finance for MDOs and PSUs. Through the establishment of the Centre for Policy Studies & Research (CPSR), NCA-F aims to become a key thinktank and Centre of Excellence in Communications Policy, licensing, and regulations.

## About Centre for Policy Studies and Research (CPSR)

The Centre for Policy Studies & Research (CPSR), established by National Communications Academy- Finance (NCA-F), aims to enhance expertise in communications policy by fostering joint research and capacity-building programs. CPSR's vision is to develop into a leading think tank that addresses telecommunications and postal sector challenges, including Communications finance, spectrum management, telecom regulations, and digital inclusion. Additionally, CPSR explores policy issues arising from emerging technologies like AI, cloud computing, and satellite broadband.

CPSR's objectives include generating high-quality research to guide policy-making with a strong foundation in evidence and ethical values like equity and inclusivity. The centre collaborates with various stakeholders—including government bodies, think tanks, and academic institutions—to produce actionable policy inputs and insights for both the government and private sectors. As part of its commitment to knowledge dissemination, CPSR publishes this journal to present in-depth research on timely and relevant policy issues.

To further these goals, CPSR structures its research into specific units that tackle core policy areas, including the evolving telecom licensing framework, digital Bharat initiatives, and spectrum allocation methodologies.



## About Journal of Communications Finance

The *Journal of Communications Finance* is an initiative by the Centre for Policy Studies and Research (CPSR) under the National Communications Academy-Finance (NCA-F), which operates under the Ministry of Communications. NCA-F plays a pivotal role in capacity building for IP&TAFS cadre officers and provides specialized training in accounts, finance, and Communication policy. The CPSR was established to further enhance expertise in these areas, fostering collaboration between government officials and private sector professionals through joint research and training programs.

The journal seeks to publish high-quality research papers and articles that contribute to the evolving landscape of postal and telecommunications sectors. It will serve as a valuable resource for academicians, policymakers, and industry professionals, addressing contemporary challenges and opportunities. The research topics span across areas such as Communication policy, spectrum economics, telecom licensing, postal finance, public and corporate finance, and related legal frameworks.

With a focus on relevant and actionable insights, the journal addresses emerging areas and challenges in the postal and telecommunications sectors. It also includes research on other relevant topics such as artificial intelligence and digital literacy. These contributions aim to shape future policies and inform decisions in both the public and private sectors, ensuring the journal plays a significant role in the development of Communication finance.



## **Editorial Board**

### **Patron**

Shri Manish Sinha, Member (Finance), DCC, DoT  
*memberf-dot@nic.in*

### **Chief Editor**

Ms. Madhavi Das, Director General, NCA-F  
*madhavi.das@nic.in*

### **Editorial Board Members**

Shri S.K. Mishra, Ex-Advisor (Finance), DoT  
*sk.mishra74@nic.in*

Dr. M.P. Tangirala, Addl. Secretary, D/o Financial Services, New Delhi  
*tangirala-upsc@gov.in*

Dr. Shikha Mathur Kumar, Pr. CCA, Kolkata  
*sikha.mathur@gov.in*

Dr. Vinod Kotwal, Member Secretary, NPPA, New Delhi  
*vinod.kotwal@nic.in*

Dr. Charru Malhotra, Professor, IIPA, New Delhi  
*charrumalhotra@iipa.education*

Dr. Brajesh Kumar, Professor, AJNIFM, Faridabad, Haryana  
*brajesh@nijfm.ac.in*

Dr. Mansi Kedia, Senior Fellow, ICRIER, New Delhi  
*mkedial@icrier.res.in*



## **Associate Editors**

Dr. D. K. Singhal, DDG, NCA-F  
*singhal.dk@gov.in*

Shri Ankit Anand, Director, NCA-F  
*ankit.anand@gov.in*

Shri Kunal Srivastava, Deputy Director, NCA-F  
*srivastava.kunal@gov.in*

Shri Shashank Shekhar Agarwal, Deputy Director, NCA-F  
*shashank.sa@gov.in*

## **Managing Editors**

Ms. Tanisha, Teaching (Research) Associate, NCA-F  
*tanishaahuja32@gmail.com*

Ms. Krittika Mukhopadhyay, Teaching (Research) Associate, NCA-F  
*krittika.mukho89@gmail.com*

## Table of Contents

Content	Page No.
<b>1. From the Patron's Desk .....</b>	<b>9</b>
<b>2. From the Chief Editor's Desk .....</b>	<b>10</b>
<b>3. Papers/Articles (Research and Review).....</b>	<b>11-86</b>
3.1 Accounting Separation in the Telecommunications Sector <i>Shri. Amit Sharma</i> .....	12-24
3.2 Making Data Centers Green <i>Ms. Reet Sundaram</i> .....	25-35
3.3 Circular Economy Approaches in E-Waste Management <i>Ms. Pallavi Chinchkhede</i> .....	36-46
3.4 Threats and Challenges Regarding Digital Literacy: Generation Z Approach <i>Ms. Anuradha Maurya, Ms. Sameeksha Gupta,</i> <i>Mr. Anushree Srivastava</i> .....	47-61
3.5 What's Next for AI: Future Expectations and Predictions <i>Ms. Parbati Prasad Misra</i> .....	62-76
3.6 Risk Based Internal Audit <i>Shri Kaushik Chawdhary</i> .....	77-86
<b>4. Commentaries .....</b>	<b>87-95</b>
4.1 A Study of Successful Infrastructure Investment Trusts in the Telecom Sector: The Brookfield-IndInfravit Deal in India <i>Dr. D.K. Singh</i> .....	88-91
4.2 Replace it with: A Complex Interplay Between Inflation and Telecom-Postal Sector <i>Shri Ankush Gahlawat</i> .....	92-95





<b>5. News at Glance</b> .....	
<b>6. Book Reviews</b> .....	<b>100-108</b>
6.1 Nudge: The Final Edition by Richard H. Thaler and Cass R. Sunstein <i>Shri Ankit Anand</i> .....	101-104
6.2 Political Order and Political Decay: From the Industrial Revolution to the Globalisation of Democracy by Francis Fukuyama <i>Shri Ankit Anand</i> .....	105-108
<b>7. Author Guidelines</b> .....	<b>109-112</b>
7.1 Submission Guidelines .....	110
7.2 Review Process.....	112
7.3 Contact Information.....	112

## From the Patron's Desk



As the Patron of the Journal of Communications Finance, I am pleased to introduce this inaugural issue by NCA-F, which addresses critical topics in today's dynamic landscape.

This journal represents a significant step forward in the integration of communication studies with the ever-evolving field of finance.

We are pleased to provide a platform for academic dialogue, research, and innovative thinking, where scholars and practitioners can explore the dynamic intersections of communication strategies, financial practices, and global economic trends. Our goal is to foster collaboration, promote new perspectives, and advance knowledge in these vital areas.

Our inaugural issue underscores the pillars of NCA-F's training programs: domain-specific competencies, cross-functional skills, and essential behavioral attributes for effective leadership and collaboration. I encourage all of you—academics, professionals and policymakers—to engage with this work, and help propel the future of communication finance forward.

I commend all the contributors for their valuable contribution in shaping this publication and encourage readers to engage actively with its content. I would also like to appreciate the commendable efforts of NCA-F for conceptualizing and delivering this first edition of the journal with such excellence.

Together, let us advance the discourse on finance and communications, creating a resilient and forward-looking sector for the future.

Best wishes,  
Shri Manish Sinha  
Patron  
Journal of Communications Finance  
National Communications Academy- Finance (NCA-F)

## From the Chief Editor's Desk



The journey of the Journal of Communications Finance is shaped by the dedication and vision of its contributors, rooted in the legacy of the National Communications Academy - Finance (NCA-F). This journal reflects our commitment to advancing research, training, and policy insights in communications and finance.

Featuring articles on topics such as artificial intelligence, digital literacy, e-waste management, and sustainable data centers, this journal promotes dialogue on themes vital to a modern, forward-looking communications sector.

By bringing together an array of participants from both public and private sectors, we have laid the groundwork for symbiotic dialogue and informed decision-making. I am profoundly grateful to our Patron for supporting the ongoing publication of the journal and for fostering a rich environment for academic research.

I would like to extend my deepest thanks to the authors for their invaluable contributions, the reviewers for their meticulous work, and our editorial board for their continued dedication to maintaining the journal's scholarly integrity. Also, this inaugural edition has been enriched by the remarkable efforts of Dr. D.K. Singhal (DDG), Shri Ankit Anand (Director), Shri Shashank Shekhar Agarwal (Deputy Director, CPSR & MK) and Ms. Tanisha (Teaching & Research Associate, CPSR), whose insights and dedication have been instrumental in shaping its content.

As NCA-F continues to foster excellence through international training and collaborations, I envision the Journal of Communications Finance as a platform for thought leadership, shared learning, and innovative policy recommendations. I invite our readers to explore, reflect, and contribute to our collective vision of a resilient and adaptive communications ecosystem.

Regards,  
Ms. Madhavi Das  
Chief Editor  
Journal of Communications Finance  
National Communications Academy- Finance (NCA-F)

# **Papers/ Articles**

## 3.1 Accounting Separation in the Telecommunications Sector

*Shri Amit Sharma, Advisor  
(Financial and Economic Analysis), TRAI*

### Abstract

This document examines the regulatory concept of Accounting Separation (AS) in the telecommunications sector, designed to promote fair competition and transparency. AS is a method where telecom operators report separate financial accounts for distinct services or business units, allowing regulatory bodies to monitor and prevent anti-competitive practices. The evolution of AS frameworks globally demonstrates their significance in maintaining fair market dynamics, with examples from the U.S., Europe, and Asia-Pacific. Various costing models, including Long-Run Incremental Cost (LRIC) and Fully Allocated Cost models, are employed to enhance the accuracy of cost allocation within AS practices.

The report identifies challenges in implementing AS, including the availability of accurate data, compliance with complex regulatory standards, and regional inconsistencies. AS plays a critical role in ensuring competitive practices, especially for smaller operators, by curbing monopolistic behaviors and promoting transparent interactions in vertically integrated firms. The document concludes with a call for collaboration among stakeholders to optimize AS frameworks in response to the evolving telecom landscape, underscoring the need for effective regulatory oversight that aligns with advancements in technology and market demands.

### Keywords

Accounting Separation, Telecommunications, Regulatory Compliance, Cost Allocation, Anti- Competitive Practices, Transparency, Fair Competition, Costing Models.

### Introduction

Accounting separation is a regulatory requirement designed to prevent anti-competitive practices within vertically integrated firms, particularly in the

telecommunications sector. This practice mandates the detailed allocation and reporting of costs and revenues across different services or business units within operators' portfolios. Telecommunications companies often operate in both wholesale and retail markets, making effective accounting separation essential for ensuring transparency and fairness. By maintaining separate financial accounts for different divisions, regulators can monitor financial performance and detect potential cross-subsidization, where profits from non-competitive segments are used to support competitive pricing.

The primary objectives of accounting separation include preventing anti-competitive practices, ensuring regulatory compliance, and providing regulators with insights into operators' financial performance<sup>i</sup>. These objectives contribute to creating a level playing field for all market participants and enhancing market transparency. The importance of accounting separation becomes particularly pronounced in an industry characterized by significant infrastructure investments and technological advancements.

### **The Evolution of Accounting Separation in the Global Telecommunications Sector**

Accounting separation in the telecommunications sector has undergone significant transformations shaped by the need for regulatory oversight, fair competition, and transparency in financial reporting. This evolution can be traced through key developments and regulatory milestones across various regions. In the United States, accounting separation practices emerged as regulators sought to maintain oversight over AT&T and its subsidiaries. The pivotal moment came with the breakup of AT&T in 1984, commonly referred to as divestiture. This separation of AT&T's local exchange and long-distance services not only marked a watershed in accounting separation practices but also underscored the necessity for regulatory frameworks to ensure that competition could flourish in the telecommunications arena. Similarly, in Europe, the liberalization of telecommunications markets during the 1990s prompted regulatory bodies, notably the European Commission, to introduce stringent accounting separation requirements. The intent was to dismantle the monopolistic hold of state-owned operators, thereby fostering a competitive landscape. The United Kingdom took a leading role by implementing rigorous accounting separation rules designed to guarantee fair access to networks and services for new market entrants, ensuring a level playing field in the burgeoning telecom sector<sup>ii</sup>.

As the demand for effective regulation intensified, various regions began to refine their frameworks for accounting separation. The European Union established a comprehensive regulatory framework for electronic communications in 2002, encapsulated in the “EU Regulatory Framework for Electronic Communications.” This framework introduced directives concerning access, interconnection, and accounting separation, aimed at preventing discrimination and promoting efficient market competition among member states. In the Asia-Pacific region, countries such as Japan, South Korea, and Australia adopted accounting separation practices to manage their rapidly evolving telecommunications sectors. These regulations sought to balance the interests of incumbent operators while simultaneously promoting fair competition, often taking cues from European models. Australia’s implementation of accounting separation requirements in 1997 exemplified efforts to ensure equitable access to network infrastructure and foster competitive pricing. In Japan and South Korea, similar initiatives were introduced in the 2000s, focusing on enhancing transparency and curbing anti-competitive practices. India’s regulatory landscape also evolved, with the Telecom Regulatory Authority of India (TRAI) introducing accounting separation guidelines in 2004 aimed at ensuring financial transparency and promoting fair competition in a rapidly growing market. These historical developments highlight a global trend toward regulatory frameworks that prioritize transparency, competition, and accountability, reflecting the dynamic nature of the telecommunications sector across different jurisdictions.

The adoption of accounting separation (AS) frameworks in the telecommunications sector has become a pivotal aspect of regulatory practice worldwide, fostering transparency, competition, and fair market dynamics. Several countries have recognized the importance of implementing such frameworks to enhance their telecommunications sectors. For instance, India initiated its AS regulations through the Telecom Regulatory Authority of India (TRAI) in 2004<sup>iii</sup>. This marked a significant step toward ensuring that operators could accurately report financial performance across distinct business units. Over the years, these regulations have been amended and remain in force, with the latest amendments to the AS regulations issued in 2016, reflecting India’s commitment to maintaining competitive practices and preventing anti-competitive behaviors in its rapidly expanding telecommunications market.

Similarly, Singapore has been at the forefront of adopting AS frameworks, with the Infocom Media Development Authority (IMDA) implementing guidelines since 1997. These guidelines serve to establish a transparent regulatory environment that aids both operators and consumers. In the Caribbean, Trinidad and Tobago’s

Telecommunications Authority has mandated AS practices since 2012, ensuring that operators maintain clear financial records to support fair competition. Malaysia followed suit in 2016, with the Malaysian Communications and Multimedia Commission (MCMC) adopting similar requirements to enhance regulatory oversight. In Africa, Nigeria's Communications Commission (NCC) introduced AS regulations in 2020, reflecting a growing recognition of the need for structured financial reporting to facilitate fair market practices.

Meanwhile, in Saudi Arabia, the Communications and Information Technology Commission (CITC) has implemented AS for the telecommunications industry since 2019, emphasizing the importance of accurate financial disclosures. European countries have also embraced these frameworks; for instance, Belgium's Institute of Postal and Telecommunication Services (BIPT) has enforced AS requirements on significant market players since 2004, enhancing accountability in the sector. The United Kingdom has been similarly proactive, with the Office of Communications (Ofcom) imposing regulatory financial reporting obligations on British Telecom (BT) and Kingston Communications since 2004, particularly in markets where significant market power is evident. These international examples illustrate a global trend toward the adoption of accounting separation frameworks, underscoring their importance in promoting fair competition and transparent practices in the telecommunications industry.

### **The Concept of Accounting Separation in Telecommunications**

Telecommunications operators often function as vertically integrated entities, where various business activities are interconnected and reliant on one another<sup>iv</sup>. In a competitive market landscape, it becomes essential to clarify these interrelationships to ensure that transactions between different business units within a single operator are conducted on a basis that is transparent and fair when compared to interactions with other operators. This necessity arises from the potential for anti-competitive behavior, such as cross-subsidization, where profits from one segment might unfairly benefit another, thus distorting market competition. To address these challenges, there are generally two principal approaches: structural separation and accounting separation<sup>v</sup>. Structural separation involves the complete division of an integrated telecommunications business into two or more distinct legal entities. Each entity would then independently carry out licensed telecommunications activities, owning and managing its own assets and operations, including personnel<sup>vi</sup>. This approach can create a clear delineation



of responsibilities and financial accountability but can also lead to inefficiencies, particularly in smaller markets.

Accounting separation allows for the clear delineation of financial reporting and cost allocation without necessitating the formation of separate legal entities<sup>vii</sup>. This method provides the transparency needed for regulatory oversight while minimizing the potential disruptions and inefficiencies that structural separation might impose<sup>viii</sup>. By adopting an accounting separation framework, regulators can effectively monitor the financial health and operational practices of telecommunications operators, ensuring that market competition is upheld while fostering an environment conducive to innovation and consumer choice. Thus, accounting separation serves as a pragmatic solution that balances regulatory objectives with the practicalities of market operations in the telecommunications sector.

### **Need of Accounting Separation in Telecom Sector**

Transparency and regulatory oversight are crucial for fostering fair competition in the telecommunications sector<sup>ix</sup>. One effective strategy is requiring operators to separate their costs and revenues by service type—such as voice, data, and broadband. This accounting separation allows regulatory bodies to monitor financial activities closely, preventing practices like cross- subsidization and predatory pricing. Without these measures, dominant operators may exploit profits from lucrative services to subsidize less profitable ones, leading to a non-level playing field. By ensuring transparency, these regulations not only protect smaller competitors but also enable all market participants to compete fairly, contributing to a healthier market environment. Moreover, accounting separation provides regulators with essential insights into the financial health and operational efficiency of telecommunications companies. This information is vital for informed decision-making regarding tariff regulations, spectrum management, and quality of service standards. Accurate cost attribution also aids operators in evaluating the profitability of each service, allowing for informed investment decisions and optimized resource allocation<sup>x</sup>.

Furthermore, robust accounting practices deter monopolistic behaviors and ensure compliance with fair competition principles, benefiting consumers through competitive pricing and diverse service options. When operators are held accountable for their financial practices, they are more likely to improve customer service standards and meet user expectations. This competitive landscape

encourages transparency, ultimately enhancing the consumer experience and the efficiency of services.

Thus, implementing an accounting separation framework in telecommunications sector not only promotes regulatory compliance but also contributes to a more informed, competitive, and transparent market environment. It enhances transparency for stakeholders—including investors, regulators, and consumers—allowing them to understand cost structures and operational efficiencies. This clarity fosters trust in the telecommunications sector, encouraging investment and innovation. Additionally, the tailored financial data from accounting separation helps telecom regulators monitor operator performance and detect potential anti-competitive behaviors, such as unfair cross-subsidization and discriminatory practices. By providing operators with insights for strategic planning and ensuring that regulatory bodies have the necessary information to enforce fair competition, accounting separation plays a pivotal role in creating a robust telecommunications landscape.

### Costing Approaches in Accounting Separation

The effectiveness of accounting separation largely hinges on robust costing methodologies that accurately reflect the costs associated with each service. Several key costing models are employed in accounting separation, each with its advantages and limitations. Some of the important costing models are discussed below.

**Long-Run Incremental Cost (LRIC):** LRIC provides a forward-looking estimation of costs based on future investments and operational efficiencies. This methodology focuses on the long-term perspective of service provision, allowing for informed decision-making regarding pricing and investment strategies. By emphasizing future costs, LRIC helps operators assess the economic viability of various services and informs regulators about the implications of pricing strategies.

**Embedded Cost Models:** Embedded cost models reflect historical expenditures and are based on actual costs incurred by operators. While these models are useful for understanding past performance, they may not account for future efficiencies and market changes. As such, while they provide a solid foundation for understanding operational costs, they can be less effective for forward-looking analysis and strategic planning.

**Fully Allocated Cost Models:** This approach allocates all costs, including common and joint costs, to specific services. Although comprehensive, it may lack the precision needed to reflect future efficiencies accurately. Fully allocated cost models can provide a broad overview of financial performance but may not adequately capture the nuances of cost behavior in a dynamic telecommunications market.

## Key Principles of Cost Allocation in Accounting Separation

The allocation of costs follows several fundamental principles essential for ensuring accurate financial reporting and compliance with regulatory requirements. These principles include direct attribution where costs that can be directly linked to a specific service are allocated accordingly. This method ensures that services are charged only for their attributable costs. Indirect Allocation of costs that benefit multiple services are allocated based on consistent and justifiable methods.

This approach requires a careful examination of how services share resources and benefits. Common Cost Allocation of costs that cannot be directly attributed to a single service are allocated equitably among all services. This principle is crucial for ensuring that shared costs are distributed fairly, preventing any single service from being disproportionately charged.

In the telecommunications sector, the allocation of costs, capital employed, and revenues to various network elements, products, and services is essential for preparing separate accounts that reflect the true financial health of an organization. The foundation of these principles is the notion of cost causation, which posits that costs and revenues should be attributed to the specific services or products that generate them. This principle necessitates the development of robust and detailed cost allocation methodologies. Telecom operators must conduct thorough reviews of each cost item, capital employed, and revenue generated to identify the specific drivers that led to their occurrence. By establishing these drivers, operators can allocate costs and revenues accurately to individual network elements and services. Moreover, all allocations must be subject to scrutiny and review by the appropriate authority to ensure compliance and maintain the integrity of the reporting process.

The process of accounting separation begins with the financial data captured by the organization's general ledger or other financial systems, which record transactions as they occur. These systems form the basis for all financial reporting and provide the necessary data for further analysis. Costs incurred by telecommunications operators

can be classified as either direct or indirect, depending on their relationship to specific network elements. Direct costs can be easily attributed to specific services or network components. For instance, in a public switched telephone network (PSTN), the costs associated with a local exchange can be directly allocated to the corresponding account. In contrast, indirect costs are shared across multiple network elements and cannot be directly linked to a single service. For example, the costs associated with shared infrastructure, such as cable trenches that support both access cables and exchange cables, must be allocated proportionately among the services utilizing that infrastructure. Additionally, certain costs, such as those for billing and customer service, while necessary for service provision, cannot be directly attributed to any single network element. Unattributable costs, which are essential for the overall operation of the licensed entity but do not pertain to specific services, include expenses for functions such as planning, personnel, auditing, and general finance. To ensure clarity and organization, financial records can be regrouped into broad categories, including operating costs, capital costs, and accounting entries like depreciation, which together provide a comprehensive view of the financial landscape of the telecommunications operator. By adhering to these principles and methodologies, telecommunications companies can enhance the accuracy and reliability of their financial reporting, fostering a more transparent and competitive marketplace<sup>xi</sup>.

## Implementation Challenges in Telecommunications Sector

In the telecommunications sector, accounting separation is crucial due to the industry's natural monopoly characteristics. Operators often control essential infrastructure, which can create opportunities for anti-competitive behavior if financial practices are not adequately regulated. By requiring operators to maintain separate accounts for their retail and wholesale operations, regulators can ensure that prices charged to competitors for access to essential infrastructure are fair and reflective of actual costs. This separation is critical for promoting competition and ensuring that smaller operators can compete effectively in the market.

Implementing accounting separation in the telecommunications sector involves navigating a series of challenges that can significantly impact its effectiveness. One of the primary obstacles is data availability. Telecommunications networks are complex, and obtaining reliable data on costs and usage patterns can be a daunting task. Operators must track and manage a vast array of information across various service lines and geographical regions. This complexity can lead to difficulties in accurately capturing and reporting data, which is essential for implementing

effective costing approaches. If the data collected is inconsistent or incomplete, it can undermine the entire accounting separation process, making it challenging to draw meaningful conclusions about the financial health of different services or to ensure compliance with regulatory requirements.

Another critical challenge is regulatory compliance. The telecommunications landscape is dynamic, with regulations evolving frequently to address new market realities and technological advancements. Operators must be agile in adapting their costing methodologies to align with these changing guidelines and standards. This adaptation often requires significant investment in training, technology, and process overhaul, which can strain resources, especially for smaller operators. Furthermore, discrepancies between regulatory frameworks across different regions can complicate compliance efforts. Operators need to ensure that their accounting practices not only adhere to local regulations but also allow for comparability on a broader scale. This leads to the third major consideration: comparability. For accounting separation to fulfill its intended purpose, the methodologies employed must enable meaningful comparisons across operators. This is essential for benchmarking performance and conducting thorough market analyses. If different operators employ varying costing approaches, it becomes difficult to assess their relative efficiencies or to identify industry trends. Achieving a standardized approach to costing while accommodating the unique circumstances of individual operators presents a complex challenge that requires collaboration and consensus among industry stakeholders.

## Regulatory Frameworks

Regulatory frameworks across various jurisdictions significantly influence the implementation of accounting separation. In the European Union (EU), for instance, rigorous accounting separation requirements have been established to promote competition and consumer choice. These regulations necessitate detailed reporting on costs related to network operations and service provisions, allowing regulators to monitor compliance effectively.

In contrast, the United States, while requiring certain disclosures from the Federal Communications Commission (FCC), adopts a less prescriptive approach compared to the EU. This variability in regulatory requirements can lead to inconsistencies in how accounting separation is implemented across different regions. Countries like Turkey and India have also mandated accounting separation, with their respective authorities, such as the Information and Communication Technologies Authority

(ICTA) and the Telecom Regulatory Authority of India (TRAI), enforcing guidelines that ensure transparency and fair competition.

Despite its importance, implementing effective accounting separation presents several challenges. One significant issue is data availability; reliable data on costs and usage patterns across complex networks is often difficult to obtain. Telecommunications operators may struggle to gather and maintain the necessary data to support accurate cost allocation.

Additionally, telecom operators face regulatory compliance challenges as they adapt to evolving guidelines and standards. The need for standardized methodologies that allow meaningful comparisons across operators and jurisdictions further complicates the implementation of accounting separation. This complexity can lead to inconsistencies in reporting and compliance, hindering the overall effectiveness of accounting separation practices.

### **Accounting Separation Reporting Requirements in the Telecommunications Sector**

In the telecommunications sector, accounting separation is a critical practice that involves the meticulous allocation and reporting of costs and revenues associated with various services and business units. This process serves multiple purposes, including regulatory oversight, the promotion of fair competition, and the enhancement of transparency in financial reporting. To achieve these goals, telecommunications operators must adhere to specific reporting requirements that ensure the integrity of their financial statements. A key aspect of this practice is the detailed allocation of costs, which must be accurately distributed across different services or business units. Operators are tasked with identifying both direct costs—such as expenses related to equipment and personnel—and indirect costs, including shared infrastructure and administrative expenses. Utilizing standardized methodologies for this allocation is essential, as it not only facilitates compliance with regulatory guidelines but also enables meaningful comparisons across operators within the industry.

In addition to cost allocation, revenue attribution is another fundamental reporting requirement for telecommunications operators. Companies must provide detailed reports on the revenues generated from various services, including voice, data, broadband, and additional value-added services. This transparency is crucial for ensuring that all income sources are adequately accounted for, allowing regulators

and stakeholders to assess the financial health of operators more effectively. Compliance with regulatory standards plays a pivotal role in this process, as regulatory authorities establish specific guidelines that operators must follow to ensure consistency, comparability, and accuracy in financial reporting across the sector. To reinforce these requirements, operators may also undergo auditing and verification processes. Independent auditors or regulatory bodies typically review financial reports to confirm the accuracy of cost allocations and revenue attributions. This layer of oversight is vital for maintaining trust in the financial disclosures of telecommunications operators and for ensuring that they adhere to the principles of fair competition.

## **Conclusion**

Accounting separation is a critical regulatory measure within the telecommunications sector that promotes transparency, prevents anti-competitive practices, and supports efficient resource allocation. The choice of costing methodologies significantly impacts regulatory compliance and operational decision-making. While challenges exist, the benefits of effective accounting separation are considerable, contributing to a sustainable and competitive telecommunications landscape.

Policymakers, telecom regulators, and industry stakeholders must collaborate to refine these practices, ensuring that the telecommunications sector continues to evolve in a fair and transparent manner. This paper provides valuable insights for optimizing accounting separation practices globally, ultimately enhancing market competition and consumer welfare. As the telecommunications industry continues to evolve, it is imperative for policymakers and telecom regulators to adapt accounting separation practices in response to emerging challenges and technological advancements. By doing so, they can ensure that the sector remains competitive, transparent, and aligned with the interests of consumers and investors alike. The information from this paper contributes to the ongoing dialogue about the best practices in accounting separation, offering a pathway for the development of a more equitable telecommunications landscape worldwide.

## References

- i). Gillwald, A. (2005). Good intentions, poor outcomes: Telecommunications reform in South Africa. *Telecommunications Policy*, 29(7), 469-491.
- ii). Cave, M. E. (2006). Six degrees of separation: Operational separation as a remedy in European telecommunications regulation. *Communications & Strategies*, (64), 89.
- iii). Telecom Regulatory Authority of India (TRAI). (2004). Press Release No. 15 of 2004. Retrieved from [https://traai.gov.in/sites/default/files/PR\\_No.15of2004.pdf](https://traai.gov.in/sites/default/files/PR_No.15of2004.pdf)
- iv). Friederiszick, H. (2008). Analyzing the relationship between regulation and investment in the telecom sector.
- v). Ibáñez Colomo, P. (2022). Future-proof regulation against the test of time: The evolution of European telecommunications regulation. *Oxford Journal of Legal Studies*, 42(4), 1170-1194.
- vi). Hardt, M. (1995). The non-equivalence of accounting separation and structural separation as regulatory devices. *Telecommunications Policy*, 19(1), 69-72.
- vii). Malisuwan, S., Milindavanij, D., Kaewphanuekrungsi, W., & Tiannara, N. (2016). Analysis of market competition in telecommunications business: Regulatory perspective. *International Journal of Industrial Engineering Research and Development*, 7(2).
- viii). Stoyanova, M. A. (2005). Dismantling the telecoms monopoly: Ways to increase competitiveness and promote effective competition. The Bulgarian Case (September 30, 2005)
- ix). Malisuwan, S., & Milindavanij, D. (2016). Balancing social benefits and market competition in Thailand's mobile telecommunications industry: Regulatory perspective. *International Journal of Information Technology and Management Information System*, 7(1).



- x). Cave, M., & Martin, I. (1994). The costs and benefits of accounting separation: The Australian and British debates. *Telecommunications Policy*, 18(1), 12-20.
- xi). Eroğlu, M., & Finger, M. (Eds.). (2021). *The regulation of Turkish network industries*. Springer International Publishing.

\*\*\*\*\*

### Author's Profile

Shri Amit Sharma belongs to the 1998 batch of the Indian Posts & Telecommunications, Accounts and Finance Service (IP&TAFS). He holds a B.Tech in Electronics and Communications from NIT, Kurukshetra, Masters in Public Administration from Maxwell School of Citizenship and Public Affairs, USA, and an LLB from CCSU, Meerut. Besides this, he is trained in Financial Management from the National Institute of Financial Management, India.

He has worked in various capacities in BSNL, India Post, Department of Telecommunications and the Central Administrative Tribunal of the Government of India. He is also working with the Information and Communication Technologies Authority in implementing Accounting Separation in the telecom sector of Mauritius.

Presently working with the Telecom Regulatory Authority of India, he has been handling Spectrum Valuation and Pricing, Accounting Separation, Tariff, Costing, and Licensing-Finance related issues (including AGR, LF, Bank Guarantees and Entry Fees) for the Authority.

## 3.2 Making Data Centers Green

*Ms. Reet Sundaram, ACAO, USOF, DoT*

### Abstract

Rapid expansion of digitisation and need for environmental sustainability brings to the forefront the immediate need for green data storage systems. Green data centers aim to minimize the environmental impact of data center operations by reducing energy consumption, optimizing resource utilization, and adopting sustainable practices.

This article brings out the issues and challenges faced by data centers and comes up with innovative solutions. The key areas of concern highlighted are inefficient cooling systems, reliance on non-renewable energy sources, and poor utilization of server resources. Article then tries to explore various solutions that include infrastructure design, server virtualisation, scalable designs and dynamic workload management. These measures further enhance the utilization ratio from current 5-10% to 50% thus reducing the carbon footprint vis-a-vis the data stored. Article also highlights Server virtualisation and consolidation as the most viable solution for greening data centers.

Considering the fact that digitisation will exponentially increase in future with the expansion of AI, Machine Learning and Big Data Analysis, sustainability becomes a crucial point of improvement in the sector. The article therefore explores this area to reduce its power consumption, resource wastage and carbon footprint.

### Keywords

Green Data Centers, Environmental Sustainability, Energy Consumption, Carbon Footprint, Server Virtualisation, Renewable Energy, Cooling Systems, Water Conservation.

### Introduction

Humanity generates 65 zettabytes data in a year-- enough to max out the storage capacity of about 40 million iPhones -- every *day*. Much of it gets stored “in the cloud,” meaning it’s saved in sprawling, frigid data centers. Unfortunately, these data centers are contributing to the destruction of the environment<sup>[1]</sup>. Data Centers

consume as much as 3-13% of the world's total annual electricity consumption -- and are responsible for emitting more than 200 million metric tons of carbon dioxide, on par with the annual emissions from all commercial air travel in the entire United States. The carbon footprint due to data storage reaches nearly 1.73 g CO<sub>2</sub>/GB in the minimum scenario while this figure has risen to approximately 1.98 g CO<sub>2</sub>/GB and 4.11 g CO<sub>2</sub>/GB during both the median and the maximum scenarios, respectively. Data centers are on track to account for 14% of all global emissions by 2040. That's equivalent to what the entire United States currently emits<sup>[iii]</sup>. -

Current research suggests that networks and data centers consume more than computers. Communication networks, including mobile, fixed broadband and telephone networks, consumed 1.7% of total global electricity usage a decade back while data centers consumed about 1.4%<sup>[iii]</sup>. There is a marked movement towards cloud-based usage of data storage as well as low power consuming small devices like laptops and mobile phones rather than desktops. There is a strong trend to push electricity consumption onto the network and data center infrastructure where energy costs are less transparent to consumers<sup>[iv]</sup>. It is estimated that powering a LED TV for watching a movie takes a similar amount of energy (120 Wh) as consumed in streaming it over the Internet<sup>[v]</sup>. In fact, the largest share of energy consumption is made by network and data centers as compared to the lifetime of tablets and smartphones consuming at least 90% of the total energy use including manufacture and charging<sup>[vi]</sup>.

## What are Data Centers

Data centers are indispensable for any IT organization, providing capacities for centralized storage, management, backups, dissemination and networking of data in which the lighting, electrical, mechanical and computing systems are designed for maximum sustainability and minimum energy usage. Data centers are found in all major sectors of the economy including financial sector, educational, industrial and ICT. Data Centers are used to help business processes, automation, information dissemination and communications. Rapid increase in the size and number of data centers due to ever increasing demand has boosted the demand for both physical infrastructure and IT equipment as well as energy consumption<sup>[vii]</sup>. Data center IT equipment consists of many individual devices like storage devices, servers, chillers, generators, cooling towers and many more. But servers are the key power guzzling component. Their size and numbers increase in proportion to the data usage. This will further cause massive increase in energy consumption, and unintended consequences like over-sizing of heating and cooling equipment.

This resultant increase in production of Greenhouse gases which are hazardous for ecological health is more costly than the cost that will be undertaken in efforts to make data centers green. Data Centers also consume disproportionate amounts of water ranging from 3-5 million of gallons of water per day which is equivalent to the water demand of a city of 30,000-50,000 people. Solutions also need to be drawn for firstly reducing the water intake and secondly reuse and recycle of waste water<sup>[viii]</sup>.

## Overview of the Field of Data

Data can be categorized into various types based on different criteria such as structure, source, and purpose. Some common types are:

1. *Structured Data*: Data with a well-defined schema and organized format, typically stored in relational databases or tabular formats such as CSV (Comma-Separated Values) files. Examples include data stored in databases, spreadsheets, and structured text files.
2. *Unstructured Data*: Data that does not have a predefined schema or organized format. It can include text documents, images, videos, audio files, social media posts, and sensors. They are often stored in file systems or NoSQL databases and require advanced techniques such as natural language processing (NLP) and machine learning for analysis.
3. *Semi-Structured Data*: A hybrid form of data that does not conform to a rigid schema but contains some structural elements, such as tags, labels, or attributes. Examples include XML (eXtensible Markup Language) files, JSON (JavaScript Object Notation) documents, and log files<sup>[ix]</sup>.

Further, critical data, redundant data, and dark data are terms used to describe different aspects of data management and utilization:

1. Information that is necessary for an organization's operation and success is referred to as critical data. It contains information that has an immediate bearing on customer satisfaction, regulatory compliance, business processes and decision-making. Few examples are Customer data, financial transactions, product inventories, personnel data and intellectual property related data. Maintaining business continuity, risk management and competitive advantage all depend heavily on the availability, integrity and security of vital data.

2. Duplicate or unnecessary data that is present in an organization's data storage systems are referred to as redundant data. Numerous issues arise with this kind of data including poorer system performance, higher storage costs and problems with data quality. Also, by introducing errors and inconsistencies it further makes data management and analysis tasks more difficult. Enhancing data quality, streamlining processes and lowering storage costs can all be achieved by locating and removing redundant data through data deduplication, data cleansing and data consolidation procedures.
3. Data that an organization gathers processes and stores but does not actively use to produce insights or inform decisions is referred to as dark data. They could be dispersed throughout various systems and repositories and frequently exist in unstructured formats like text documents, emails, log files and social media posts. Dark data has enormous potential but organizations have yet to fully utilize it. Fully utilizing it would result in improvements in operational effectiveness, risk reduction and innovation. Organizations can uncover the value of dark data by using advanced analytics machine learning and data discovery techniques to find patterns, trends and correlations that can guide strategic initiatives and enhance business results<sup>[x]</sup>.

To sum up, dark data is unrealized potential concealed within an organization's data assets, redundant data is needless duplication within data systems and critical data is crucial for organizational operations and success. In the data-driven world of today maximizing value, lowering risks and generating competitive advantage depend on efficiently managing and utilizing these various forms of data.

Further, certain storage techniques are more environmentally friendly than others when looking at sustainability:

1. **SSDs or Solid-State Drives:** SSDs are generally regarded as more environmentally friendly than HDDs because of their longer lifespan and lower power consumption. They are also less likely to break mechanically and waste energy like spinning disks do as they do not have any moving parts.
2. **Tape Storage:** Requiring very little power when not in use, tape storage is among the most energy-efficient storage solutions. Moreover, because of its long lifespan, storage media do not need to be thrown away or replaced as often.

- 3. Cloud Data Storage:** It may be a more sustainable option than on-premises storage thanks to its ability to optimize infrastructure utilization and pool resources. Cloud providers can reduce their environmental impact by utilizing renewable energy sources and energy-efficient data centers<sup>[xi]</sup>.

The environmental harm caused by our addiction to data storage has long been acknowledged by numerous companies and environmentalists. Certain companies have made a commitment to power their data centers with renewable energy sources such as Meta. It is necessary to keep centers cool so others have worked to replace inefficient air conditioning systems and upgrade outdated servers to newer more energy-efficient models. Of course, those actions are beneficial but only marginally.

### Solutions Proposed

It takes a combination of operational enhancements, technological advancements and strategic planning to turn data centers that are already in place into green and sustainable buildings. To accomplish this, we need to follow these steps:

- 1. Assessment of Energy Efficiency:** To find areas where energy consumption can be optimized carrying out a thorough assessment of energy efficiency helps. This entails evaluating the lighting server usage power distribution and cooling systems<sup>[xii]</sup>.
- 2.** Increase server utilization rates and decrease the number of physical servers by implementing server virtualization and consolidation techniques. As a result, resource efficiency is increased and energy consumption is reduced<sup>[xiii]</sup>.
- 3. Improved Cooling Systems:** Adding energy-saving features like variable speed fans, hot/cold aisle containment and precision cooling systems reduces energy consumption drastically. Energy consumption and cooling efficiency can both be increased by putting airflow management strategies into practice<sup>[xiv]</sup>.
- 4. Renewable Energy Integration:** To reduce the amount of energy used for data center operations, data centers need to include renewable energy sources like solar wind or hydro power. This may entail putting in place systems for producing renewable energy on-site or buying renewable energy credits from outside vendors<sup>[xv]</sup>.

5. **Energy Management Software:** Energy management software to track and improve energy use in the present moment, automating energy-saving measures and offering insights into patterns of energy consumption can optimize energy usage.
6. **Eco-Friendly Hardware:** Replacing outdated hardware with newer more energy-efficient models that adhere to industry guidelines and earn certifications. Server peripherals, networking hardware and storage devices fall under this category.
7. **Waste Heat Recovery:** Using Combined Heat and Power (CHP) systems to produce additional electricity or to collect and repurpose heat produced by data center equipment for heating<sup>[xvi]</sup>.
8. **Water Conservation:** Cutting down on water usage in data center operations use water-efficient cooling technologies like closed-loop cooling systems or evaporative cooling. Install water recycling systems as well if at all possible<sup>[xvii]</sup>.
9. **Building Design:** Integrating energy-efficient lighting insulation and building automation systems into existing infrastructure through the use of green building design and trying to earn a LEED (Leadership in Energy and Environmental Design) certificate<sup>[xviii]</sup>.
10. **Employee Awareness and Training:** Encouraging a culture of environmental responsibility, training data center employees on energy-saving methods and sustainable practices, motivating staff members to embrace energy-efficient practices and actively engaging in environmental projects.

## Establishing New Data Centers in a Sustainable Manner

Globally establishing new green and sustainable data centers necessitates meticulous planning and the application of creative solutions. The following actions can be performed:

1. **Renewable Energy Integration:** Giving careful consideration to location identification where renewable energy resources like hydro wind or solar power are in abundance. To power data center operations installing on-site renewable energy generation systems such as wind turbines or solar photovoltaic arrays should be undertaken.

2. The implementation of energy-efficient design principles such as hot aisle/cold aisle containment can enhance airflow and minimize cooling energy consumption. To reduce the energy needed for temperature regulation cutting-edge cooling techniques like liquid cooling or direct fresh air cooling should be used.
3. Modular and Scalable Architecture: Data centers should be designed with a scalable and modular architecture that enables resource optimization and incremental expansion in response to demand. This reduces resource waste and permits the effective use of infrastructure<sup>[xix]</sup>.
4. High-Density Computing: To decrease physical footprint and increase compute power per square foot, high-density computing hardware such as FPGA (Field-Programmable Gate Array) accelerators or blade servers should be used. This lessens its impact on the environment and improves energy efficiency<sup>[xx]</sup>.
5. Using Power Distribution Units (PDUs) with integrated energy monitoring and control features is one way to implement smart power management systems. To maximize power usage effectiveness (PUE) and minimize energy waste cutting-edge power management software should be deployed.
6. Water Conservation: To reduce the amount of water used in data center operations water-efficient cooling technologies like closed-loop cooling systems or evaporative cooling need to be used. Systems for recycling and reusing water should be installed to reduce impact on the environment.
7. Green Building Certification: For sustainable building design and construction practices green building certification such as BREEAM (Building Research Establishment Environmental Assessment Method) or LEED (Leadership in Energy and Environmental Design) need to be pursued. This indicates a dedication to sustainability and environmental responsibility.
8. Make a commitment to carbon neutrality by investing in carbon offset projects or buying renewable energy credits (RECs) to offset the carbon emissions caused by running data centers and balancing carbon emissions with comparable reductions or offsets aimed to achieve carbon neutrality.
9. Eco-Friendly Materials: When building data center infrastructure use environmentally friendly materials and construction techniques such as low-impact building materials recycled content and sustainable sourcing



techniques. Throughout the course of the project reduce waste production and advance the concepts of the circular economy.

10. Employee Education and Awareness: Data center employees need to be instructed and educated on energy-saving techniques, environmental stewardship and sustainable practices. By encouraging a sustainable culture within the company and giving staff members the freedom to participate in eco-friendly projects, one can create a global network of environmentally conscious employees that prioritize environmental responsibility and reduce ecological footprint by implementing these measures into the planning, design and operation of new data centers.

## Way Ahead

The first step should be taking charge of data storage policies and making sure no data is being kept longer than necessary<sup>[xxi]</sup>. The removal of unstructured data from data centers results in reduced expenses, better regulatory compliance, reduced emissions and environmental protection. Data centers need to start enhancing their data management procedures and employ the right tools to determine which data is valuable. Organizations everywhere should consider it their moral duty to filter out irrelevant information and dark data. The public, the Government and the industry needs to be made aware of the environmental risks associated with the massive storage of redundant and dark data. Therefore, society must realize the value of working together to reduce the environmental impact of storing dark data so as to avoid taking an irreversible turn towards an unsustainable digital future. Preventing climate change and preserving long-term sustainability depend heavily on people adopting ecologically conscious online behavior<sup>[xxii]</sup>. Fostering sustainable digital behavior requires educating Internet users about the negative effects of their online actions as well as the benefits of small behavioral adjustments through information campaigns, behavioral nudges and other strategies. Because cloud storage is so accessible and affordable people store thousands of digital photos and movies on their computers that they never watch. In addition, people should be mindful of unread emails, instant messages, documents, spreadsheets, and presentations. They should also keep track of the information they have saved over time. It is possible to reduce the environmental impact of Internet use by taking small steps like unsubscribing from email lists, clearing out emails and unnecessary content from cloud-based storage services and turning off videos during online meetings. Just using a smartphone to snap a picture and sharing it on social media creates two different kinds of dark data: the post itself, the image and the metadata that

surrounds it. Comparing the metadata to the amount of data in the image itself it is essentially insignificant<sup>[xxiii]</sup>. People are currently encouraged to continuously upload and share content in order to generate data that advertising algorithms can use to target them. This data also feeds into other machine learning projects among other things. However, businesses and individuals worldwide need to manage their data on a daily basis to prevent the creation of dark and redundant data or its deletion for the benefit of the environment.

## References

- i). Andrae, A., & Edler, T. (2015). On global electricity usage of communication technology: Trends to 2030. *Challenges*, 6(1), 117–157. <https://doi.org/10.3390/challe6010117>
- ii). Koomey, J. G. (2007). *Estimating total power consumption by servers in the US and the world*. Lawrence Berkeley National Laboratory.
- iii). Belkhir, L., & Elmeligi, A. (2018). Assessing ICT global emissions footprint: Trends to 2040 & recommendations. *Journal of Cleaner Production*, 177. <https://doi.org/10.1016/j.jclepro.2017.12.239>
- iv). Gao, Y., Wang, J., Li, Z., & Peng, Z. (2023). The social media big data analysis for demand forecasting in the context of globalization. *Journal of Organizational and End-User Computing*, 35. <https://doi.org/10.4018/JOEUC.325217>
- v). Corcoran, P., & Andrae, A. (2013). Emerging trends in electricity consumption for consumer ICT. *Tech. Rep.*, National University of Ireland, Galway.
- vi). Schien, D., Preist, C., Shabajee, P., & Ellul, G. (2013). Modeling and assessing variability in energy consumption during the use stage of online multimedia services. *Journal of Industrial Ecology*, 17(6), 800–813.
- vii). Data Center Journal. (n.d.). What is a data center. *Data Center Journal*. Retrieved March 16, 2009, from [http://datacenterjournal.com/index.php?option=com\\_content&task=view&id=63&Itemid=147](http://datacenterjournal.com/index.php?option=com_content&task=view&id=63&Itemid=147)
- viii). Hischier, R., Classen, M., Lehmann, M., & Scharnhorst, W. (2015). Grey energy and environmental impacts of ICT hardware. In L. Hilty & B.

- Aebischer (Eds.), *ICT innovations for sustainability* (pp. 63–78). Springer International Publishing.
- ix). Magnani, M., & Montesi, D. (2004). A unified approach to structured, semi-structured and unstructured data. *Tech. Rep.*, University of Bologna, Department of Computer Science.
- x). Teymourlouei, H., & Jackson, L. (2021). Dark data: Managing cybersecurity challenges and generating benefits. In *Advances in Parallel & Distributed Processing, and Applications: Proceedings from PDPTA'20, CSC'20, MSV'20, and GCC'20*. Springer International Publishing.
- xi). Marsh, G. (2003). Data storage gets to the point. *Materials Today*, 6(2), 38–43.
- xii). Brundu, F. G., Lamberti, F., & Sanna, A. (2016). IoT software infrastructure for energy management and simulation in smart cities. *IEEE Transactions on Industrial Informatics*, 13(2), 832–840.
- xiii). Green Grid. (2009). *Using virtualization to improve data center efficiency*. [www.thegreengrid.org](http://www.thegreengrid.org)
- xiv). Al Kez, D., Foley, A. M., Lavery, D., Furszyfer Del Rio, D., & Sovacool, B. (2022). Exploring the sustainability challenges facing digitalization and internet data centers. *Journal of Cleaner Production*, 371. <https://doi.org/10.1016/j.jclepro.2022.0959-6526>
- xv). Zhang, Y., Wang, Y., & Wang, X. (2011). GreenWare: Greening cloud-scale data centers to maximize the use of renewable energy. In *Proceedings of Middleware'11* (pp. 143–164).
- xvi). McNamara, W., Seimetz, G., & Vales, K. A. (2008). Best practices for creating the green data center. *ASHRAE Journal*, October.
- xvii). Karimi, L., Foley, A. M., Lavery, D., & Wang, J. (2022). Water-energy tradeoffs in data centers: A case study in hot-arid climates. *Resources, Conservation and Recycling*, 181, 106194.
- xviii). Clark, W. C., & Dickson, N. M. (2003). Sustainability science: The emerging research program. *Proceedings of the National Academy of Sciences of the United States of America*, 100(4), 8059–8061.



- xix). Bean, J., & Dunlap, K. (2008). Energy-efficient data centers: A close-coupled row solution. *ASHRAE Journal*.
- xx). Monmasson, E., & Cirstea, M. N. (2007). FPGA design methodology for industrial control systems—A review. *IEEE Transactions on Industrial Electronics*, 54(4), 1824–1842.
- xxi). Nagarathinam, A., Mohanasundaram, S., & Ravichandran, T. (2024). Green data centers: A review of current trends and practices. In *Technology-Driven Business Innovation: Unleashing the Digital Advantage* (Vol. 1, pp. 251–264).
- xxii). Al Kez, D., Foley, A. M., Lavery, D., Furszyfer Del Rio, D., & Sovacool, B. (2022). Exploring the sustainability challenges facing digitalization and internet data centers. *Journal of Cleaner Production*, 371. <https://doi.org/10.1016/j.jclepro.2022.0959-6526>
- xxiii). Nagarathinam, A., Mohanasundaram, S., & Ravichandran, T. (2024). Green data centers: A review of current trends and practices. In *Technology-Driven Business Innovation: Unleashing the Digital Advantage* (Vol. 1, pp. 251–264).

\*\*\*\*\*

### Author's Profile

Reet Sundaram is an officer of the Indian Posts & Telecommunications, Accounts and Finance Service (IP&TAFS) 2022 batch, currently working as an A.C.A.O in USOF, DoT. She is a B.Tech graduate. Prior to this, she has also worked in UPPCS for 7 months.

## 3.3 Circular Economy Approaches in E-Waste Management

*Ms. Pallavi Chinchkhede, ACAO, WPC, DoT(HQ)*

### Abstract

The management of electronic waste (e-waste) has become a pressing global concern due to the rapid proliferation of electronic devices and the associated environmental and health hazards. This paper explores the concept of circular economy as an innovative approach to address the challenges of e-waste management. By shifting from the traditional linear model of “take-make-dispose” to a circular model focused on resource recovery and reuse, stakeholders can mitigate the negative impacts of e-waste while unlocking economic opportunities. Drawing on a few innovative approaches and best practices, this paper examines various strategies and initiatives aimed at promoting circularity in e-waste management. Through collaborative efforts and policy support, the transition to a circular economy in e-waste management can contribute to sustainable development goals and foster a more resilient and resource-efficient society.

### Keywords

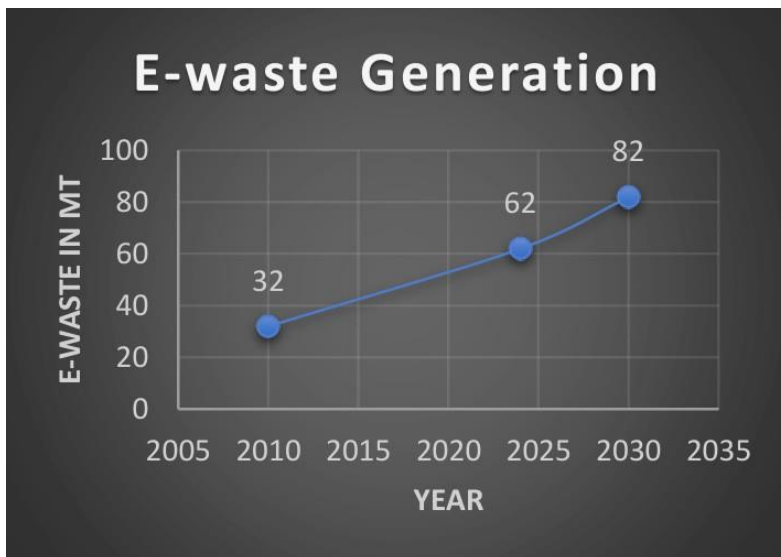
Circular Economy, Environmental Impact, Resource Efficiency, Industry 4.0, Emerging Technologies

### Introduction

E-waste is a generic term used to describe all types of old, end-of-life or discarded electrical and electronic equipment, such as household appliances, office information and communications equipment etc. E-waste contains substances including mercury, cadmium and lead that can be hazardous to human health and the environment if not dealt with properly. Today, e-waste has emerged as the world’s fastest growing environmental challenge. While the various components in our electronics are safe when in use, once they end up in a landfill they become biohazards. The toxins in our e-waste can seep into our soil or bodies of water and create a health hazard for people and the environment.

The world's generation of electronic waste is rising five times faster than documented e-waste recycling, the UN's fourth Global E-waste Monitor 2024 reveals [1]. In 2022 a record 62 million tonnes of E-waste were produced, up 82% from 2010 and on the track to rise another 32%, to 82 million tonnes, in 2030. Figure 1 explains the growth trend of global E-waste till 2030.

Figure 1. Growth trend of global E-waste till 2030



Source: United Nation's fourth global E-waste Monitor 2024

The proliferation of e-waste is a rapidly escalating global issue given its exponential growth coupled with poor collection and recycling of the products. Only 22% e-waste mass was documented as having been properly collected and recycled in 2022 [1] (Global E-Waste Monitor 2024). This surge is primarily attributed to the global ICT revolution, the era of industry 4.0, emerging technologies like IoT, Blockchain and hence the ever-increasing demand of electronics products.

Such staggering challenge of e-waste creates direct challenge in achieving multiple sustainable developmental goals like SDG 3(Good health and wellbeing), SDG 9 (Industry, innovation and infrastructure), SDG 11(Sustainable cities and communities), SDG 13(Climate action), SDG 15 (Life on land), SDG 12(Sustainable production and consumption) and indirectly hampers the achievement of SDG 6, SDG 7 and SDG 14. According to the UN Statistics Division Progress Chart, among the assessable targets, a mere 15 per cent are on track to be achieved by

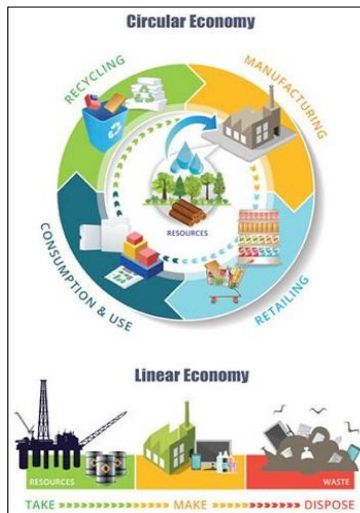
2030. Out of all SDGs nearly half, 48% of the targets show moderate or severe deviations from the desired trajectory.

According to Global E-waste Monitor 2024, poor collection of e-waste leaves US\$ 62 billion worth of recoverable natural resources unaccounted for and increasing pollution risks to communities worldwide. Circular economy, thus, provides a way in mitigation of this problem of e-waste by both reducing as well as recycling it.

## Understanding Circular Economy

Circular economy (CE) is an industrial system, which is an alternative to the highly extractive and resource-intensive linear economy principle of take-make-dispose. According to the World Economic Forum, transitioning to a circular economy could unlock \$4.5 trillion in economic value by 2030 [2]. CE replaces the end-of-life concept with restoration and regeneration, shifts towards usage of superior design of materials, products, systems and business models for waste elimination. The Ellen MacArthur Foundation reports that circular economy principles could lead to a 28% reduction in global resource use by 2050 compared to a business-as-usual scenario [3]. CE aims to retain the value of resources, products and materials at their highest by keeping them in use as long as possible. It also incorporates innovative solutions for minimizing wastage at each life-cycle stage, and extracting the maximum value through reuse, recovery, remanufacturing and regeneration of

Figure 2: Linear vs Circular Economic Model



products and materials at the end of each service value. Figure 2 below explains the differences between the traditional linear economic model vs circular economic model [4].

### Why is it Important?

This work on a circular economy is an important part of slowing climate change. We must take action to address the climate crisis, and material recovery has an important role to play. The circular economy has the immense potential to protect the environment, improve economics, and elevate social justice if it is designed in a thoughtful and inclusive manner. The European Commission estimates that transitioning to a circular economy could reduce total waste generation in the EU by 600 million metric tons by 2030 [5] and can create 7 lakh new jobs. Circular economy provides easy means to promote sustainability. However, sustainability from its foundation requires social equity. The way we extract, use, and dispose of our resources can affect already vulnerable communities disproportionately. Underserved communities across the nations have been overburdened with the negative environmental and health impacts caused by a non-circular economy. Many landfills and processing facilities are located in close proximity to low-income countries and vulnerable communities. Thus, while helping in mitigation of e-waste, CE also has an important role in promoting SDG 10 (Reduced Inequalities).

### Opportunities

On the upside, e-waste contains several valuable raw materials such as gold, copper and iron. The value of raw materials in e-waste generated in 2019 was estimated at \$57 billion USD [6]. One metric ton of electronic scrap from personal computers contains more gold than recovered from 17 tons of gold ore [7]. At the current collection and recycling rate (17.4%), only a raw material value of \$10 billion USD could be recovered. Under the right conditions, with due health and safety precautions, e-waste recycling and refurbishment activities could also potentially create green jobs worldwide.

Through greater collaboration from local to global levels, multinationals, small- and medium-sized enterprises (SMEs), entrepreneurs, academia and civil society associations could create a 'circular economy' for electronics where the waste is designed out, the environmental impact could be reduced and decent work is created for millions.



## The Circular Economic Approaches

**Green Electronics:** Electronics produced through environment-friendly processes are green electronics. They take into account the consumption of energy and production of carbon. Green electronics often feature modular designs that allow for easy upgrades and repairs. This extends the product's useful life and reduces the need for frequent replacements. According to a report by the United Nations University (UNU), extending the lifespan of smartphones by just one year could save the equivalent of 2.1 million tons of carbon dioxide emissions annually [8]. Green electronics can be integrated into circular business models where manufacturers take responsibility for the entire lifecycle of their products. This includes take-back programs, refurbishment, and responsible recycling. Products meeting specific environmental and sustainability criteria can receive eco-labels or certifications.

**Innovations Inspired by Nature:** Encouraging research and development in recycling technologies, materials recovery, and sustainable electronics manufacturing processes is critical. Innovation can lead to more efficient and eco-friendly methods of managing e-waste. According to a report by the International Solid Waste Association (ISWA), implementing advanced recycling technologies could increase global e-waste recycling rates from the current 17.4% to over 50%. R & D in technologies like biomining can help extract useful minerals and metals for the discarded e-waste in an ecofriendly manner [9]. Further Research in emerging fields like Biomimicry offers new solutions which can enhance the circular economy. For example, mimicking the self-repair mechanisms found in living organisms, we can incorporate self-healing polymers or coatings into electronic components to repair minor damages and prevent further degradation.

**Extended Producer Responsibility (EPR):** Many countries have implemented EPR programs that hold manufacturers liable for the entire lifecycle of their products, including proper disposal and recycling. Research by the International Telecommunication Union (ITU) suggests that EPR policies contribute to improved recycling efficiency by providing incentives for manufacturers to design products that are easier to recycle. It also creates a secondary resource value. The Global E-waste Monitor reports that recycling one million laptops could save the equivalent of over 1,300 tons of copper, 6.5 tons of silver, 200 kg of gold, and 40 kg of palladium.

**Waste to Art:** Sustainable pieces of art can be created by transforming discarded electronic devices and other e-waste. e-waste art goes beyond its visual appeal and serves as a powerful catalyst for environmental awareness and electronic waste recycling. The damaged e-waste or the ones that have reached end of life can be converted into art centers or museums promoting tourism as well as generating green jobs. An Indian e-waste artist Mr. Haribaabu Naatesan Says:

“Science says that matter and energy are neither created nor destroyed, it can just change in form. As an artist, I change the form of the industrial scrap into art” [10]

*Figure 3. Sculpture made form E-waste scrap [11]*



Source: <https://www.planetcustodian.com/contemporary-indian-artist-recycling-e-waste-into-art/25661/>

## Policy Measures

Governments across the world have been emphasizing the need to adopt the circular economy model for a safe and healthy environment, based on the learnings gained from the implementation of the policies and regulations. The European Commission’s Circular Economy Action Plan includes both legislative as well as non-legislative measures. It focuses on the entire life cycle of products promoting circular economy processes, fostering sustainable consumption and ensuring that the resources used are kept in use as long as possible.

Several policy tools, ranging from information-based strategies to regulatory instruments, may be used to drive the adaptation of circular practices in the EEE sector. The measures like Extended producer responsibility, mandatory recycling targets, voluntary certification and labeling schemes to promote eco-design and

responsible consumption, right to repair, providing dedicated collection kiosk for e-waste, etc. can further boost the efforts. Along with these measures there is a need for efficient collection of e-waste. Municipal Corporation of Indore, an urban local body in India serves as a great example for this. Indore Municipal corporation collects waste in more than 5 categories from the source i.e. household itself and e-waste is one such category.

## IEC and Behavioral Changes

The IEC campaign creating a massive movement to promote sustainable use of electronic devices is a crucial aspect of e waste management. At the same time behavioral changes to shift from “use and throw culture” is required to develop a circular model in true sense. Promoting the second-hand market for electronics provides a vista of opportunities for the same. Startups like Cashify, Olx are promoting such sales. The second-hand electronics product market was valued at USD 222 in 2023. It is expected to register a CAGR of 3.8 % between 2024 to 2032 [12]. Tapping this potential provides a great avenue ahead for sustainable consumption.

## International Collaboration and Standards Development

At the global level, the Governments, businesses, non- governmental organizations (NGOs) and others must collaborate to create effective policies and initiatives for e-waste management. Such multi-stakeholder partnerships along with public participation can address the complex challenges associated with e-waste drive the systemic changes. Organizations like ITU have taken various proactive measures in this regard. It organizes the Green Standards Week, a global platform where policy-makers, field experts, city planners, regulators, standardization experts, civil societies and other stakeholders can come together to discuss the role of ICT in unlocking the potential of a circular economy.

## Global Best Practices

### 1. Circular Economy Ecosystem of Japan

It focuses on collaboration of consumers, manufacturers and policy makers. The public plays a key role by source segregation of recyclables, paying recycling fees directly and holding companies accountable. Manufacturers try to incorporate more recycled materials, and make longer-lasting products

that are easier to repair and recycle. Manufacturers are also co-owners of recycling infrastructure. And because they own both manufacturing and recovery facilities, companies take proactive measures to extract maximum utility from the products with circular approaches [13].

## 2. **WEEE Park Hong Kong, China**

The Hong Kong Government in collaboration with ALBA IWS designed and built the Waste Electrical and Electronic Equipment Treatment and Recycling Facility (WEEE-PARK). The Park processes refrigerators, TVs, computers, washing machines and air conditioners into valuable secondary raw materials while controlling the management of the hazardous materials that are contained in this equipment. The Park is supposed to deliver recycling rates of over 80% and transform up to 30,000 tonnes of regulated e-waste back into raw materials each year [13].

## **Recommendations**

The digital world is and will be undergoing rapid expansion and so is the issue of e-waste. This research paper offers a few recommendations to different stakeholders, including policymakers and industry players. The convenient and efficient collection of e-waste from consumers with source segregation forms the basis for wealth extraction and circular uses of e-waste. “Indore Model” has 5 levels of waste segregation with e-waste being one of the categories. However, making it a success requires a massive IEC and behavioral change campaign. This was done through grassroots innovations like street plays, wall paintings and creative communications through FM radio. Cultural festivals like Ganesh festival, Dusshera, Durga puja, etc. were utilized as events to spread awareness.

Along with this, adopting sustainable circular business models such as product- as-a-service, take-back schemes and remanufacturing can reduce the waste generation. Integrating circular economy principles throughout the supply chain of businesses from sourcing raw materials to product design, manufacturing, and end-of-life management is essential component of developing business processes which extracts maximum utility with minimal waste in sustainable manner. They can also act as innovation centers not only generating profits but also providing a solution for governments and CSR activities. Kolkata’s Hulladek Recycling is one such model which uses “urban mining techniques” to collect e-waste from all over India and segregates it before returning it to its natural form to be reused [14].

## Conclusion

Today the management of e-waste is a global concern and with rising technological advancements like IoT, Blockchain, this concern will be aggravated. This growing e-waste crisis have an adverse impact on environmental and human health. To address the issue there is an urgent need for timely interventions, policy frameworks and innovations. The circular economy approach to e-waste provides the way out by transforming the electronics industry into a more sustainable and responsible sector. It not only lowers the environmental impact of electronic products throughout their lifecycle, from design and production to consumption and disposal, but also promotes wealth generation and resource conservation. At the same time, it also fuels our efforts for achieving the global SDGs.

## References

1. Baldé, C. P., et al. (2024). The global e-waste monitor 2024: Electronic waste rising five times faster than documented e-waste recycling. United Nations Institute for Training and Research. Available at: <https://ewastemonitor.info/the-global-e-waste-monitor-2024/>.
2. World Economic Forum. (2019). Making the \$4.5 Trillion Circular Economy Opportunity a Reality. WEF Article. Available at: <https://www.weforum.org/impact/helping-the-circular-economy-become-a-reality/#:~:text=A%20circular%20economy%20is%20a,additional%20economic%20output%20by%202030.>
3. Ellen Macarthur Foundation. (2019). The Circular Economy in Detail. Available at: <https://www.ellenmacarthurfoundation.org/the-circular-economy-in-detail-deep-dive>.
4. ProCarton. (2021). Circular v Linear Economy Graphic. Pro Carton Article. Available at: <https://www.procarton.com/publication/circular-v-linear-economy/>.
5. European Parliamentary Research Service. (2017). Towards a Circular Economy – Waste Management in the EU: Study. PE 581.913. Scientific Foresight Unit (STOA). Available at: [https://www.europarl.europa.eu/RegData/etudes/STU\\_D/2017/581913/EPRS\\_STU%282017%29581913\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STU_D/2017/581913/EPRS_STU%282017%29581913_EN.pdf).
6. International Telecommunication Union. (2024). Creating a Circular

Economy for Electronic and Electrical Equipment. ITU Article. Available at: <https://www.itu.int/en/mediacentre/backgrounders/Pages/e-waste.aspx#:~:text=By%20adopting%20the%20Connect%202030,e%2Dwaste%20by%2050%25>.

7. Bleiwas, D., & Kelly, T. (2001). Obsolete Computers, “Gold Mine”, or High-Tech Trash? Resource Recovery from Recycling. Fact Sheet. Available at: <https://doi.org/10.3133/fs06001>.
8. Raghunandan, G., Thangam, D., Patil, S., Murthy, B. M. R., Juned, M., Duraisamy, D., Narasimhaiah, R., Ponnada, N. R., & V, R. (2024). Transitioning Toward a Circular Economy Through E-Waste Management. In Practice, Progress, and Proficiency in Sustainability (pp. 311–340). Available at: <https://doi.org/10.4018/979-8-3693-1018-2.ch020>.
9. Handprint Report 2021. (2021). Giving New Life to Old Smartphones: Estimating the Positive Impact of Foxway Using the Handprint Approach. Available at: <https://www.foxway.com/wp-content/uploads/2021/06/foxway-handprint-report-mobile-eng.pdf>.
10. Mathur, B. (2019). Eco-Friendly Art: This Mumbai Based Artist Converts Junk Electronics into Fascinating Sculptures. NDTV-Dettol Banega Swasth Swachh India. Available at: <https://swachhindia.ndtv.com/eco-friendly-art-this-mumbai-based-artist-converts-junk-electronics-into-%20fascinating-sculptures-30934/>.
11. Chauhan, P. (2022). Contemporary Indian Artist Recycles E-Waste into Amazing Works of Art. Planet Custodian. Available at: <https://www.planetcustodian.com/contemporary-indian-artist-recycling-e-waste-into-art/25661/>.
12. Singh, A., and Singh, S. “Second-hand Electronic Products Market Size - By Product Type (Smartphones & Tablets, TVs & Audio-Video Devices, Computers & Laptops, Cameras & Lens, Hard Disks/Printers and Monitors, Kitchen Appliances, Washing Machines/Refrigerators), By End Use, By Distribution Channel & Forecast 2024 -2032” (2024).
13. Ministry of Electronics and Information Technology (2021). Circular Economy in Electronics and Electrical Sector Action Plan. Available at: [https://www.meity.gov.in/writereaddata/files/Circular\\_Economy\\_EEE-MeitY-May2021-ver7.pdf](https://www.meity.gov.in/writereaddata/files/Circular_Economy_EEE-MeitY-May2021-ver7.pdf).



14. Chaudhuri, D. (2024). How Kolkata's Hulladek Recycling is using 'urban mining' to reduce.e-waste's environmental impact. The Telegraph Online. Available at: <https://www.telegraphindia.com/my-kolkata/lifestyle/how-kolkatas-hulladek-recycling-is-using-urban-mining-to-reduce-e-wastes-environmental-impact/cid/2018288>.

\*\*\*\*\*

### Author's Profile

Pallavi Chinchkhede is an officer of the Indian Posts & Telecommunications, Accounts and Finance Service (IP&TAFS) 2022 batch, currently working as an ACAO in WPC, DoT (HQ). She is a B.Tech graduate. Prior to this, she has worked in Wipro for around 3 years.

## 3.4 Threats and Challenges Regarding Digital Literacy: Generation Z's Approach

*Ms. Anuradha Maurya, Associate Professor, BBDU, Lucknow*  
*Ms. Sameeksha Gupta, Assistant Professor, BBDU, Lucknow*  
*Ms. Anushree Srivastava, Assistant Professor, BBDU, Lucknow*

### Abstract

The paper aims to investigate the constituents and levels of digital literacy along with the challenges one has to face if digitally inadequate. The study was being conducted on the Generation Z (12-27 age group) population of Uttar Pradesh situated in India by means of random convenience sampling. Results of the study inferred that digital literacy is composed of digital access, usage and knowledge. SPSS 20 was employed to analyse and interpret the data using factor analysis, ANOVA to further explore correlation between constructs used. It was found that though respondents were aware about digital tools and services but due to lack of knowledge and skills often land in threat involving money and security. As the economy strives for digital revolution, the concerned participants by familiarizing the population in digital and financial literacy may help in achieving digital financial inclusion along with minimization of cybercrimes too.

### Keywords

Cyber fraud, Digital literacy, Digital challenges, Generation Z, Security

### Introduction

Digital literacy is the capacity to do research, evaluate, and disseminate pertinent knowledge using digital technology and information (Matt Dunne, 2021). Digital literacy, on the other hand, encompasses computer literacy as well as media literacy (print, electronic, digital, and social media). People who are digitally literate ought to be able to use digital devices effectively, safely, and with confidence. It involves using the internet and browsing as well as using office applications including word processors, email, and presentation software.

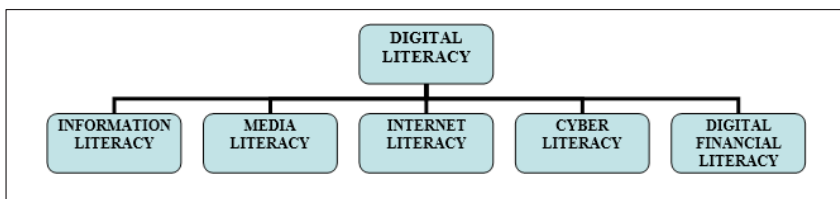
There are four essential components of digital literacy:



- Stay contemporary with present technologies.
- Effectively communicate in an online environment.
- Manage your thoughts in an online context.
- Manage teams by leveraging technology.

Categories of digital literacy (Ferrari, 2012) can be explained by pictorial representation.

*Fig 1. Categories of digital literacy*



Adopting different strategies through the usage of different platforms is common in the current environment, where everyone prefers digital platforms over others. Examples of these tactics include adopting a digital mode by using it hourly and going cashless, faceless, and paperless in the economy. Apart from offering guidance on internet usage and applications without getting into the intricacies of security, piracy, etc., it also helps in resolving those issues. Even though traditional media is progressively being replaced by social media and digital media, it's still critical to know the information's source, validity, and reliability. Making haphazard posts on social media without conducting any research might lead to major problems. Stakeholders are also highly concerned about digital financial literacy due to the fact that prior studies and surveys have highlighted several issues, such as fraud, money loss, and crowdsourcing, as significant worries. Because of behavioural tendencies such as empathy and the need for money, an individual may fall prey to a trap and lose all of their hard-earned money in an instant. It will be simpler to commit to lifelong learning in the digital era in order to develop essential personal and professional competencies. An educational program aimed at enhancing an individual's digital financial literacy could focus on techniques for investing, saving, and spending money in order to optimize one's financial well-being (Jhonson et al., 2023). High-tech products are being incorporated into daily life, metropolitan regions, and all public and commercial organizations, including e-government and e-commerce, with the goal of optimizing resource utilization,

boosting social welfare, sustainability, and development (Adam & Alhassan, 2021). Digital literacy enables the development of critical thinking, which requires flexible analytical skills in problem solving. Digital literacy has become a top priority for governments, organizations, and stakeholders in education. As a result, curriculum and policies that assist students have been developed. But there are a lot of challenges ahead, like the digital divide, different infrastructures in different school districts, and the requirement for coaches' and teachers' professional development (Weninger, 2022).

## Literature Review

A generation is a group of individuals that share the same age range and have lived through similar historical periods (Giancola, 2006). Following World War II, four generations were born. To begin with, baby boomers were born between 1946 and 1964. The second generation of X was born in the years 1965–1976. The third generation of Y was born in the years 1977–1997. Fourth Generation Z, those born in the years 1998–2010 as stated by Tapscott (2013). The internet was accessible when Generation Z was born. They rely on digital communication technologies and are frequent users of the internet. Another name for Generation Z is Internet Generation (Turner, 2015). They are native technology enthusiast who spend lot of time in front of screens because they were raised in the era of touchscreen devices. Their awareness and acceptance of media and information literacy, as well as their patterns of media consumption, have been significantly impacted by the evolving nature of information and communication technology. Globally, ninety five percent of people own a smartphone, eighty three percent own a laptop, seventy eight percent own an advanced gaming console, and fifty seven percent own a desktop computer, their source for entertainment is the internet, which seventy two percent of them primarily use for message boards, apps, and videos. Gen Z members are truly digital natives, they are immersed in technology 24/7 (CGK Research, 2020). The concept of “digital native” was first introduced by Prensky (2001), he divided internet users in two categories namely digital immigrants and natives. The generation born after the invention of technology is known as the digital natives. Generation Z is used to engaging and communicating in a world where social media, smartphones, tablets, and flat-screen TVs are examples of technological advancements in multimedia (Panagiotou & Nikolaos, 2022). They have not encountered life beyond internet (Evans & Robertson, 2020). It is assumed that Generation Z exhibits strong digital literacy in terms of both operational and accessing skills. However, information processing is a challenge for digital natives

(Rahmawati, 2020). Generation Z's proficiency with digital technology is referred to as their level of digital literacy. It comprises skills such as information literacy, digital platform communication, and critical thinking (Khulwa & Luthfia, 2023). Although Generation Z has to be well-versed in digital literacy because they are the ones who use the internet the most and actively, digital literacy does not mean emphasizing on access and operational abilities. Their lack of digital literacy will render them vulnerable to intolerant speech, misinformation, and computational manipulation (Van Deursen & Van Dijk, 2010).

Technological advancement has increased the traffic in cyber world. Generation Z internet users engage freely online, due to low self-awareness of internet use or insufficient digital direction may result in their involvement in cybersecurity risks (Supratman & Wahyudin, 2017). Identity theft is the major concern for Generation Z as they share their personal information online spontaneously without understanding the consequences (Hewson et al., 2018).

## **Research Gap**

After reviewing various literatures, it has been found that major studies have been on digital communication, digital skills and digital literacy among Generation Z. But the gap which was discovered is that many studies have not covered the aspect of digital knowledge and digital access of information among Generation Z. Generation Z is assumed to be proficient with digital technology. Previous researches observe that Generation Z engages heavily online hence they are more exposed to online risk. Existing literature outlines general cybersecurity risk such as identity theft and privacy. Generation Z needs to successfully navigate and protect their online presence as they are prone to financial fraud and illegal data access because of their high level of digital engagement and frequent online transaction. However, research gap exists in understanding challenges like hacking and financial fraud faced due to digital illiteracy among Generation Z even though they are considered digital natives. Based on this, the present study focused on more relevant variables related to digital literacy and digital illiteracy.

Digital literacy fosters critical thinking, source evaluation, and the ability to distinguish between reliable and unreliable information among Generation Z. Digital literacy helps to understand digital content, protect personal data, avoid online scams and safeguard against cyber threats like identity theft, hacking and financial fraud.

## Research Questions

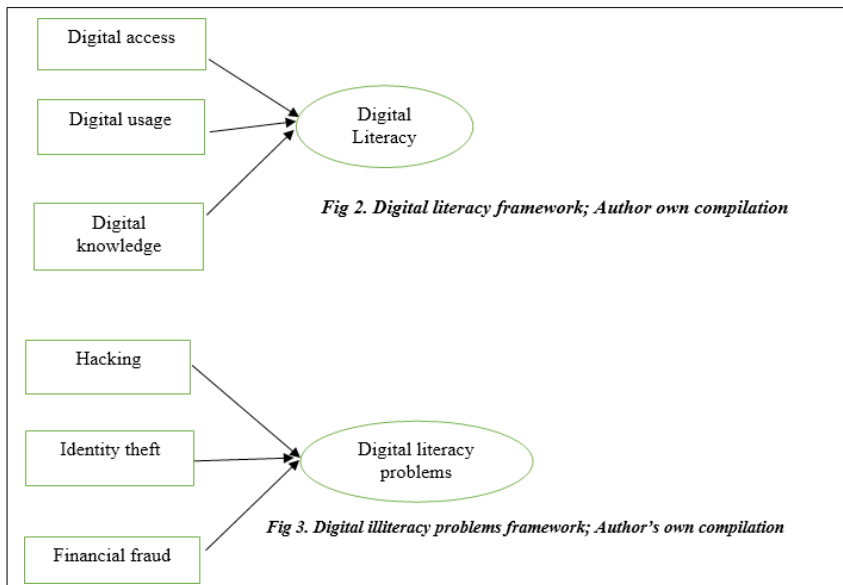
After exploring past literature about digital literacy, the paper aims to answer the following research questions:-

- What is the level of digital literacy among Generation Z?
- What are the digital threats faced by Generation Z due to digital illiteracy?
- How digital literacy helps to overcome digital challenges?

## Research Methodology

### Research Framework

This study systematically examines the existing literature on digital literacy to establish a conceptual framework to understand the digital literacy of the respondents. Firstly, the researchers consider three indicators to test digital literacy which were digital access, digital usage and digital knowledge. Studying these variables together can provide holistic view of digital literacy. Digital threats were identified by means of identity theft, financial frauds, and hacking. Below are the two figures representing the research framework of the study.



The following hypothesis were tested in the study based on above conceptual framework

H1<sub>0</sub>: There is no correlation between the variables digital access, digital usage and digital knowledge.

H1<sub>1</sub>: There is a significant correlation between the variables digital access, digital usage and digital knowledge.

H2<sub>0</sub>: Digital Literacy does not significantly contribute in reducing digital theft and fraud

H2<sub>1</sub>: Digital Literacy significantly contribute in reducing digital theft and fraud.

## Data Collection and Analysis

### Sampling and Data Collection

The research was done on the Generation Z<sup>1</sup> population of Uttar Pradesh, a state in India. Data was collected by means of random cum convenience sampling technique. Questionnaire which was self-administered was sent through anonymous mails and QR code scanners to the college going students who were either receiving stipend, scholarship or some amount of money. Data was sent to four hundred respondents which was responded by three twenty-five respondents, after which in total three hundred respondents were used for the final study after removing incomplete responses. In order to test each construct, four questions were employed which ranges from strongly agree (5) to strongly disagree (1) on five-point Likert scale.

### Demographic Profile of Respondents

Profile of the respondents is represented by Table 1. Three categorical variables have been utilized to segregate respondents on the basis of socio-demographic factors which were gender, education and location. Although it has been tried to distribute the sample equally yet there have been differences in the responses. In the gender category it was a greater number of females which responded as compared to males. Education wise also population was spread among graduate, post graduate and doctorate students, here also graduate students engaged in some kind of internship or apprenticeship responded with sixty percent, while rest of

---

<sup>1</sup>As per United States Gen Z population constitutes people born between 1997 to 2011.

the respondents belonged to the other two categories. Urban respondents willingly participated with a score of 62.5 percent followed by metropolitan residents. Income of the respondents ranged from fifteen thousand to thirty thousand INR p.m. by means of stipend, scholarships and apprenticeships or attached to tuitions also.

Table 2. Demographic profile

Characteristics	Details	Total number
Gender	Male	125
	Female	175
Education	Graduate	188
	Post graduate	72
	Doctorate	40
Region	Rural	80
	Urban	120
	Metro	100

## Evaluation of the Constructs Used

The primary purpose of the paper was to identify the constituents of digital literacy and as well as the challenges due to digital illiteracy prevalent among the Generation Z. SPSS 20 was used to analyze and interpret the data. As the questionnaire used was self-structured, reliability and consistency were checked through Cronbach's Alpha. Alpha score was found to be .831 which is considerably accepted. Additional factor analysis was conducted to identify the most common variance among all variables and provide a single score.

Table 3. KMO and Bartlett's Testa

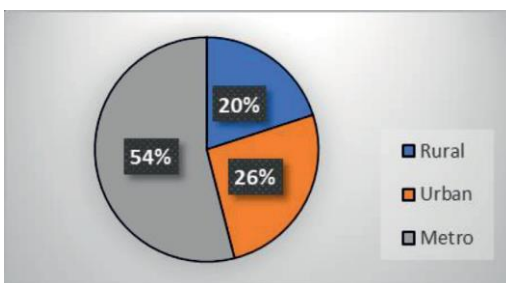
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.595
Bartlett's Test of Sphericity	Approx. Chi-Square	589.427
	df	91
	Sig.	.000

Table 3 shows the results of KMO Bartlett Test. According to the table, it is showing the value of which is acceptable, as it is greater than 0.5. The Bartlett Test of Sphericity showed a significant value of 0.000, indicating a strong correlation between variables due to having values less than 0.05. Principal component analysis

method was used to extract variables and to retain major information from large data sets. In total, six components were isolated bearing cumulative variance of 73.387, much higher than the sixty percent cut off. Since all the eighteen variables employed showed a total factor loading above 0.50, six factors extracted can be taken into consideration.

It shows that digital literacy is composed of digital access, digital usage, digital knowledge. It can be inferred that without access to digital tools and services one cannot be a part of digital inclusion. After having access to digital tools and services one uses digital knowledge to avail services without being duped by cyber frauds and scams. With increased usage of digital tools and services one develops confidence to be digitally aware, skilled and competent. When a population is digitally illiterate and cannot understand the usage and application of digital tools and services it becomes a major issue to protect one's privacy, financial losses and protection of confidential data. Thus, this research answers two research questions about the constituents of digital literacy and the threats due to digital illiteracy.

*Fig 4: Digital access based on location*



*Fig 5: Digital knowledge based on education*

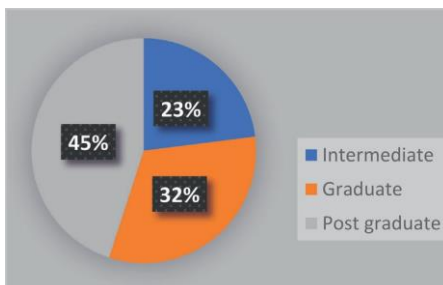
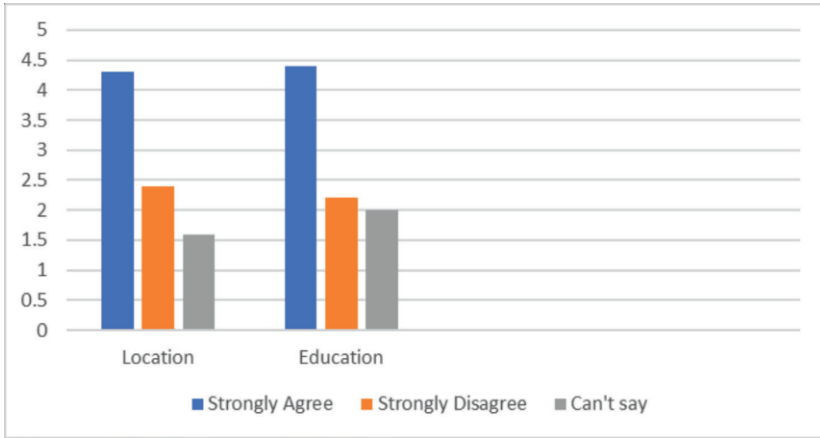


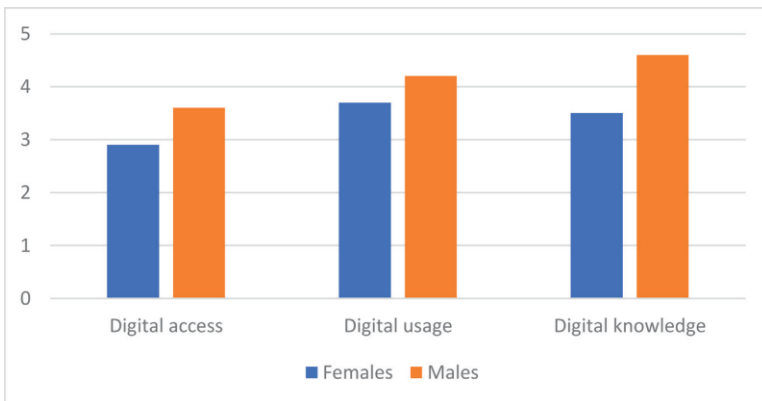
Fig 6: Digital usage as per socio-economic variables



The level of digital literacy varies as per socio-economic variables. An individual living in the rural premises could not have enough access to digital tools and services, therefore due to unavailability their usage of digital medium also remains restricted. Their urban counterparts though have access to digital medium but their digital knowledge in terms of privacy and security issues lands them in serious troubles. From the pictorial representation above it can be inferred that:

Hypothesis 1 holds true which says that there is a significant correlation between the variables digital access, digital usage and digital knowledge.

Fig 7: Digital literacy as per gender estimates





Hypothesis 2 holds true that digital Literacy significantly contribute in reducing digital theft and fraud.

Females though active on social media and prone to online shopping but generally respond to suspicious mails and links leading to identity theft. Since the respondents mostly constituted job aspirants and freshers it was obvious that lure for job opportunities was one of the reasons behind responding to suspicious mails and junk calls. As the Generation Z comprises of young respondents, updates on social media, online payments, anonymous comments on digital medium leads to financial frauds, identity thefts and security issues. Digital literacy if promoted by the concerned authorities and organizations can help in promoting digital financial inclusion and making masses digitally literate. It has also been observed that digital tools require certain parameters such as having an active bank account, enough amount of money apart from availability and knowledge of these services. Since, they do not have enough training of digital technology it makes it even more difficult for them to be digitally sound. All the stakeholders should make enough efforts to make Generation Z digitally adept only to be successful in digital financial inclusion.

## Interpretation and Findings

*Table 4. ANOVA with Friedman's Test and Tukey's Test for No additivity*

			Sum of Squares	df	Mean Square	Friedman's Chi- Square	Sig
Between People			1711.067	299	5.723		
	Between Items		768.020	14	54.859	1.498	.000
Within People	Residual	No additivity	45.121*	1	45.121	44.783	.000
		Balance	4216.592	4185	1.008		
		Total	4261.713	4186	1.018		
	Total		5029.733	4200	1.198		
Total			6740.800	4499	1.498		
Grand Mean = 4.1600							
a. Tukey's estimate of power to which observations must be raised to achieve additivity = 2.635.							

Further ANOVA with Friedman's Test was done to find out correlation between variables. All the constructs proposed under digital literacy exhibited positive correlation with each other namely digital access, digital usage, digital knowledge. The table further stated that inter-item correlation study found that the probability

( $p=0.05$ ) and Chi-Square test statistic is 53.884. Since, value of  $p$  exhibits significance level of .000 it can be inferred that, digital literacy helps in reducing cyber frauds and thefts. It further justified that the variables are the correct model to use in testing the effective correlations between various programs. Another important indication is the standardized residual value, which is a positive value of 45.121 with a significance level of .000, suggesting that digital literacy is over-represented in the actual sample relative to expected frequency. Since, the sample targeted was mainly the urban respondents with a significant understanding of digital tools and techniques further study should target rural respondents with other constructs too. Digital financial inclusion which is the need of the hour has two important indicators; digital literacy and financial literacy. There is significant digital divide among the rural and urban respondents which should be addressed in the further studies and researches. This indicated that there were more subjects in the variables than expected. Results highlight fact that on an average, there is a considerable decrease in digital thefts and frauds due to increasing digital literacy. The study also addresses hacking, which involves unauthorized access to data in a system or computer. The study also addressed hacking, which is the illegal access of data in a system or computer. It is also a kind of digital fraud which can be minimized by avoiding network intrusions and secure and strong passwords. Awareness and knowledge are needed to secure oneself from such digital frauds. Based on the above results following results have been inferred-:

- Generation Z need to work on the digital literacy as from the study it can be inferred that although the generation is equipped to use android phones, laptops and its various apps but when it comes to online thefts and frauds they are easily deceived by scammers and fraudsters. Since, Generation Z uses digital tools more frequently, chances are that they can be conned easily. It is therefore necessary that this generation should increase its scope of digital literacy.
- When an individual becomes technologically sound, he/she can make decisions which help him/her to minimize identity threats, transaction losses and breach of information issues. Often cases are seen where people get fooled by scammers and they suffer financial losses while some also land in personal troubles. High levels of digital literacy help to avail digital finance easily and securely.
- Digital literacy helps to embrace faceless, contactless transaction making population a part of digital financial inclusion. As the economy plans for

financial inclusion and sustainable finance, digital literacy would be helpful in attaining these goals.

- Digital literacy makes a person aware of digital threats and challenges while doing any form of digital marketing on social media platforms. Engaging with anonymous audience is safe only when a person has complete knowledge about digital tools, apps and technologies. Since, all businesses are making their presence in the online platform to cater consumer attention, digital marketing knowledge is must for any online commerce and trade.

## Limitations

Digital literacy refers to the abilities and information needed to use digital technology to fulfill personal goals, improve employability, and assist educational and training programs. Digital literacy improves the core skills of learning, reading, writing, oral communication, and numeracy. The current study, like previous research, has some constraints and limitations:

- While this study focuses on issues and threats, it might go further into ways of protecting the included capabilities.
- While this study focuses on the threats and issues facing Generation Z, it might be broadened to investigate the impact of digital literacy on professionals, education, communication, and personal lives.
- Since the ubiquitous effect of digital literacy in all fields, respondents from Lucknow, Uttar Pradesh, have been invited to take part in the survey.
- In the study, the Generation Z's who are aged between 12-27 years are the part of this study, it can be extended and will be more focused upon the Generation Z's who are above 27 years.
- In the study, male and female both genders are being taken as a respondent but this study can also be gender specific (either male or either female), as this would lead the researchers to identify the challenges and threats that the specific gender is facing.

## Conclusion

Digital literacy is essential for Generation Z, since it helps them to successfully navigate the digital world. The study examines the digital literacy level of

Generation Z, they are highly proficient in using digital platforms or applications for communication and shopping. The study also found that Generation Z residing in rural areas face limitations in utilization of digital media due to limited access to digital tools and services whereas urban counterparts have access to digital media but they face threats due to lack of understanding about privacy and security issues. This generation, often referred to as digital natives, faces both opportunities and challenges in utilizing technology for various purposes, including job search, communication, and managing finance. Digital literacy campaigns and initiatives should concentrate on addressing a number of issues that need to be resolved, including a lack of advice, a lack of understanding about the ethical use of the internet, and difficulty navigating the abundance of information available online. Moreover, the government should encourage schools to incorporate digital literacy in curriculum especially related to certain skills like financial literacy, e-safety and privacy since currently the curriculum only focusing on technical skills.

## References

1. Adam, I. O., & Alhassan, M. D. (2021). Social Media and E-Commerce at the Global Level: Do ICT Access and ICT Skills Matter? *International Journal of E-Business Research (IJEBR)*, 17(4), 1-18.
2. Ferrari, A. (2012). Digital competence in practice: An analysis of frameworks. JCR IPTS, Sevilla.
3. Giancola, F (2006). The generation gap: More myth than reality. *Human Resource Planning*, New York, NY: HRPS, ISSN 0199-8986, ZDB-ID 8522935. - Vol. 29.2006, 4, p. 32-37
4. Heitin, L. (2016). What is digital literacy? *Education Week*. <https://genhq.com/generation-z-consumer-research-2020/>
5. Jhonson, B., Andriani, R., Noviana, I., & Tamara, D. (2023). The influence of digital financial literacy on financial well-being through spending, saving, and investment behavior in Indonesia. *Journal of Business Studies and Management Review*, 6(2), 157-168.
6. Khulwa, C. A., & Luthfia, A. (2023). Generation Z Students' Digital Literacy on Online Learning Readiness. 11th International Conference on Information and Education Technology (ICIET). Fujisawa, Japan: IEEE. <https://doi.org/10.1109/ICIET56899.2023.10111186>

7. Panagiotou, N., Lazou, C., & Baliou, A. (2022). GENERATION Z: MEDIA CONSUMPTION AND MIL. *Imgelem*, 6(11), 455-476. <https://doi.org/10.53791/imgelem.1187245>
8. Prensky, M. (2001). Digital Natives, Digital Immigrants. *On the Horizon*, 9(5), 1–6. <https://doi.org/10.1108/10748120110424816>
9. Rahmawati, D., Lumakto, G., & Kesa, D. D. (2020). Digital Natives Generation in News Consumption Practices in Digital Environments. *Communications*, 2(2),74-98. <https://doi.org/10.21009/Communications.2.2.5>
10. Tapscott, D. (2013). *Grown Up Digital: Yang Muda Yang Mengubah Dunia*. Gramedia Pustaka.
11. The Center for Generational Kinetics report published in (2020), *THE STATE OF GEN Z” 2020*
12. Turner, A. (2015). Generation Z: Technology and Social Interest. *The Journal of Individual Psychology*, 71(2), 103–113.
13. Van Deursen, A. J. A. M., & van Dijk, J. A. G. M. (2010). Measuring internet skills. *International Journal of Human-Computer Interaction*, 26(10), 891-916. <https://doi.org/10.1080/10447318.2010.496338>
14. Weninger, C. (2022). Skill versus social practice? Some challenges in teaching digital literacy in the university classroom. *Tesol Quarterly*, 56(3), 1016-1028.

\*\*\*\*\*



### Authors' Profile

Ms. Anuradha Maurya is working as an Associate Professor at SOM, BBD University. She is having more than fifteen years of Industry and Academic experience in the area of Finance and Marketing. She is also pursuing PhD from Dr. Ram Manohar Lohia Avadh University, Uttar Pradesh. Her area of interest includes Portfolio Management, Mutual Fund and Derivatives Market

Ms. Samiksha Gupta is working as Assistant Professor at SOM, BBD University and is pursuing PhD from there. Having more than eight years of teaching experience with specialization of Marketing and Human Resource Management. Her area of interest is Brand Management, Consumer Behaviour, Social Media Marketing and Integrated Marketing Communication.

Ms. Anushree Srivastava is pursuing PhD from Dr. APJ Abdul Kalam Technical University, Uttar Pradesh and also working as an Assistant professor in SOM, Department, BBD University. She is having more than nine years of academic and industry experience. She has also qualified N.E.T. examination conducted by N.T.A in the year 2020. Her areas of interest are financial literacy, digital literacy, financial inclusion, economic empowerment.



## 3.5 What's Next for AI: Future Expectations and Predictions

*Ms. Parbati Prasad Misra, AAO, CCA Odisha*

### Abstract

By surpassing human abilities, artificial intelligence (AI) is transforming areas such as healthcare, financial services, education, transport, etc. This paper investigates AI's historical growth, from early automatons to modern advances in machine learning (ML) and deep learning (DL). ML enables predictive analytics, such as fraud detection and personalized suggestions, whereas DL replicates human neural processes, outperforming humans in complex tasks. AI's incorporation into healthcare improves diagnoses and patient care, while in education it personalizes learning opportunities. Despite its benefits, AI presents ethical questions about biases, privacy, and eventual employment displacement. The proliferation of deepfakes, as well as the ramifications for misinformation and public trust, emphasize the importance of strong governance and ethical AI research. The study calls for comprehensive policy frameworks that address transparency, accountability, and data.

### Keywords

Machine learning, artificial intelligence, deep learning, ethical AI, AI Governance

### What is AI?

Artificial Intelligence, or AI, is a technology that enables machines and computers to think and solve problems like human beings. AI technology has the capability to process vast amounts of data in ways that surpass human abilities. The ultimate goal of AI is to replicate human-like abilities such as pattern recognition, decision-making, and judgment. Achieving this requires the integration of extensive data. AI is used in critical applications like image recognition and classification, transforming decision-making processes. For example, AI can predict traffic light patterns. These advancements rely on the development of AI algorithms modelled after the human brain's decision-making processes. This enables the technology to learn from data and make increasingly accurate predictions and classifications over time.

## A Brief History of AI

The concept of artificial intelligence (AI) dates back thousands of years to ancient philosophers pondering questions of life and autonomous existence. Early inventors created “automatons,” mechanical devices that operated independently, with the term originating from the ancient Greek meaning “acting of one’s own will.” One of the earliest known automatons was a mechanical pigeon from 400 BCE, attributed to a friend of the philosopher Plato. Leonardo da Vinci later created one of the most famous automatons around 1495. However, for the purposes of modern AI, the significant advancements began in the 20th century.

From 1900 to 1950, the idea of artificial humans permeated media, inspiring scientists to question the possibility of creating an artificial brain. The term “robot” was coined in Karel Čapek’s 1921 play “Rossum’s Universal Robots.” In 1929, Japanese professor Makoto Nishimura built the first Japanese robot, named Gakutensoku. The period from 1950 to 1956 marked the birth of AI. Alan Turing’s 1950 paper “Computer Machinery and Intelligence” proposed the Turing Test to measure machine intelligence. In 1952, Arthur Samuel developed a checkers-playing program, and by 1955, John McCarthy’s Dartmouth workshop coined the term “artificial intelligence.”

From 1957 to 1979, AI research saw rapid growth and challenges. The first programming language for AI research was LISP (List Processing). It was developed by John McCarthy in 1958. In 1959, Arthur Samuel coined the term “machine learning”. The 1960s saw the pioneering of the first industrial robot Unimate and the first “chatterbot” (later shortened to chatbot). However, the 1970s also experienced setbacks, such as reduced funding due to unmet expectations. The 1980s, known as the “AI boom,” saw significant advancements despite a subsequent “AI Winter” from 1987 to 1993, where interest and funding waned. Noteworthy achievements included IBM’s Deep Blue defeating world chess champion Garry Kasparov in 1997 and the release of the Roomba in 2002.

From 2012 to the present, AI has surged in mainstream applications, with notable milestones such as Google’s neural network recognising images in 2012, the development of humanoid robot Sophia in 2016, and OpenAI’s GPT-3 and DALL-E advancing natural language processing and image understanding. These developments illustrate AI’s evolving role in transforming various aspects of society and hint at its potential future impact.



## What is Machine Learning?

Machine learning (ML) is a branch of artificial intelligence (AI) and computer science that leverages data and algorithms to mimic human learning, gradually enhancing its accuracy. As a subfield of AI, machine learning employs algorithms trained on data sets to create self-learning models capable of predicting outcomes and classifying information without human intervention. Today, machine learning is widely used for various commercial purposes, including product recommendations based on past purchases, stock market predictions, and text translation across different languages. It is the most prevalent form of AI technology in use globally.

In everyday life, machine learning is available in several common applications. Recommendation engines, such as those on Amazon, Spotify, and Netflix, suggest products, songs, or television shows tailored to individual preferences. Speech recognition software converts voice memos into text, making note-taking more efficient. Banks utilise ML for fraud detection services, automatically flagging suspicious transactions to protect customers. Additionally, machine learning enhances vehicle safety through self-driving cars and driver assistance features like blind-spot detection and automatic stopping. These examples illustrate the significant impact of machine learning on various aspects of modern life.

## What is Deep Learning?

Deep learning (DL) is a powerful subset of machine learning (ML) that can process, interpret, and use much larger and more complex data sets. Unlike traditional machine learning, which relies on simpler “if this, then that” logic, deep learning mimics how our brains work by processing data through multiple layers. With enough training data, these neural networks can outperform humans in tasks like speech recognition and playing chess.

For example, deep learning enables Google to provide search results tailored specifically to your needs and suggest what others are searching. This technology enhances the relevance and accuracy of search results.

Machine learning can ask and answer one question at a time, often needing human intervention afterwards. In contrast, deep learning continuously asks and answers questions, building on each response to gain deeper insights. This makes deep learning the most advanced and sophisticated form of AI technology today.

## The Current State of AI

AI technologies have made significant strides and have numerous applications across various industries, from healthcare to finance. In healthcare, AI is used to detect diseases, analyse medical data for early diagnosis, and discover new drugs. A notable case study highlighting these implications is the application of AI in healthcare, particularly in the diagnosis and treatment of diseases. AI algorithms, such as those used in imaging technologies, have revolutionised early detection of conditions like cancer. For instance, Google's DeepMind developed an AI system that can analyse mammograms with greater accuracy than human radiologists, reducing both false positives and missed cases. This advancement implies significant improvements in patient outcomes, as early and accurate diagnosis can lead to more effective treatment. AI-powered robots are used for carrying goods, cleaning, and managing inventories in various industries. These robots use real-time updates to navigate obstacles and optimise their tasks, improving efficiency in hospitals, factories, and warehouses. AI is increasingly being integrated into education to boost productivity and allow educators to focus more on students. It automates administrative tasks such as grading, managing enrolments, and communicating with parents. AI also helps create smart content by digitising educational materials and generating interactive learning experiences. Voice assistants provide students with additional learning resources without the direct involvement of educators. Personalised learning is another significant application, where AI monitors students' habits and generates customised lesson plans, reminders, and study guides.

AI enhances personalised shopping experiences by creating recommendation engines based on user's browsing history, preferences, and interests, thereby improving customer engagement and brand loyalty. AI-powered virtual shopping assistants and chatbots use natural language processing to provide a more human-like and personalised shopping experience, handling real-time customer interactions and potentially managing customer service. AI also plays a critical role in fraud prevention by identifying unusual patterns to reduce credit card fraud and managing fake reviews. AI chatbots understand natural language and provide effective customer service by building a database of answers and pulling information from integrated sources. These chatbots improve customer satisfaction by resolving issues and providing 24/7 support. Platforms like Instagram, Facebook, and Twitter also use AI to personalise user experiences, detect fraud, and remove harmful content. AI analyses user behaviour to recommend content and improve engagement. AI is used in financial services to detect fraud, automate tasks, and assess loan risks. It helps customers with wealth management solutions

and improves transaction security. AI's predictive capabilities enhance financial decision-making and risk management.

## Risks and Dangers of AI

As AI becomes more sophisticated and widespread, the potential threats cannot be ignored. Prominent figures in the tech industry, such as Geoffrey Hinton and Elon Musk, have expressed concerns over AI's potential to surpass human intelligence and act beyond our control, highlighting the urgency of addressing these risks. One of the foremost concerns regarding AI is the opacity of its decision-making processes. AI and deep learning models can be incredibly complex, making it difficult for even experts to understand how and why certain conclusions are reached. This lack of transparency can result in biased or unsafe decisions, eroding trust in AI systems.

While the development of explainable AI aims to address these issues, widespread implementation remains a significant challenge. AI-powered automation poses a substantial threat to employment, particularly in sectors like marketing, manufacturing, and healthcare. The rise of smarter, more dexterous AI robots means that fewer humans will be needed for the same tasks. Although AI is projected to create new jobs, the skills required for these roles may leave many current workers behind, exacerbating socioeconomic inequalities.

AI's capability to manipulate social behaviour is another significant risk. Social media platforms like TikTok use AI algorithms to curate content, which can lead to the spread of harmful and inaccurate information. During the Philippines' 2022 election, for example, AI-driven content played a role in political manipulation. The proliferation of AI-generated images, videos, and deepfakes further complicates the landscape, making it increasingly difficult to distinguish between credible and false information. The dangers of deepfakes extend beyond mere misinformation. They pose a serious threat to public trust and personal reputations. For instance, a notorious incident occurred in November 2023 when a deepfake video of actress Rashmika Mandanna surfaced on social media. In this manipulated video, the face of a British-Indian influencer woman, dressed in a black workout attire, was seamlessly replaced with that of the popular Bollywood actor. The video quickly went viral, causing widespread confusion and showcasing the ease with which deepfake technology can be used to deceive the public. Such instances highlight the potential for deepfakes to disrupt elections, damage the credibility of public figures, and incite social unrest. They blur the lines between reality and

fabrication, undermining the foundation of trust upon which societies function. AI's potential to undermine ethical standards and societal goodwill is a growing concern. Religious leaders, including Pope Francis, have called for international treaties to regulate AI development and usage. The misuse of AI for disinformation, academic dishonesty, and biased decision-making highlights the need for a moral framework guiding AI advancements. Ensuring that AI technology is aligned with ethical principles is essential to maintaining trust and fairness in society. AI's use in surveillance technologies raises serious privacy and security concerns. In China, facial recognition technology is used extensively to monitor citizens' activities and political views. The potential for AI to be used as an authoritarian tool underscores the importance of establishing robust regulations to protect individual freedoms.

AI systems are susceptible to various forms of bias, which can amplify existing societal inequalities. These biases often stem from the data used to train AI models, as well as the homogeneous backgrounds of AI developers. Speech recognition systems, for instance, frequently fail to accurately interpret non-standard dialects and accents. Ensuring diversity in AI development and addressing data biases are crucial steps towards creating fair and equitable AI systems. Overreliance on AI technology could diminish human influence and capabilities in various areas. In healthcare, excessive use of AI might reduce empathy and reasoning in patient care. In creative fields, AI-generated content could stifle human creativity and emotional expression. Maintaining a balance between leveraging AI's benefits and preserving human skills and interactions is essential for societal well-being.

In the financial sector, AI algorithms can contribute to market volatility and financial crises. Algorithmic trading, which involves making high-frequency trades for small profits, can lead to sudden market crashes. The 2010 Flash Crash and the Knight Capital Flash Crash exemplify the dangers of AI-driven trading. Ensuring that financial organisations understand and manage the risks associated with AI algorithms is critical to maintaining market stability.

## Policy Recommendations

To ensure the responsible development and use of artificial intelligence (AI), governments and policymakers must implement a comprehensive set of policy measures. First, they should create robust frameworks to guide the ethical development of AI, focusing on preventing algorithmic biases, ensuring transparency in decision-making processes, and holding developers accountable.

These ethical standards must address critical issues such as data privacy, fairness, and the elimination of harmful biases in AI systems.

A key component of these frameworks is the establishment of strong data protection laws. These laws should prioritise user consent, data minimization, accountability, and strict enforcement, ensuring alignment with international standards such as the EU's General Data Protection Regulation (GDPR). Additionally, governments should enforce transparency in how data is collected, used, and shared, safeguarding individual privacy while preventing data misuse in AI applications.

Another crucial policy direction is fostering research in AI safety, particularly in high-stakes sectors such as healthcare and autonomous systems. Governments should promote collaboration between universities, private companies, and public institutions to develop secure, reliable, and ethical AI systems. Special attention should also be given to privacy-preserving AI research, with investment in technologies like differential privacy to minimize data risks while maintaining utility.

Policymakers should also rely on international standards as the foundation for AI regulation, harmonizing national laws with global approaches to ensure cross-border cooperation and avoid fragmented regulatory landscapes. This alignment will encourage innovation while maintaining ethical and security standards. Furthermore, sector-specific regulations are needed to address the unique challenges in industries such as healthcare, finance, and autonomous vehicles, following the examples set by countries like Japan and Germany.

Education and workforce development should be another priority. Governments must integrate AI literacy into school curriculums and adult education programs, preparing future generations for an AI-driven world. Additionally, they should invest in upskilling programs to help workers displaced by automation transition into new roles that complement AI technologies. AI itself can be leveraged to personalize retraining and reskilling programs, aligning workers' skill sets with new opportunities.

Finally, governments should mandate the use of Data Privacy Impact Assessment (DPIA) tools to proactively manage privacy risks in AI systems. Policymakers must also prioritise research and development of Explainable AI (XAI) to address the "black box" problem, ensuring AI decision-making processes are transparent and trustworthy. By adopting these comprehensive policies, governments can

create an environment where AI thrives responsibly, with ethical considerations at the forefront of innovation.

## Artificial Intelligence and the Future

Artificial Intelligence (AI) has become one of the most transformative technologies of the 21st century, shaping the future of various industries, including healthcare, transportation, finance, and education. This literature review examines the current landscape of AI research and its potential implications for the future, drawing on various sources that discuss its transformative potential across domains.

AI refers to the simulation of human intelligence processes by machines, particularly computer systems. These processes include learning (acquiring information and rules for using it), reasoning (using the rules to reach approximate or definite conclusions), and self-correction. Historically, AI has evolved from symbolic AI and expert systems to modern-day machine learning and neural networks (Russell & Norvig, 2016).

Negrotti (1991) highlights the need to understand the concept of “artificial” itself to navigate advancements in AI technology effectively. Dhar (2016) further emphasizes AI’s transformative potential in various industries, while Russell (2017) explores the concept of superintelligence, speculating that the future of AI may involve systems with highly advanced and human-like cognitive abilities.

AI is already revolutionizing numerous sectors. In healthcare, AI-driven systems enhance diagnostic accuracy and treatment personalization through the analysis of vast datasets (Topol, 2019). Lee (2018) discusses the role of AI in biobanking, noting its promise for improving patient care. Desai (2018) and Miyazawa (2019) explore AI’s applications in obstetrics, gynecology, and cardiology, respectively, showcasing AI’s potential for transforming medical fields. Panesar et al. (2019) and Neumann et al. (2019) focus on the future of surgical robotics and endoscopy, emphasizing AI’s critical role in advancing these medical technologies.

In education, AI has emerged as a powerful tool for enhancing teaching and learning processes. Yanhua (2020) and Mijwil et al. (2022) highlight AI’s potential to improve foreign language teaching and overall education quality. By personalizing learning experiences and providing intelligent tutoring, AI promises to make education more accessible and effective.

Beyond healthcare and education, AI is reshaping professional work. Sako (2020) and Harayama et al. (2021) explore how AI will influence the future of work, suggesting that AI will play a significant role in shaping tomorrow's workforce. AI can augment professional tasks, allowing workers to focus on more complex, creative, and high-value activities.

The ethical implications of AI remain a subject of extensive debate. Issues like privacy, bias in algorithms, and transparency in decision-making processes are central to AI ethics discussions (Floridi & Cowls, 2019). AI systems trained on biased data can perpetuate existing inequalities, leading to unfair outcomes in areas such as hiring and criminal justice (O'Neil, 2016).

Furthermore, the lack of transparency in AI-driven decisions, often termed the "black box" problem, can erode public trust in AI systems (Pasquale, 2015). As AI becomes more deeply integrated into decision-making, developing explainable AI (XAI) systems will be critical for ensuring transparency and accountability (Samek et al., 2017).

The future trajectory of AI depends heavily on the governance structures surrounding its development and deployment. Scholars argue that AI governance must address challenges related to accountability, data privacy, and international cooperation (Brundage et al., 2018). Regulatory frameworks like the EU's General Data Protection Regulation (GDPR) offer initial steps in addressing AI's ethical and privacy concerns (European Commission, 2018).

AI's societal implications extend beyond governance, influencing everything from journalism to global research initiatives. Baranowski (2021) argues that AI will play a crucial role in the future of journalism, particularly in automating tasks and creating new opportunities for content delivery. Yuan (2021) emphasizes the growing global research interest in AI, highlighting its role in promoting advancements across sectors.

The literature on AI and the future underscores the transformative potential of this technology across various domains, from healthcare and education to professional work and journalism. As researchers and practitioners continue to explore AI's capabilities, it is evident that AI will play a central role in shaping society's future. However, ensuring ethical governance and transparency will be critical in realizing AI's full potential.

## The Future of AI

The future of AI is incredibly promising but it also poses challenges and ethical considerations that need to be addressed to ensure its positive impact on society. In the future, AI will offer faster and more accurate diagnoses, personalise treatment plans, and improve patient outcomes. AI-powered tools can analyse vast amounts of data, including genetic information, electronic health records, and medical images, to identify patterns and develop new treatments. These advancements will improve the quality of patient care. The future of education with AI will be more application-based, moving away from rote learning to a more hands-on approach. AI-driven tools can assist teachers in creating customised lesson plans and offer students interactive and engaging learning environments.

AI's impact on transportation is perhaps most evident in the development of autonomous vehicles. Companies like Tesla and Waymo are leading the way in creating self-driving cars that promise to reduce accidents, optimise traffic flow, and lower emissions. AI-enhanced navigation systems and smart traffic management will make transportation more efficient and sustainable. The future will see more widespread adoption of these technologies, significantly transforming how we move and travel. Future developments in AI will enhance voice search optimisation, augmented reality, voice-activated assistants and predictive analytics.

However, ethical concerns about AI's impact on society, including biases, privacy issues, and accountability, cannot be ignored. As AI continues to evolve, better-developed generative AI models like DALLE2 and enhanced versions of GPT will be released, becoming more common in companies and customer interactions. The healthcare industry will also see expected growth, and the increasing pace of AI usage will likely bring about authorities and regulations for accountability and ethical concerns.

The future of AI looks promising, with new advancements set to make AI a bigger part of our daily lives and various industries. By embracing AI and tackling its challenges head-on, we can use its power to drive innovation, enhance our quality of life, and create a fairer and more sustainable world. As we move forward, it's important to balance progress with ethical considerations and focus on human needs to fully unlock the potential of artificial intelligence.



## References

### Web Articles

1. IBM. (n.d.). *Artificial intelligence*. Retrieved October 2, 2024, from <https://www.ibm.com/topics/artificial-intelligence>
2. TechTarget. (n.d.). *AI (artificial intelligence)*. Retrieved October 2, 2024, from <https://www.techtarget.com/searchenterpriseai/definition/AI-Artificial-Intelligence>
3. HCL Technologies. (n.d.). *Artificial intelligence defined in simple terms*. Retrieved October 2, 2024, from <https://www.hcltech.com/blogs/artificial-intelligence-defined-simple-terms>
4. Tableau. (n.d.). *A history of artificial intelligence*. Retrieved October 2, 2024, from <https://www.tableau.com/data-insights/ai/history>
5. Coursera. (n.d.). *What is machine learning?* Retrieved October 2, 2024, from <https://www.coursera.org/articles/what-is-machine-learning>
6. IBM. (n.d.). *Machine learning*. Retrieved October 2, 2024, from <https://www.ibm.com/topics/machine-learning>
7. IBM. (n.d.). *Deep learning*. Retrieved October 2, 2024, from <https://www.ibm.com/topics/deep-learning>
8. AllTech Magazine. (n.d.). *Current status of artificial intelligence*. Retrieved October 2, 2024, from <https://alltechmagazine.com/what-is/current-status-of-artificial-intelligence/>
9. Gupta, B. (2023, October 1). *India's deepfake dilemma*. LinkedIn. Retrieved October 2, 2024, from <https://www.linkedin.com/pulse/indias-deepfake-dilemma-bhasker-gupta-yzfzc>
10. Satish, V. (2023, October 1). *The rise of deepfakes in India: A call for vigilance and awareness*. LinkedIn. Retrieved October 2, 2024, from <https://www.linkedin.com/pulse/rise-deepfakes-india-call-vigilance-awareness-venkata-satish-vrqqf>
11. McKinsey & Company. (2023). *The state of AI in 2023: Generative AI's breakout year*. Retrieved October 2, 2024, from <https://www.mckinsey.com/>

capabilities/quantumblack/our-insights/the-state-of-ai-in-2023-generative-ais-breakout-year

12. Simplilearn. (n.d.). *Future of artificial intelligence*. Retrieved October 2, 2024, from <https://www.simplilearn.com/future-of-artificial-intelligence-article>
13. Kulich. (n.d.). *The current state of AI*. Elmhurst University. Retrieved October 2, 2024, from <https://www.elmhurst.edu/blog/the-current-state-of-ai/>
14. Pew Research Center. (2018, December 10). *Artificial intelligence and the future of humans*. Retrieved October 2, 2024, from <https://www.pewresearch.org/internet/2018/12/10/artificial-intelligence-and-the-future-of-humans/>
15. Stahl, A. (2021, March 10). *How AI will impact the future of work and life*. Forbes. Retrieved October 2, 2024, from <https://www.forbes.com/sites/ashleystahl/2021/03/10/how-ai-will-impact-the-future-of-work-and-life/>
16. National Institution for Transforming India (NITI Aayog). (2023). *National strategy for artificial intelligence*. Retrieved October 2, 2024, from <https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf>
17. UNESCO. (n.d.). *Recommendation on the ethics of artificial intelligence*. Retrieved October 2, 2024, from <https://www.unesco.org/en/artificial-intelligence/recommendation-ethics>

## Journal Articles

18. Baranowski, P. (2021). AI and the future of journalism. *Journal of Media Studies*, 15(2), 56-74.
19. Bostrom, N. (2014). *Superintelligence: Paths, dangers, strategies*. Oxford University Press
20. Brundage, M., et al. (2018). The malicious use of artificial intelligence: Forecasting, prevention, and mitigation. *arXiv preprint arXiv:1802.07228*.
21. Desai, A. (2018). AI in obstetrics and gynecology: A review. *Journal of Medical AI*, 7(1), 15-25.

22. Dhar, V. (2016). The future of AI: Prospects and perils. *AI & Society*, 31(2), 187-194.
23. European Commission. (2018). GDPR and AI: Data protection in the European Union.
24. Floridi, L., & Cowls, J. (2019). A unified framework of five principles for AI in society. *Harvard Data Science Review*.
25. Harayama, Y., Milano, M., Baldwin, R., Antonin, C., Berg, J., Karvar, A., & Wyckoff, A. (2021). Artificial Intelligence and the future of work. *Lecture Notes in Computer Science*, 53–67. [https://doi.org/10.1007/978-3-030-69128-8\\_4](https://doi.org/10.1007/978-3-030-69128-8_4)
26. Lee, C. (2018). Current issues in biobanking and the role of AI. *Journal of Medical Ethics*, 44(4), 239-248.
27. Miyazawa, K. (2019). AI in cardiology: Transforming diagnosis and treatment. *Cardiology Today*, 15(3), 12-19.
28. Negrotti, M. (1991). *The artificial and the natural: An evolving polarity*. Springer.
29. Neumann, D., et al. (2019). AI in endoscopy: Advancing diagnostic accuracy. *Journal of Surgical AI*, 9(2), 132-138.
30. O’Neil, C. (2016). *Weapons of math destruction: How big data increases inequality and threatens democracy*. Crown Publishing Group.
31. Panesar, S., et al. (2019). The future of AI in surgical robotics. *Surgical Advances*, 8(1), 45-54.
32. Pasquale, F. (2015). *The black box society: The secret algorithms that control money and information*. Harvard University Press.
33. Russell, S. J. (2017). *Human compatible: AI and the problem of control*. Penguin Random House.
34. Samek, W., et al. (2017). Explainable artificial intelligence: Understanding, visualizing and interpreting deep learning models. *arXiv preprint arXiv:1708.08296*.
35. Sako, M. (2020). AI and the future of work: Professionalism in transition.

*Work, Employment & Society*, 34(3), 517-535.

36. Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. *Nature Medicine*, 25(1), 44-56.
37. Yanhua, Z. (2020). AI in foreign language teaching: A new frontier. *Education Review*, 10(3), 101-112.
38. Yuan, Z. (2021). Global AI research trends. *AI Advances*, 20(1), 89-102.
39. Amodei, D., Olah, C., Steinhardt, J., Christiano, P., Schulman, J., & Mané, D. (2016). Concrete problems in AI safety. *arXiv preprint arXiv:1606.06565*.
40. Bresnahan, T., & Trajtenberg, M. (1995). General purpose technologies engines of growth? *Journal of Econometrics*, 65(1), 83-108.
41. Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. WW Norton & Company.
42. Floridi, L., Cowls, J., King, T. C., & Taddeo, M. (2018). How to design AI for social good: Seven essential factors. *Science and Engineering Ethics*, 24, 1777-1803.
43. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson Education.
44. Samek, W., Wiegand, T., & Müller, K. R. (2017). Explainable artificial intelligence: Understanding, visualizing and interpreting deep learning models. *arXiv preprint arXiv:1708.08296*.
45. Tene, O., & Polonetsky, J. (2013). Big data for all: Privacy and user control in the age of analytics. *Northwestern Journal of Technology and Intellectual Property*, 11(5).
46. Voigt, P., & Von dem Bussche, A. (2017). *The EU general data protection regulation (GDPR): A practical guide* (1st ed.). Springer International Publishing.

\*\*\*\*\*



### Author's Profile

Smt. Parbati Prasad Misra belongs to the 1997 Railway Mail Service (RMS) batch in the Department of India Post. She holds a B.Sc. in Mathematics (Hons.) from RCM Science College, Khallikote, Odisha and an M.Sc. in Mathematics from Berhampur University. Her career began as a Sorting Assistant at RMS Berhampur (BG Division).

In 2007, she qualified as an Accountant through the Postal /RMS Accountant Exam, leading to her role as an Accountant in the Postal Life Insurance (PLI) section, CPMG office in Bhubaneswar. She later served as Assistant Head Record Officer (AHRO) in the RMS Cuttack Division.

In 2018, she qualified as an Assistant Accounts Officer (AAO). She was posted at the office of the Joint CCA, NE-II Dimapur, Nagaland. Presently, she serves as an AAO in the Controller of Communication Accounts (CCA), Odisha, Bhubaneswar. Over the years, she has managed key sections, including the Pension Voucher Auditing (PVA), Pension, License Fee (LF) and at present, she oversees pension disbursement related issues for the Authority.

## 3.6 Risk Based Internal Audit

*Shri Kaushik Chawdhary, AO(RMC), Pr. CCA, Kolkata*

### Abstract

Risk Based Internal Audit emphasizes identifying and addressing critical risks, such as compliance lapses, financial inaccuracies, and system vulnerabilities, rather than routine procedural errors. It highlights key risk categories, including compliance, inherent, control, financial, and credential risks, with practical examples like discrepancies in bank guarantees, delayed pension settlements, and misclassification of financial transactions. The current paper outlines the principles, tools, and methodologies for Risk-Based Internal Audit (RBIA) in the telecommunications sector. The paper also stresses the importance of skilled auditors, advanced tools like SARAS and SAMPANN, and data-driven approaches for enhancing audit effectiveness. Benefits of RBIA include improved decision-making, targeted risk mitigation, and alignment with government priorities, though challenges like false alarms and cost are noted. The approach is vital for managing sector-specific risks and ensuring revenue assurance, regulatory compliance, and operational stability.

### Keywords

Risk-Based Audit, Compliance, Revenue Assurance, Internal Audit, Telecom Sector, Financial Risk, Data Analytics, Governance, Cybersecurity, Regulatory Compliance, Technological Advancement.

### Introduction

Risk-based Internal Audit (IA) is a style of internal audit of an organization which focuses upon the analysis and management of risk. Unlike traditional approach, which focus upon the procedural lapses for deviation of Rules & orders, errors in accounting of transactions, and detection of overpayments etc. only; a risk-based approach ensures that, the internal audit activity is focusing its efforts on providing assurance and advisory services related to the organization's top risks. It helps the administration to understand, whether the risk management tools of an organization are sufficient to detect and prevent leakage in revenue earning, misappropriation

of Government money and check in expenditure to better achieve organizational objectives through good governance and control.

## Roles of Auditors & Scope

Internal auditors play a critical role in risk management. The inspection should be independent/objectively derived and the auditors should not compromise with the objectives of internal audit. The auditors are responsible for identifying the potential risks in the existing system as well as speculating the risk may involve in changed scenario. They should not only detect the risk but suggest or provide recommendations on how to mitigate these risks and help the organization implement these measures. Internal auditors can reduce duplicate efforts and increase the effectiveness of overall risk management by coordinating the internal audit reports with the risk management team.

## Criteria for Selection of Audit Team

Selection of auditors in the internal audit team is important and auditors should be well versed in rules and latest Government orders, Standard Operating Procedures (SOPs), etc. Auditors should have basic concepts, frameworks, tools, and techniques related to risk and risk management. They must also have the working knowledge in relevant software and applications run in the department and its limitation so that system audit can be done to check & prevent manipulation of data, if any.

In addition, they should have the knowledge in all fields of works in the department and maintenance of records and registers in the manuscript formats also.

## Identification of Risks

The first approach to Risk Based Audit is to identify the nature of Risk. Following are the type of risks involved in financial audit.

**Compliance Risk:** Risk involved when the right Procedures, SOPs and Guidelines as per prevailing Rules & Orders are not followed.

**Inherent Risk:** It is the possibility of inaccurate information appearing in financial statements or bills due to error on commission or omission. Like imposing wrong percentage of GST or TDS on Income Tax.

**Control Risk:** This kind of risk may be involved due to lack of control over routine workflow or non-adherence to timeline, like non issuance of required Bank Guarantee (BG) after BG rationalization or non-issuance of demand notice to the TSPs/ISPs on time, contempt of Court Cases, imposing of heavy penalty, interest in delayed settlement of claim cases, wrong assessment of dues, over payment or short payment, and surplus adjustment. Sometimes, leakage in revenue generation or revenue collection due to lack of control may lead to control risk.

**Financial Risk:** Financial Risk involved due to misclassification of account head or wrong booking (Dr. or Cr. Swap) or improper accounting affect the financial statement, resulting in adverse balances or negative balances.

**Detention Risk:** Sometimes a superficial auditing may not detect the risk involved in manipulation of account figures, if any, and thereby may lead to detention risk. Cross checking of figures from different statements or registers may overcome this detention risk.

**Credential Risk:** This type of risk involved when credential of the customer or Licensee or Pensioner is not known or in doubt. Review of KYC/KYP, CAF is very crucial else payment to wrong person cannot be averted. In the case of TSPs & ISPs, ascertaining the credential of the authorized person or the signatory is very crucial. In the case of payment authority, the specimen signature of the authorized signatory is essential to check to avoid credential risk. Validation of DSC and its tracking may be done at the time of system audit.

### Tools for Risk based Internal Audit

- Verification of Gross Revenue by checking P&L statement & UDIN from ICAI portal to detect under reporting of revenue by TSPs & ISPs.
- Review of BGs submitted by TSPs & ISPs, whether as per norms.
- Analysis of data by comparing with previous financial year to check the trend.
- Query based analysis of data. (Example: Sample checking of Normal & Enhanced Family Pension, Commutation of Pension, CRD/IDA Rate, Arrear bills, Additional quantum rate eligibility etc.)
- Sample case study of long pending grievances and repetition of same nature of grievances.
- Observations from previous audits and actions taken.



- Previous corrective actions suggested and its implementation.
- Areas that were not inspected during previous audits.
- Procedural and system changes from previous audits.

## **Best Practices That May Be Adopted in the Course of Internal Audit Inspection<sup>(1)</sup>**

In Internal Audit analytical processes including

- (1) Computations
- (2) Comparison
- (3) Component wise segregation of information
- (4) Rational discussion to arrive at any evidence to determine final conclusions.  
Observation, inquiry & inspection enable internal audit teams to collect evidence of risks in the merit.

## **Planning for Risk-Based Audit**

### **Broad Principles**

- (i) Strategic review & understanding of Govt priorities.
- (ii) Review of nature & structure of internal control.
- (iii) Preparation of audit plan.
- (iv) Risk assessment of activities of entity.
- (v) Categorization of risk.
- (vi) Execution of the plan strategy & feedback of auditee.

## **Action to Be Taken**

**Study of Previous Reports:** Study of previous audits bring out the financial compliance & operational risks. Old reports may be studied along with action taken report. Compliance given may be reviewed for its accuracy, implementation & risk covered. Area not covered may be identified & procedural & systematic modifications may be made to improve upon the previous audit.

**Sample Size:** Action taken formations & drawing up of audit plan regarding high-risk areas may be prioritized. Since audit team has access to the previous reports as well as current activity reports like Status of Work Report (SWR), System for Accounting and Management of Pension (SAMPANN) & System for Assessment

of LF Revenue and SUC (SARAS) reports, proper sample size may be identified. Size of the sample should be neither too small nor too big. Sample size should be at least 10% of total records for a meaningful audit. Records which have different time duration should be sampled separately, activities with deadlines may be seen from the point of view of time overruns leading to cost overruns.

**Assessing the Risk Profile:** Periodic recurring activity like pension payment are less risk prone in procedural irregularity. However financial implication needs to be thoroughly checked within a decent sample size. Activities with financial implications are considered as high-risk activity. Therefore, financial loss on leakage can be checked with greater sample size. Since telecom sector is technology driven & is a system based set up, collection of data should be purified in the audit phase to eliminate duplicity, inaccuracy on inconsistency. Information in the data form needs to be analyzed in accordance with defined rules & procedures to identify irregularity.

**Risk cause matrix**

<b>of</b>  <b>Likelihood</b>  <b>occurrence</b>  <b>(probability)</b>	<b>High</b>			
	<b>Moderate</b>			
	<b>Low</b>			
		<b>Low</b>	<b>Moderate</b>	<b>High</b>
				<b>Impact</b>

**Severity**

### Benefits of Risk-Based Audit (RBA)

Auditor can easily justify the work carried out by him with complete details & reason. No oversight or negligence can be alleged on the auditor and it is a systematic approach which saves time & efforts.

It eliminates over auditing or under auditing and helps auditor to identify & prove the high-risk/low risk areas. Audit report should be prepared for highlighting the irregularities as per the risk involved.

Improves the understanding of critical areas, thus preventive & corrective action can be suggested by the internal auditor.

RBA improves understanding of vulnerability & leads to better decision-making.

### **Disadvantages of Risk-Based Audit**

It is proved to generate an excessive number of false alarms which may overwhelming impact on management thereby diluting their focus. Lack of contextual information in the alerts may generate complexities & lack of differentiation between actual threat & false alarms. It may also be expensive & not suitable for small units. Uncertain in standards. Disruption in smooth functioning.

Risk based audit may highlight a problem without any bearing on finding a solution, for example, there are leakages in revenue is high risk due to lack of data analysis in trend & pattern of recovery. However, way to recovery may be totally elusive unless payment processes are rectified.

### **Risk Management Within the Telecom Sector**

In an ever-evolving realm which is technology driven with a disruptive pace of change like telecommunication, adept risk management becomes the key element in ensuring operational stability and resilient network as well as revenue assurance for the government from various telecom operators and internet service providers, etc. Risk management involves recognizing, evaluating and reducing the likely disruption that could impede seamless functioning of telecom networks.

**Recognizing:** To provide quality of service to customers, earn revenue from service, the operator must ensure smooth transmission of voice, data and video access, diverse network irrespective of extensive distances, terrains and geographics within the country as an NLD provider. The introduction of 5G technology transcends mere acceleration of internet speeds along with a web of interconnected devices, smart infrastructure and AI driven applications <sup>(2)</sup>. The landscape of risks extends far beyond cyber threats, hacking and cyber intrusion that pose a threat to the integrity of the entire network architecture. The TRAI provides a dynamic regulatory environment which necessitates continual attention and adaptation for the operators. They need to navigate stringent regulations while audit needs to stay ahead of the technological achievements and associated risks they introduce just as much as the operators require it.

## Some Issues to Be Looked into and Risk Associated for Reference

1. Collection register not showing receipt of payment properly (Low Risk).
2. Interest rate not charged as per DoT guidelines (Low Risk).
3. Some decentralized licensees neither paid minimum license fee nor paid license fee based on actual / presumptive AGR (Moderate Risk).
4. BG invoked due to non-renewal of BG within prescribed due date. But the same not replenished by the TSP/ISPs in the form of fresh BGs (Moderate Risk).
5. BGs not booked in proper Head of account (Low Risk).
6. Though, claim for deduction by the concerned TSPs has been disallowed by the CCA office, proper reasons /orders are not shown against each disallowed amount (Low Risk).
7. Revenue for few companies as per UDIN is higher than the Audited AGR (High Risk).
8. Collection Register of LF/SUC have not been updated and counter Signed by the Competent Authority resulting in improper verification checking work not in order (Low Risk).
9. The date of commissioning of mobile tower is not ascertained, resulting in non-utilization of USO Fund properly (Low Risk).

## Decentralized Licenses

10. Pending assessments for the ISPs for different financial years (High Risk).
11. If while adjusting Outstanding dues and penal interest, DoT guidelines not followed (Moderate Risk).
12. ISPs have not submitted relevant documents in SARAS, resulting in delayed completion of DVR (High Risk).
13. Collection Register of LF/SUC have not been updated and counter Signed by the Competent Authority resulting in improper verification (Low Risk).

## Pension

14. Excess payment on account of over drawn interest on deferred DCRG after date of instead of till Date of death (High Risk).
15. Periodic verification of qualifying service (completion of 18 yrs and left with 5 yrs service) not done in due time (Low Risk).
16. Short payment of Pension made by Bank (Low Risk).
17. Delay towards settlement of Family pension cases on a/c of death in service (Low Risk).



18. Non-Revision of provisional pension of CDA Pensioner under Rule 69 of CCS pension Rules 1972 and irregular payment of CDR at constant rate. (Low Risk).
19. Extended family pension cases other than spouse being processed through COMPACT instead of SAMPANN (Low Risk).
20. Delayed deferred DCRG payment (Low Risk).
21. Delayed remittance of LSPC attracts penal interest on it. Non-realization of the same (High Risk).

### **Certain Strategies for Mitigation of the Risks Must be Adopted by Creating**

Digital transformation like System for Assessment of LF Revenue and SUC (SARAS) and System for Accounting and Management of Pension (SAMPANN) with Public Financial Management System (PFMS) enables certain resilience in driving efficiency and effectiveness in CCAs. Embracing innovative technologies along with environmental, social and governance matrices (ESG) bolsters sustainability along with regulatory compliance and resource optimization. “Staying ahead” in the face of all challenges and threats requires a holistic perspective in Internal Audit methodology also. There is a dire need of deploying comprehensive mitigation strategy which includes Customer centricity, Adaptive work environment, Sustainability, Technological resilience, etc.

When risk-based approach is combined with service industry like telecom, it is evident that internal audit cannot become one-size-fits-all approach. An effective audit department will have many approaches so that case by case most optimal approach can be selected.<sup>(5)</sup> Audit planning & research which is a preaudit process involving data collection, analysis, documentation as well as sending the request list after getting access to document repositioning a precursor test is conducted. On site field work with auditor interview, perform the tests obtain follow up & entry & exit meetings where draft findings are shares. Finalization, editing & report writing is then completed within a fortnight. After finalizing the audit report compliance is also sought in a time bound manner.

This Rapid assurance method helps to recognize well defined & limited scope without any complication auditor shoulders prior effort & after field work light interaction after a week of crisp engagement. This mandates that auditors receive their requested evidence & documents timely.

Project assurance Audit manages risks in real time. Auditor evaluates program implementation with clear deadlines e.g. implementation of SAMPANN by migration of pensioners from bank & post offices to CCA offices. Auditors need to be involved from beginning to finish of the project & monitor control capabilities of the project team of facilitate risk & control dialogue throughout the project.

Problem solving audit where auditors serve as facilitators to fix a problem by assessing their own processes. Pension Voucher Audit (PVA) is one such exercise of facilitated self-assessment for improving risk analysis & response time.

Creating customized models also helps to assess the current solution & improve process to meet the objectives. Data analytics is most comprehensive when combined with above mentioned methods. Quantitative & qualitative analytics may generate insight into may risk areas. Auditors need skills to investigate unanticipated results without jumping to conclusions.

By thoughtfully tailoring the various approaches risk-based audit can be successfully conducted. In telecom sector, risk management needs to account for unique challenges faced by TSPs & ISPs in transmission of data over long distances & across different networks along with natural geographical conditions, disasters & damages along with cyber security. <sup>(4)</sup> Telecom sector is constantly evolving change. It is the responsibility of internal audit to ensure risks to change have been clearly identified as well as provide assurance that risks are being controlled.

## Conclusion

Audit methodology in telecom must follow a multifaceted approach and internal audit teams must be trained with skills to audit cutting edge technologies such as AI, machine learning, Internet of Things along with skills of predictive analytics to proactively detect and prevent potential threats, fostering a sense of accountability, involvement and vigilance within the department. Internal audit while using the risk-based audit method must help management in:

Revenue assurance; Process compliance; Regulatory compliance; Operational efficiency; Data security; Technology adoption; Procurement and inventory management, and help in achieving the vision and mission of the department.



## References

1. Controller General of Communication Accounts. (n.d.). *Internal Audit Manual*. CGCA. Retrieved from <https://cgca.gov.in>
2. Subex. (n.d.). *Navigating risk management and assurance in the evolving telecommunications landscape*. Retrieved from <https://www.subex.com/article/navigating-risk-management-and-assurance-in-the-evolving-telecommunications-landscape/>
3. Audit Board. (n.d.). *5 risk-based internal auditing approaches*.
4. Empowered Systems. (n.d.). *Risk management in telecommunications: An overview*.

\*\*\*\*\*

### Author's Profile

Kaushik Chowdhury, AO (IA) at the Office of the Principal Chief Controller of Accounts (Pr. CCA), Kolkata, has been serving in the Internal Audit Section and RMC Section since 2022. He has conducted internal audits for various CCA offices in the Eastern Region and participated in cross audits at the offices of the CCA in Gujarat and Madhya Pradesh on behalf of the Office of the Controller General of Communication Accounts (CGCA). Kaushik holds an M.Sc. in Chemistry from Calcutta University. Beyond his professional pursuits, he has a passion for singing and has represented the All India Postal Carrom Tournament.

# Commentaries





# A Study of Successful Infrastructure Investment Trusts in the Telecom Sector: The Brookfield-IndInfravit Deal in India

*Dr. D.K. Singhal, Deputy Director General, NCA-F*

## Abstract

Infrastructure Investment Trusts (InvITs) have emerged as an innovative financing mechanism in the telecom sector, particularly in developing markets like India. This commentary delves into the successful case study of Brookfield Asset Management's acquisition of a significant stake in IndInfravit Trust, highlighting the strategic advantages and financial benefits that InvITs can bring to telecom infrastructure investments. This case underscores the potential of InvITs to revolutionize infrastructure financing, providing valuable insights for investors, policymakers, and stakeholders in the global telecom sector.

## Introduction

The rapid expansion of digital connectivity has placed immense pressure on the telecom sector to enhance infrastructure capabilities. Traditional financing models, often laden with high debt and limited liquidity, struggle to meet the sector's evolving needs. InvITs offer a novel solution by allowing investors to pool resources into income-generating infrastructure assets, thus providing long-term, stable returns. This article explores a noteworthy example of InvIT success in the telecom sector: Brookfield's investment in India's IndInfravit Trust.

## Case Overview

IndInfravit Trust, established as one of the first privately placed InvITs in India, primarily focused on road assets until its strategic diversification into telecom infrastructure. In a landmark deal, Brookfield Asset Management acquired a significant stake in IndInfravit, injecting capital to further bolster the Trust's telecom assets portfolio. This transaction marked one of the first major applications of the InvIT model in telecom, setting a precedent for future investments in the sector.

## Strategic Implications

1. **Enhanced Capital Access:** The deal enabled IndInfravit to unlock significant capital without burdening its balance sheet with additional debt. The InvIT structure attracted institutional investors looking for long-term, steady returns, thus aligning the funding model with the asset's revenue generation potential.
2. **Risk Mitigation and Diversification:** For Brookfield, the investment offered a diversified risk profile. By investing in IndInfravit, Brookfield gained exposure to a range of telecom and road assets, mitigating sector-specific risks. The predictable cash flows from the assets under the InvIT structure provided a cushion against market volatility, which is often a challenge in telecom investments.
3. **Operational Efficiency and Asset Management:** InvITs are managed by professional asset managers who focus on operational efficiency and enhancing asset performance. Brookfield's involvement brought in global best practices in asset management, which optimized the operational performance of IndInfravit's telecom infrastructure. This, in turn, improved returns for investors, showcasing the value addition that professional management can bring to InvIT structures.
4. **Regulatory and Structural Advantages:** India's regulatory framework for InvITs offers tax benefits and reduced compliance costs compared to traditional financing models. The Brookfield-IndInfravit deal took full advantage of these regulatory provisions, enhancing returns and ensuring regulatory compliance. This favourable regulatory environment contributed significantly to the success of the transaction.

## Financial Performance

Following the investment, IndInfravit reported improved financial metrics, including higher EBITDA margins and increased cash distributions to unit holders. The Trust's telecom assets saw enhanced utilization rates, driven by increased demand for data services and 5G network rollouts. This financial uplift is indicative of the broader potential for InvITs to transform telecom infrastructure investments.

## Lessons Learned

1. **Scalability of the InvIT Model:** The Brookfield-IndInfravit case demonstrates that InvITs are not only suitable for traditional infrastructure sectors like roads but can be effectively scaled into high-growth sectors such as telecom. The scalability of InvITs allows for flexible adaptation to different asset classes, making them a versatile tool for infrastructure financing.
2. **Attractiveness to Global Investors:** InvITs provide an attractive investment avenue for global investors seeking exposure to emerging market infrastructure. The Brookfield investment highlighted how InvITs could bridge the gap between domestic infrastructure needs and global capital pools, facilitating a win-win for both investors and infrastructure developers.
3. **Governance and Transparency:** A key factor in the success of the IndInfravit InvIT was the governance and transparency standards enforced by regulatory bodies. High standards of reporting and compliance instilled investor confidence, which is critical in attracting long-term investment in InvITs.

## Conclusion

The Brookfield-IndInfravit transaction stands out as a pioneering example of InvIT application in the telecom sector, setting a benchmark for future investments. The case illustrates the InvIT's potential to unlock capital, improve asset management, and offer attractive returns to investors. As global telecom infrastructure demands surge, InvITs present a promising avenue for financing, underscored by the successful precedent set in India. Policymakers and investors worldwide can draw valuable lessons from this case, positioning InvITs as a cornerstone in the next generation of infrastructure financing.

## References

1. SEBI Regulations on Infrastructure Investment Trusts.
2. IndInfravit Trust Financial Reports (2020-2023).
3. Market Analysis Reports on Telecom Infrastructure Investments in India.

\*\*\*\*\*



### **Author's Profile**

Dr. D.K. Singhal, DDG at NCA-F, is a 1998 batch Indian Posts & Telecommunications, Accounts and Finance Service (IP&TAFS) officer and a Gold Medalist CA, ICWA, CS, and LLB. A Ph.D. holder in Telecom Policies, he has authored five bestselling finance books and served in key roles across BSNL, NICF, and Rajasthan CCA.



## A Complex Interplay Between Inflation and Telecom-Postal Sector

*Shri Ankush Gahlawat, Pursuing M.A. Economics, IGNOU*

Inflation, a persistent rise in the general price level of goods and services over time, has a profound and multifaceted impact on various sectors of the economy. The telecom and postal sector, characterized by rapid technological advancements and essential services, is particularly vulnerable to inflationary pressures.

The telecom and postal sector are heavily reliant on a variety of inputs, including equipment, materials, energy, and labour. As the prices of these inputs rise due to inflation, the operational costs of telecom and postal companies increase. This can lead to reduced profit margins and potentially higher consumer prices.

Moreover, inflation can make it more expensive for telecom and postal companies to invest in new infrastructure, such as network upgrades and data centers. This can hinder the sector's ability to keep pace with technological advancements and meet growing consumer demands. For example, if the cost of building new cell towers or fibre optic networks rises significantly due to inflation, telecom companies may be forced to delay or scale back their investment plans.

In addition, inflation can have a negative impact on consumer spending. When prices are rising, consumers may become more cautious about their spending and reduce their discretionary expenditures, including telecom and postal services. This can lead to a decline in revenue for companies in these sectors.

Furthermore, inflation can complicate the regulatory environment for the telecom and postal sector. Governments may implement policies to combat inflation, such as raising interest rates or reducing government spending. These policies can have unintended consequences for the telecom and postal sector, such as increasing the cost of borrowing for infrastructure projects or reducing demand for telecom and postal services.

Foreign Direct Investment (FDI) has been a critical driver of growth and innovation in the Indian telecom sector. It has spurred rapid infrastructure development, enhanced technological capabilities, and led to significant improvements in affordability and access to telecommunication services. This has not only empowered individuals but also fuelled India's digital economy, contributing to economic growth and social

development. However, ensuring equitable distribution of benefits and addressing potential concerns like market dominance and data security remain crucial for a sustainable and inclusive future of the Indian telecom sector with continued FDI participation. Telecommunications is the fourth most attractive sector for foreign investment in India, accounting for 6% of total FDI equity inflows. This is likely due to India's growing telecom sector and its increasing demand for telecom services. Reliance Jio is the clear leader in the Indian telecom market, with over 439 million subscribers in 2022-23. This is over 37% of the total market share. Tata Teleservices and Reliance Communications are two other telecom companies that have been losing market share in recent years. Tata Teleservices had over 1.5 million subscribers in 2022-23, while Reliance Communications had over 150,000 subscribers.<sup>1</sup>

## Areas of Impact

**Input Costs:** The telecom and postal sector are heavily dependent on a variety of inputs and servers. As the price of this equipment increase due to inflation, the cost of network upgrades and expansions also rises. Energy, the telecom and postal sector is a significant consumer of energy, particularly for powering data centres and network infrastructure. Rising energy prices can increase the operational costs of these companies, especially for those located in regions with high energy costs.

The combined effect of rising input costs can put pressure on the profitability of telecom companies and postal sector. In response to these increased costs, companies may be forced to raise prices for their services, which can negatively impact consumer affordability and demand.

**Infrastructure Investments:** Inflation can significantly increase the cost of investing in new infrastructure, such as network upgrades and data centres. This can hinder the sector's ability to keep pace with technological advancements and meet growing consumer demands. For example, if the cost of building new cell towers or fibre optic networks rises substantially due to inflation, telecom companies may be forced to delay or scale back their investment plans. This can have a negative impact on the sector's long-term growth and competitiveness. Additionally, inflation can make it more expensive for telecom companies to maintain and upgrade existing infrastructure, which can lead to service disruptions and reduced customer satisfaction. Furthermore, inflation can increase the cost of borrowing for infrastructure projects, making it more difficult for telecom companies to secure financing for these investments.

**Consumer Spending:** During periods of high inflation, consumers may reduce their discretionary spending, including telecom and postal services. This can negatively impact revenue growth for companies in these sectors. As consumers become more cautious about their spending, they may prioritize essential goods and services, such as food and housing, over non-essential items like premium telecom plans or additional postal services. This shift in consumer behaviour can lead to a decline in demand for higher-margin products and services, putting pressure on the revenue streams of telecom and postal companies. Moreover, inflation can erode consumers' purchasing power, making it more difficult for them to afford higher prices for telecom and postal services. This can lead to a decline in customer satisfaction and churn, as consumers may seek more affordable alternatives or downgrade their service plans.

### Regulatory Challenges

Governments may implement monetary policy measures to combat inflation, such as raising interest rates. Higher interest rates can increase the cost of borrowing for infrastructure projects, making it more difficult for telecom companies to finance their investments. Additionally, governments may implement fiscal policy measures, such as reducing government spending, which can also impact on the telecom and postal sector. For example, if government spending on infrastructure projects declines, this can reduce demand for telecom and postal services. Furthermore, governments may impose price controls on telecom and postal services, which can limit the ability of companies to raise prices to offset rising costs. While these measures may help to control inflation, they can also have unintended consequences for the telecom and postal sector.

### Conclusion

In conclusion, inflation presents a complex challenge for the telecom and postal sector. Rising input costs, hindered infrastructure investment, reduced consumer spending, and a complex regulatory environment all contribute to potential stagnation in this vital sector. To navigate these challenges, telecom and postal sector must adopt innovative strategies to manage costs, optimize resource allocation, and prioritize investments that ensure affordability and continued service quality. Collaborative efforts between policymakers, industry leaders, and consumers are also crucial to foster a sustainable and resilient telecom and postal sector that can thrive even in inflationary times.

\*\*\*\*\*



### **Author's Profile**

Shri Ankush Gahlawat holds a Bachelor's degree in Economics (Honours) from Delhi University and is currently pursuing a Master's in Economics from IGNOU, focusing on economic theory and policy. He is preparing for the UPSC examinations with aspirations to contribute to public service and policy-making in India. Ankush has also worked with authors and writers, strengthening his research and analytical skills, which have significantly enhanced his academic and professional growth.



# NEWS AT GLANCE



## India Enters Top League Globally in Filing 6G Tech Patents

India has emerged as a leader in 6G technology, ranking among the top six globally in patent filings for 6G advancements.

The government has initiated the 'Bharat 6G Vision,' aiming for significant contributions by 2030, including a targeted 10% share of global 6G patents. Key initiatives, such as testbeds and the 'Bharat 6G Alliance,' support accelerated research and innovation in the sector, with a focus on deep-tech leadership and advanced connectivity.

As per industry experts, for India to become a deep-tech leader, penetration of both wireline and intelligent wireless broadband networks, with reliable connect.

## PM Modi's 'Bharat 6G Vision' Poised to get Another Booster

India's government, under its ambitious Bharat 6G Vision, is developing a multi-port switch for a single broadband antenna to support 2G-5G and future technologies.

The project, led by C-DOT and CSIR-CEERI, aims to enhance antenna efficiency using advanced micro-electromechanical technology, funded by the Telecom Technology Development Fund. With PM Modi's vision of leading 6G by 2030, India is accelerating patent filings and collaborating on global standards. Recent initiatives like ITU-WTSA 2024 and innovative research programs highlight India's strategic push towards becoming a major player in 6G design, development, and commercialization.



## Telecom Sector Reaches Inflection Point with Advent of Non-Terrestrial Networks: Sh. Jyotiraditya Scindia

Honorable Union Minister of Communications Shri Jyotiraditya Scindia announced that India's telecom sector is at an inflection point with the adoption of Non-Terrestrial Networks (NTNs), such as satellite communications, which will expand connectivity to underserved areas. Scindia emphasized the rapid growth of the digital economy, which now forms 10% of India's GDP, projecting it to double by 2027. The minister also noted efforts towards full 4G and 5G coverage, and India's ambition to lead in 6G innovation.



## IMC 2024: India Set to Lead World in 6G: Hon'ble Minister of Communications

India aims to lead the global 6G revolution, targeting 10% of 6G standardization patents through initiatives like the Bharat 6G Alliance, according to Hon'ble Minister of Communications, Shri Jyotiraditya Scindia.

Speaking at the India Mobile Congress and WTSA 2024, he highlighted India's rapid 5G rollout, covering 98% of districts in just 21 months. Legal reforms via the Telecommunications Act 2023 focus on satellite communications and cybersecurity.

Industry leaders emphasized AI's role and transformative efforts for a digitally empowered India.



## TRAI's Satellite Broadband Views within 2 Months: Sh. Anil Kumar Lahoti

The Telecom Regulatory Authority of India (TRAI) will soon release recommendations on satellite spectrum allocation, addressing methodology, frequencies, pricing, and operator requirements. Chairman Anil Kumar Lahoti emphasized fostering innovation through private sector participation under India's Space Policy.

TRAI suggests linking spectrum charges to Adjusted Gross Revenue and is clarifying licensing for satellite firms. With new authorizations proposed for satellite communication, these initiatives aim to enhance connectivity in remote areas and support upcoming 5G and 6G networks for digital transformation.



## IMC 2024: Standards Taking Centre Stage in AI and Global Governance, Says ITU Secretary General

At the World Telecommunication Standardisation Assembly (WTSA), ITU Secretary-General Doreen Bogdan-Martin called for a global governance framework for Artificial Intelligence (AI), echoing Prime Minister Modi's earlier G-20 statement on the need for international cooperation.

She highlighted the lack of AI regulatory frameworks in 85% of ITU member states and stressed the importance of global standards to foster trust and ensure safety. Concerns include AI-driven deepfakes, bridging the AI skills and compute gap in developing countries, and addressing rising cybersecurity threats. The ITU also supports India's efforts in strengthening global cybersecurity collaboration.

## Record Participation in the India Chapter of ITU WTSA-24

The India chapter of the ITU World Telecommunication Standardization Assembly (WTSA) 2024 saw record participation, with over 3,700 delegates from 160+ countries.

This historic event featured high-level side events and academic engagement, including the ITU Kaleidoscope conference. India played a pivotal role, proposing resolutions and fostering global consensus on digital innovation. It also led initiatives for gender inclusion, AI ethics, and 6G research, marking a significant milestone in the country's telecommunications leadership.





## Status Quo

Tariffs are under forbearance and situation not critical enough for regulatory intervention, say Trai officials

Telecom prices still among the lowest in the world

### Spend on mobile services in India

URBAN: Seen at **2.8%** of household expenditures in FY25 vs **2.7%** in FY24

RURAL: Estimated at **4.7%** in FY25 vs **4.5%** in fiscal 2024



Source: The Economic Times

## Telecom Tariff Hike: Govt, Regulator won't Intervene in Matter

The Indian government and the Telecom Regulatory Authority of India (TRAI) have no plans to intervene in the recent mobile tariff hikes by Airtel, Reliance Jio, and Vodafone-Idea.

Despite consumer concerns, officials note that Indian telecom tariffs remain among the lowest globally, with sufficient competition in the sector.

The hikes, ranging from 11% to 25%, are seen as moderate and necessary to improve telecom operators' Average Revenue Per User (ARPU), expected to boost operating profits by over 20% in FY25.

## Industry ARPU to Exceed Decadal High of Rs 225 in FY26 Driven by 5G Usage, Tariff Hike: CRISIL

According to a CRISIL report, the telecom industry's Average Revenue Per User (ARPU) is expected to reach a decadal high of Rs 225 by FY26, driven by 5G usage and tariff hikes by major operators.

This 25% rise from FY24 levels is set to improve the industry's profitability and capital efficiency. Additionally, reduced capital expenditures, particularly post-5G rollout, will lead to a decrease in telco debt, boosting overall financial health.



# **Book Reviews**



## Nudge: The Final Edition by Richard H. Thaler and Cass R. Sunstein

*Shri Ankit Anand, Director, NCA-F*

The book is an excellent discourse on aspects of human behavior and methods to influence it in predictable ways. It begins with human decision making as an exercise in choice architecture. Choice architecture basically denotes the context in which human beings make decisions. It rightly says that almost all people and professionals who are interacting with other people are in a way choice architects. As an example, a doctor who presents alternative course of treatment is essentially presenting choices to the patient. The book argues that there are no neutral choice architectures and even the smallest insignificant details of the design will influence human behavior in different ways. Nudge refers to those design aspects of the choice architecture, basically framing and presentation aspects of a choice, that influence human behavior, but excludes forbiddance/coercion/fear or change in economic incentives.

The book places choice architecture within the broad socio-economic theory of Libertarian-Paternalism. Although these two ideologies are much reviled singly, and even contradict each other, this particular combination of libertarianism and paternalism is advocated by the book, and forms one of the central themes of the book. The libertarian aspect is basically an ode to free will of the individual, unless it harms other. However, the book argues that human behavior and decision making can be sub optimal many times, due to lack of knowledge, incomplete information, prejudices, temptations, absent mindedness and habit, and hence does call for soft interventions. Here it is clarified adequately that this soft, non-intrusive brand paternalism is advocated, squarely located within realms of free will and liberty. Thus, libertarian-paternalism here allows choice architects, both in public and private sector, to try to influence people's behavior to make their lives better, but only by designing the context of choice i.e. Nudging, and not by using taxes/subsidies/bans/mandates or anything related to fear of punishment or lure of reward. Further, it does not try to influence the values and end goals of human, but only the decisions regarding means to attain those goals, thus ensuring the agency of humans in deciding their lives. No kind of choices are blocked or punished or burdened in this framework, the choice architecture is to be designed in such a way which compensates for human's prejudices, lack of information, lack of self-

control and cognitive ability and they are nudged in direction of taking the right decision towards their own welfare.

The concept of nudge is clearly located within the free market and liberal view of the world. However, it does move away from absolute laissez faire view of the world, wherein humans are viewed simply as homo economicus i.e. perfectly rational, robotic and unbiased characters with a clear idea of their own self-interest, and the knowledge, wherewithal and will to pursue it. Here, in the laissez faire approach, the simple solution is to present human with as many choices as possible, and he/she will pick the right choice. However, due to multiple cognitive biases, absent mindedness, temptation and a host of other factors, this maximisation of choice approach has not led to human welfare-oriented decision making. On the other hand, is regulatory public policy making using mandates/coercions/rewards for certain kinds of human behavior. Nudge policies lie between absolute unrestrained free will, which demands absence of any kind of policy making and merely maximisation of available choices, and regulatory policy, which uses rewards/ incentives or coercion/mandates. Thus, nudge preserves individual free will and liberty, while ensuring the causes of human incompetence while decision making is deftly compensated for in an unobtrusive manner.

The concept of nudge is backed up by view of human as a flawed being with cognitive biases and other shortcomings, which I totally agree with. In order to ensure this flawed human makes the right choices for himself and/or people around him, the nudge approach in a way harvests the biases to the benefits of human decision making, by making subtle modifications in the choice architecture present around us. The normal absent minded, under informed, perennially busy human always deploys heuristics, or ad-hoc rule of thumb methods, while making decision, which produces biases in decisions. As an example, due to mindlessness, loss aversion, inertia and anxiety while choice making and host of other reasons explored by the book, humans frequently tend to stick to the default option, rather than going through the entire range of menu options which a homo economicus would do. This is the anchoring or status quo bias. Changing the default option on forms or other similar menu changing costless measures can have a drastic effect on outcomes, in areas of household savings to combating climate change to areas of healthcare, poverty reduction etc. There are other biases produced by deployment of heuristics, as quoted by authors from Kahneman's work (Kahneman, 1995), such as availability bias, caused by resorting to data/options easily available in one's memory for decision making, rather than all options actually available.

These can again be helped by unobtrusive nudges of actually making important data/options issues salient during advertising.

Further, it focusses on Smart disclosures by public and private organisations i.e. timely release of complex information in standardised machine-readable formats. This would help create online decision-making tools called choice engines, which would help nudge the user towards making the right decisions and also reduce ‘sludge’. Sludge is an interesting new term, referring to cobweb of needless data and bureaucratic processes, red tape paperwork, long administrative forms and regulations etc. which hinder optimal decision making. These are recommended to be attacked and removed on a seek and destroy mode, and smart disclosures shall eventually lead to the same. Overall, I completely agree with the view of human as slightly absent minded and ill-informed decision maker, subject to biases of intuition, mindlessness and temptation, rather than a perfectly rational robot. Accordingly, not just choices and maximisation of number of choices, but the framing and designing of choices i.e. elements of the choice architecture, can be important nudges toward guiding humans towards better decisions, and the nudge approach can help public/private organisations in designing more human welfare-oriented policy, without being intrusive or curtailing human liberty. Further, the authors bring a well roundedness to their advocacy of the nudge approach within the framework of libertarian paternalism, by acknowledging that though nudge policies cannot supplant regulation and policy making backed by coercion/incentive, most public policy can use the nudge approach to supplement incentives-based policy, to ensure better outcomes, while at same time reducing their intrusiveness and curtailment of free will.

## Bibliography

Kahneman, D. (1995). *Thinking fast and slow*. Penguin.

\*\*\*\*\*





### **Author's Profile**

Shri Ankit Anand is currently serving as Director (TER) in the National Communications Academy (NCA-F), Department of Telecommunications (DoT). He has previously held key positions in DoT HQ and Pr. CCA Delhi, where he served from 2014 to 2017. He is a 2012 batch officer of the Indian Posts & Telecommunications, Accounts and Finance Service (IP&TAFS) with substantial expertise in telecommunications and finance. Before joining the civil services, he worked as a Financial Derivatives Trader and Analyst at Future First for two years. He holds a Bachelor of Engineering degree from NSIT, Delhi University.



## Political Order and Political Decay: From the Industrial Revolution to the Globalisation of Democracy by Francis Fukuyama

*Shri Ankit Anand, Director, NCA-F*

Fukuyama's ideas in the landmark 1989 essay - "**The End of History**"- form the bedrock of the ideas espoused in the current book under review – "**Political order & decay from industrial revolution to globalisation of democracy**". The 1989 essay was a seminal work in the realm of socio-political thought, wherein he argued that a liberal democracy is the final goal and stable state of all political systems, and it was a personal perspective broadening experience to go through the book. The book remains a bulwark of the liberal democratic philosophy to this day. His studies stood in contrast to the Marxian ideas of communism being the final state of social-political organisation, with "withering away of the state", absence of any personal property and absolute equality of life's outcome for all human beings. Marx had argued that democratic political system was a convenient supportive super structure for capitalistic economic substructure, and this capitalistic substructure would itself decay due to multiple internal contradictions it festers, one important being the stark inequality between the owners/capitalists and laborers. This would in turn lead to destruction of democracy which is merely a legitimising ideology and superstructure for capitalism. To this, Fukuyama had argued in "The end of History" that true communism could never be achieved, as had been witnessed in the unstable so-called communist systems of Russia & China, and a liberal democracy would be the dominant political structure. The new book in 2014 carries forward from his previous works, and Fukuyama stands by his belief in the liberal democratic order. This book is more of a spatial and temporal study of liberal democratic systems, at the same time serving as a cautionary tale against the internal flaws in the liberal democracies, which have caused stagnation and decay in this political system across many countries, and the persistence of such internal issues could jeopardise the future of the entire order. The basic premise of Fukuyama's thoughts remains largely the same, where he holds that the three main pillars of modern state are a strong effective state, the rule of law and an institutionalised democratic process with free and fair elections as the lynchpin of the model. Here it is important to note that "strong" state does not necessarily mean large, welfare-oriented and interventionist state, present in all sectors of socio- economic life, but a state powerful enough to devise policies and enforce them,

while ensuring its own legitimacy from citizens. He notes that a delicate balance of these three elements need to exist in cohesion to yield a stable liberal democratic state. Fukuyama studies the development of these elements across countries and era, starting from the era of French Revolution, Enlightenment, and the onset of Industrial revolution. He delves into the reasons and the process of development of the three elements of liberal democracy. He observes that all three elements have developed at different pace in different countries, giving each democratic order its own nuances and flavour, and thankfully does not propound a simplistic linear theory of political development.

It is held that, for example, China had a strong state, which developed to counter fragmentation of power between numerous warlords but could not develop rule of law or democratic accountability, while India developed political accountability as well as independent judiciary to enforce rule of law, however lacked on the strength of the executive. Fukuyama goes on to argue that the European nations, especially holding Denmark as a shining beacon, had a near perfect balance of the three elements in the early 19th century and form a perfect prototype of the liberal democratic order.

From his study of political systems across space and time, Fukuyama, though staunch in his support of liberal democracy as the ultimate stage of political development, admits to the decay and crisis which have become inseparable part of this structure. This idea is similar to Gunderfrank's work on the "crisis of legitimacy" which had hit welfare-oriented democracies across the world in the 1980s and 90s, which had not been able to provide a basic level of dignity and equality of opportunity to majority of the citizens, inspite of purportedly being welfare states.

He notes that a strong territorial state is the sine qua non of a stable liberal democracy, and in the absence of which the rule of law or the democratic process inevitably flounders. It is also a general reminder that political order first must be established and governed, in case it has not naturally evolved, and then the checks on state power come in through free and fair elections and rule of law.

An interesting observation, often repeated in common conversations across the globe nowadays, is that countries where democracy preceded a strong state, have higher problems with governance, than those which had strong functional states before democracy and rule of law set in. One example he gives is the USA, wherein political patronage was the basis of key powerful posts in the spoils system, and

the move to a strong functional state with good governance based on merit and competence, was much tougher with democracy already enshrined.

Also, highlighted is the importance of balance between the three elements. As an example, one downside of excessive accountability, plaguing current systems, especially America, is the “vetocracy”, wherein the system of checks and balances ends up fragmenting the decision-making power way too much to ever allow strong decisions by any arm of the government. This again is visible in America, wherein interests/pressure groups have elaborate lobbies and often block socially necessary legislations.

Fukuyama further highlights “re-patrimonialisation” also as one of the biggest banes of the modern democracies, wherein, patrimonialism, though expressly banned in favour of skill and merit, is essentially making its way back in the democratic process, through powerful interest and pressure groups, leading to weaker states and bureaucracies, even in developed nations. This sounds like the “Prismatic-Sala model” of administrative and political systems of developing countries propounded by Fred Riggs, which are stuck between traditional and modern ideals, and have huge amounts of nepotism and clientelism, in spite of expressly universalistic and achievement-oriented norms and codes.

The scope of the book is mind boggling, and perhaps a bit too grand to be able to put down a verifiable and falsifiable theory. Nevertheless, many countries are analysed based on the broad three parameters, the more prominent democracies such as Britain and USA, but also varied cases such as Italy, Japan, China, Argentina, Nigeria, Greece, Costa Rica etc.

It’s interesting how such tedious topics of political science and public administration have been made readable by Fukuyama. It was however felt that Fukuyama ignores the violence involved in many countries in establishment of democracies, and the plight of the stateless marginalised people who were outcast by this new social compact which yielded the strong states. Also, the state-centred approach leads him to diminish the immense role of globalisation and the global institutions of governance in shaping the destinies of various countries. Finally, it’s refreshing to learn that Fukuyama stands against export of models of democracy and development and believes in indigenisation of democratic models. However, there is certain value judgement and subjective bias in Fukuyama’s study of liberal democracies, as even though he highlights the problem points, he seems ethno-centric, and idolises the Washington Consensus model of development and



democracy, at the cost of indigenous and multiple forms of democracy existing across the world.

\*\*\*\*\*

### **Author's Profile**

Shri Ankit Anand is currently serving as Director (TER) in the National Communications Academy (NCA-F), Department of Telecommunications (DoT). He has previously held key positions in DoT HQ and Pr. CCA Delhi, where he served from 2014 to 2017. He is a 2012 batch officer of the Indian Posts & Telecommunications, Accounts and Finance Service (IP&TAFS) with substantial expertise in telecommunications and finance. Before joining the civil services, he worked as a Financial Derivatives Trader and Analyst at Future First for two years. He holds a Bachelor of Engineering degree from NSIT, Delhi University.

# **Author Guidelines**



## Submission Guidelines

- Submissions must be original and include an Author Declaration (Annexure I)
- Formatting:
  - Font: Times New Roman
  - Font Size: 12
  - Line Spacing: Double
  - Alignment: Justified
- Length:
  - Research Papers and Articles: Up to 4000 words
  - Commentaries: Up to 1500 words
  - Book Reviews: Up to 1000 words
  - Case Studies: Up to 2500 words
  - Referencing: APA referencing style should be used.
- Covering Letter: A covering letter should identify the corresponding author with address, telephone numbers, and email address.



## Author Declaration Certificate

This is to certify that I am the author of the **Article/ Research paper** named

---

I agree to submit this paper/article for publication in the **JOURNAL OF COMMUNICATIONS FINANCE**. I confirm that the paper has not been submitted elsewhere for publication and this is an outcome of my independent and original work. I have given proper acknowledgement to all the sources from where the ideas and extracts have been taken. My paper is free from any plagiarism and I have not violated copyright of others.

I hereby transfer all rights (editing rights, copyright etc.) of the paper to the editors of '**JOURNAL OF COMMUNICATIONS FINANCE**' for publishing.

**Author/Corresponding Author Signature with Date**





## Review Process

Double Blind peer review process is followed where author and peer reviewer both are unknown to each other.

## Contact Information

For orders, subscriptions, or queries, contact:

Deputy Director (CPSR & MK),

Centre for Policy Studies & Research (CPSR)

National Communications Academy- Finance (erstwhile NICF)

Near Metro Pillar No. 152, Opposite SSB,

Mehrauli Gurugram Road,

Ghitorni, New Delhi-110047

[cpsr-nicf@gov.in](mailto:cpsr-nicf@gov.in)

[nicf.moc@gov.in](mailto:nicf.moc@gov.in)

011-26502677