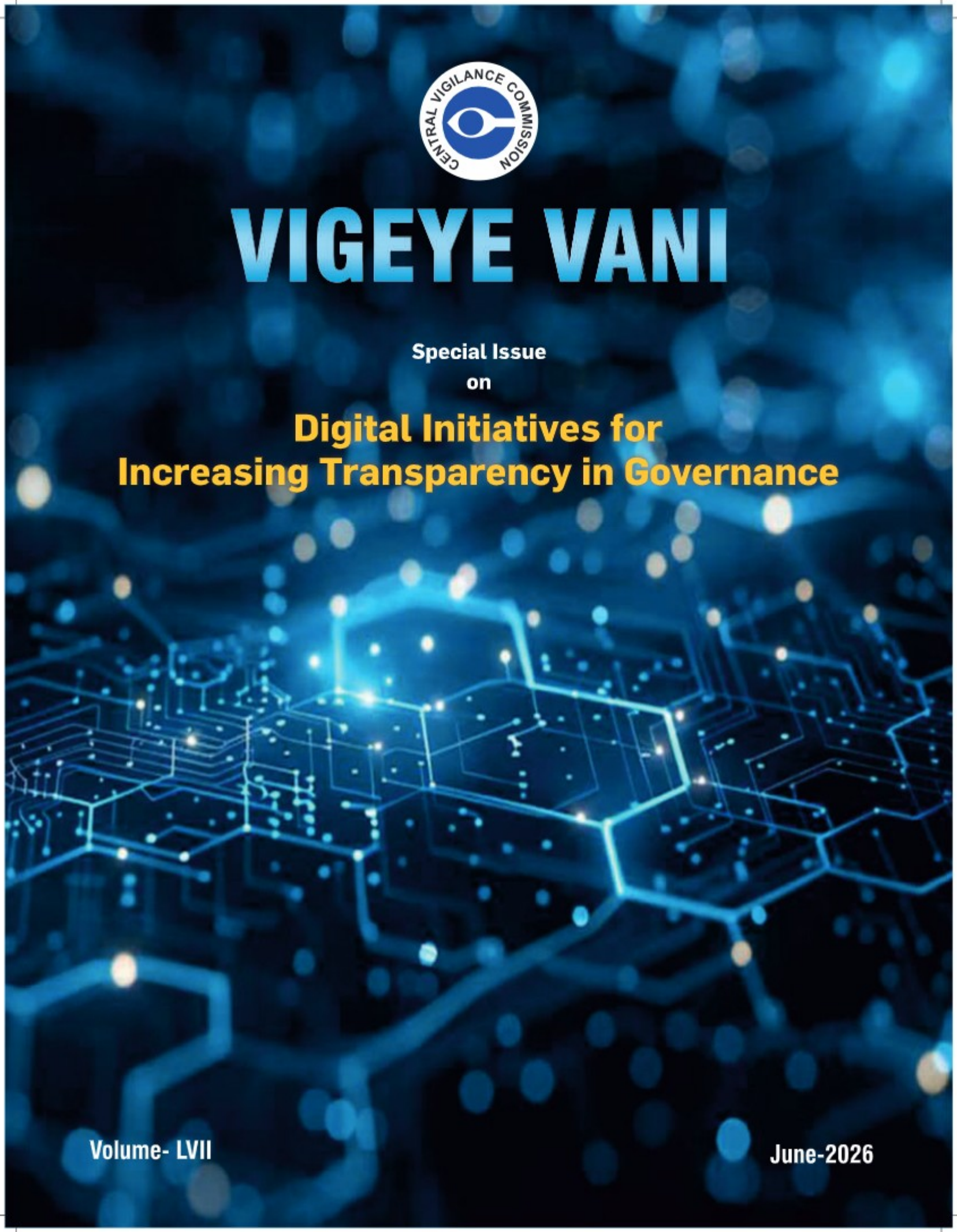
VIGEYE VANI

Special Issue

on

Digital Initiatives for Increasing Transparency in Governance



Volume- LVII

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MESSAGE FROM THE COMMISSION

The Central Vigilance Commission continues to promote integrity, transparency, and accountability in governance through initiatives focused on preventive and systemic vigilance. In this direction, a Workshop on **"Digital Initiatives for Increasing Transparency in Governance"** was organised on the occasion of the Commission's Foundation Day.

The workshop brought together Chief Vigilance Officers and Chief Technology Officers of Central Government Departments and Central Public Sector Enterprises as well as leading experts from the private sector. The workshop was also webcast live and viewed online by more than 1600 participants. It served as a platform to deliberate on the growing role of digital technologies in strengthening governance and vigilance administration.

The discussions highlighted the evolution of vigilance from a predominantly punitive approach to a preventive, participative, and increasingly predictive framework. With the adoption of digital platforms, data analytics, and automation, organisations are now better positioned to move from reactive detection to proactive risk identification and mitigation. The participants shared insights on a range of digital initiatives, including real-time project monitoring systems, analytics driven fraud detection in financial systems, digital asset management & predictive maintenance frameworks, and citizen centric service delivery platforms. The deliberations emphasised that while technology is a powerful enabler, its effectiveness depends on strong governance frameworks, data integrity, cybersecurity, and capacity building. The digital systems must remain aligned with the principles of fairness, transparency, and ethical governance.

This special edition of ***Vigeye Vani*** reflects the Commission's continued commitment towards encouraging innovation in vigilance administration. The insights emerging from the workshop reaffirm that digital technologies are not merely tools of efficiency but strategic enablers in building transparent, accountable, and citizen centric governance systems. A key takeaway from the workshop is the need to institutionalise and scale up such digital initiatives across organisations. By embedding vigilance into systems and processes, organisations can reduce discretion, strengthen internal controls, and foster a culture of integrity and accountability.

The Commission encourages all organisations to adopt these learnings and leverage technology responsibly to strengthen preventive vigilance. The future of vigilance lies in harnessing digital technologies with ethical intent - transforming it into a proactive and predictive function that enhances transparency, accountability, and public trust.

(Praveen Vashista)
Vigilance Commissioner

(A.S. Rajeev)
Vigilance Commissioner

(Praveen Kumar Srivastava)
Central Vigilance Commissioner


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MESSAGE FROM THE SECRETARY

The workshop on **"Digital Initiatives for Increasing Transparency in Governance"** marks an important step in our continued efforts to strengthen integrity, accountability and transparency in vigilance administration. A key focus of the Commission has been to move beyond the punitive approach to vigilance; and instead emphasize on preventive vigilance through systemic improvements and process reforms. In this context, technology has emerged as a critical enabler. By reducing manual intervention, minimizing discretion, and enhancing transparency in service delivery, digital initiatives are playing a transformative role in strengthening governance frameworks across organizations.

The Commission has, in recent years, undertaken several initiatives to promote this transformation. Workshops were conducted in 2024 on *"Leveraging Technology for Increasing Transparency in Governance"* and *"Digital Initiatives to Prevent Banking, Financial Services and Insurance Frauds,"* as also a workshop during the Vigilance Awareness Week 2025 on "Artificial Intelligence and Emerging Technologies for Ethical Governance". These provided valuable platforms for knowledge sharing and collaboration in these areas. As part of the current initiative, Ministries, Departments, Banks and Financial Institutions were invited to share details of digital initiatives aimed at improving transparency and governance. These initiatives were evaluated on parameters such as innovation, impact, and scalability, and the selected best practices were identified for presentation during the workshop.

The workshop provided a valuable platform for learning, engagement and exchange of ideas. These deliberations are expected to provide practical insights into how technology can be leveraged to strengthen systems and reduce vulnerabilities.

This special edition of ***Vigeye Vani*** presents the core insights from the workshop, along with contributions from participating experts. I encourage all organisations to adopt and adapt to these learnings, leveraging technology responsibly to strengthen preventive vigilance mechanisms. By doing so, governance systems can evolve to become more resilient, responsive, and trusted by the public. I also convey my sincere appreciation to the team led by Shri Ashok Kumar and Shri Kapil Deo Narayan, CTEs at the Commission, for their dedicated efforts in compiling and publishing this edition of ***Vigeye Vani.***

Trishaljit

(Trishaljit Sethi)
Secretary, CVC


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FROM THE EDITOR'S DESK

I am pleased to present this special edition of the Commission's newsletter ***Vigeye Vani,*** which encapsulates the presentations, interactions, and key takeaways from the workshop on **"Digital Initiatives for Increasing Transparency in Governance".** The newsletter provides valuable insights into the innovative use of technology and highlights opportunities for organizations to strengthen governance through digital transformation.

As part of the initiatives undertaken by the Commission, organizations were invited to submit details of digital initiatives aimed at enhancing transparency and governance. The response was highly encouraging, with around 130 entries received from various organizations.

These entries were evaluated by the Group Coordinators on parameters such as innovation, impact, and scalability. I extend my sincere appreciation to Sh. Shiv Pal Singh, CVO, BHEL; Sh. Himanshu Jain, CVO, SECL; Sh. Pradeep Kumar, CVO, IRCTC; and Sh. Ajay Sahani, CVO, IREDA; for coordinating with respective organizations and for selecting the best initiatives for presentations during the workshop.

I convey my gratitude to all participating organizations, particularly the speakers, for effectively showcasing their digital initiatives and sharing valuable experiences and insights. I extend special thanks to Sh. Raghvendra Kumar, CVO, Punjab National Bank and his team members for their valuable support in successfully organizing the workshop, and publication of this newsletter.

My heartfelt appreciation also goes to the members of the editorial team and the rapporteurs for their dedicated efforts in compiling and shaping this edition of ***Vigeye Vani.***

I hope this edition of ***Vigeye Vani,*** highlighting the digital initiatives demonstrated during the workshop, will encourage organizations to effectively leverage technology and emerging digital tools to strengthen their vigilance frameworks.

(Ashok Kumar)
Chief Technical Examiner

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Overview of Workshop

The Central Vigilance Commission has been of the view that vigilance should not be confined to only punitive actions, instead the focus should shift to preventive vigilance. This can be achieved by systemic improvements / strengthening systems and procedures, automation through migrating manual processes to digital platforms to reduce human interface, early warning mechanisms to spot red flags, reducing discretion, and increasing transparency and accountability. It is in this context that technology plays the role of an enabler.

The Commission has been encouraging leveraging of technology for ethical governance. The Commission had previously conducted two workshops in 2024 on "Leveraging Technology for Increasing Transparency in Governance" and on "Digital Initiatives to prevent Banking, Financial Services and Insurance Frauds". During Vigilance Awareness Week 2025, a workshop was organized on "Artificial Intelligence and Emerging Technologies for Ethical Governance". In continuation of the same line of thought, the Commission organised a workshop on "Digital Initiatives for increasing Transparency in Governance" on 11th February 2026. The workshop brought together the Chief Vigilance Officers and Chief Technology Officers of Central Government Departments and Central Public Sector Enterprises as well as leading experts from the different sectors. The workshop was also webcast live and viewed online by more than 1600 participants.

The workshop was organised in four sessions. The in-house digital initiatives undertaken by seventeen organisations were showcased for probable adoption across the organisations. Session-I focussed on digital initiatives in project management. Session-II deliberated on banking fraud

prevention and risk management. Session-III discussed on asset management and predictive maintenance. Session-IV showcased effective public service delivery through digital initiatives.

Session-I: Digital Initiatives in Project Management

Session-I focussed on digital initiatives in project management. The session revolved around transformation of organisations by digitisation and increased transparency in governance.

Sh. Amandeep Garg, IAS, Additional Secretary, Ministry of Environment, Forest & Climate Change provided an overview of "PARIVESH 2.0" portal to streamline environmental approvals through a single window online platform integrating Environmental Clearance, Forest Clearance, Wildlife Clearance and Coastal Regulation Zone clearance. He highlighted how digitisation has transformed the regulatory ecosystem by enabling paperless processing, improved transparency, faster decision making and enhanced monitoring of environmental safeguards. The portal supports project proponents, regulators and expert committees through automated workflows, GIS-based analysis and real time dashboards.

Sh. S. Lakshmi Narayanan, DGM, Corporate Centre, B&FIC, L&T highlighted the digital transformation initiatives of Larsen & Toubro (L&T) in project management covering project stages from tendering to execution. He discussed on adoption of integrated digital platforms to enable real time monitoring, improved efficiency and data driven decision making across large infrastructure projects of L&T. He explained that the initiatives aim to move from manual monitoring to monitoring from a centralised digital ecosystem covering the entire project life cycle to strengthen transparency and accountability

Ms. Shruti Bajaj, Senior Manager (CSR), Indian Oil Corporation Limited (IOCL) presented the digital monitoring system developed by IOCL to manage and monitor its large portfolio of Corporate Social Responsibility (CSR) initiatives. She highlighted that being one of India's leading energy organisations, IOCL manages hundreds of CSR projects across the country using this centralised digital platform for efficient monitoring and reporting. She explained the rationale of developing a CSR dashboard to improve visibility, ensure regulatory compliance and track the social impact of projects undertaken by the organisation.

Ms. Vinita Singh, GM (Projects), Steel Authority of India Limited (SAIL) showcased the Digital Project Management Solution (DPMS) implemented by SAIL to transform project monitoring and execution. She explained that DPMS is an integrated digital platform to manage projects from concept to completion. She highlighted that this digital system aims to enhance transparency, improve coordination among stakeholders and enable real time monitoring of physical and financial project progress. She presented that through DPMS, SAIL can monitor both macro and micro project indicators, enabling timely identification of delays and corrective actions. She also presented that the use of geo-tagged photographs and digital documentation improves progress tracking and reduces the risk of misinformation.

Sh. Saikat Bhowal, GGM, Digital Technology Solutions, Engineers India Limited (EIL) presented an AI-based cost estimation tool by EIL. He explained that the tool leverages historical project data and machine learning algorithms to produce faster and accurate cost estimates in comparison to traditional cost estimation methods which were often time consuming. He highlighted that the initiative demonstrates how artificial intelligence can support engineering organisations in improving bidding strategies and project planning.

Session-II: Banking Fraud Prevention & Risk Management

Session-II brought together senior banking experts who presented on banking frauds, cyber frauds, money mules, mobile induced frauds, etc. The various modus

operandi of frauds (Digital Arrest Fraud, APK File Fraud, Investment Fraud) and also their prevention were discussed in detail.

Sh. Baldev Prakash, DMD & CRO, State Bank of India (SBI) presented that banking frauds pose financial risk, systemic risk and reputational risk. He explained the increasing scale, complexity and digital nature of frauds. He stressed that public trust and accountability are critical for banks. He explained that technology is a strategic enabler of banking governance. He also talked about the key fraud risk areas and pro-active risk management using digital approach.

Sh. Manish Agrawal, Senior Executive Vice President, HDFC highlighted the evolving landscape of cyber frauds which shows that frauds are not confined to a single method but take diverse forms, often adapting to new technologies and user behaviour. He explained that the increase in internet usage with lower awareness on financial risk leads to such frauds. He also explained that fraudsters take advantage of human emotions to defraud the customers by inducing fear or greed. He emphasized the need to strengthen onboarding process and customer awareness using data analytics. He highlighted "Vigil Aunty", a citizen awareness campaign on various social media platforms.

Sh. Sanjeevan Nikhar, CGM & CCO, Punjab National Bank (PNB) presented that growth of digital transactions in India has led to a corresponding rise in cyber enabled frauds with approximately 75% cyber frauds pertaining to mobile induced frauds. He explained that scammers have shifted from hacking systems to hacking people and 80% of cyber frauds involve Social Engineering. He further explained the risk mitigation measures of PNB by onboarding on DPIP (Digital Payments Intelligence Platform) of Reserve Bank of India which enables identification of suspected customers based on hashed value of Personal Identifiable Information (PII) like Aadhar, etc. He also explained the strategic collaboration of PNB with Department of Telecommunication (DoT) for Mobile Number Revocation List (MNRL), Fraud Risk Integrator (FRI) and Mobile Number Verification Service (MNVS).

Session-III: Asset Management & Predictive Maintenance

Session-III discussed on use of AI / ML to modernize inspection and maintenance of assets. The session presented improved operational reliability using intelligent predictive maintenance system. The session also addressed the challenges of managing operations at a scale where manual monitoring becomes impossible, leading to inefficiency.

Sh. Himanshu Jain, CVO, South Eastern Coalfields Limited (SECL) explained the digital overhaul in SECL mines using DigiCOAL initiative, which was launched to address the challenges of managing operations on a large scale. He explained the implementation of Integrated Command & Control Centre for 24x7 real-time monitoring of mining machines spread over a vast area. He also highlighted the fuel management system which is a shift from manual records to an automated system featuring fuel dip sensors, geofenced parking and GPS enabled Quick Response Team vehicles. He further explained digitalization of thousands of land record files into a searchable database to streamline land management and compensation.

Ms. Resmi Devasia, DGM Technology (Retail), Bharat Petroleum Corporation Limited (BPCL) explained the Integrated Risk Information System (IRIS) which serves as the digital nerve centre for BPCL, providing comprehensive visibility and real-time monitoring across a massive supply chain network. She further explained that the system is designed to integrate safety, security and operational efficiency through interconnected intelligence for continuous 24x7 oversight of retail outlets and tanker lorries from a centralized control centre.

Sh. P. Sampath Kumar, GM, BHEL-GE Gas Turbine Services Ltd discussed Remote Monitoring and Diagnostics (RM&D), which is an advanced approach used for asset management of gas turbines. He explained that the traditional monitoring systems rely on fixed alarm set points and only respond after a fault has occurred leading to delayed

maintenance actions, higher repair costs and increased downtime of equipment, whereas RM&D provides a proactive and data-driven solution.

Sh. Mahendra Kumar Kaloria, Sr. DGM, Power Grid Corporation of India Limited (PGCIL) discussed on PG-AMRIT, an in-house digital platform developed by PGCIL. He explained that the system uses AI / ML based image processing to modernize inspection and maintenance of transmission towers. He further explained that this initiative aims to replace traditional manual patrolling – which requires extensive manpower – with an automated AI-driven inspection system. He also explained that by analysing drone and ground inspection images, the system improves defect identification, reduces human error and enhances reliability of transmission infrastructure.

Dr. Vishwesh Jatala, Assistant Professor, Computer Science & Engineering, IIT Bhilai presented a collaborative research initiative between IIT Bhilai and Bhilai Steel Plant of SAIL aimed at improving operational reliability in the Bar and Rod Mill (BRM). He explained that the intelligent predictive maintenance system integrates multivariate sensor data analytics with video analytics to detect early signs of equipment failures and cobble events which are industrial events where hot metal rods deviate from the rolling path resulting in considerable production downtime costing approximately Rs. 15 lakh per hour. The initiative aims to shift maintenance practices from reactive troubleshooting to a pro-active AI-driven monitoring framework that enhances efficiency, safety and productivity.

Session-IV: Effective Public Service Delivery through Digital Initiatives

Apart from the digital initiatives demonstrated by various organisations in Sessions- I, II & III, the Session-IV also witnessed demonstration of some more initiatives on public service delivery like building plan approvals, e-Pantry Services, comprehensive software platform for real-time flood forecasting & risk management and use of AI for a comprehensive defense system in telecom sector.

Ms. Manju Paul, Commissioner (Planning), Delhi Development Authority (DDA) highlighted Single Window Online Building Plan Approval System (OBPAS) developed in DDA. She explained that the system aims to create a fully integrated digital platform through which applicants and architects can submit, track and obtain building plan approvals and related No Objection Certificates (NOCs) from multiple departments through a single interface. She further explained that the objective is to strengthen system robustness, improve user experience and align the approval process with the provisions of Unified Building Bye-Laws (UBBL), 2016 and Ease of Doing Business guidelines of the government.

Sh. Pradeep Kumar, CVO, IRCTC presented e-Pantry Service, a technology driven initiative designed in-house through which passengers of Mail and Express trains with pantry cars can pre-book their meals at the time of ticket booking or later through the IRCTC account. A Dashboard is used for monitoring delivery status and generating reports for making payments to Vendors.

Ms. Manjusha Mishra, GM (Civil), National Hydroelectric Power Corporation (NHPC) presented that a comprehensive software platform "e-Aabhas" has been designed by NHPC for real-time flood forecasting and risk management. She explained that as mandated by the Ministry of Power, this is a "one of its kind" system which represents a transformative leap in transparency and disaster preparedness for protecting downstream communities and national assets. She highlighted that the system has been adopted by other hydropower organizations also.

Sh. Sanjeev Kumar Sharma, DDG (Digital Intelligence Unit), Department of Telecommunication (DoT) presented that the digital revolution has transformed India into a connected nation which has also opened new frontiers for cybercriminals, thus posing challenges for citizens. He explained that these challenges demand citizen empowerment, stakeholder collaboration and use of AI for a comprehensive defense system. He further explained that DoT, being a technology guardian, deploys cutting-edge solutions to protect millions of mobile users from sophisticated fake digital arrests to elaborate phishing scams

through spoofed calls for imbibing trust in the digital ecosystem. He also discussed Jan Bhagidari fighting cyber frauds through Sanchar Saathi and Financial Fraud Risk Indicator (FRI) as a fraud prevention tool.

Conclusion and Key Takeaways

The workshop concluded with re-affirmation that use of digital initiatives can strengthen systems and procedures of organisations. The digital platforms can reduce human interface, enable early warning mechanisms to spot red flags, reduce discretion and increase transparency and accountability.

Let us remember that digital systems must always be aligned with the principles of fairness, transparency and integrity. While digitalisation offers enormous promise, it must be accompanied by robust safeguards, strong oversight and continuous capacity building so that systems inspire confidence and uphold public trust.

Together, let us explore how digital initiatives can become not merely instruments of efficiency, but strategic enablers in our collective endeavour to build a more transparent, accountable and efficient governance ecosystem.

The workshop successfully facilitated the organisations for knowledge sharing and capacity building. The Commission look forward for replicating by organisations the digital initiatives demonstrated in the workshop as well as encouraging development and adoption of new digital initiatives.

Session-I : Digital Initiatives in Project Management

केंद्रीय सतर्कता आयोग
CENTRAL VIGILANCE COMMISSION

Workshop
on
Digital Initiatives for Increasing Transparency in Governance

Session-I
Digital Initiatives in Project Management

11th February 2026
New Delhi

PARIVESH 2.0

Sh. Amandeep Garg, IAS
Additional Secretary
Ministry of Environment, Forest & Climate Change

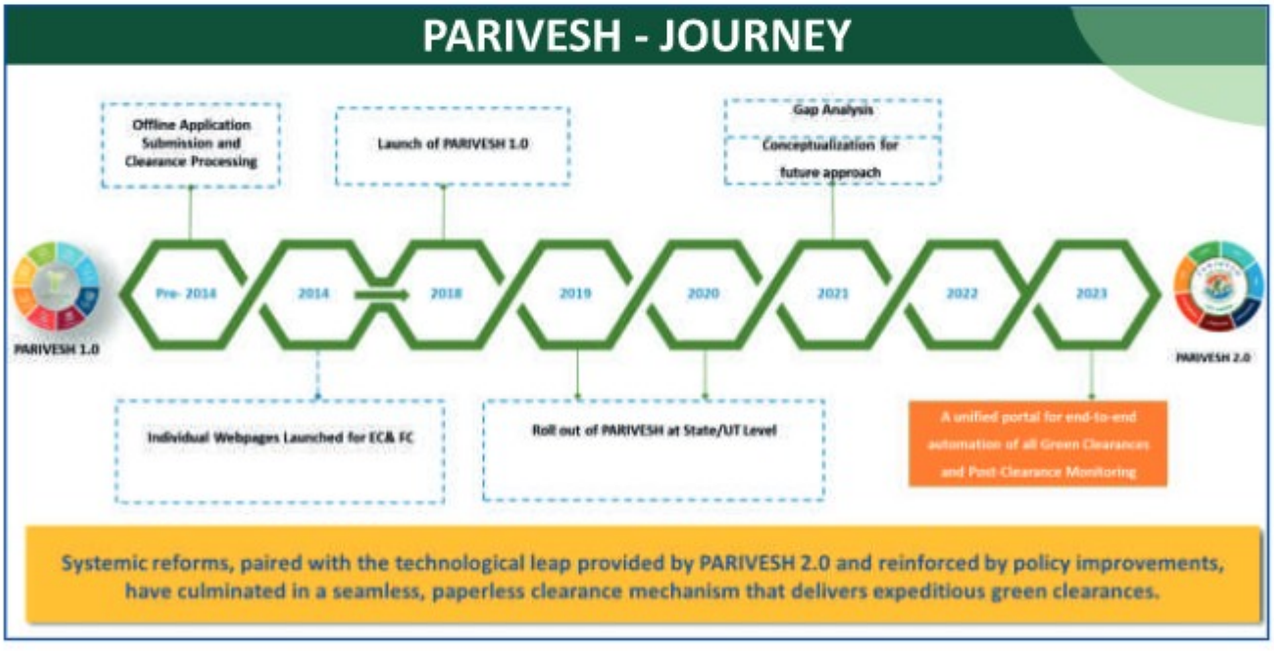
Introduction

Prior to 2014, submission and processing of applications relating to Environment, Forest, Wildlife and Coastal Regulation Zone (CRZ) clearances were done through offline mode. Applications were submitted in physical form and processed through multiple offices, resulting in limited visibility of application status, dependence on manual record keeping, and significant scope for delays. The absence of a unified system meant that traceability of applications, time-bound monitoring and institutional accountability were difficult to enforce in a consistent manner.

In line with the Government's vision on e-governance, for the first time individual webpages were rolled out by the Ministry in 2014 facilitating the online submission of clearance application. While this marked an important shift from a purely offline system, the processing of proposals continued to remain fragmented, with no single platform providing end-to-end solution.

PARIVESH Journey

A major reform initiative was undertaken in 2018 with the launch of the PARIVESH portal (Pro-Active and Responsive facilitation by Interactive, Virtuous and Environmental



Single Window Hub). PARIVESH was launched by the Hon'ble Prime Minister on 10 August 2018, with the vision of establishing a single-window digital platform for Environment, Forest, Wildlife and CRZ clearances. Subsequently, in the Year 2019, PARIVESH was rolled out covering both Central and State-level authorities and establishing a nationwide framework for digital processing of green clearances.

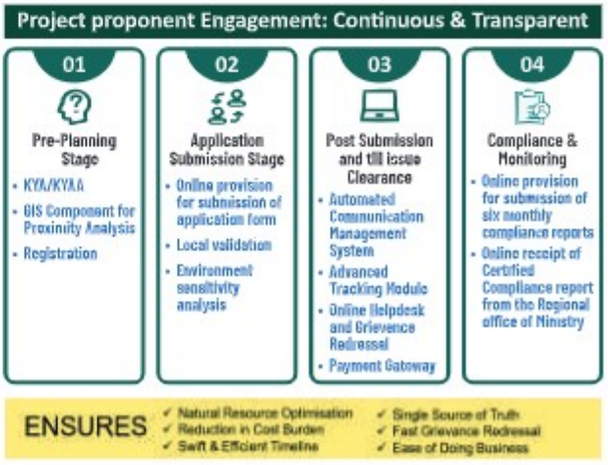
Over time, PARIVESH has undergone continuous refinement to align with evolving statutory provisions, policy reforms and user requirements. The platform ensured continuity of clearance services even during the COVID-19 period, when physical movement and in-person interactions were severely constrained. This phase demonstrated the robustness of the system and its ability to support essential regulatory functions under challenging conditions.

To further enhance user experience on PARIVESH and align the platform with modern web application standards, the Ministry, from 2022 onwards, expanded the scope and capabilities of the existing PARIVESH platform, leading to the evolution of PARIVESH 2.0 by leveraging advanced digital technologies. PARIVESH 2.0 introduced a fully integrated and paperless workflow, covering the entire lifecycle of a clearance proposal. Applications are now submitted online by project proponents and appraised and processed digitally by the regulatory authorities through system-defined workflows. Interactions between proponents and authorities, preparation of agendas and recording of Minutes of Meetings are all carried out within the system. Final clearance letters are issued digitally and made available for download through the portal, ensuring uniformity and authenticity.

Project Proponent Engagement

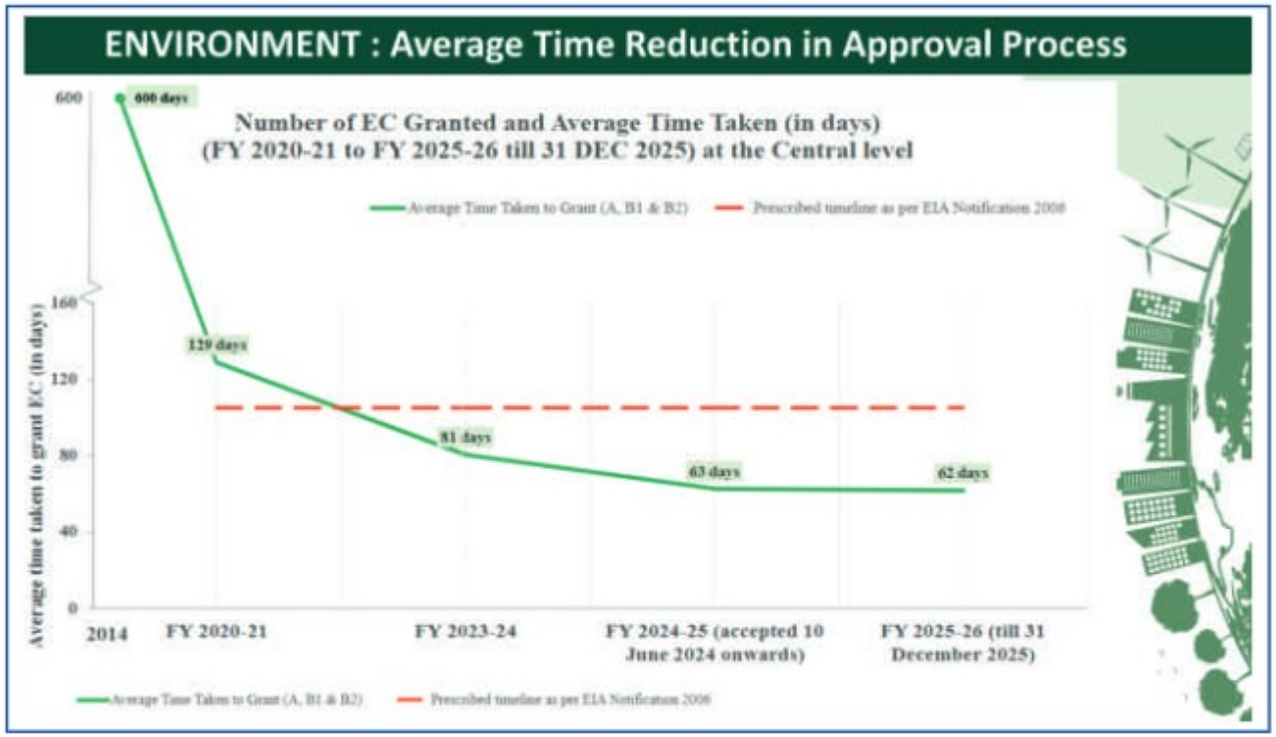
Through PARIVESH 2.0, a massive exercise has been carried out in Government Process Re-engineering (GPR) at every stage. As part of this exercise, the following key features and enhancements have been introduced:

- **Know Your Customer (Entity Validation):** Users register through PAN/CIN, ensuring authenticity via API-based integration with NSDL and the Ministry of Corporate Affairs.
- **Know Your Approval:** As guiding tool, KYA helps stakeholders to understand project location proximity and assess tentative clearances applicable to the proposed project.
- **Decision Support System:** GIS-based DSS provides insights into environmental sensitivity around project locations, aiding informed decision-making by the Expert Committees and Regulatory Authorities.
- **Common Application Form (CAF):** Minimizes repetitive efforts, ensuring a single version of truth across all applicable clearances.
- **End-to-End Online Processing:** Complete automation of clearance processes, including agenda and minutes generation, ensures e-governance.
- **Analytical Reports:** Data Analytics module aids in analysing data as per the Ministry's requirements.
- **Compliance & Monitoring:** Automation of submission of six-monthly compliance report.
- **Consultant Management:** API-based integration with QCI & NABET ensures accredited consultant organizations prepare EIA/EMP reports.



Impact

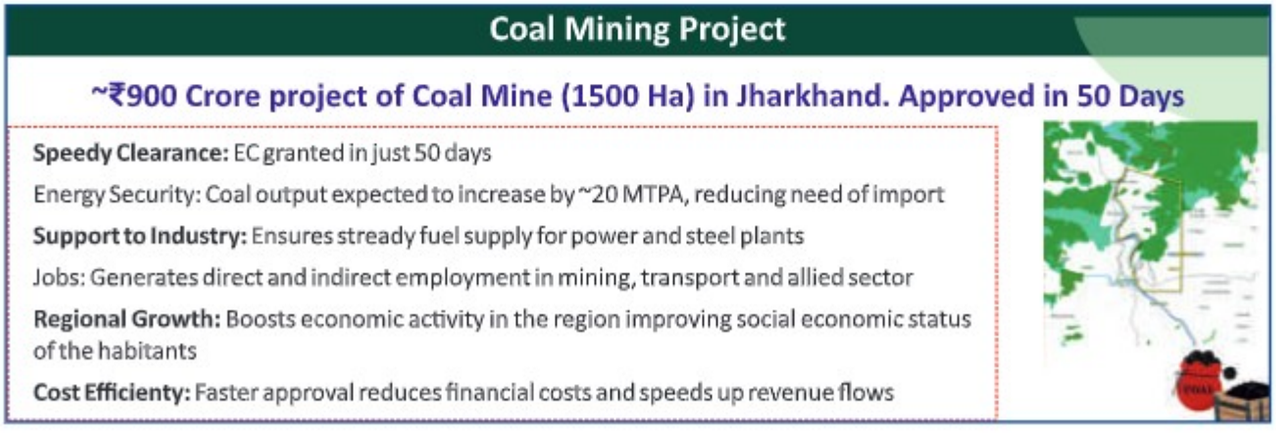
PARIVESH 2.0 serves as a single source of truth for all clearance-related information, replacing fragmented records and parallel processes, while strengthening transparency and accountability through standardized workflows, time-stamped actions, and role-based access controls. Following the adoption of unified digital workflows, the average timeline for grant of Environmental Clearance has reduced from 129 days in 2021 to 62 days in 2025.



Case Study

Several projects demonstrated the efficiency of the system. These include the following:

- **Coal Mining Project in Jharkhand (Rs. 900 Crore):** Environmental clearance was granted in 50 days.



- **Highway Project in Andhra Pradesh (Rs. 3500 Crore):** Environmental clearance was granted in 35 days.

Road Project

A ~₹3500 Crore Highway Project Andhra Pradesh. Approved in 35 days

Speedy Clearance: Clearance granted in 35 days, accelerating project start

Better Connectivity: 108 km highway improves access between districts

Trade and Logistic: Freight enhances efficiency and strengthens industrial corridors.

Jobs: Generates substantial direct and indirect employment during construction and operational phase.

Regional Growth: Boosts regional development and industrial investment in Andhra Pradesh.

Cost Efficiency: Swift approval reduces funding delays, carrying costs & speeds up benefits for citizens.

- **Hydro Power Project in Maharashtra (Rs. 5500 Crore):** Environmental clearance was granted in 50 days.

Pumped Storage Project

A ₹5500 Crore Hydro Power Project in Maharashtra approved in 50 days

Speedy Clearance: Faster Approval: Clearance in 50 days, ensuring timely project start.

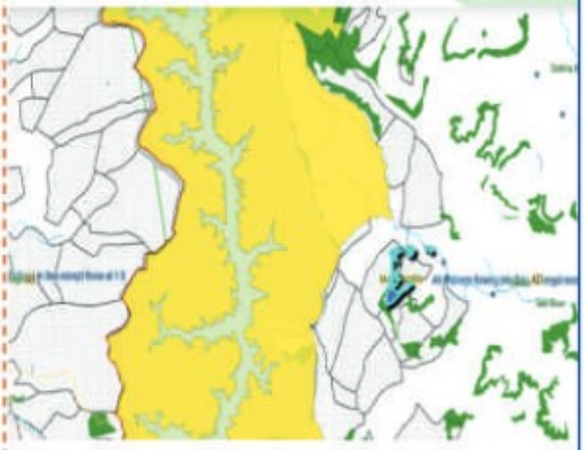
Energy Security: Beneficial in meeting the peaking requirement of energy during evening/night in the beneficiary state.

Renewable Energy & Reducing Emissions : Supports clean energy goals by reducing reliance on fossil fuel plants.

Jobs: Generates substantial direct and indirect employment during construction and operational phase.

Infrastructure Development : Improvements in local infrastructure: roads to connect the sites, bridges, access roads, possibly upgraded water supply, communications.

Cost Efficiency: Swift approval reduces funding delays, carrying costs & speeds up benefits for citizens.



Conclusion

The successful adoption of PARIVESH 2.0 has been supported by sustained capacity-building efforts. As the portal continues to be enhanced with new modules and functionalities, periodic training and handholding are provided to ensure effective utilisation. A dedicated helpdesk has also been established to address user queries and technical issues in a timely manner.

The transformation brought about by PARIVESH and its successor PARIVESH 2.0, has ensured that development projects proceed with robust environmental safeguards, contributing to sustainable development by reducing the time taken for clearances, streamlining processes, and enhancing transparency and accountability at every stage. PARIVESH today represents a mature e-Governance platform that aligns regulatory efficiency with the principles of transparency, accountability and sustainable development.

Application of Digitization in Business and Projects

Sh. S. Lakshmi Narayanan
DGM, Corporate Centre, B&FIC, L&T

The construction industry today stands at a defining moment - where traditional engineering excellence converges with powerful digital technologies to build a smarter, safer and more productive future. For an organization that has evolved over eight decades - from manufacturing dairy equipment to contributing to India's space missions - the digital journey is not merely an adaptation but a natural progression of its legacy of Imagineering. With a global presence in 50+ countries, a revenue footprint exceeding $30 billion, and a workforce of more than 575,000, the scale of operations demands a new paradigm of efficiency, intelligence, and sustainability.

The Industry Landscape: Challenges Fueling Change

Construction sites across the world grapple with complex and persistent challenges: shortage of skilled manpower, low productivity, material wastage, inconsistent quality, and the perennial risks of time and cost overruns. At the same time, global imperatives such as carbon footprint reduction and sustainable construction practices call for dramatic improvements in planning, execution and monitoring. Against this backdrop, digital technologies – Artificial Intelligence (AI), robotics, analytics, automation, and Internet of Things (IoT) - are no longer optional enhancements but the fundamental tools shaping the next generation of project delivery.

The Evolution: From Manual Processes to Intelligent Systems

The digital transformation journey in project management has unfolded in well defined phases. The initial focus was to shift from manual workflows to digital systems of record, ensuring structured data capture across engineering, procurement, and site operations. As maturity increased, dashboards, mobile applications, and visualization platforms enabled real time reporting and seamless information flow.

Today, the ecosystem is anchored in intelligence - leveraging predictive analytics, prescriptive insights, and interconnected digital systems. Integration of sensors, IoT gateways, BIM, automated reporting, and AI based analysis enables decision makers to foresee risks, optimize resources, and improve quality with unprecedented accuracy.

Some of the Digital Solutions in Action: Transforming Every Value Chain

1. **Workforce Management**

   One of the most complex components of any construction project is workforce handling. Digital platforms now streamline worker induction, daily attendance, competency checks, and on site movement. With more than 3.5 million workers onboarded and 300,000 workers connected daily, the system provides unmatched transparency and control. Additionally, "uberization" of workmen deployment enables agile manpower allocation across activities and sites.

2. **IoT Connected Equipment Ecosystem**

   Modern sites deploy thousands of assets - cranes, batching plants, generators, and heavy machinery. IoT connectivity ensures live tracking of equipment health, reliability, productivity, and even specific fuel consumption. Over 15,000 machines across 350 asset families are digitally connected, enabling remote diagnostics, benchmarking, and edge based computing for quick site interventions.

3. **Safety Through Technology**

   Safety remains paramount. Digital inspection apps allow seamless recording of EHS compliance, while vision based AI systems support detection of hazardous situations - crowding, unsafe postures, vehicular risks, and real time alerts. With 500,000+ EHS records submitted monthly and 18,000+ preventive alerts, data driven safety has shifted from reactive to proactive.

4. **Integrated Material Management**

   End to end visibility of materials, from procurement to consumption, mitigates wastage and stock discrepancies. Mobile apps enable real time material tracking across warehouses, remote stockyards, and project sites. More than 1.5 million material units have been digitally tagged, ensuring precision in planning, consumption, and reconciliation.

5. **Quality Management Digitized**

   Quality processes, traditionally paper heavy, are now streamlined through low-code / no code platforms. Over 200,000 quality data records and 17 quality modules deliver a standardized, transparent, and auditable quality framework across 400+ projects.

6. **Geospatial Intelligence**

   GeoDatabank provides a unified space for spatial datasets - toposheets, resource maps, and site intelligence - used from pre bid stages to construction execution. With thousands of spatial datasets, geospatial intelligence enhances planning accuracy, route optimization, and risk assessment.

7. **Visual Analytics and Planning**

   Centralized project hubs offer real time visibility into work progress, schedules, compliance, and risks. Visual analytics help project leaders make data-driven decisions, forecasting delays or bottlenecks well in advance.

8. **Design and Engineering Automation**

   More than 60 in house tools and 30 external tools integrate into powerful design management systems - standardizing drawings, automating design workflows, and enabling seamless document control across engineering teams.

Unified Project Management- Integrated Project Management Systems: The Connected Digital Ecosystem

At the heart of the transformation is the Unified Project Management Dashboard, a single window that connects BIM models, planning tools, safety systems, quality platforms, procurement engines, and contract administration frameworks. Tools such as BEXELS for BIM, iShield for safety, EDMS for design management, and integrated procurement solutions deliver a connected, duplication-free digital experience.

This unified platform feeds into L&T Data One Lake and L&T Eye analytics, ensuring a single source of truth for all stakeholders across planning, execution, engineering, CRM, and corporate systems.

Looking Ahead: 2026 and Beyond

The digital roadmap envisions accelerated adoption of AI / ML, advanced computer vision, robotics, integrated logistics management, and sustainable automated solutions. Future value chains will be built around intelligent optimization, predictive modeling, and autonomous operations redefining productivity benchmarks for the entire industry.

Conclusion

Digital transformation in project management is far more than the adoption of new tools. It is a strategic reinvention of how construction is envisioned, planned, executed, monitored, and optimized. By integrating systems, digitizing value chains, and harnessing real-time intelligence, the industry is poised to deliver faster, safer, greener, and more cost-efficient infrastructure for the world. With a strong foundation already laid, the coming years will only accelerate this remarkable journey toward a digitally empowered construction ecosystem. Digital transformation is not about technology alone, it is about re imagining construction, redefining reliability, and empowering our people. L&T has always built the nation and now building the future of project management.

CSR Dashboard

Ms. Shruti Bajaj
Senior Manager (CSR), IOCL

About Indian Oil Corporation Limited

Indian Oil Corporation Limited (IndianOil), a "Maharatna" Public Sector Enterprise under the Ministry of Petroleum and Natural Gas, stands as India's largest commercial enterprise and a Fortune Global 500 company. With a formidable presence across the entire hydrocarbon value chain, IndianOil recorded a revenue from operations of ₹8.45 lakh crore in FY 2024-25, reflecting the scale of its integrated operations across refining, pipelines, marketing, petrochemicals and gas.

IndianOil's Corporate Social Responsibility Framework

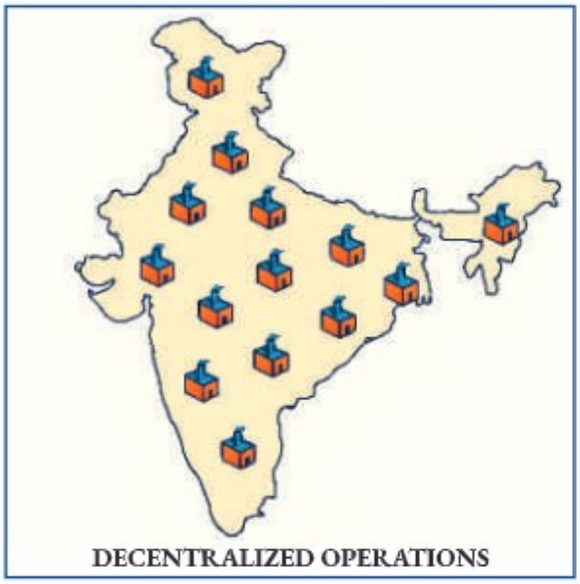
Legacy and Commitment

IndianOil's commitment to Corporate Social Responsibility predates the legislative mandate under Section 135 of the Companies Act, 2013, representing a legacy of community partnership spanning several decades. Over the past 11 years since CSR legislation, IndianOil has invested ₹3,912.93 crore in CSR initiatives, exceeding its mandated budget of ₹3,642.55 crore demonstrating unwavering commitment to social development.

For FY 2024-25, IndianOil undertook more than 850 CSR projects across various thrust areas with a total expenditure of ₹583.03 crore, achieving 100% CSR budget utilization for the eighth consecutive year. Notably, ₹365.20 crore (63% of total CSR expenditure) was allocated to thematic areas of Health and Nutrition and PM Internship Scheme, aligning with Department of Public Enterprises (DPE) guidelines. The corporation's CSR initiatives span across various thrust areas viz: Healthcare and Sanitation, Education and Employment-enhancing Vocational Skills, Safe Drinking Water and Protection of Water Resources, Rural Development, Environment Sustainability, Empowerment of Women, and Support to Socially and Economically Backward Groups. These interventions have positively impacted over 25 million lives during the past decade.

Picture 1: Training of girls at Assam Oil School of Nursing, Digboi under CSR initiative of IndianOil

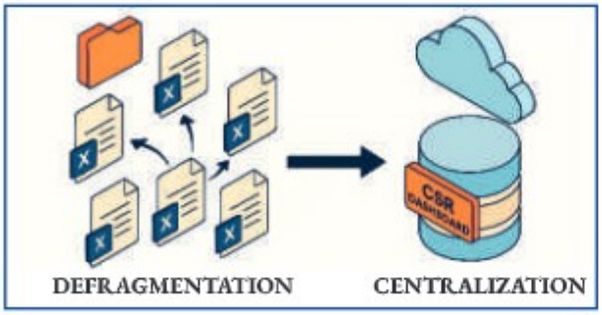
The Challenge: Need for Digital Transformation in CSR Governance



DECENTRALIZED OPERATIONS

Decentralized Operations and Monitoring Complexity

IndianOil's extensive geographical footprint encompasses 32 operational units distributed across diverse states and divisions throughout India, each independently managing CSR activities within their respective jurisdictions. This decentralized operational model, while enabling localized responsiveness to community needs, presented significant challenges in consolidated performance monitoring, reporting, and governance.



DEFRAGMENTATION CENTRALIZATION

Limitations of Legacy Data Management Systems

Prior to digital intervention, CSR data compilation and reporting relied predominantly on Excel-based formats distributed across multiple units. This fragmented approach created several operational impediments:

1. **Data Fragmentation:** Project information scattered across multiple Excel files maintained by different units, creating data silos
2. **Compilation Inefficiency:** Manual consolidation of data from 32 units resulted in time-intensive processes and delayed reporting cycles
3. **Limited Real-time Visibility:** Absence of centralized access prevented timely monitoring of project implementation and fund utilization
4. **Inconsistent Reporting Standards:** Variations in data formats and reporting practices across units compromised data quality and comparability
5. **Restricted Analytical Capability:** Difficulty in generating comprehensive unit-wise, state-wise, district-wise, and thrust area-wise analytical reports
6. **Media Documentation Challenges:** Inadequate and inefficient mechanisms for systematic storage and retrieval of project photographs and media clippings
7. **Knowledge Sharing Barriers:** Limited visibility across divisions hindered cross-learning and replication of successful intervention models

These systemic challenges necessitated a technology-enabled solution to transform CSR governance, enhance accountability, and enable data-driven decision-making for optimized social impact.

The Solution: IndianOil's Centralized CSR Dashboard

System Architecture and Design Philosophy

IndianOil CSR Dashboard represents a strategic digital initiative designed to address the governance challenges inherent in managing decentralized CSR operations at scale. Developed as a web-based centralized platform, the dashboard embodies principles of transparency, accessibility, periodic monitoring, and comprehensive reporting; fundamental tenets that align with the vision of leveraging technology to prevent inefficiency and enhance organizational governance.

Core Technical Features and Capabilities

1. **Centralized Data Repository:** The dashboard functions as a unified digital repository capturing comprehensive project data from all 32 operational units across India. This centralized architecture ensures:
   - Single source of information for all CSR project information
   - Elimination of data redundancy and inconsistencies
   - Standardized data capture protocols across units
   - Secure cloud-based data storage with appropriate access controls
   - Version control and audit trail mechanisms

2. **Multimedia Documentation Management:**

Recognizing the importance of visual documentation in validating project implementation and community impact, the dashboard incorporates robust multimedia management capabilities:

- Seamless upload functionality for project photographs and media clippings
- Organized storage linked to specific projects and locations
- Quick retrieval mechanisms for impact storytelling and verification
- Support for multiple image formats with compression optimization

3. **Periodic Update Mechanism**

The system enables designated CSR officials at each unit to periodically update project details through user-friendly interfaces, ensuring:

- Role-based access control for data entry and modification
- Real-time data synchronization across the platform
- Progressive tracking of project milestones and fund utilization
- Workflow-based approval mechanisms for data validation
- Automated reminders and notifications for timely updates (under development)

4. **Multi-dimensional Reporting and Analytics**

The dashboard's advanced reporting engine generates comprehensive analytical reports across multiple dimensions:

Report Category	Capabilities
Unit-wise Reports	Consolidated view of CSR activities, expenditure, and beneficiary reach for each operational unit
State-wise Reports	Aggregated CSR investment and impact metrics at state level for policy alignment
District-wise Reports	Granular visibility of CSR interventions at district level, including Aspirational Districts coverage
Thrust Area-wise Reports	Thematic analysis of investments across Healthcare, Education, Water, Environment, Rural Development, etc.
Financial Reports	Budget allocation, expenditure tracking, and utilization percentages with drill-down capabilities
Beneficiary Reports	Quantitative and qualitative metrics on community reach and demographic distribution

Table 1: Multi-dimensional Reporting Capabilities of CSR Dashboard

5. **Enhanced Cross-Divisional Visibility**

The dashboard democratizes access to CSR project(s) information across the organization, enabling:

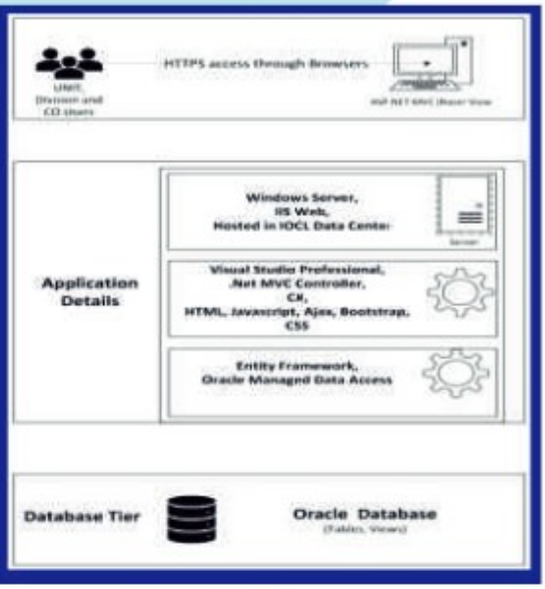
- Officers across divisions to view CSR projects implemented by other units
- Identification of best practices and innovative intervention models
- Facilitation of knowledge exchange and collaborative learning
- Prevention of duplication of efforts in similar geographical areas
- Promotion of standardization in high-impact intervention strategies

Technical Architecture and Security Framework

The CSR Dashboard is built on modern web technologies ensuring scalability, security, and performance:

- **Platform Architecture:** Web application with responsive design for browser access
- **Database Management:** Relational database with normalized schema for efficient data storage and retrieval (Oracle)
- **Security Protocols:** Multi-layered security including SSL encryption, role-based access control (RBAC), and audit logging
- **Integration Capabilities:** APIs for potential integration with financial management systems, ERP.
- **User Interface Design:** Intuitive dashboard design with data visualization using charts and graphs
- **Backup and Recovery:** Automated backup schedules with disaster recovery protocols

- Web application accessed through browsers
- Accessible within IOCL network
- Developed in MVC .net framework.
- It is hosted in IOCL data center, windows environment.
- It is in house developed.
- Uses Oracle database.



Impact and Benefits

Transformation in CSR Governance

Operational Efficiency and Data Integrity

Reduced Reporting Time
Consolidation of reports from 32 units reduced from weeks to instant report generation with periodic updates

Data Standardization
Standardized data entry protocols eliminated inconsistencies and improved accuracy

Enhanced Data Quality
Automated processes replaced manual compliation, freeing resources for strategic activities

Improved Compliance
Systematic documentation ensures adherence to regulatory reporting requirements

Strategic Decision-Making and Resource Optimization

Evidence-based Planning
Data-driven insights inform future CSR strategy and thrust area prioritization

Resource Allocation
Visibility into expenditure patterns enables optimized budget allocation across units and themes

Gap Analysis
Identification of underserved geographical areas and beneficiary segments

Impact Assessment
Quantitative and Qualitative metrics facilitate evaluation of project outcomes and community reach

Performance and Accountability Enhancement

Audit Trail
Complete documentation of project lifecycle from approval to completion

Budget vs. Expenditure Monitoring
Real-time visibility into fund utilization against allocated budgets

Performance Monitoring
Periodic tracking of project milestones prevents delays

Knowledge Management and Organizational Learning

Best Practice Documentation
Successful intervention models accessible for ease of replication

Cross-learning Platform
Visibility into diverse project approaches fosters innovation and adaptation

Capacity Building
Documented learnings support training of new CSR personnel

Conclusion and Future Roadmap

The IndianOil CSR Dashboard represents a paradigm shift from fragmented, manual CSR data management to an integrated, technology-enabled governance system. By addressing the challenges of decentralized operations through digital innovation, the platform has enhanced operational efficiency, strengthened accountability mechanisms, and enabled data-driven decision-making for maximized social impact.

This initiative demonstrates how large enterprises can leverage digital technologies to transform governance processes, aligning with national priorities for e-governance and digitalization. The dashboard's success in consolidating information from 32 geographically dispersed units into a unified platform offers valuable lessons for other large organizations managing decentralized social initiatives.

As IndianOil continues to scale its CSR operations, having touched over 25 million lives and invested nearly ₹4,000 crore over the past decade, the dashboard will evolve as a strategic asset for planning, monitoring, and amplifying community impact. Future enhancements may include mobile applications for field-level data capture, integration with geographic information systems (GIS) for spatial analysis, artificial intelligence-enabled insights for intervention optimization, executive summary generation for reporting of impact, timestamping and geolocation metadata for authenticity verification of media files etc.

In an era where data-driven governance and transparency are paramount, IndianOil CSR Dashboard stands as a testament to the power of digital transformation in strengthening corporate social responsibility frameworks and enhancing standards of governance.

Digital Project Management Solution

Ms. Vinita Singh
GM (Projects), SAIL

Introduction

Effective Project Management is the backbone of successful project outcomes. Continuously tracking & assessing progress to ensure alignment with project objectives, reducing risks and optimising resources isn't just a best practice – it's a strategic tool that enables growth and success.

Digital Project Management Solution (DPMS) is an online platform that has been implemented to streamline the project management process across SAIL. This implementation represents a major milestone in SAIL's digital transformation journey, offering real-time project monitoring, streamlined approval cycles, enhanced transparency, and improved documentation control. DPMS empowers teams to collaborate effectively, make data-driven decisions, and significantly improve project execution efficiency across the enterprise.

> **What gets measured, gets managed**
> **– Peter F Drucker**

It is a comprehensive platform that assists project officials in planning, execution, monitoring, and reporting of projects. The DPMS platform has been configured for enabling a fully integrated and seamless workflow, tailored to the organization's specific requirements viz. flow of data from project site(s) to authorized users with customized dashboards and appropriate interfaces for monitoring with 3D model, L-2 schedules, graphs & charts etc. The system will also enable data storage and record keeping of construction time data linked to 3D model including status of work, test reports, data sheets, other document etc. The system will ensure data integrity and centralized information management, fostering collaboration across all SAIL units and project sites.

Salient features of IT System

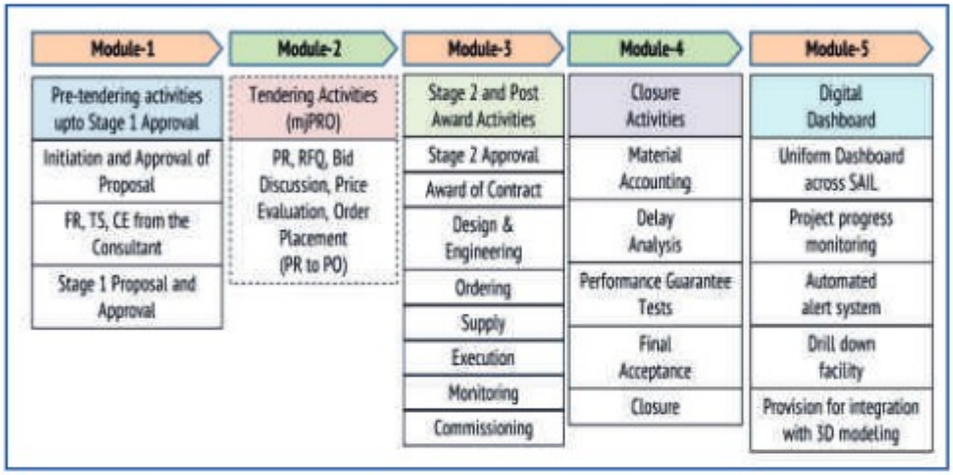
- DPMS is on the n-Pulse platform from Bentley Systems, with M/s Mansycom Consultants Pvt. Ltd. as the implementation partner.
- System is hosted on the AWS cloud, providing secure, scalable, and 24x7 accessible digital project management capabilities over the internet.
- One of the key strengths of this solution is its ease of accessibility. End users can operate the system via any standard PC or laptop with a stable internet connection and a mainstream operating system.
- No proprietary hardware or on-premise infrastructure is required - users simply log in through a web browser to access dashboards, reports, documentation, and approval workflows.

The architecture ensures secure data flow, role-based access control and seamless interoperability across SAIL's digital ecosystem.

Salient features of DPMS

DPMS streamlines workflows from conceptualization to project closure, delivering real-time monitoring, enhanced transparency and improved collaboration across all stakeholders.

It has been divided into five modules including pre-tendering activities, tendering activities, post award activities, Digital Dashboard & Reporting and closure activities. This makes the system a single source of truth for all project related information ensuring data consistency, accuracy & organisation wide accessibility.



i. Module 1 – Pre-Tendering Activities up to Stage 1 approval

ii. Module 2 – Tendering Activities, finalisation of L-1 bidder (mjPRO).

iii. Module 3 – Stage 2 approval, Award of contract and Post Award activities

iv. Module 4 – Closure Activities

v. Module 5 – Digital Dashboard

With use of Application Programming Interfaces (API), DPMS has been integrated with existing systems to automatically exchange data and trigger actions. This has enabled unified workflow and reduced the need to switch between different applications.

- Integration with mjPRO: For tendering activities, SAIL has adopted e-tendering solution for which DPMS has been integrated with e-Procurement Module of M-Junction (mjPRO).
- Integration with Electronic Drawing and Document Management System (EDDMS): For transfer of approved drawings from existing EDDMS of CET (in –house consultant of SAIL) to DPMS.
- Integration with SAP: Purchase Order (PO) will be created in SAIL's existing SAP ERP system. The data and approvals of PO in SAP ERP system will flow to DPMS.

Impact & Benefits

Implementation of DPMS will automate various processes from conceptualization to closure; will track the progress of projects and act as a central repository of various documents created during a project life cycle.

The system will display macro and micro level details related to the project in a convenient & easy to use format and as per roles & authorizations granted to the users. Following benefits are expected from the implementation of DPMS:

- **Real-Time Visibility:** Interactive dashboards provide project KPIs at macro and micro levels, enabling data-driven decisions and proactive issue resolution
- User friendly graphic interface for review of physical / financial progress
- Provision of uploading geo-tagged and time stamped photographs
- Interfaces with 3D models & L-2 schedules. Enables storage of construction time data linked to 3D models
- **Enhanced Collaboration:** Stakeholders across units access a common platform, facilitating seamless communication and improved team co-ordination
- **Centralized Repository:** Project documents & information stored in a single location throughout the lifecycle, serving as comprehensive archives post-completion
- **Transparency & Accountability:** Regular monitoring promotes transparency, keeps teams aligned with project goals and holds them accountable for deliverables
- Provision of Hindrance register / Delay analysis through the system
- Mapping of project timelines with provision of escalation

The above outcomes shall help in strengthening project management with effective monitoring & analysis along with facilitating SAIL management in taking proactive decisions.

Way Forward

DPMS has been implemented in SAIL in August 2024. With optimum utilisation of all features available in the system and continual improvement with use of latest technology, the aim is to move towards-

- **Process Automation:** Transition from manual data entry to automated capture of process data
- **Enhanced Reporting:** Develop tailored reports meeting specific stakeholder requirements
- **Financial Integration:** Enable Annual Plan preparation with seamless CAPEX data flow from SAP to DPMS for comprehensive budget management
- **4D BIM Simulation:** Integrate 3D models with erection schedules, creating 4D simulations for project visualization
- **E-Measurement:** Digital measurement systems for work performed, streamlining billing processes and ensuring accurate progress tracking
- **IT Team Engagement:** Strengthen internal IT team involvement in DPMS maintenance, building institutional knowledge and reducing dependency on external partners

With the right tools, discipline & mind-set, delivering projects on time and under budget should not feel like a once-in-a-lifetime achievement – it can become the default mode of operation.

Integrated AI-based Cost Estimation System

Sh. Saikat Bhowal
GGM, Digital Technology Solutions, EIL

Challenges of Cost Estimation

Cost prediction in engineering procurement remains inherently complex due to wide design variability and the limited availability of comparable historical data. Traditional estimation methods are largely manual, time-consuming, and heavily dependent on the skill and experience of the estimator. Accurate estimation often requires analysis of extensive datasets, which can exceed human capability when parameters and data volumes grow large.

Additionally, uncertainties in bidding, such as fluctuating market conditions, risk perceptions, and bidder strategies - further complicate accurate cost forecasting.

While conventional cost estimation tools are widely used, they are primarily suited for early-stage estimates where achieving high accuracy is generally not possible due to high uncertainty and limited information. Achieving procurement-grade accuracy requires calibration with internal cost data and vendor inputs. These challenges highlight the need for a data-driven, explainable, ML-based cost estimation solution.

Motivation

Cost estimation is integral to procurement across all projects. Although commercial tools support preliminary estimates, they require organization-specific calibration for higher fidelity outputs.

Recognizing this need, EIL developed an AI-based cost estimation application to generate rapid, rational, and data-driven cost predictions. The solution has been developed in-house by the Digital Technology Solutions Division, leveraging domain expertise in engineering and cost estimation, historical project data, and artificial intelligence capabilities. AI-based cost estimation was identified as a strategic use case within Supply Chain Management to enhance efficiency and reliability.

Concept of AI-Based Cost Estimation

Artificial Intelligence is well suited for cost estimation applications, as it can identify cost drivers, detect patterns in large datasets, and generate rapid outputs.

The model leverages historical procurement data and technical specifications. Economic indices such as the Wholesale Price Index (WPI) and Consumer Price Index (CPI) are incorporated to escalate past awarded costs and align estimates with prevailing market trends.

Critical cost-influencing parameters are identified in consultation with Subject Matter Experts (SMEs), ensuring domain knowledge is embedded within the AI framework.

Pilot Case-Pressure Vessels

Pressure vessels were selected as the pilot case for model development. The objective was to build a machine learning model capable of assisting cost engineers in estimating vessel prices based on technical requirements and other relevant information with reasonable accuracy.

The selection was driven by several factors:

- Pressure vessels are engineered in-house by EIL. Procurement of pressure vessels in EIL projects is for engineered vessels. Accordingly, there is no variation between bidders depending on their engineering.
- A substantial internal database is available.
- Approximately 200–300 vessels are procured annually, making estimation effort-intensive and impactful.

Methodology

The AI development process began with domain understanding to identify cost components such as vessel weight, material of construction and shell thickness. Key parameters were finalized through Subject Matter Experts (SMEs) inputs and validated through data analytics.

The process included model development, verification, and deployment. Model performance is continuously monitored with periodic retraining and tuning using new project data.

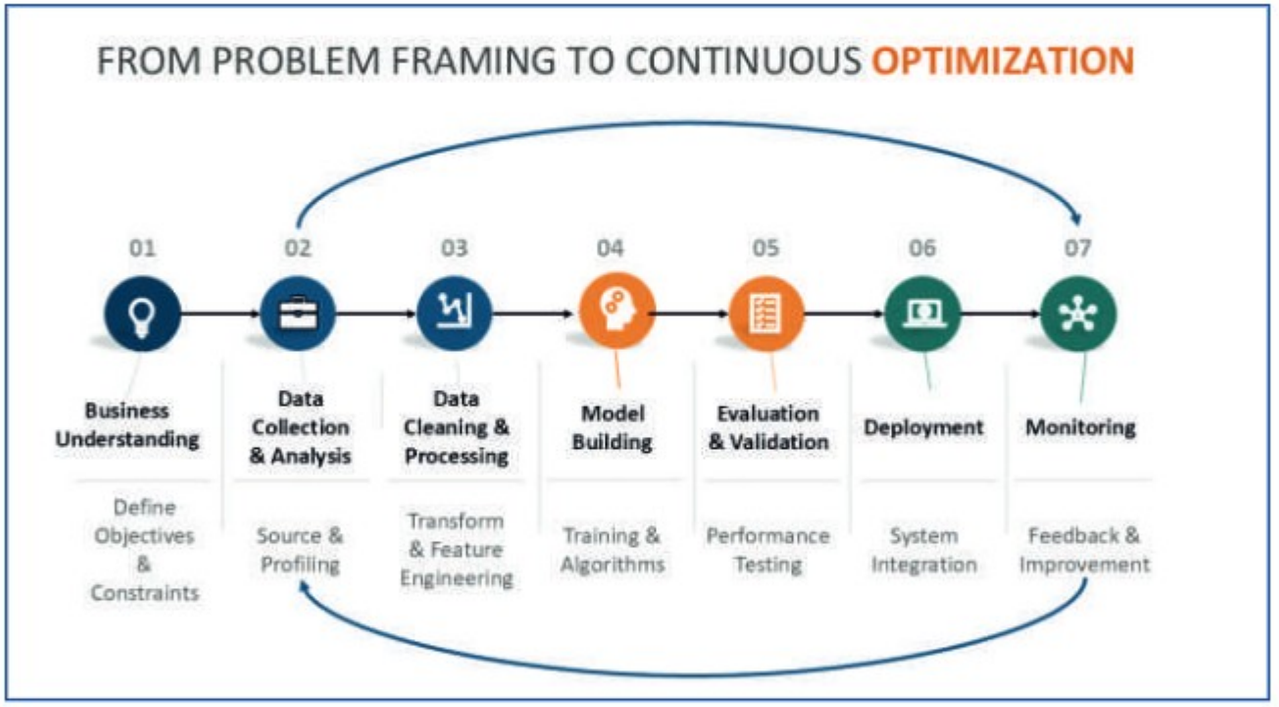


Figure-1: Methodology

AI Model Development

Model development commenced with rigorous data cleaning, including data extraction, segregation, and removal of outliers in consultation with SMEs.

Feature engineering was applied to enhance model performance. For instance, the non-linear relationship between shell thickness and cost was addressed by categorizing thickness ranges to reflect market realities, such as reduced manufacturer availability beyond certain thresholds.

The dataset was split into training and testing sets. Multiple algorithms were evaluated, and the best-performing model was validated using unseen data before deployment.

Application Architecture

The application integrates seamlessly with existing digitized systems at EIL. Standard cost estimation inputs are automatically transferred into the AI platform, ensuring efficiency and eliminating redundant manual data handling.

Data Sets and Analysis

Data analysis revealed skewness and non-uniform variation in historical records. For example, carbon steel vessels constitute 85% of the past database. Model accuracy is influenced by dataset size and diversity, making Subject Matter Expert's insights critical for improving performance, for example, by feature engineering.

ML Model Training & Inference

Model outputs are benchmarked against awarded costs and compared with traditional manual estimates, as no industry benchmark currently exists for AI-based cost estimation.

Upon satisfactory evaluation, the model is deployed for operational use. The application supports estimation prior to Earnest Money Deposit (EMD) submission and during bid comparison stages.

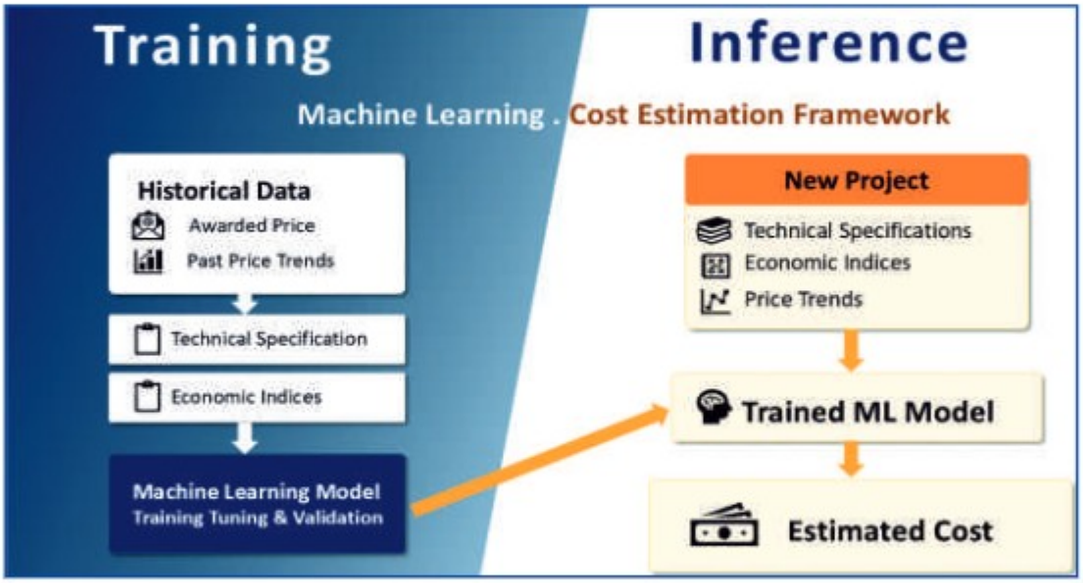


Figure-2: ML Model Training and Inference

Envisaged Benefits

Initially deployed as an assistive technology, the AI-based cost estimation solution offers significant advantages:

- Data-driven, no human bias
- Enhanced speed through automation
- Agnostic to individual skills and experience
- Embedded SME expertise
- Provides ready reference to similar historical tags
- Reduced manual errors

Initial results show better performance for AI based solution than manual estimates. AI solution saves 98% of manhours spent on cost estimation using manual method.

Way Forward

The ML model is continuously validated and refined using data from ongoing projects. Based on insights gained, similar AI-based cost estimation models will be developed for other categories of equipment, expanding the scope and impact of EngAICosting® across procurement functions.

Session-II :
Banking Fraud Prevention & Risk Management

Enterprise Wide Risk Management & Fraud Prevention

Sh. Baldev Prakash
DMD & CRO, SBI

All the Banks carry the responsibility of protecting not only customer deposits but also public trust. While the Banks carry continuously strengthens its internal vigilance and fraud risk management systems, customer awareness remains the first and strongest line of defence.

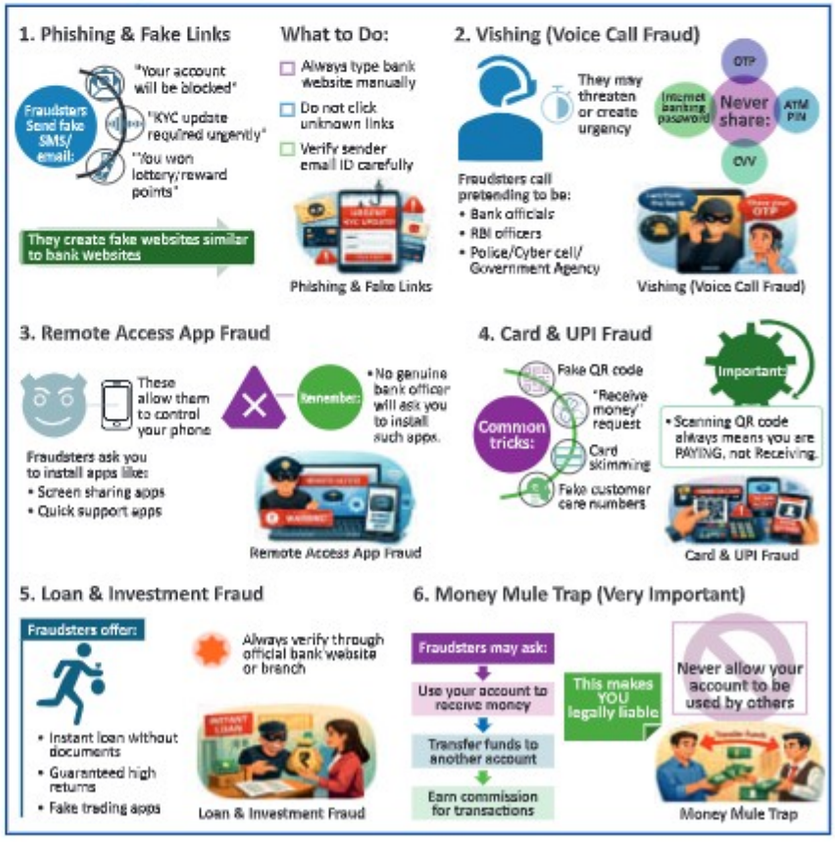
Fraud prevention is a shared responsibility. Technology can detect patterns and flag suspicious activity, but customers play a crucial role in preventing fraud by staying alert, informed, and cautious.

Why Customer Awareness Matters

In today's fast-evolving financial and banking environment, fraud is not merely a technical or operational issue, it is a direct threat to customer's hard earned savings, financial stability, and public confidence in the banking system. With the rapid expansion of digital channels such as internet banking, mobile applications, UPI, cards, and emerging platforms like CBDC, banking services have become faster and more convenient. However, this digital transformation comes with the menace of frauds.

Fraudsters today operate with high levels of sophistication. They use social engineering, phishing, fake investment schemes, impersonation calls, mule accounts, malware, and layered transactions to deceive customers. These frauds occur with speed and scale, often across multiple accounts and geographies.

Understanding Common Types of Banking Frauds



How the Bank is Strengthening Fraud Prevention

- The Bank has adopted a proactive, technology-driven vigilance framework.
- Real-Time Monitoring
- The Proactive Risk Management Department (PRMD) monitors digital transactions 24×7. Real-time detection of suspicious transactions enables immediate preventive action such as debit freeze or channel blocking.
- Integration with national platforms and agencies such as:
  - Reserve Bank of India
  - National Payments Corporation of India
  - Indian Cyber Crime Coordination Centre enhances industry-wide intelligence sharing and fraud risk mitigation.

Behavioural Biometrics & Device Intelligence

Advanced systems analyse behavioural patterns when customers access digital channels. Any deviation from normal behaviour: unusual device, IP change, abnormal transaction pattern generates alerts and may trigger step-up authentication. This ensures suspicious transactions are detected before they are completed.

Analytical Layer & AI/ML Models

The Bank is implementing an integrated Enterprise Fraud Risk Management (EFRM) framework combining:

- Customer demographics
- Transaction data
- External intelligence inputs
- Complaint data
- AI/ML predictive analytics

The objective is to detect fraud before financial loss occurs-shifting from reactive detection to preventive containment.

Cyber Security Enhancements

Key initiatives include:

- SOC 3.0 – Upgradation of Security Operations Centre into AI/ML-driven Cyber Defence Centre
- Identity & Access Management (IDAM) – Centralised access control
- Hybrid Secure Service Edge (H-SSE) – Secure internet and VPN routing
- Data Security Defence Centre – Monitoring and response to data incidents

These initiatives aim to ensure a secure digital ecosystem for customers.

What Customers Should Do-Practical Safety Measures

☑ DO's	☒ DON'Ts
☑ Keep your mobile number updated	☒ Don't share OTP PIN
☑ Use strong passwords	☒ Don't click unknown links
☑ Enable SMS & email alerts	☒ Don't trust urgency or threats
☑ Verify beneficiary before transfer	☒ Don't install unknown apps
☑ Logout after internet banking use	☒ Don't search bank customer care on Google randomly
☑ Update apps only from official stores	☒ Don't allow strangers to use your account

Building a Culture of Vigilance

Fraud prevention is not only about systems and surveillance - it is about awareness, ethics, and accountability. The Bank conducts:

- SMS awareness campaigns
- Email advisories
- Customer education drives
- Special outreach for senior citizens and youth

However, awareness must translate into responsible action. Every customer interaction whether digital or physical must be approached with caution and verification.

Conclusion

The landscape of banking fraud is dynamic, and technology driven. As fraudsters evolve, so must our vigilance. The Bank is strengthening its fraud risk management architecture through real-time monitoring, analytics, AI/ML, behavioural intelligence, and enhanced cyber security.

Yet, the most powerful defence remains an informed and alert customer.

By following safe banking practices, promptly reporting suspicious activity, and remaining cautious in digital interactions, customers play a vital role in safeguarding not only their own finances but also the integrity of the broader banking system.

Banking security is a shared responsibility. Together, we can ensure a secure, resilient, and trustworthy financial ecosystem.

Enterprise Wide Risk Management & Fraud Prevention

Sh. Manish Agrawal
Senior EVP, HDFC

Introduction

Transparency and accountability are fundamental pillars of good governance in the banking sector, particularly for banks that manage significant volumes of public funds. Digital systems create structured workflows, automated controls, and comprehensive audit trails, which significantly reduce the scope for manual intervention and enhance monitoring capabilities. In recent years, banks have adopted several digital initiatives that support transparency in governance, strengthen fraud prevention mechanisms with the rapid digital transformation of banking operations, technology-driven solutions are increasingly being leveraged to strengthen transaction monitoring, onboarding of right set of customers, vigilance mechanisms, central audit to reduce operational risks even in tier 3-4 cities, transparency of regulatory compliance, preventive checks at gate to avert fraud risk and promote ethical conduct across banking processes.

Digital fraud today is deeply embedded in everyday digital activity, with most transactions initiated and authenticated on the same device. This convergence makes it difficult to distinguish genuine user actions from fraudulent ones, as

Evolution of Cyber frauds

- *The evolving landscape of cyber frauds shows that frauds are not confined to a single method but take diverse forms, often adapting to new technologies and user behaviour.*
- *Increase in the internet users with lower awareness on financial risk leads to such frauds*
- *Fraudsters take advantage of human emotions to defraud the customers by stimulating fear or greed*

compromised devices can mask illegitimate transactions as legitimate. The result is a near-frictionless fraud environment that operates within normal user behaviour, making detection increasingly complex. This calls for stronger device-level controls, adaptive authentication, and enhanced customer awareness to mitigate emerging risks. All the cyber enabled fraud funds move via Money Mule accounts.

This shift highlights the need for a balanced approach combining strong onboarding controls, transaction security controls, behavioural monitoring, and continuous customer awareness.

Evolution of Mule Account

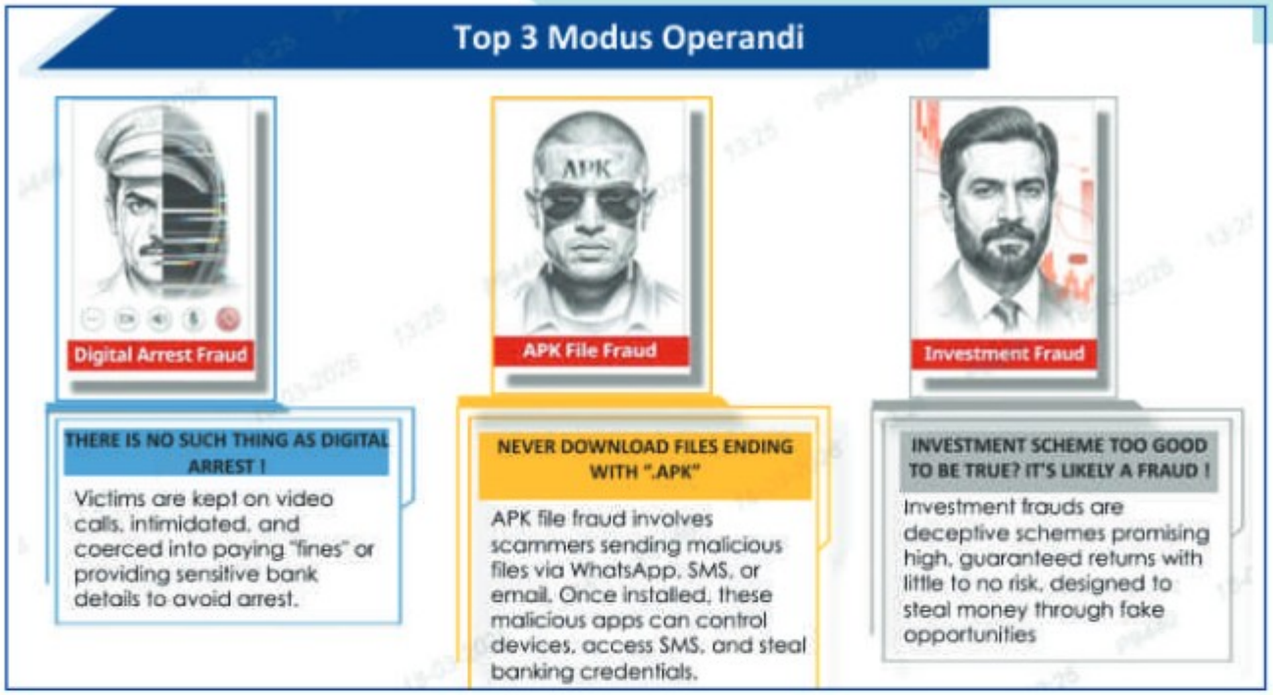
The money mule ecosystem has evolved from isolated misuse of accounts to a structured, technology-driven network supporting organized financial crime. Initially driven by exploitation of vulnerable individuals, it has scaled rapidly due to gaps in remote onboarding and verification. Today, mule operations are centrally managed using advanced tools, making them more coordinated, scalable, and difficult to detect.

Key Points

- Shift from localized misuse to organized mule networks
- Recruitment via job, investment, and relationship scams
- Weak remote KYC enabling bulk account creation
- Use of device/SIM farms and remote access tools
- Growing scale, coordination, cross-border highly sophisticated tech-driven

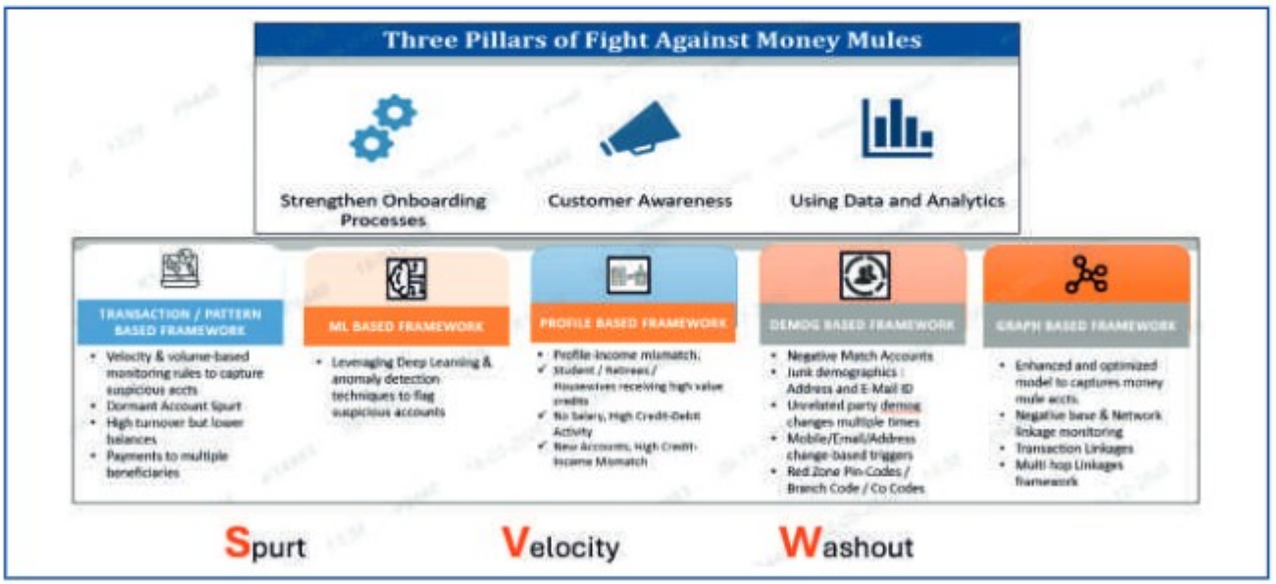
Case Study of Contemporary Digital Frauds

Recent case analyses highlight three predominant fraud typologies shaping the current threat landscape. Digital arrest frauds leverage impersonation and intimidation to coerce victims into making payments or sharing sensitive banking details. APK-based frauds involve the distribution of malicious applications that compromise device integrity, enabling unauthorized access and transaction execution. Investment frauds exploit the promise of high, risk-free returns to lure victims into transferring funds to fraudulent accounts. These patterns reflect a convergence of social engineering and technological exploitation, underscoring the need for heightened customer awareness, secure digital practices, and proactive monitoring frameworks.



Fight Against Mule Ecosystem

The Bank has adopted a structured, multi-layered framework for effective detection and actioning against money mule accounts, anchored on strong onboarding controls, customer awareness, and advanced analytics. The approach integrates transaction pattern monitoring, machine learning models, profile and demographic-based triggers, along with graph analytics to identify mule networks and linkages. By focusing on key risk indicators such as transaction spurts, abnormal velocity, and rapid fund washout, the framework enables early detection and swift intervention. This integrated strategy strengthens the Bank's capability to proactively identify, monitor, and dismantle mule ecosystems.



Strengthening Onboarding Controls

A key pillar of governance is ensuring that risk is controlled at the point of entry itself. Bank has implemented a multi-layered onboarding control framework, combining rule-based validation, and external intelligence. Onboarding improves identity verification, detects synthetic identities, and assigns risk scores at the account opening stage. A key focus area has been strengthening controls at the onboarding stage, the Bank ensures robust identity verification and early risk detection. Controls such as deduplication checks, liveness detection, telecom intelligence (FRI/MNRL), RBI developed Hunter, MHA suspect registry checks and Bank's internal negative database screening enable identification of high-risk profiles at the entry point itself.

Key Control Mechanisms

- De-duplication checks: Mobile, Email, PAN commonality detection
- Liveness detection: Prevents impersonation and synthetic identity fraud
- UIDAI mobile validation: Ensures identity authenticity
- RBI-Hunter for suspicious mule deduction
- MHA Suspect Registry
- DOT MNRL-FRI data intelligence

Conclusion

Bank continues to enhance its digital capabilities to build a secure and resilient financial ecosystem. This represents a shift toward predictive, integrated, and transparent control frameworks.

Collaborative Strategy in Combating Mobile Induced Cyber Fraud

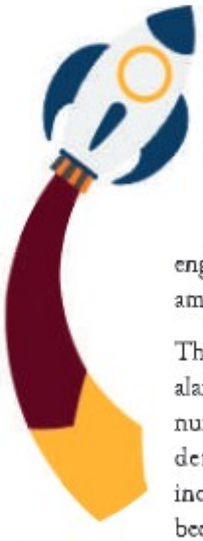
Sh. Sanjeevan Nikhar
CGM & CCO, PNB

India's financial landscape has undergone a dramatic transformation over the past decade, driven by digitalization. This evolution is not just about convenience—it is reshaping economic participation, financial inclusion, and the very structure of the country's economy. This transformation has been backed by government initiatives such as the Digital India Programme, which accelerated the adoption of digital platforms, and the Pradhan Mantri Jan Dhan Yojana, which brought millions into the formal banking system, among several others. These initiatives, coupled with digital transaction technologies like the Unified Payments Interface (UPI) and FinTech innovations (mobile wallets, algorithmic trading, blockchain, etc.), have reshaped India's financial markets.

While the nation's digital ecosystem is booming, widespread internet penetration and the availability of affordable smartphones have played a key role in the adoption of digital financial platforms across the economy. Today, with the second-highest number of mobile subscribers globally (around 117 crore) and the highest number of data users (approximately 97 crore internet users), India ranks among the world's leaders in mobile and data usage. The annualized growth of digital transactions has surged by 44–47%, reaching nearly 18,000 crore transactions in FY 2025.

In terms of economy-wide digitalization, the digital economy is growing almost twice as fast as the overall economy, paving the way for numerous opportunities, especially in rural and semi-urban areas. As per the Government of India Survey dated 29.05.2025, in rural areas, over 95% of smartphone users are aged 15–29 years, while in urban areas the figure is nearly 98%. These developments have led to increased efficiency, accuracy, innovation, and several more transformations yet to come.

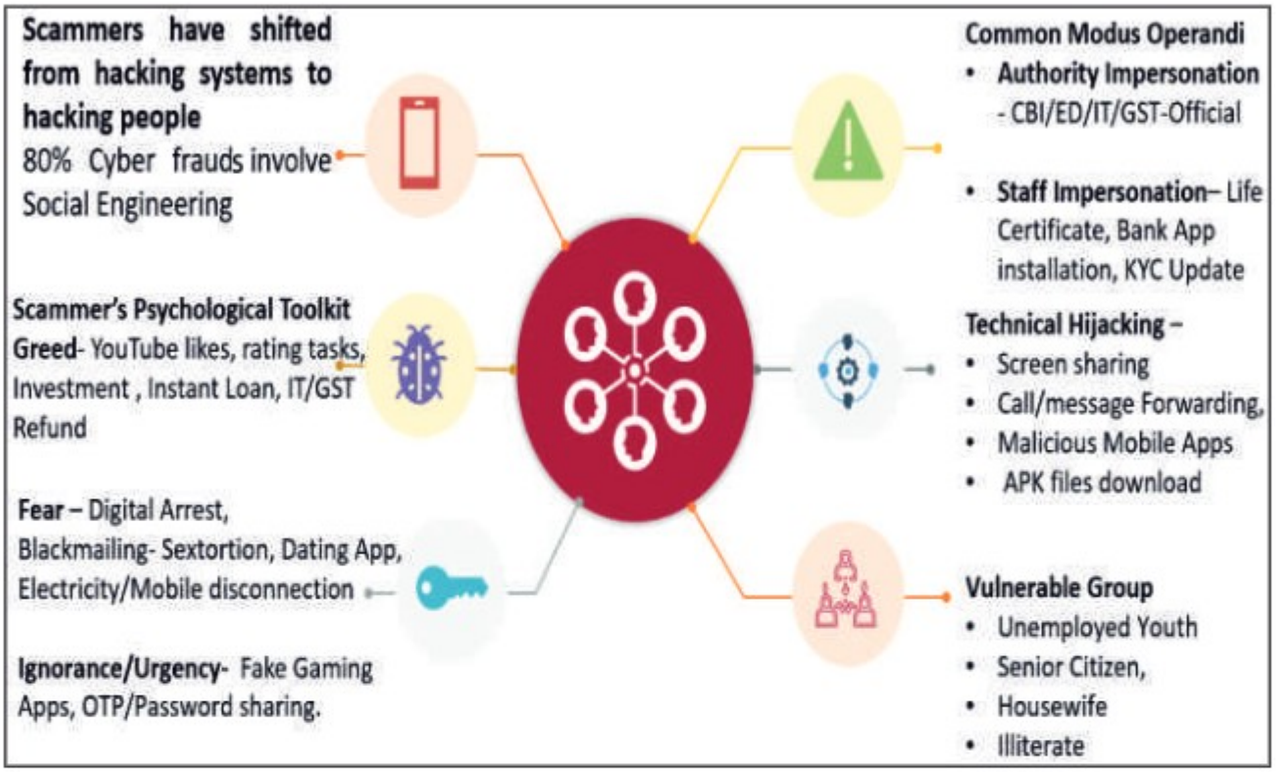
However, this rapid expansion has also opened the door to cyber-enabled fraud, ranging from financial scams to organized anti-national activities and financing of terrorism. These groups are often early adopters of technology and misuse it unethically to serve their vested interests. With the easy availability of information, such groups operate like professionals, constantly exploring system vulnerabilities for infiltration. Some of the latest techniques adopted by them include digital arrest scams, social engineering tactics, and investment frauds, among others.



The government and all stakeholders are alarmed by the manifold increase in both the number of reported cases and the amount defrauded. National-level initiatives, including various policy decisions, have been undertaken and implemented by the Government and regulatory bodies such as the Reserve Bank of India (RBI) and FIU-IND. Two major factors are common in almost all reported cases of cyber fraud:

1. Social engineering and human manipulation
2. Exploitation of technical vulnerabilities

The Shift in Modern Cybercrime

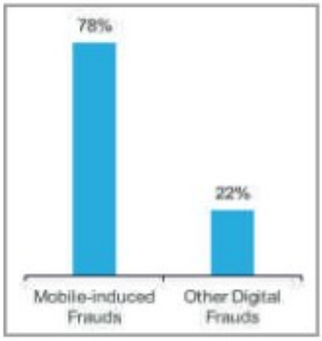


Fraudsters persistently use social engineering tactics through platforms and schemes such as YouTube promotions, fake ratings & likes, fraudulent investment opportunities, instant loan offers, Income Tax/ GST refund scams, sextortion, dating apps, and threats of electricity or mobile disconnection etc. Other common methods include fake gaming apps, OTP/ password sharing, life certificate frauds, malicious bank app installations, and fake KYC update requests.

The Rising Threat of Mobile-Induced Frauds

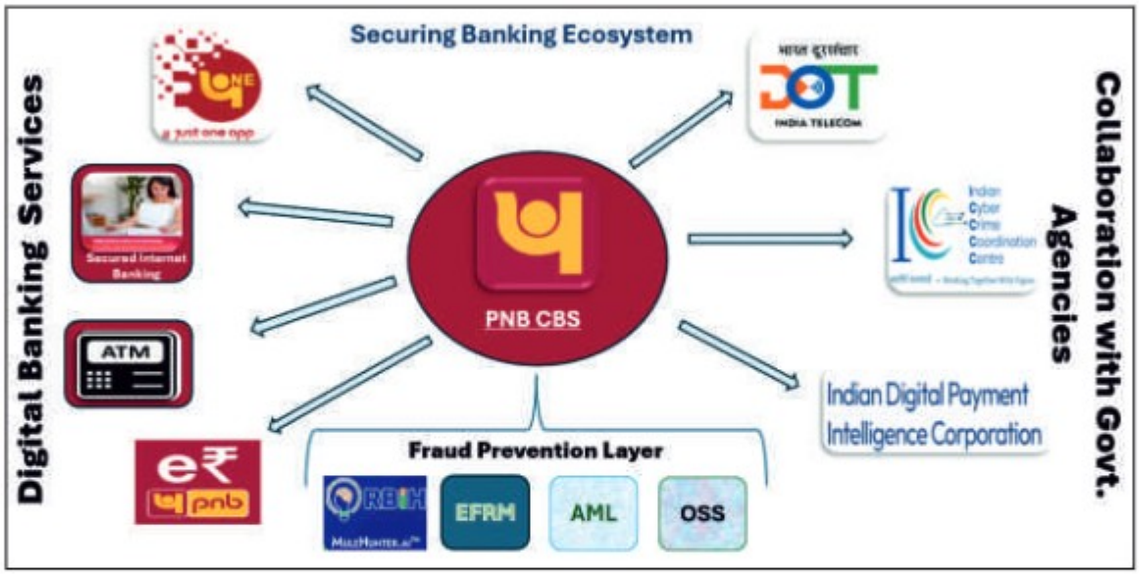
PNB's internal analysis reveals that **over 75% of cyber fraud complaints stem from mobile-enabled frauds.** Fraudsters exploit vulnerabilities such as:

- Easy access to multiple SIM cards
- Low acquisition costs and the disposable nature of SIMs to erase evidence
- Social engineering tactics that exploit greed, fear, and urgency over mobile channels
- Increased targeting of vulnerable groups such as unemployed youth, senior citizens, and homemakers, reflecting a shift from hacking systems to "hacking people"



PNB's Defence System against Mobile-Induced Frauds

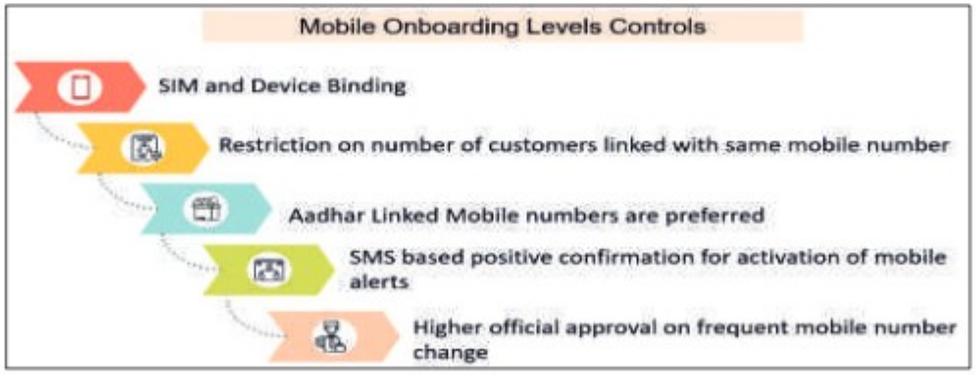
PNB is dedicated to nation-building and strengthening digital financial security for its customers. As a leading, trusted, and proactive institution, PNB actively drives key national initiatives. The Bank has built a robust infrastructure, including an **Enterprise-wide Fraud Risk Management (EFRM) Solution, an Anti-Money Laundering (AML) Cell, an Offsite Surveillance System (OSS), and MuleHunter.AI** (in partnership with the RBI Innovation Hub), to safeguard its customers.



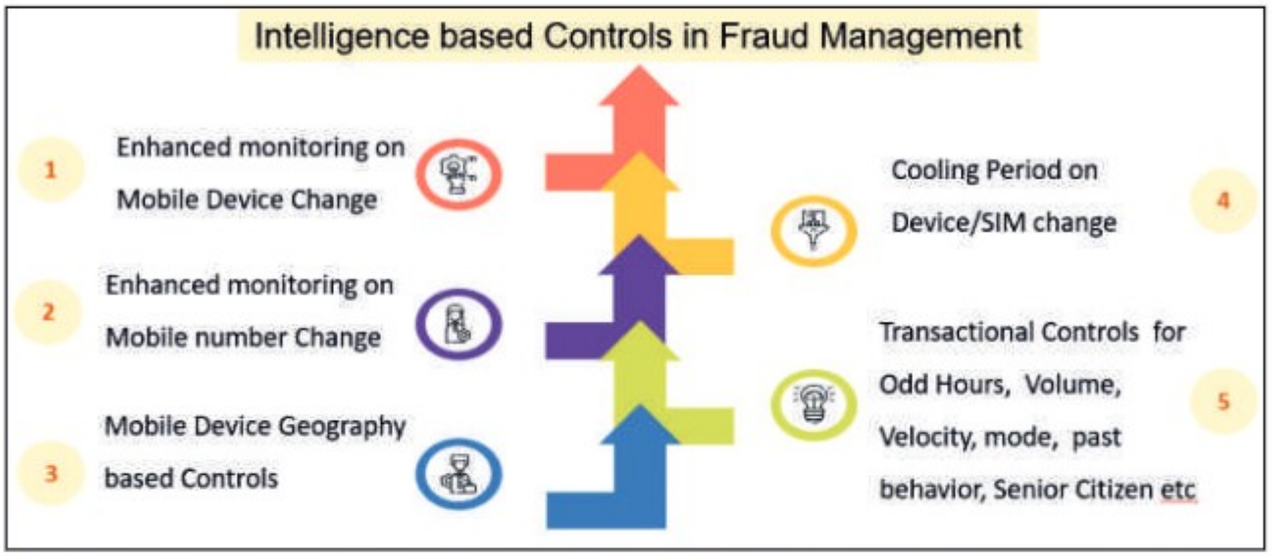
As a flag-bearer, PNB is among the most preferred banks for stakeholders and is proactively engaged with leading national agencies such as the Indian Cyber Crime Coordination Centre (I4C), RBI Innovation Hub (RBiH), National Payments Corporation of India (NPCI), Indian Digital Payment Intelligence Corporation (IDPIC), and the Department of Telecommunications (DoT).

PNB's Multi-Layered Defense

The Bank also has strong internal defense mechanisms at the customer onboarding stage:



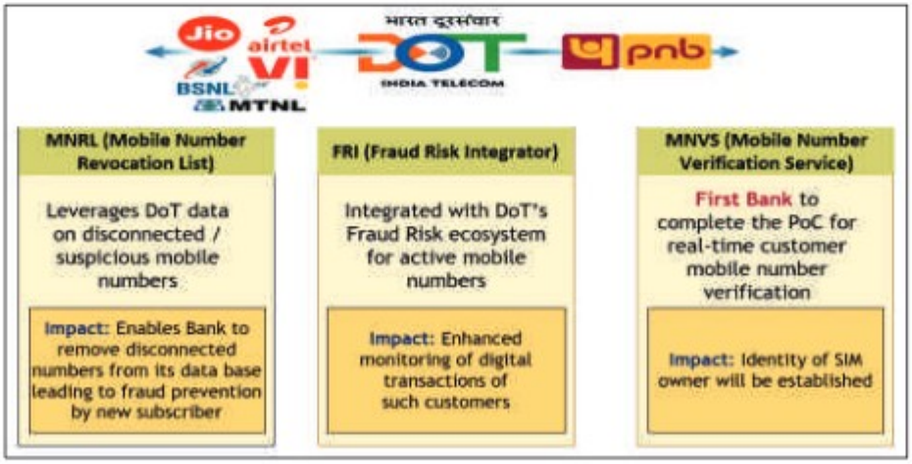
In addition to above, Bank also has intelligence-based controls to mitigate fraud.



PNB's Strategic Collaboration

As financial fraud schemes grow increasingly sophisticated, it became imperative for banks to stay ahead of the curve by embracing innovative, resilient, and comprehensive defense strategies. Central to this effort is the integration of advanced technologies such as **Artificial Intelligence (AI) and Machine Learning (ML),** which enable real-time detection and prevention of cyber-enabled fraud. By deploying dynamic risk scenarios, strengthening preventive controls, and maintaining continuous customer awareness campaigns, financial institutions can minimize losses and safeguard their channels from misuse for illicit fund placement. In today's rapidly evolving threat landscape, proactive vigilance is no longer optional-it is the cornerstone of trust and security in modern banking.

Hence, the need for a collaborative shield against the cyber fraudsters was felt by the stakeholders, giving way to advance joint operation. In this line, Bank's fight against fraud is strengthened through strategic collaboration with Department of Telecommunications (DoT) in the following projects:



Bank's Strategic Collaboration

PNB is embracing AI/ML-driven fraud detection and Dynamic Additional Authentication to stay ahead of cybercriminals. By onboarding onto the RBI's Digital Payments Intelligence Platform (DPIP), the Bank aims to leverage collective intelligence across the financial ecosystem.

Indian Digital Payment Intelligence Corporation (IDPIC)

- IDPIC serves as a central repository for participating members to prevent digital cyber fraud in the banking system using AI/ML.
- The Bank has onboarded IDPIC and is in the process of implementing it at customer onboarding, transaction validation, and beneficiary addition stages.

AI/ ML Based EFRM

- The Bank has implemented AI/ML score-based transaction risk analysis to distinguish suspicious or abnormal transactions from normal pattern-based transactions.
- This will help reduce false positives while improving control over suspicious transactions.

Dynamic Additional Authentication

- In line with RBI advisories, the Bank is exploring the implementation of dynamic additional authentication that is memory-driven and device-independent.
- This will help mitigate digital cyber fraud cases arising from the compromise of customer devices or credentials.

Conclusion

PNB's strategy reflects a collaborative, technology-driven approach to combating mobile-enabled cyber fraud. By combining infrastructure, intelligence, and partnerships, the Bank is not only protecting its customers but also reinforcing its role as a ***symbol of trust*** in India's digital banking revolution.

Session-III : Asset Management & Predictive Maintenance

DigiCOAL

Sh. Himanshu Jain
CVO, SECL

The scale and complexity of modern coal mining operations demand a paradigm shift from conventional manual oversight to technology-driven management. In response to this need, DigiCOAL has emerged as a comprehensive digital transformation initiative aimed at strengthening operational efficiency, transparency, and real-time monitoring across the flagship mega mines of Coal India Limited (CIL). At South Eastern Coalfields Limited (SECL), the implementation of DigiCOAL in the mega mines of Gevra, Kusmunda and Dipka marks a significant milestone in the modernisation of mining operations.

PROBLEM STATEMENT

These three mega mines alone span more than 10,700 hectares, with reserves of approximately 2,305 million tonnes and a combined production capacity of about 180 million tonnes per year. Operations of this magnitude involve hundreds of machines operating round-the-clock, extensive blasting activities, continuous movement of heavy earth moving machinery (HEMMs), large-scale fuel consumption, and complex logistical coordination. Managing such vast operations through traditional manual systems had increasingly become inefficient and vulnerable to operational leakages. The absence of real-time monitoring mechanisms limited effective oversight and allowed inefficiencies such as fuel pilferage, manual trip counting errors, idle machinery, and fragmented information systems to persist.

DigiCOAL

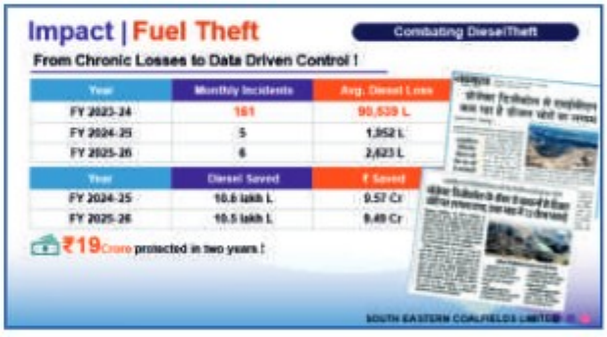
Recognising these challenges, CIL undertook a major digital transformation initiative by deploying the DigiCOAL platform with professional implementation support. The initiative was designed not merely as an IT project but as a comprehensive operational backbone for digital mining, integrating planning, monitoring, analytics, and compliance into a unified digital ecosystem. The system brings together multiple digital modules including integrated mine planning and scheduling tools, drill and blast optimisation systems, spare lifecycle management platforms, learning management systems, land acquisition management systems, analytics-powered fleet monitoring systems, connected worker technologies, drone-based surveys, video analytics, and centralised digital war rooms.

Scale of Deployment

The scale of digital deployment under DigiCOAL is unprecedented in mining operations. The system integrates sensor-based monitoring, GPS tracking, worker tagging, geofencing, and cloud-based analytics to create a real-time digital view of mine operations. Thousands of assets and operational points are digitally connected through fuel sensors, activity sensors, and location sensors installed across HEMMs and critical infrastructure. Data flows through communication networks and gateways into cloud-based processing systems where advanced analytics generate insights, automated alerts, dashboards, and audit logs for operational decision-making. This architecture ensures that physical mining activities are continuously monitored through digital intelligence, enabling supervisors and management to respond instantly to operational deviations.

IMPACT

One of the most significant impacts of DigiCOAL has been in combating diesel pilferage, which had earlier emerged as a persistent operational concern. Prior to digitization, an average of 161 incidents of diesel theft per month were recorded during FY 2023-24, resulting in an estimated loss of over 90,000 litres of diesel per month. Through the introduction of geofenced parking zones, sudden fuel-dip sensors, GPS-enabled quick response vehicles, and digital worker tagging, suspicious fuel withdrawals are now detected immediately and investigated with digital evidence trails. As a result, diesel theft incidents have reduced dramatically to single-digit levels per month, with substantial financial savings. The system has enabled the protection of approximately Rs.19 crore worth of diesel over two years, demonstrating the transformative value of data-driven oversight.



DigiCOAL has also contributed significantly to optimizing equipment utilization by reducing idle time of heavy earth moving machinery. Through real-time dashboards and shift-wise monitoring of equipment utilization, operational bottlenecks such as haul road congestion, shovel-dumper mismatches, and inefficient routing are promptly identified and corrected. Continuous monitoring and data-driven review mechanisms have resulted in measurable reductions in idling across the major mines. By converting idle machine hours into productive operational time, the system has

generated additional efficiency gains estimated at around Rs.15 crore over two years.

Way Forward

Beyond immediate operational benefits, DigiCOAL has established the foundation for future-ready intelligent mining systems. The platform's modular architecture allows scalable deployment across additional mines within Coal India Limited. It has already replaced legacy systems and has been replicated in other mining clusters, demonstrating its adaptability. Looking ahead, the digital backbone created by DigiCOAL enables the integration of advanced technologies such as AI-driven fleet dispatching, predictive maintenance of mining equipment, autonomous haulage systems, and centralized national dashboards for real-time monitoring of coal production across CIL mines.

In essence, DigiCOAL represents a strategic shift in coal mining governance—moving from manual supervision to data-driven operational intelligence. By integrating sensors, analytics, automation, and digital monitoring across the entire mining ecosystem, the initiative has strengthened transparency, minimized operational losses, and significantly enhanced productivity. It demonstrates how digital transformation can safeguard national energy resources while simultaneously improving efficiency and accountability.

Thus, DigiCOAL is not merely a technological solution; it is the emerging operating system of India's coal mining future, redefining how large-scale mining operations are monitored, managed, and optimized in the era of digital governance.

IRIS (Integrated Risk Information System)

Ms. Resmi Devasia
DGM Technology (Retail), BPCL

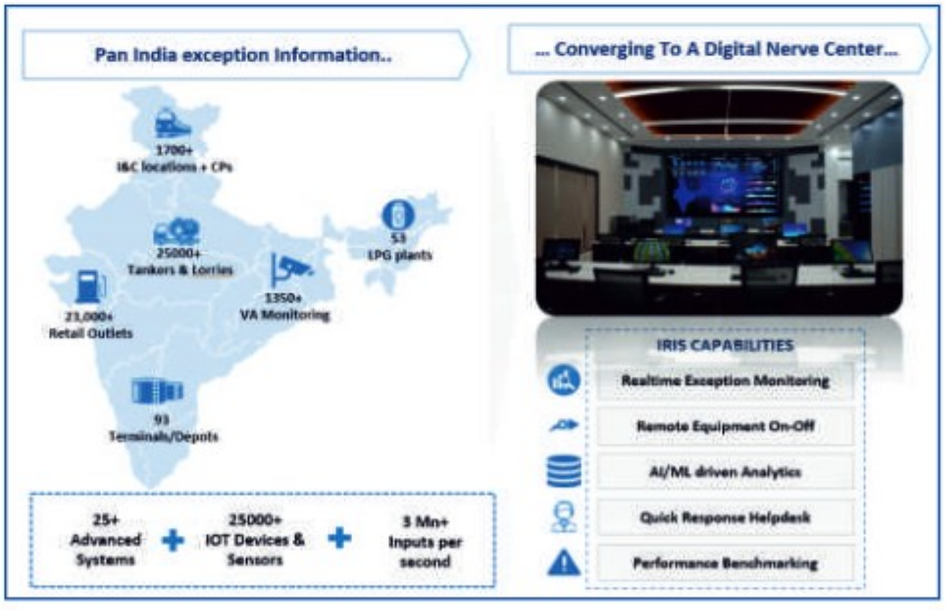
Overview

Bharat Petroleum Corporation Limited (BPCL) has embraced digital transformation to strengthen operations, enhance safety, improve efficiency, and boost customer trust. At the heart of this journey is IRIS **(Integrated Risk Information System)**, conceptualized as BPCL's 'Digital Nerve Centre'. IRIS unifies inputs from thousands of devices, systems, and operations across India to provide real-time monitoring, advanced analytics, and actionable insights.

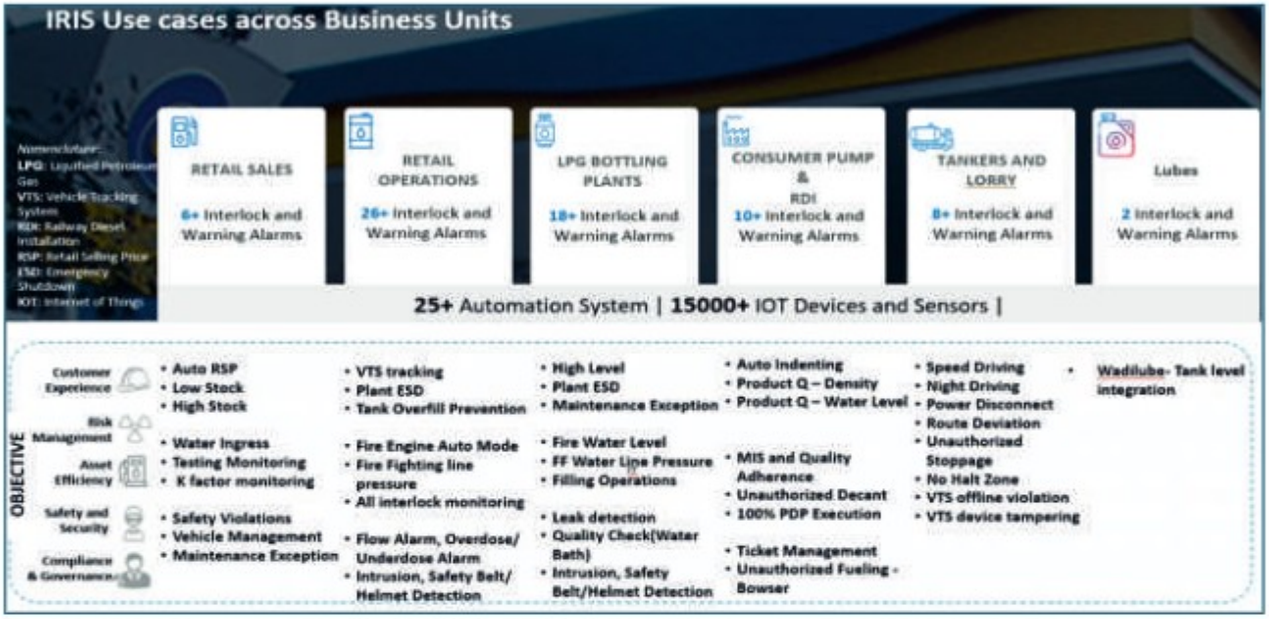
Earlier BPCL faced several systemic challenges common to large, geographically distributed organizations. Safety compliance monitoring was largely manual, which often led to delays in detecting critical issues such as fire engine non-availability or interlock failures. Similarly, tanker tracking relied on fragmented systems, making it difficult to prevent pilferage or diversion. Retail outlets lacked unified surveillance, leading to theft and tampering going unnoticed until much later. The absence of centralized intelligence meant that alerts, even if generated, were siloed and difficult to act upon promptly. These problems created inefficiencies, potential safety hazards, and gaps in customer trust.

Salient features of IRIS

IRIS connects BPCL's vast operational footprint: over 1,700 Industrial & Commercial locations, 25,000+ tankers and lorries, 23,000+ retail outlets, 53+ LPG plants, 93+ terminals, and more than 25 advanced systems. With 1,000+ IoT devices and sensors generating over 3 million inputs per second, IRIS converges these into a central intelligence platform.



The system offers real-time KPI (Key Performance Indicator) monitoring, AI/ML-driven analytics, quick-response helpdesk support, and advanced alerting mechanisms for violations or exceptions. These capabilities drive four key outcomes: enhancing safety and security, improving asset efficiency, ensuring compliance, and fostering business growth and customer trust.



Workflows

How IRIS Works in Practice

To move beyond theory, IRIS can best be understood through real-world examples of its application in BPCL's daily operations:

(i) Integration of Automation Units

IRIS seamlessly integrates with automation units across the value chain, including Forecourt Controllers at retail outlets, Terminal Automation Systems, Local Automation at LPG plants, Railway Depots, Vehicle Tracking, and CCTVs. All these systems feed into a unified IRIS interface accessible through a central video wall, web portal, and mobile application.

(ii) Preventing Unauthorized Fuelling in Tankers

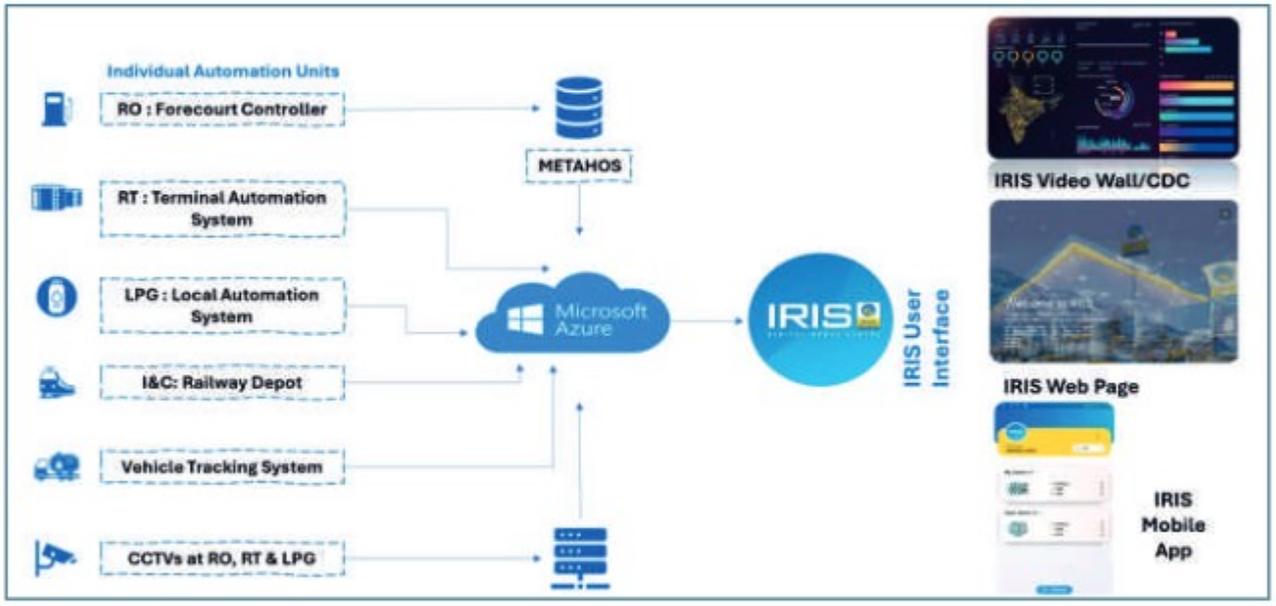
Fuel diversion during transportation is a common industry challenge. By integrating with the Vehicle Tracking System (VTS), IRIS ensures full visibility of tanker movement. Route deviations, unauthorized stoppages, or decanting attempts trigger instant alerts. Additionally, pre- and post-decantation are secured through OTP-based controls. If a tanker driver tries to offload fuel at an unapproved location, IRIS blocks the transaction, thus preventing pilferage and ensuring customers receive the right quantity and quality of product.

(iii) Intrusion Detection at Petrol Pumps

Petrol pumps are vulnerable to theft or equipment tampering. Through CCTV video analytics, IRIS identifies anomalies like not wearing a helmet, intrusion after working hours, or suspicious activities near dispensing units. If an intruder attempts to force open a dispenser at night, IRIS raises an immediate alert to the central monitoring desk and field officers. The system can even trigger an emergency shutdown remotely, safeguarding assets and reinforcing customer confidence.

(iv) Safety-Preventing Fire Hazards at LPG Plants

At LPG bottling plants, safety is paramount. IRIS continuously monitors critical interlocks such as tank overfill prevention, process shutdown systems, and fire engine auto-mode. If it detects that a fire engine is offline or water reserves fall below the safe limit, IRIS instantly generates a critical alert. In extreme cases, the system can automatically halt the invoicing process until the issue is addressed. This proactive mechanism prevents unsafe operations and protects both employees and infrastructure.



Impact and benefits

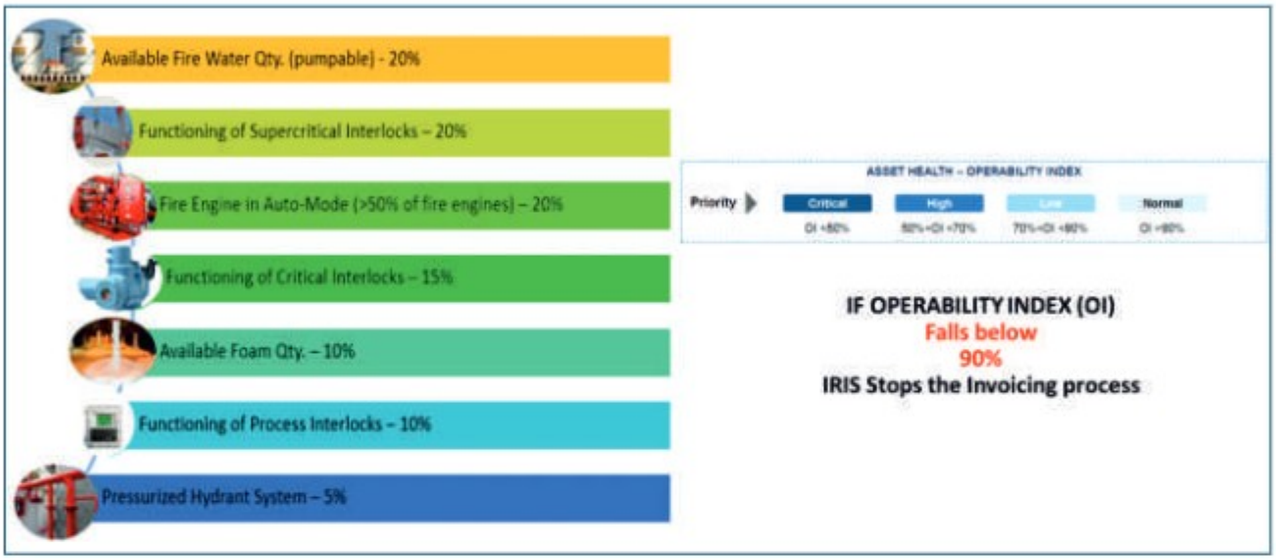
(i) Benefits to BPCL and Channel Partners

The benefits of IRIS are tangible. Revenue maximization comes from reducing lost sales via automated indenting and stock monitoring. Costs are reduced through predictive maintenance and improved asset uptime. Health, Safety, Security, and Environment (HSSE) standards are strengthened with real-time safety violation alerts and analytics. Customer trust is enhanced by accurate Retail Selling Price (RSP) checks, queue management, and assurance of quality and quantity through monitoring. For channel partners, IRIS means better dealer management, digital reinforcement of field forces, and streamlined operations.

(ii) Advanced Monitoring and Risk Management

IRIS doesn't just detect issues; it quantifies operational health. Through an Asset Health and Operability Index, it evaluates factors like available firewater quantity, functioning of interlocks, and foam reserves. If the

Operability Index falls below 90%, IRIS automatically halts invoicing to ensure operations remain within safe parameters. This scientific, data-driven approach minimizes risks and enforces compliance.



(iii) Alerts, Trends, and Insights

The system generates and categorizes thousands of alerts across operations, such as VTS violations (speeding, route deviations, tampering), retail automation failures (ATG communication, unauthorized fuelling), and safety violations captured by video analytics. IRIS provides trend analysis over weeks and months, helping managers identify recurring issues and take preventive actions rather than reactive measures.

Replicability in Other Organizations

The success of IRIS demonstrates a model that can be replicated across other large organizations, both in the oil & gas sector and beyond. Industries such as logistics, power, manufacturing, and mining face similar challenges of distributed operations, safety compliance, and asset monitoring. By customizing the framework of IRIS, these organizations can establish their own centralized command centres to enhance governance, reduce operational losses, and strengthen stakeholder confidence.

Role in Reducing Corruption

One of the less visible but highly impactful contributions of IRIS is its ability to reduce opportunities for corruption. With every transaction-from tanker movement to retail dispensing-digitally logged, tracked, and verified, the system eliminates human discretion in critical areas where leakages often occur. OTP-based tanker decantation, automated RSP checks, and real-time video audits make it nearly impossible to manipulate records or bypass processes. By ensuring transparency, traceability, and accountability, IRIS acts as a strong deterrent to malpractice, thereby protecting company revenues and building public trust.

Remote Monitoring and Diagnostic Center for Gas Turbines

Sh. P. Sampath Kumar
GM, BHEL-GE Gas Turbine Services Ltd.

Introduction

Remote Monitoring and Diagnostics (RM&D) is an advanced approach used for asset management of gas turbines. This system is implemented by BHEL–GE Gas Turbine Services Pvt. Ltd. (BGGTS). Gas turbines play a critical role in captive power plants by providing reliable electricity and supporting steam generation. RM&D helps in ensuring efficient operation, minimizing downtime, and improving overall performance.

Industry Challenges

The gas turbine industry faces several operational and maintenance challenges. These include ineffective equipment strategies, inefficient correction strategies and lack of control & standardization. These issues lead to forced outages, increased downtime, high operational costs, and reduced reliability of assets.

Limitations of Traditional Monitoring

Traditional monitoring systems rely on fixed alarm set points and only respond after a fault has occurred. This reactive approach leads to delayed maintenance actions, higher repair costs, and increased downtime of equipments.

RM&D Solution

RM&D provides a proactive and data-driven solution. It includes 24/7 monitoring, real-time data collection, and centralized analytics. The system uses sensors, control systems like Mark VIe, and secure communication networks to transmit data to a central monitoring station for analysis and visualization.

Coverage Areas

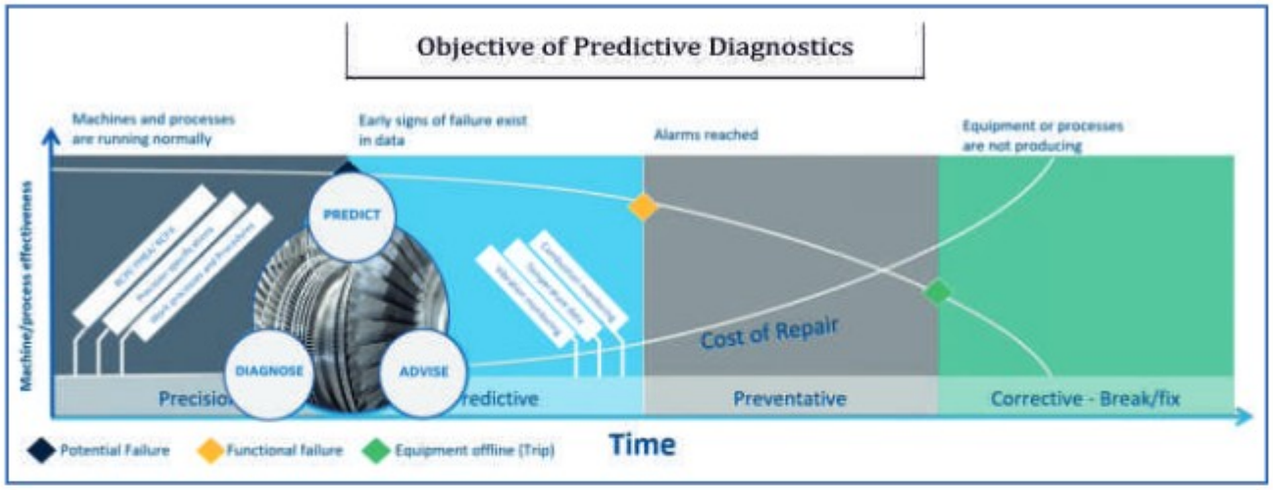
RM&D monitors various components and systems of gas turbines including rotor dynamics, compressor systems, combustion dynamics, and control systems. This ensures comprehensive monitoring of turbine health.

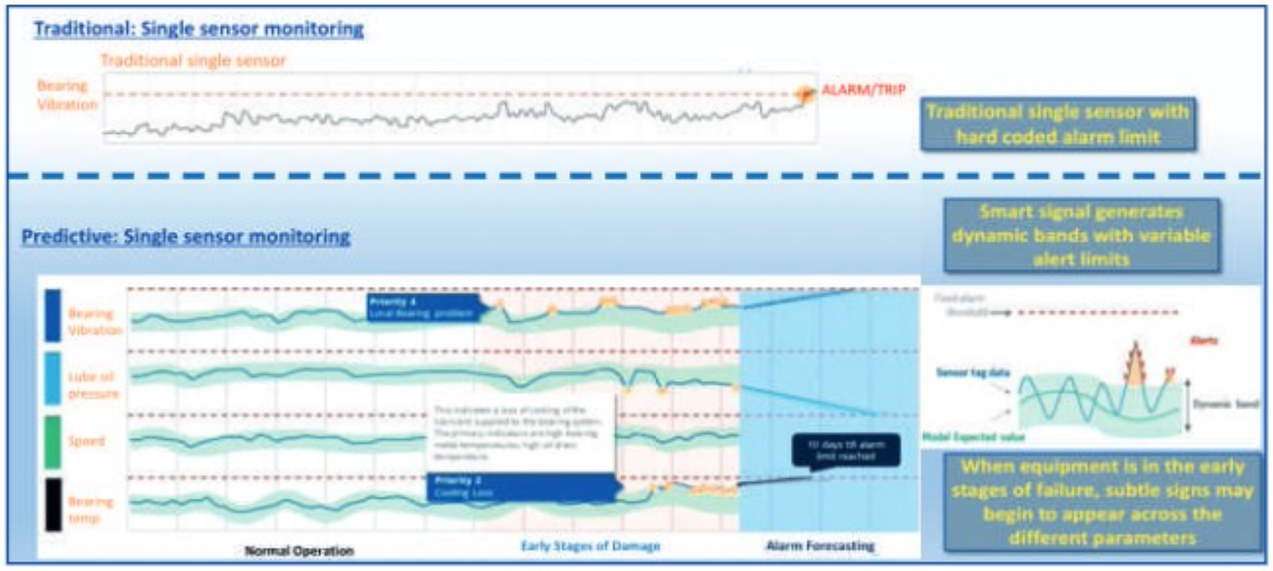
Role of AI/ML (SmartSignal)

AI/ML technologies enable predictive analytics, which helps in early detection of abnormalities. Diagnostic analytics identifies probable causes, while forecasting estimates when an alarm limit will be reached, which in turn allows optimal maintenance prioritization. Digital twin models simulate expected behavior for each asset and compare it with real-time data.

Predictive vs Traditional Monitoring

Predictive monitoring is proactive and identifies/alerts failures before they occur, whereas traditional monitoring is reactive. Predictive systems reduce downtime, improve efficiency, and lower maintenance costs.





Business Benefits

Implementation of RM&D for IOCL resulted in a reliability increase from 97.1% to 99.7 %, reduction in trips by 6%, reduction in forced reduced outages by 5% and reduction in MTTR (Mean Time To Repair) by 9%.

Asset Management – Forward Path

The path forward lies in development of asset intelligence, which will provide actionable intelligence at the point of impact. This will lead to increased asset availability, reduced O & M cost, improved return on capital and reduced capex.


ASSET INTELLIGENCE
INCREASE ASSET AVAILABILITY
REDUCE O&M COST
IMPROVE RETURN ON CAPITAL EMPLOYED
REDUCE CAPEX
BY PROVIDING ACTIONALBE INSIGHTS AT THE POINT OF IMPACT
Rounds/ Rounds pro
Field data
Times series
Alerts and cases
Work history
PERFORMANCE
EMISSIONS
SAFETY AND INTEGRITY
RELIABILITY
Defect elimination
Operational risk
Asset health
Asset Intelligence
Asset Health Index (AHI) & Confidence Index (CI)
Estimated Remaining Life (ERL)
Probability of Failure (POF)
Recommendations
Asset maintenance index
Analytics
AI apps
ML Ops
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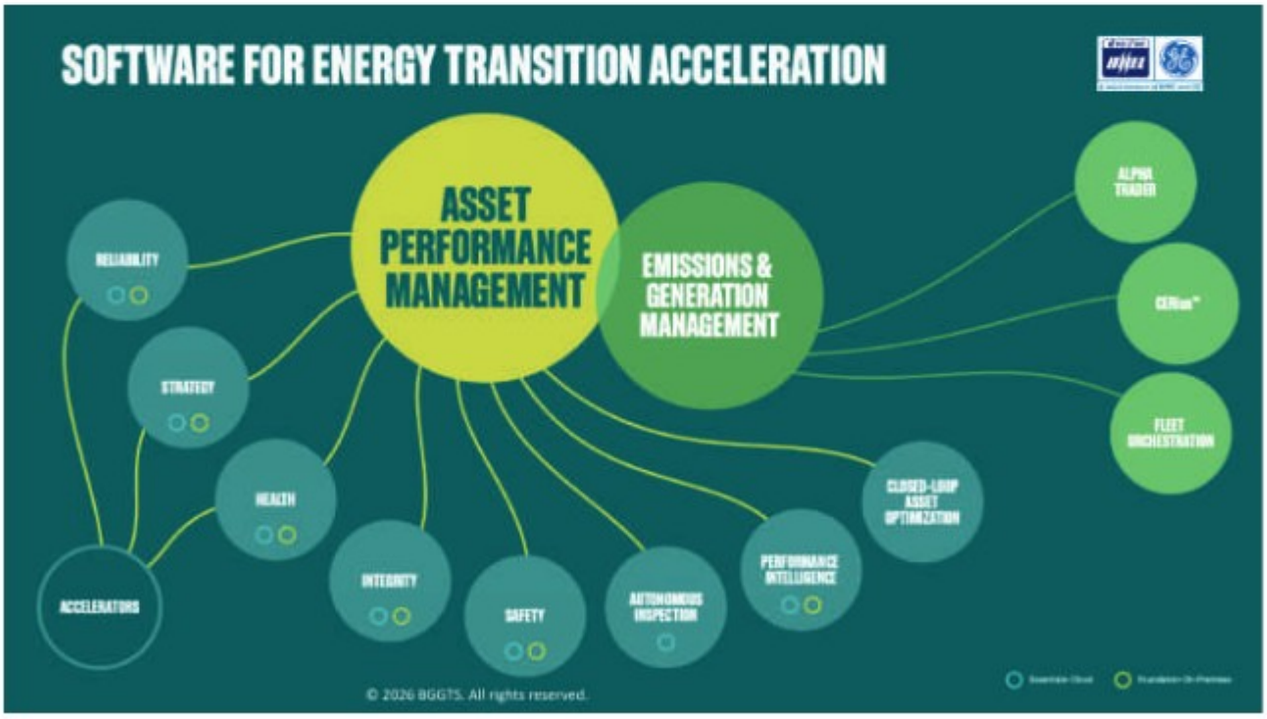
SOFTWARE FOR ENERGY TRANSITION ACCELERATION
ASSET PERFORMANCE MANAGEMENT
EMISSIONS & GENERATION MANAGEMENT
RELIABILITY
STRATEGY
HEALTH
INTEGRITY
SAFETY
AUTONOMOUS INSPECTOR
PERFORMANCE INTELLIGENCE
CLOSED-LOOP ASSET OPTIMIZATION
ACCELERATORS
ALPHA TRADER
FLEET ORCHESTRATION
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Asset Management-Application (AI-based image processing platform)

Sh. Mahendra Kumar Kaloria
Sr. DGM, PGCIL

Introduction & Objective

POWERGRID operates one of the world's largest and most complex transmission networks, comprising nearly three lakh towers spread across deserts, forests, hilly terrains, riversides and coastal regions. The health of each tower is as vital to the national power system as the human backbone is to the human body. Every tower carries conductors transporting hundreds of megawatts, forming the structural foundation of the National Grid. Even a single loose bolt, bent tower member, damaged insulator or missing bird guard has the potential to escalate into serious operational hazards such as line tripping, tower collapse, extensive grid disturbances or even risks to public safety. Traditionally, transmission line patrolling/ inspection involved capturing thousands of photographs which were manually reviewed by field teams. This method consumed significant time and was prone to human subjectivity, regional inconsistencies and potential oversight of critical anomalies. Maintaining uniform inspection quality across diverse terrains through purely manual methods was extremely challenging.

To address these technological and operational gaps, POWERGRID developed PG-AMRIT an Artificial Intelligence (AI)/ Machine Learning (ML) based platform *(Integrated in PG-DARPAN patrolling platform)* aimed at replacing subjective, manual image review with automated, accurate and consistent defect identification, thereby significantly reducing inspection time, minimizing errors and improving National Grid reliability.

Figure 1: Login Page of PG-AMRIT

Brief Description of the Initiative

PGAMRIT (POWERGRID Asset Management through Artificial Intelligence in Transmission) was launched in 2024 as an indigenous AI/ML-based platform capable of automatically analysing patrolling photographs from both drone and ground-based inspections. PGAMRIT is equipped with a powerful set of features that significantly enhance the quality and speed of transmission line inspection. The system can automatically detect more than 30 types of defects from both drone based and ground based patrolling

images, including missing tower bolt, missing bird guard, damaged or broken insulators, reversed grading rings, bird nests, bent tower members, hanging components and missing joint plates, thereby ensuring comprehensive coverage of all critical structural and electrical anomalies. Its highspeed AI engine is capable of processing nearly 400 photographs per minute with up to 90% accuracy, drastically reducing analysis time when compared to manual review. PGAMRIT leverages GPS based identification, enabling it to automatically determine the exact tower number and transmission line name from geotagged photographs and generate complete, standardised defect reports including SAP notifications without requiring any manual sorting or tagging. Together, these features make PGAMRIT a highly reliable, efficient and evidence driven asset management tool for strengthening the transmission network.

Instead of engineers spending hours in front of screens, the model identifies abnormalities and marks them with bounding boxes and machine-readable labels. These outputs are not just labels, they form structured digital evidence that seamlessly integrate into POWERGRID's maintenance workflows. Each system-generated defect record triggers a notification or work order, thereby ensuring a direct link between defect detection, maintenance action and eventual closure. This shift has transformed the organisation's maintenance philosophy from experience-based to evidence-based asset management.

Development & Implementation

The development of PG AMRIT involves separate AI models for drone images and ground-level photographs, as defect signatures differ significantly based on camera angle and distance. The data pipeline incorporates robust data curation practices, version control mechanisms and continuous improvement loops, ensuring that model accuracy improves with every new batch of labelled data. Broadly there are 4 development phases of PG-AMRIT as shown in Figure-2 with following features:

(i) Annotation Pipeline

- Annotation through CVAT (Computer Vision Annotation Tool)
- Dataset developed and expanded using feedback from TL experts
- Periodic retraining cycle to enhance defect detection accuracy

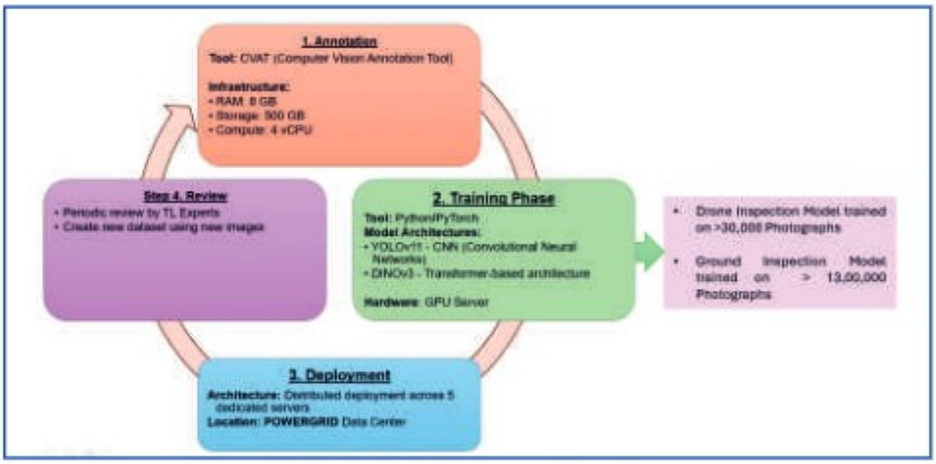


Figure 2: Development phases of PG-AMRIT

(ii) Training of AI/ML Engine

- Built using PyTorch with YOLOv11 (CNN-based) and DINOv3 (Transformer-based) hybrid models.
- Drone Model trained on 30,000+ images
- Ground Patrolling Model trained on 13,00,000+ images
- Uses convolutional neural networks and transformer models for high accuracy.
- Training performed on GPU servers

(iii) Deployment Architecture

- Distributed architecture deployed across POWERGRID Data Centre

- Low latency integration with patrolling web portal and mobile app
- Integrated with SQL database for storing:
  - ➤ Tower characteristics
  - ➤ Defect metadata
  - ➤ User login and approval data
  - ➤ ERP-linked defect history

(iv) ERP Integration & Review

- Auto-creation of maintenance notifications for approved defects
- Updation of defect closure status
- End-to-end traceability of defect, rectification activity and inventory use
- Review of output and create new data set

The IT backbone of PG AMRIT comprises five dedicated servers integrated with the patrolling portal, patrolling mobile app, SQL-based defect repository and ERP backend. This architecture enables frictionless movement of information from image upload to AI detection, to approval workflows, to the issuance of work orders and the final closure updates in the ERP system. The system supports automated email reminders, escalation workflows and analytic dashboards for defect monitoring. Workflow of PG-AMRIT is indicated in Figure-3.

Impact And Benefits

The impact of PG AMRIT on POWERGRID's operational efficiency has been substantial. Automated image analysis has drastically reduced the time required for defect detection and significantly improved decision-making speed. Cycle times from detection to work order creation and closure are now tracked digitally and trendlines show a sustained reduction in defect backlog along with better planning of outages. The platform has also enhanced transparency by reducing human bias and ensuring uniform interpretation of defects. The digital traceability created by PG AMRIT links every defect to its associated maintenance action and even correlates tower health with material consumption patterns, thereby improving inventory planning and supporting preventive vigilance.

Replicability / Way Forward

PG AMRIT's design is scalable and replicable across other transmission utilities, state transmission corporations, distribution networks and other sectors reliant on large-scale visual inspections. Going forward, POWERGRID is working to further improve model accuracy, expand the AI defect library, integrate edge computing for near real-time processing in remote locations and develop predictive analytics for tower health forecasting. Additional enhancements include linking construction-stage quality checks and real-time mapping of maintenance actions with inventory consumption. By introducing objectivity and traceability into inspection and maintenance, PG AMRIT continues to reinforce POWERGRID's commitment to ensuring a reliable, safe and resilient National Grid.

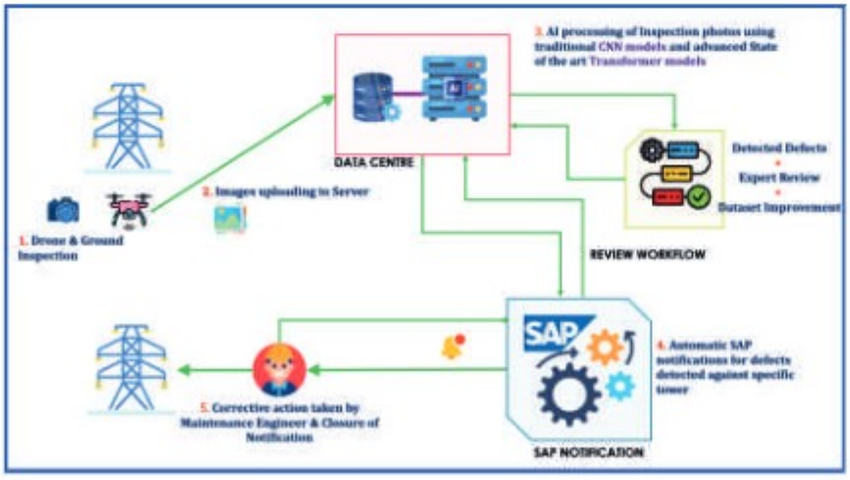


Figure 3: Application workflow for PG-AMRIT

Pre-Failure Alert Generation for Equipment & Cobble Reduction based on Data Analytics and Video Analytics at BRM at BSP

Dr. Vishwesh Jatala
Assistant Professor
Computer Science & Engineering, IIT Bhilai

Introduction

Artificial Intelligence has emerged as a critical enabler in predicting failures in industrial manufacturing environments, particularly in safety-sensitive domains such as the steel industry. The Bar and Rod Mill (BRM) at the Bhilai Steel Plant (BSP), which we studied in our project, is equipped with heavy machinery. The rolling process at BRM is continuous, with the same metal simultaneously processed at different stands, fast-finishing blocks, and other equipment. Any cobble/failure at any of the equipment can be a result of any abnormality in upstream or downstream equipment, along with the equipment where it occurs. The failure could be the effect of any abnormal behavior in the previously rolled metal. Thus, it is important to incorporate AI-driven solutions in BRM so that operators can interpret key insights in real time and, as a result, prevent critical failures. These insights are difficult to be drawn by the operators themselves, in real time, in view of the vastness of process data, the speed of the process, the complexity in correlation of process data & its derivatives with quality & productivity, etc. The said insights help boost productivity, increase integration, save energy and costs, and enhance the safety of people and assets.

To address these challenges, we present an AI-driven solution and share our experience deploying and operating a failure prediction system at one of the largest steel plants in the world (a detailed version of the article has been published in [1]). The system has been analyzed on a large-scale, high-dimensional industrial dataset with 2 million+ data points collected over many months.

System Overview

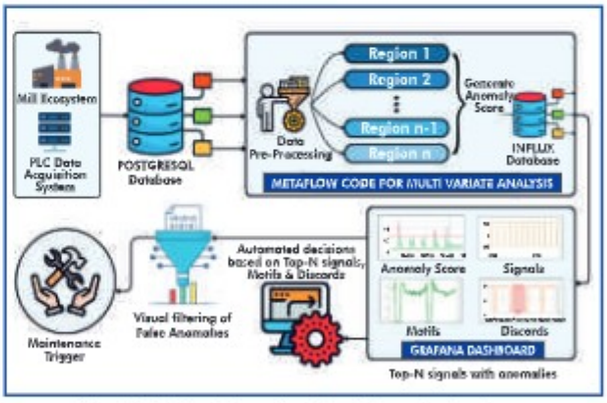


Fig. 1. High-Level Overview of Pre-failure Alerting System

Fig. 1 presents the high-level overview of the proposed AI-driven solution for failure prediction and alert generation. The method involves collecting real-time multivariate time series data from the PLC (Programmable Logic Controllers) data acquisition server in the Bar and Rod Mill (BRM) and processing it through the metaflow pipeline [4] to generate anomaly scores and visualize it on Grafana [3].

Data Acquisition:

The initial step in the system pipeline involves capturing process signals recorded from a Data Acquisition System, which provides comprehensive access to various PLCs and sensors for measuring, displaying, and recording these signals at chosen granularities. The system collects 2623 signals at 1-second granularity and stores them in a PostgreSQL database.

Data Preprocessing, Regionalization, and Cleaning:

Data preprocessing is handled by Metaflow [4], which includes handling null values, filtering columns based on predefined regional criteria, and scaling signals to standardize the data, making it suitable for anomaly prediction.

The signals are categorized into 14 regions based on their location and relevance within the BRM. Out of the total signals, 430 signals are selected for detailed analysis, comprising 115 digital signals and 315 analog signals. Dividing the entire dataset into regions (signals may overlap between regions) speeds up the end-to-end process as it allows parallel processing of multiple regions using Metaflow, thus reducing overall processing time and enhancing efficiency. This also restricts the number of signals in each region, thereby reducing false positive cases and making root cause analysis with motifs and discords more efficient.

Anomaly Prediction:

For predicted anomalies in the signals, we employ Autoencoder-based anomaly detection. First, the data is transformed into a lower-dimensional latent representation using an encoder. Subsequently, the latent representation is transformed back to its original dimensionality using a decoder. The difference between the original and decoded data is computed, representing the loss. The encoder and decoder are trained on normal data, which is free of failures. The anomaly score for each region is calculated based on this loss, with each region being processed in parallel, leveraging the Metaflow framework. Post anomaly detection, the raw data alongside the calculated anomaly scores and loss of each signal are stored in InfluxDB [2].

Alerting Dashboard:

The processed data is visualized using Grafana for real-time monitoring and quick identification of anomalies and their potential causes.

Fig 2. Displays the alerting dashboard indicating that the region encountered the failure. The dashboard also displays (Fig. 3) the root cause of the signals that have shown abnormal behavior, along with their patterns as shown in Fig. 4a and Fig. 4b.

Fig. 2. Alerting Dashboard

Fig. 3. Alert Window

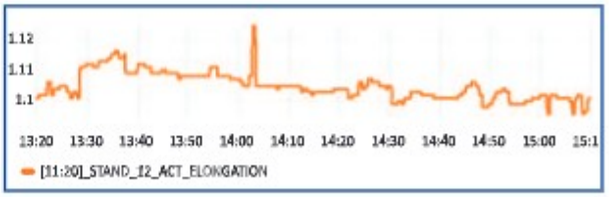


Fig. 4a. Root cause signal (Stand-12 Elongation)

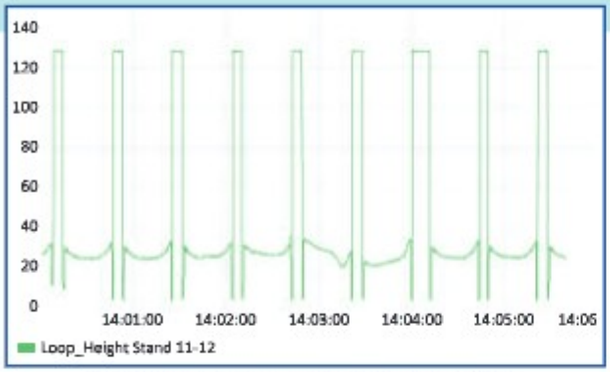


Fig. 4b. Root cause signals (Looper Height, Stand 11-12)

Video Analytics:

Along with analyzing PLC signals, we perform video analytics by deploying cameras at key vulnerable locations across the mill. Fig. 5 displays real-time analysis of the rod movement passing through the dog-house area in the mill. The system tracks rod alignment and vibration behavior, predicts abnormal behavior during the rolling process, and issues alerts to the operator.

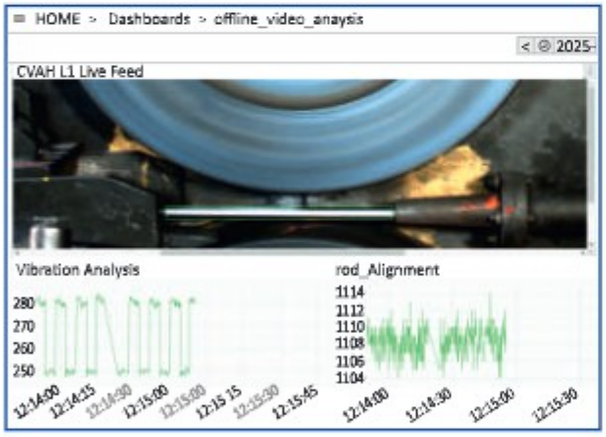


Fig. 5. Video analytics

Real-Time Impact:

The proposed system was deployed at the BRM. Notably, the system prevented 36 failures over the six-month period from July 2025 to December 2025 (Fig. 6), resulting in an approximate 13.4-hour reduction in downtime.

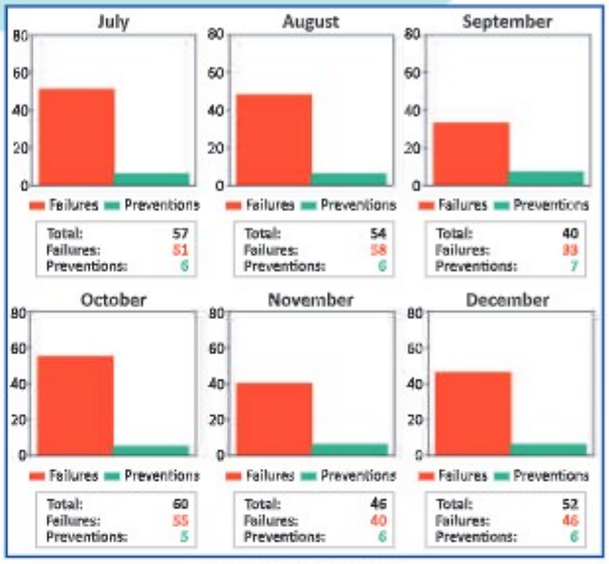


Fig. 6. Real-time impact

Conclusion and Way Forward

In summary, data analytics has proven to be a powerful tool for predicting failures in real-time Bar and Rod Mill operations. Looking ahead, the developed system can be adapted and deployed across other industrial domains to enhance throughput and operational efficiency. In addition, the system can be further refined to enhance prediction precision and usability for mill operators.

Project Team

The project has been developed by the team led by Dr. Gagan Raj Gupta at the Indian Institute of Technology Bhilai in collaboration with the BRM team at Bhilai Steel Plant, led by Mr. Yogesh Shastri, CGM BRM, Mr. Ashish, GM(E), BRM, and Mr. Ravishankar, CGM, Automation & Digitalization.

References:

[1] N. Agarwal, G. R. Gupta, V. Jatala, and A. Saha, "Multivariate Time Series Data Mining for Failure Prediction & Root Cause Analysis," ICASSP 2025 - 2025 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Hyderabad, India, 2025

[2] Influxdb: https://www.influxdata.com/

[3] Grafana: https://grafana.com/

[4] Metaflow: https://metaflow.org/

Session-IV : Effective Public Service Delivery through Digital Initiatives

Single Window Clearance System (SWCS) – DDA Building Plan Approval

Ms. Manju Paul
Commissioner (Planning), DDA

Building Byelaws: Foundation of Planned Urban Development

Building Bye-Laws provide the regulatory framework for planning, design, and construction of buildings to ensure orderly urban development, public safety, and environmental sustainability. They lay down standards related to land use, floor area ratio (FAR), ground coverage, setbacks, height, fire safety, structural stability, parking, and access, thereby ensuring uniformity in development, urban infrastructure (such as roads, drainage etc.), light and ventilation.

Building Plan Approval System in Delhi

In Delhi, building plan approvals are primarily administered by the Delhi Development Authority (DDA), the Municipal Corporation of Delhi (MCD), and the New Delhi Municipal Council (NDMC), each within their respective jurisdictions. The approval process is governed by the Building Bye-Laws, which were modernized with the introduction of the Unified Building Bye-Laws (UBBL), 2016, replacing the earlier Building Bye-Laws of 1983. The revised framework aimed to simplify procedures, standardize regulations, and promote more efficient development practices.

Shift Digital Transformation through Online Building Plan Approval System (OBPS)

In line with the Government of India's emphasis on Ease of Doing Business (EoDB) and digital governance, the Online Building Plan Approval System (OBPAS) was introduced by DDA in 2017. This initiative marked a significant shift from manual submissions to a fully digital process, enabling architects/ applicants to submit building plans online with a mandated approval timeline of 30 days. Since its implementation in DDA, nearly 3,000 building plan sanctions have been processed through the system, covering a wide range of developments including residential, commercial, institutional, educational, and industrial buildings.

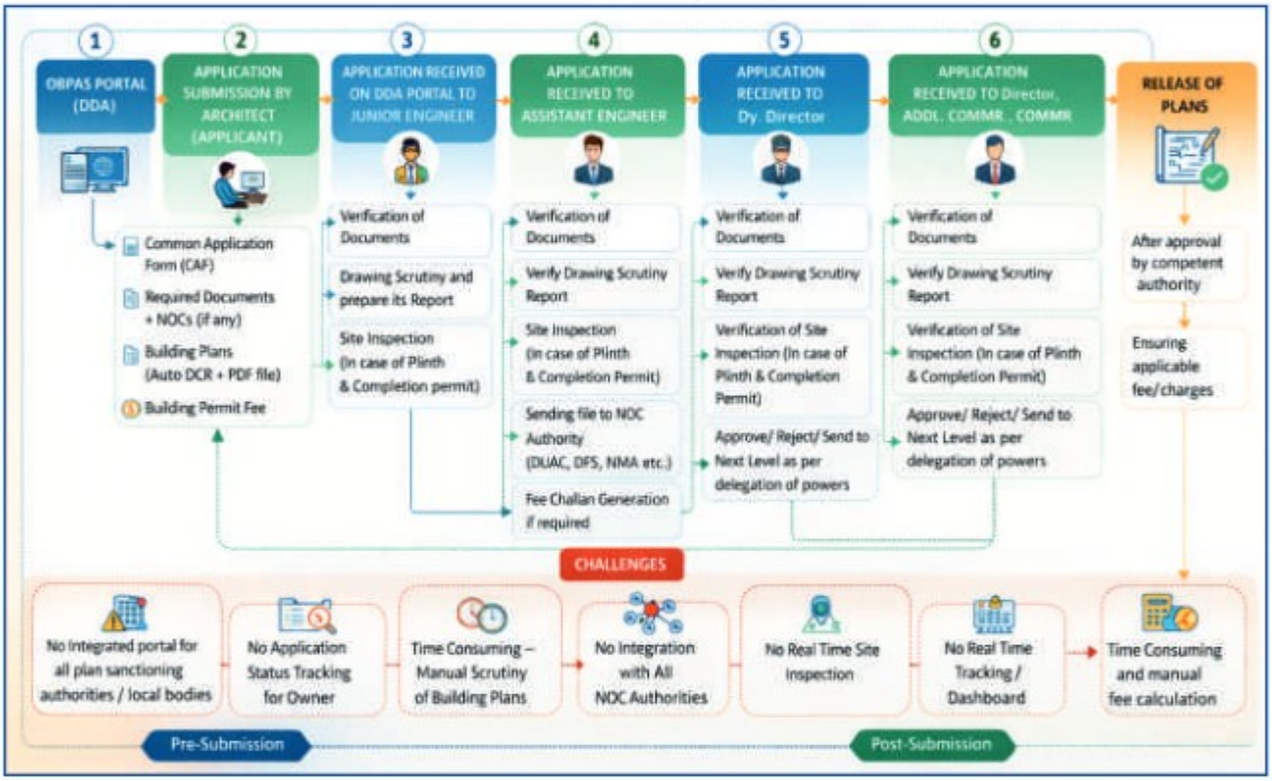
Workflow of Existing Online Building Plan Approval System (OBPAS)

The approval workflow begins with the submission of the Common Application Form, building drawings, required documents, NOCs, and permit fees through the online citizen interface. Applications are then processed through the Auto-DCR system, which performs automated scrutiny of building drawings. Subsequently, documents and drawings

are verified by field officials such as the Junior Engineer and Assistant Engineer, and site inspections are conducted for stages like plinth and completion. In many cases, proposals are also referred to external authorities for No Objection Certificates (NOCs), such as the Delhi Urban Art Commission (DUAC), Delhi Fire Service (DFS), and the National Monuments Authority (NMA). After technical scrutiny and verification, the proposal is forwarded to higher authorities including the Deputy Director, Director, or Commissioner for final approval or rejection.

Challenges in the Current Approval System

Despite the automation, operational challenges continued to affect the efficiency of the current system which are manual scrutiny, lack of full integration with all NOC-granting agencies, manual fee calculations, limited real-time tracking of site inspections, and absence of comprehensive monitoring dashboards and digital audit trails. These gaps lead to delays and reduced the overall efficiency and transparency of the approval process.



Upgraded Single Window Online Building Plan Approval System (OBPAS)

To address these challenges, an upgraded Single Window Online Building Plan Approval System (OBPAS) has been developed in DDA. This enhanced system aims to create a fully integrated digital platform through which applicants and architects can submit, track, and obtain building plan approvals and related NOCs from multiple departments through a single interface. The objective is to strengthen system robustness, improve user experience, and align the approval process with the provisions of UBBL-2016 and Ease of Doing Business guidelines.

Workflow of Upgraded Single Window (OBPAS)

The upgraded OBPAS will function through the E-SUGAM portal, which will serve as a unified digital platform connecting all the plan-sanctioning authorities in Delhi and various regulatory agencies. The process will begin with the owner registration and entry of property details, followed by submission of the Common Application Form, project details, building documents, and standardized drawings prepared by the architect. A rule-based Auto-DCR engine, fully powered by AI, will automatically scrutinize the drawings against the applicable building regulations. Any deficiencies or queries generated by the system will be communicated to the applicant through the portal dashboard, enabling quick online compliance.

On successful completion of the automated scrutiny, the system will forward the proposal electronically to relevant NOC agencies through integrated links. The platform will also facilitate online compliance of objections, automatic fee calculation, digital payment, and generation of digitally signed building plans. In the post-submission stage, a workflow engine will route the proposal to field officials such as the Junior Engineer for verification and site inspection using a mobile application. Any additional queries will be communicated digitally through the portal. Once all the requirements are satisfied, the building permit certificate will be digitally signed and issued to the applicant through the system.

Way Forward: Strengthening Transparency and Accountability

Looking ahead, further strengthening of the OBPAS requires continued emphasis on transparency and accountability. Proactive disclosure of rules, procedures, fee structures, and user tutorials can help reduce information gaps for applicants. Clear display of workflow stages and responsible authorities will enhance process transparency, while recording reasons for approval or rejection supported by auto-generated scrutiny reports will promote decision transparency. Financial transparency can be ensured through online fee calculators, digital receipts, and public disclosure of applicable charges.

Additionally, the introduction of time-bound service delivery with auto-escalation mechanisms, public dashboards, digital audit trails, version histories, and secure record management will significantly improve accountability. Clearly defined roles, jurisdictional boundaries, and escalation mechanisms will further strengthen citizen confidence in the approval process.

Conclusion: Towards Efficient and Transparent Urban Governance

The transition towards a Single Window Online Building Plan Approval System represents an important step in modernizing urban governance. By leveraging digital technologies and integrated workflows, the system has the potential to make building approvals faster, more transparent, and more efficient, ultimately supporting sustainable and well-planned urban development in Delhi.

e-Pantry Service by IRCTC

Sh. Pradeep Kumar
CVO, IRCTC

Introduction

Indian Railway Catering and Tourism Corporation (IRCTC) as an extended arm of Indian Railways is mainly involved in providing various hospitality related services like catering services on Indian Railways (on-board & off-board), online ticketing for trains, Air ticketing (online/ offline), tour packages (domestic/ international, Packaged drinking water etc.

Core areas of IRCTC services are:

- **Catering Services on Railways**- IRCTC is one of the largest hospitality and catering companies of the country with services spread over passenger trains/railway stations.
- **Online ticketing for Trains**- Offers ticket booking services through website and mobile application. Accounts for over 87% of total reserved ticket booking in trains.
- **Online/offline ticketing for Airlines**- Offers domestic and international air ticket booking.
- **Tour Packages**- Offers domestic and international tour packages, educational tours, charter train packages and cruise packages. Operates special tourist trains like Buddhist Circuit, Bharat Darshan and theme based tourist trains as well as Luxury trains like Maharaja Express and Golden Chariot.
- **Packaged Drinking Water (Rail Neer)**- To enhance passenger amenities, the IRCTC launched Rail Neer, a branded packaged drinking water for the rail commuters. 20 operational plants across India with installed capacity of producing around 1.84 million bottles per day.

For Catering services, IRCTC relies on a contractor (Vendor) based model in which IRCTC grants licenses to the vendors for providing catering services. Catering services over Indian Railways includes:

- **Major Stations (static units):** Catering services at major Railway Stations and its premises through catering units like Jan-Ahars, refreshment rooms, cell kitchens, food-plazas and food courts etc.
- **Trains (Mobile Units):** Providing Catering services in trains (on- board), which is a bit cumbersome process in which the food prepared and packed in designated base kitchens after which it is cooled so that it is not get staled during transportation, its then delivered to railway stations using Refrigerated vans and loaded in the train. Food is again reheated and served to passengers.

  Modes of mobile catering are:

  - **Prepaid mode:** Available in premium trains like Rajdhani, Shatabdi, Duronto, Vande-Bharat, Gatimaan, etc. in which catering charges are included in the train fare and passengers need not to pay at the time of service.

* **Post-Paid mode:** Catering services in other Mail/ Express trains (with or without Pantry Car) is provided through this mode in which the passengers needs to purchase the food by paying the charges on spot. In trains with Pantry car, passenger can buy food from the Pantry Car staff and in trains without pantry car (Train Side Vending), food can be purchased from authorised vendors who will source the food from designated stations.

- E- catering: Passengers can book food of their choice from partner restaurants and food outlets (like Haldiram, Dominos, Zomato etc.) while travelling on train. Food is being delivered to the passengers on their respective seat/berth.

At a Glance

- *IRCTC provides catering services in around 1250+ **trains serving 16 lacs + meals** every day.*
- *Prepaid trains accounts for approx. 16% of total meals served.*
- *Post- paid trains (with or without pantry car) accounts for 78% of total meals.*
- *E- catering accounts for approx. 6% of total meals served*

Issues in Post-Paid Catering Services:

While premium trains such as Rajdhani, Shatabdi and Duronto have long had organized catering systems with digital traces to address public complaints, service deficiencies and other malpractices, a large proportion of passengers travel on **Mail and Express trains.** Historically, catering on these trains (Post-paid Catering Services) has faced persistent challenges due to involvement of cash as well as non-availability of digital tracking.

Challenges

- ***Sale of food by unauthorized hawkers:** Due to direct selling (involving cash), sale of food by unauthorised hawkers is also noticed, resulting in poor hygiene standards and passenger complaints related to quality/ overcharging.*
- ***Overcharging:** Lack of awareness/ displayed pricing allowed vendors to charge arbitrarily. Penal actions are taken by IRCTC on receipt of complaints.*
- ***Non-issuance of bills:** While unauthorised hawkers do not provide bills to passengers, authorised vendors are also reluctant to issuue bills to avoid accountability.*
- ***Lack of digital monitoring:** No centralized tracking system existed for catering compliance and sales assessment.*
- ***Passenger dissatisfaction:** Unsafe, overpriced and unverified meals reduced the trust in on-board catering services.*
- ***Negative Impact:** Hamper passenger experience and Railways/IRCTC's image.*

Addressing the Issue-Preventive Vigilance Measures:

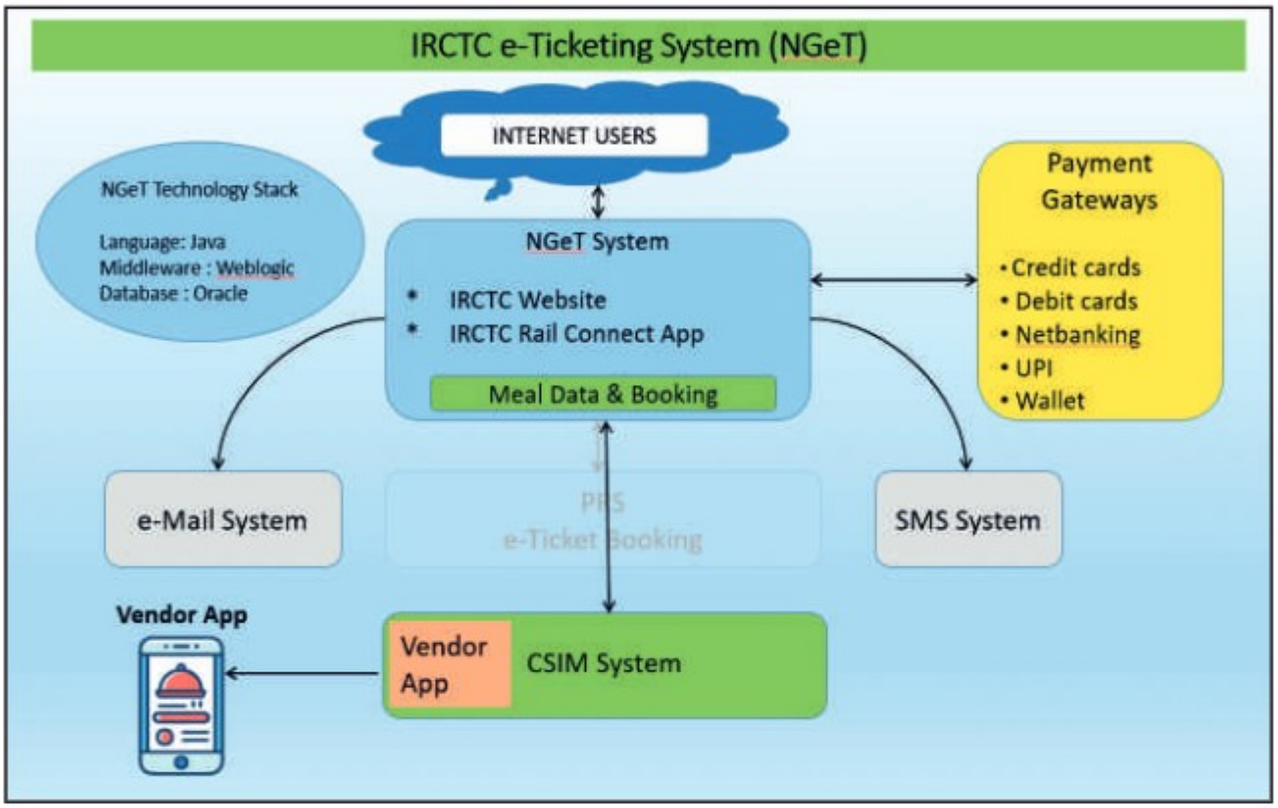
To tackle the above problems, IRCTC launched the E-Pantry Service – a technology-driven initiative designed indigenously through which passengers of Mail and Express trains (with pantry cars) can:

- ➪ Pre-book their meals.
- ➪ Meals can be booked at the time of ticket booking or later through the IRCTC account.
- ➪ Ensures safe, fairly priced and digitally verified quality meals.

System Architect (Workflow/ Process of IT System):

E-pantry module has been developed in-house by integrating the existing NGeT (Next Generation e- ticketing) system of ticketing with the CSIM (Catering Service Information Management) system. While NGeT system is used for e-ticketing having functional payment Gateway system and features to provide booking information to passengers through SMS and e-mail, CSIM on other hand is an application developed by IRCTC for monitoring, inspecting, and managing catering services on trains and at stations.

For implementation of e-pantry service, the meal data (train-wise availability of meal services) has been loaded in the NGeT server. Further, a Vendor App has also been developed and installed in the mobile handsets available with vendors for informing the meal booking details to them and marking of delivery status. Following diagram depicts the connectivity of various elements.



When a passenger books the meal, the meal booking information is pushed by NGeT server into CSIM server which is then passed to the vendors through vendor app. Meal- wise MVCs (Meal Verification Codes) is/are shared with passenger through email and also on the date of journey through SMS.

Message after meal booking

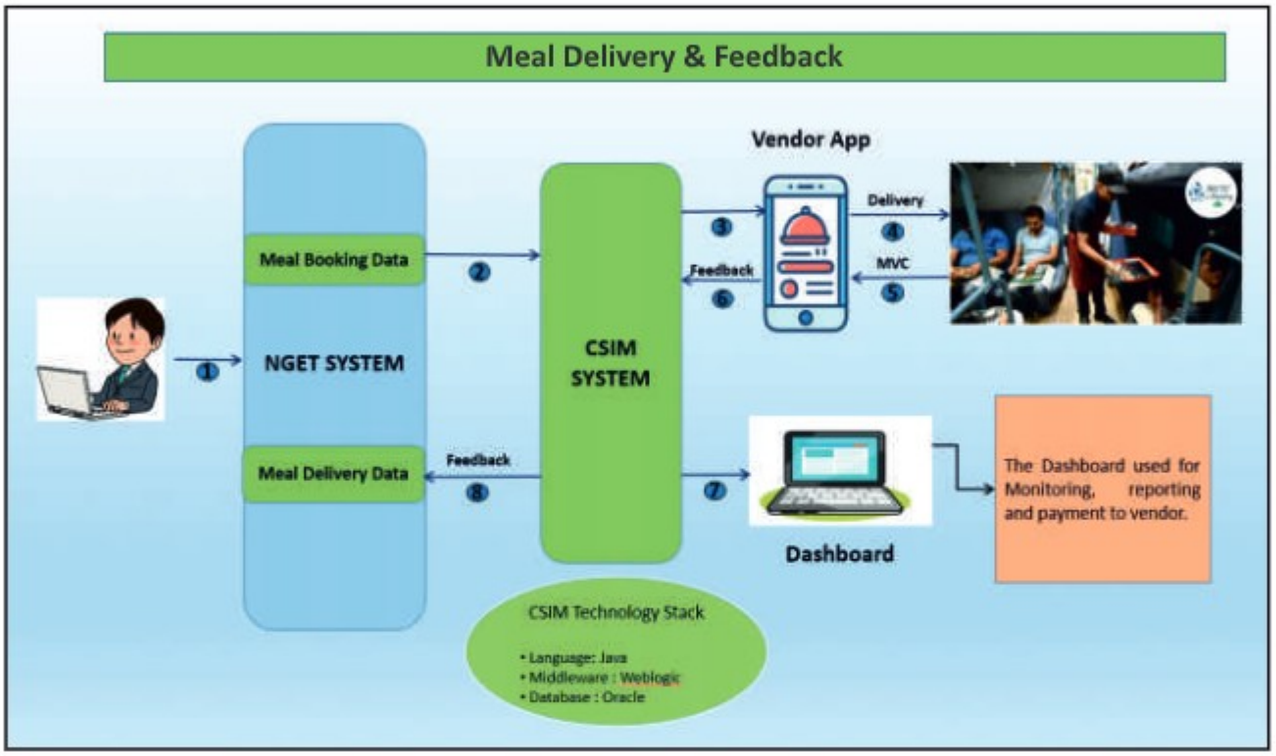
PNR:4735935499,TRN:12554,DOJ:04-04-25,Fare:280. Your meal has been booked successfully. Meal delivery code will be sent on DOJ. -IRCTC

Message on the date of journey containing MVC

Dear Passenger,
Meals booked against PNR 29****50:
Day 1–Morning Tea-2(XXXX),Dinner-1(XXXX),Rail Neer-2
Day 2–Evening Tea-1(XXXX),Breakfast-2(XXXX),Lunch-2(XXXX), Dinner-1(XXXX),Rail Neer-2(XXXX)
Please share the 4 digit Meal Verification Code with the delivery boy

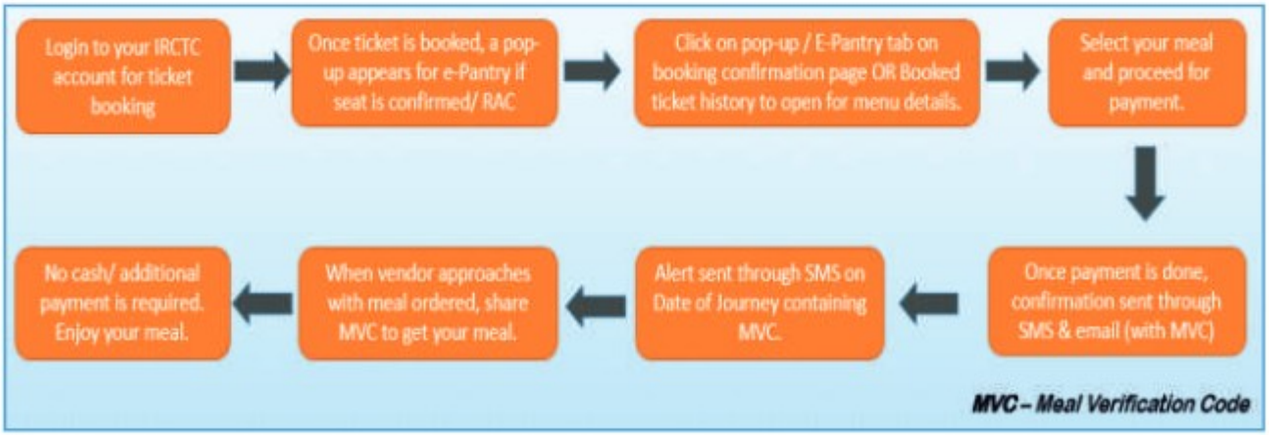
Mail Delivery and Feedback System:

For meal delivery, the passenger needs to provide MVC to vendor, who feeds it into the vendor app. On getting correct MVC, the vendor app sends delivery confirmation to CSIM and in-turn to NGeT system. In case NGeT system does not get delivery confirmation (wrong MVC/ no MVC fed), it initiates refund process. CSIM Dashboard is used for monitoring delivery status and generating reports for making payments to Vendors.



Process Flow:

Indicative Flow Chart



Impact Analysis:

Qualitative Impact

Key Features of E-Pantry Services

- Online payments eliminate scope for overcharging or cash-related malpractices.
- Unique MVC with passengers and pantry staff eliminates unauthorized vending.
- Digitally trackable transactions for compliance, delivery status, and billing.
- If meal not delivered, refund is provided to the passenger.
- Positive cultural shift towards cashless, accountable catering.
- Functionality extend within the IRCTC Rail Connect App. So that Passengers can book meals more conveniently

Quantitative Impact

Growth in average meal booking/ day

- Inception (April 2025) - 03 meals/day
- January 2026 - 467 meals/day
- Peak booking - 727 meals on 02.02.2026.

Set to rise exponentially with inclusion of more trains along with more public awareness through social media handles and other sources.

Universal Application

The E-Pantry model has significant potential for cross-sectoral adoption which may include Other Railway Segments i.e. trains where vendors operate like TSV (Train Side Vending).

By embedding technology + vigilance, the model ensures not just better service but also system-wide accountability.

Way Forward

While E-Pantry has proven effective, continuous improvement is key. Potential enhancements include:

- Use of AI to predict demand patterns based on passenger bookings.
- Use of Data Analytics to Minimize food wastage and ensure stock optimization.
- Staff and pantry cars of trains to be rated on compliance based on passenger feedback and visible rating displayed on app/website.
- Target rollout in **75+ trains** within next year and in all Mail/ Express trains with Pantry Cars by 2027-28.

Conclusion

The E-Pantry Service aims to improve the public services by enhancing accountability. By directly addressing issues of overcharging, unauthorized vendors and billing related irregularities, it has not only protected passenger interests but also strengthened financial integrity and organizational accountability.

Early Warning System e Aabhas

Ms. Manjusha Mishra
GM (Civil), NHPC

Introduction: The Himalayan Challenge

The Himalayan region is increasingly susceptible to volatile natural disasters, including cloudbursts, flash floods, avalanches, and Glacial Lake Outburst Floods (GLOF). Notable events such as the 2013 Uttarakhand disaster, the 2021 Chamoli flash floods, and the 2023 Teesta Basin GLOF have caused catastrophic loss of life and severe damage to critical hydropower infrastructure and other infrastructures. In this context, the Early Warning System (EWS) has shifted from being a technical requirement to a moral and governance imperative for protecting downstream communities and national assets.

e-Aabhas: A Digital Leap in Governance and Safety

NHPC has developed "e-Aabhas," a comprehensive software platform designed for real-time flood forecasting and risk management. Mandated by the Ministry of Power, this is a "one of its kind" system representing a transformative leap in transparency and disaster preparedness.

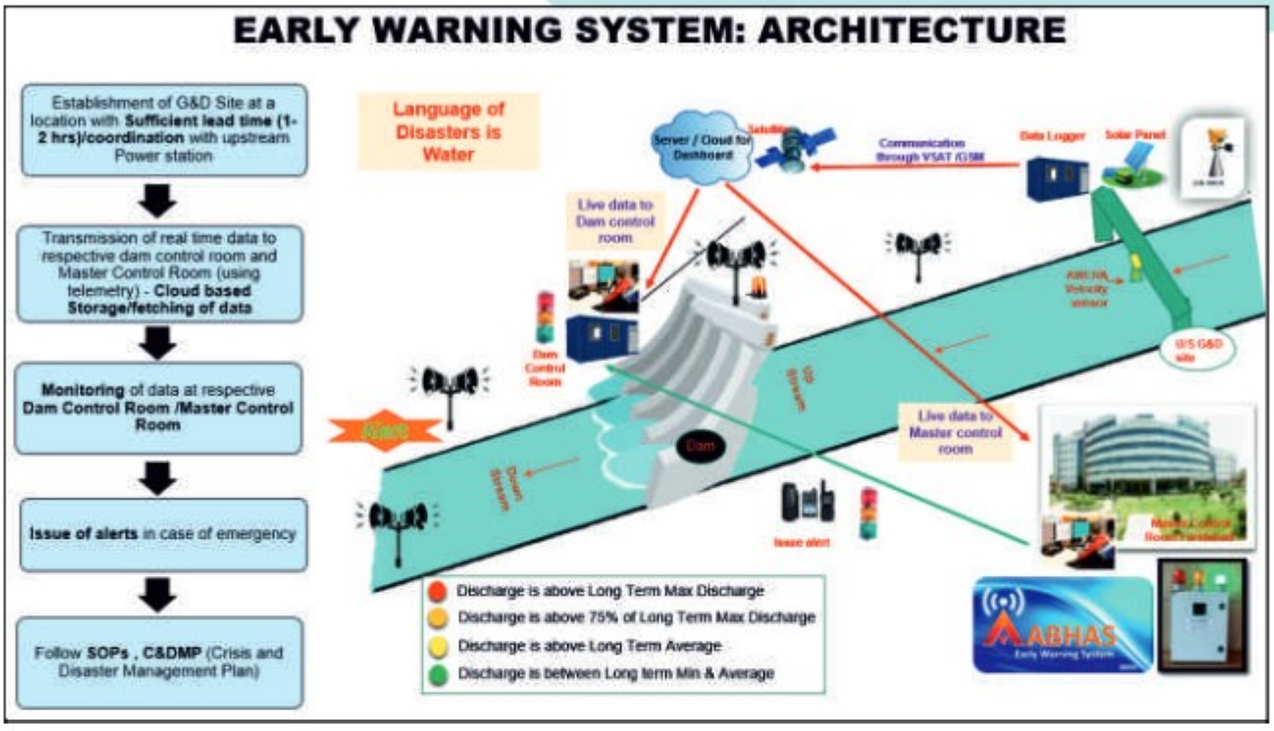
Core Technical Features:

- **Predictive Intelligence:** It forecasts flood discharge at dam sites with available lead times.
- **Automated Alerts:** Generates immediate warnings via SMS, email, sirens, and hooters.
- **24/7 Monitoring:** Supported by a state-of-the-art Master Control Room (MCR) in Faridabad that monitors hydropower plants nationwide 24/7 in addition to Central Control and Command Station (CCCS) at projects sites.
- **Integrated Data Flow:** Utilizes a network of Automatic Water Level Recorders (AWLR) and velocity sensors along with real time data from up stream projects (where ever applicable) for advanced warnings.

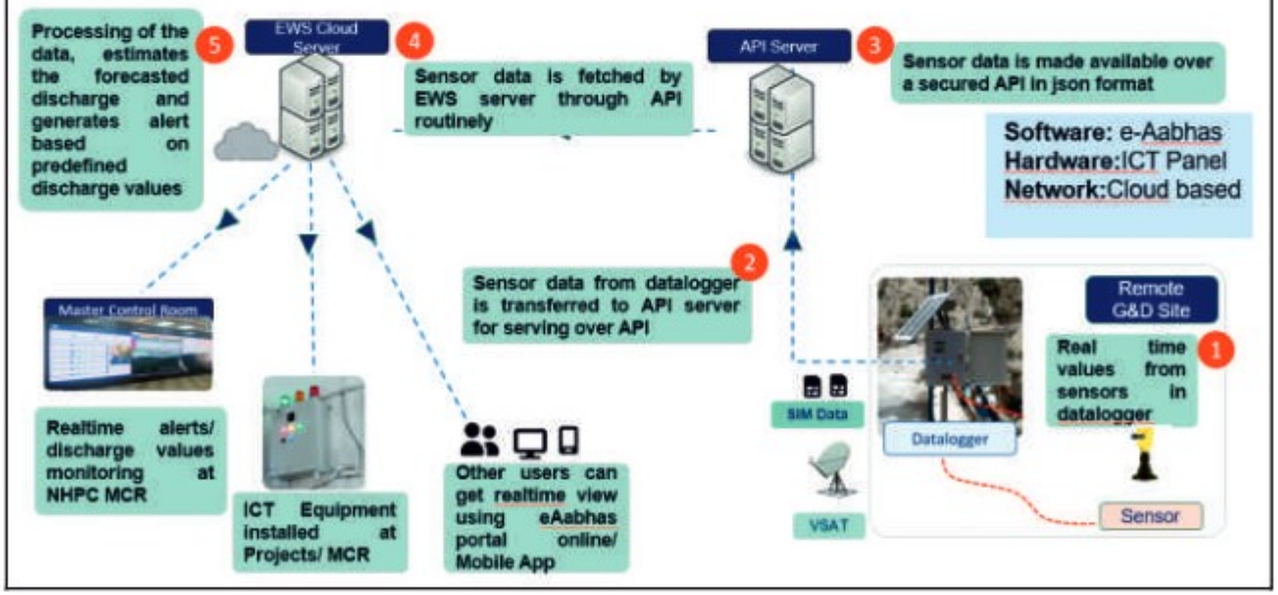
System Architecture and Operational Flow

The EWS architecture relies on telemetry and cloud-based processing to ensure data integrity and transparency.

EARLY WARNING SYSTEM: ARCHITECTURE



IT ARCHITECTURE



Impact and Benefits: Proven Success Stories

The implementation of e-Aabhas has resulted in tangible socio-economic benefits by mitigating costs like infrastructure damage, optimization of operation and reduction in cost & business interruptions.

- **Subansiri Lower HEP:** On multiple occasions in 2022, 2024 and 2025, lead times of up to 6 hours allowed for the complete evacuation of approximately 5,000 workers and equipment worth crores.
- **Kiru HEP:** On 18th June 2023, lead times of up to 2 hours allowed for the complete evacuation of approximately 100 workers and equipment worth crores.
- **Parbati III Power Station:** On 25th June 2025, timely opening of Spillway gates and activation of emergency sirens at the dam site, Sainj market, NHPC colony and Salwar Village saved lives of downstream people.
- **Rangit-IV Project:** In 2022 and 2023, the system enabled the evacuation of personnel and high-value machinery such as concrete pumps, transit mixers, electrical panels etc. before floods of 550 and 900 cumec hit the site.

Overflowing of Diversion Channel (Rangit IV)

Evacuation of the Site (Rangit IV)

- **Salal Power Station:** Sudden rise in discharge at EWS site in August 2025 was conveyed to Power Station before interruption in communication network.

Replicability and the Way Forward

The system has been already adopted by other hydropower organizations, who are actively integrating their projects into the MCR platform. The success of e-Aabhas in the hydropower sector offers a blueprint for other critical sectors with following potential applications:

- Energy Grids: Predicting overload or faults.
- Structural Health: Monitoring bridges, dams and buildings for stress.
- Chemical Plants: Early detection of gas leaks or pressure anomalies.
- Manufacturing: Detection of predictive maintenance and quality issue.

To stay ahead of the escalating climate risks, the next phase of the Early Warning System focuses on technological sophistication and inter-agency synergy like

- Integration of AI/ML and Data Science to improve the accuracy of forecasts, enable predictive analytics for early warning and support data-driven decision-making in real time.
- Deployment of additional upstream monitoring stations for broader catchment coverage.
- Implementation of satellite-based communication systems for remote areas where mobile/VSAT connectivity is unreliable.
- Seamless connectivity with NDMA, IMD, CWC and local administration for coordinated response.

Conclusion

Investment in robust EWS like e-Aabhas is a cornerstone of sustainable development. By fostering long-term resilience and ensuring the safety of communities, NHPC's digital initiatives exemplify the evolution of hydroelectric projects into socially responsible and technologically advanced public assets.

Sanchar Saathi and Financial Fraud Risk Indicator

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Introduction

In an age where cybercriminals exploit every digital avenue to deceive innocent citizens, India's Department of Telecommunications (DoT) has emerged as a technological guardian, deploying cutting-edge solutions to protect millions of mobile users. From sophisticated fake digital arrests to elaborate phishing scams through spoofed calls, DoT's comprehensive initiatives are safeguarding what matters most to every citizen-their trust in the digital ecosystem.

Problem Statement

The digital revolution that has transformed India into a connected nation has also opened new frontiers for cybercriminals. Three critical challenges have emerged in the fight against telecom-based cyber fraud: the urgent need to enable citizen reporting of fraudulent communications, the requirement for a unified platform bringing together all stakeholders for seamless data sharing, and the necessity for advanced AI-based analytics to generate actionable intelligence against increasingly sophisticated threats.

These challenges demanded an unprecedented response-one that would combine citizen empowerment, stakeholder collaboration, and AI into a comprehensive defense system.

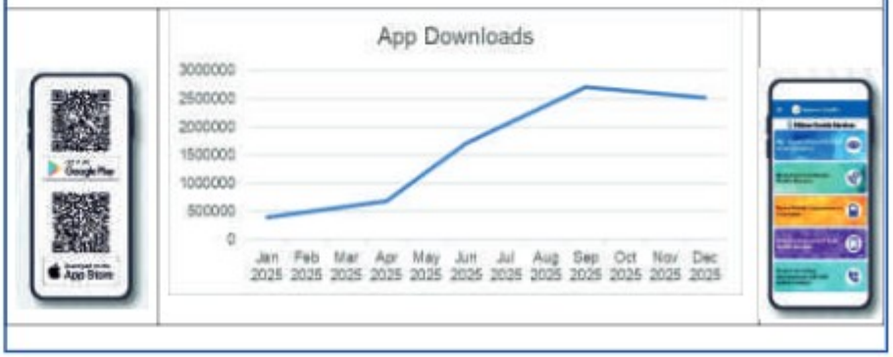
Addressing the Issue

DoT's Comprehensive Digital Defense Strategy

I. Sanchar Saathi: Empowering Digital Citizens through various facilities

Jan Bhagidari to fight cyber frauds through Sanchar Saathi – Our Citizens our Strength

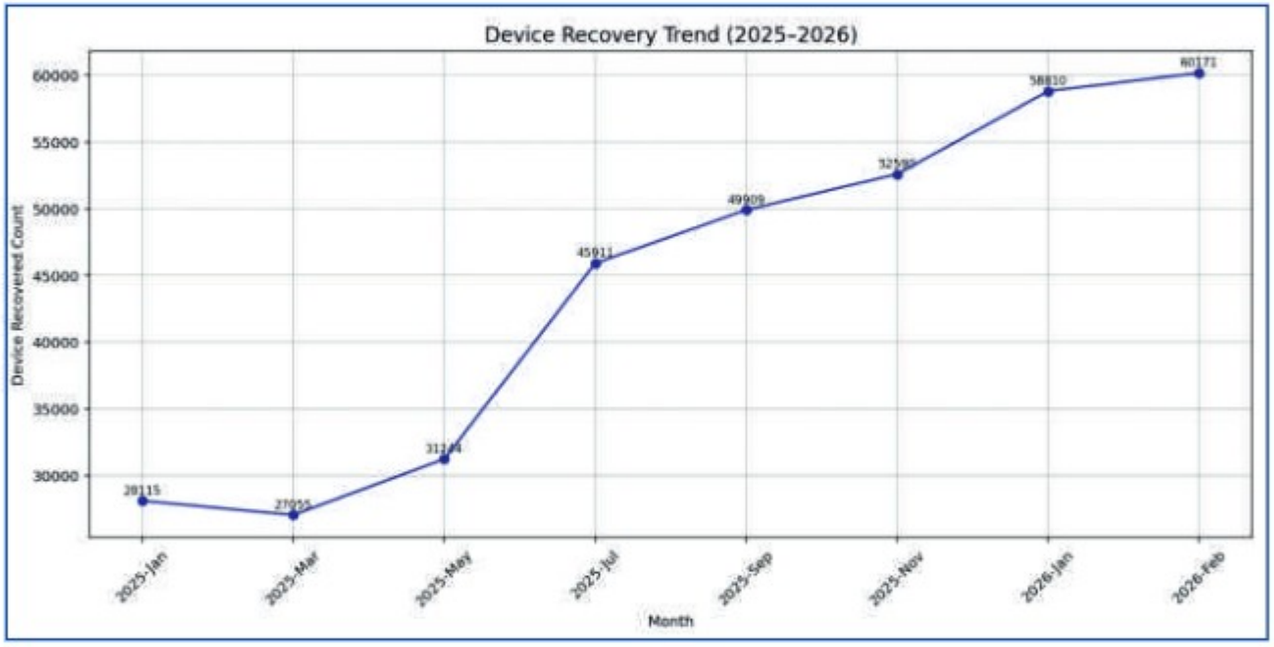
At the heart of DoT's citizen -centric approach is Sanchar Saathi, a comprehensive platform launched as both a web portal (May 16, 2023) and mobile app for Android and IOS (January 17, 2025). This initiative represents a paradigm shift from reactive to proactive cyber defense, placing powerful tools directly in citizens' hands.



A. Chakshu: The platform's flagship feature, Chakshu, serves as a digital reporting system, enabling citizens to report suspicious fraud communications or spam across calls, SMS, and WhatsApp. The results have been remarkable as based on citizen reports, DoT amplifies the action taken against the fraudsters. Based on one complaint, action is taken on multiple fronts of the telecom ecosystem like on mobile numbers, mobile handsets, SIM sellers, SMS headers, whatsapp etc.

B. Block your lost / stolen mobile handset:

The feature has become a lifeline for victims of phone theft. With over 37 lakh devices blocked, 22.60 lakh traced, and an impressive 5.64 lakh recovered and returned to owners, this service demonstrates the power of coordinated digital response. If a citizen loses his/ her mobile phone, he can report on this facility for blocking the lost handset and making it unusable in the Indian network. When someone tries to use the handset, a trace is generated using which the mobile phone can be recovered by the State police or Railway Protection Force and handed over to the rightful owner.



C. Know Mobile Connections in Your Name:

It facilitates citizen to check the number of mobile connections taken in his/her name. It also facilitates to report the mobile connection(s) which are either not required or not taken by the citizen under 'Not My Number' and 'Not Required' categories. Reported mobile connections are provided to TSP concern for reverification. This feature has processed over 2.28 crore requests, helping citizens identify and report unauthorized connections. This transparency tool has resolved 1.93 crore requests, enabling better control over personal digital identity.

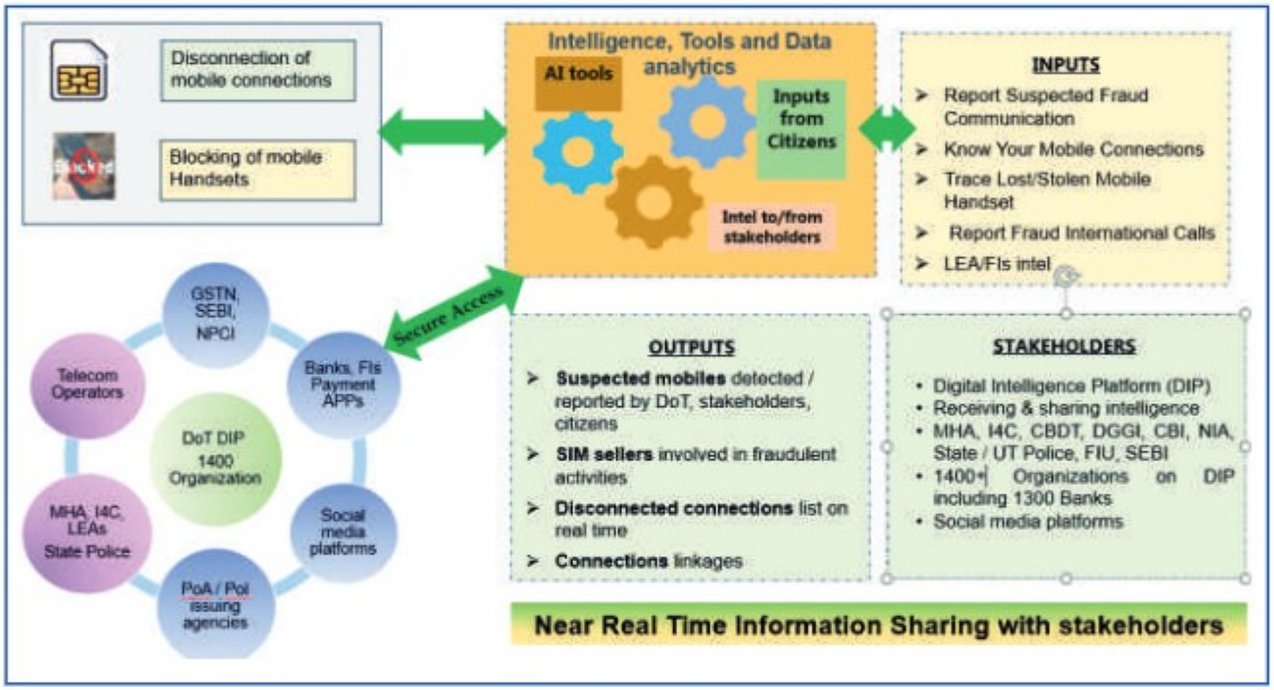
D. Report Incoming International Call with Indian Number: It facilitates citizens to report international calls received with Indian mobile as calling number (CLI). These calls are suspected to originate via illegal telecom setups in India which are used to bypass the licensed telecom routes for anti-national activities and financial frauds etc.

E. Know Genuineness of Your Mobile Handset: This facility allows to check the genuineness of mobile handset while buying a new/old device.

II. Digital Intelligence Platform: Uniting the Defense Ecosystem

DoT's Digital Intelligence Platform (DIP) represents a revolutionary approach to inter-agency cooperation. By bringing together 620 organizations-including central security agencies, state police forces, banks, financial institutions, telecom service providers, and digital platforms like WhatsApp-DIP creates an unprecedented intelligence-sharing ecosystem.

This platform hosts real-time lists of disconnected and suspected mobile connections along with disconnection reasons, enabling stakeholders to take immediate action, including disengaging associated services linked to these numbers.

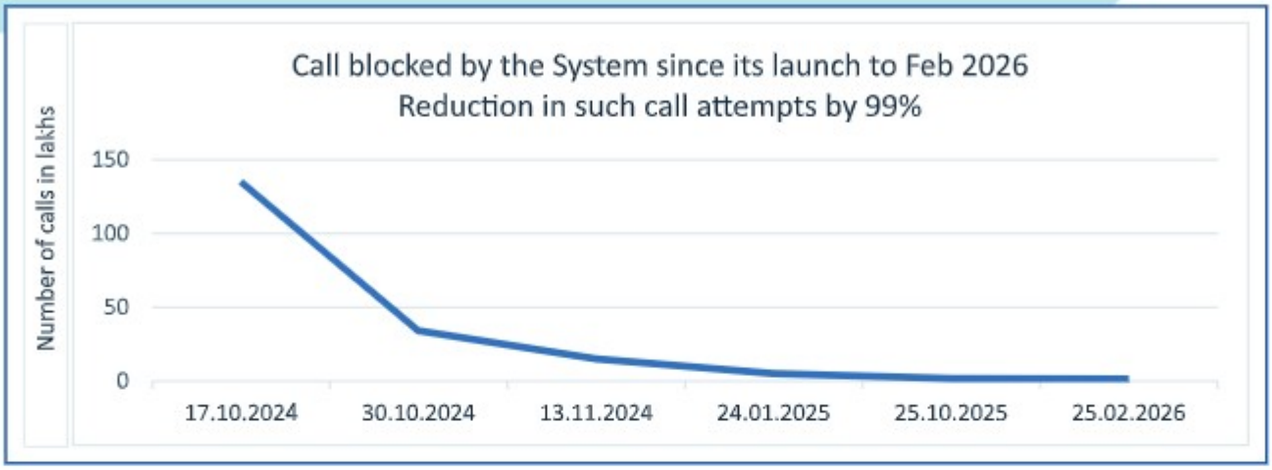


III. AI-Powered Fraud Prevention: The Technology Edge

A. CIOR: Blocking International Spoofed Calls

DoT's International Incoming Spoofed Calls Prevention System (CIOR), launched on October 17, 2024, represents a technological breakthrough in preventing cross-border cyber fraud. This system identifies and blocks spoofed calls i.e. international calls that display Indian mobile numbers, appearing to originate within India but actually made by overseas cybercriminals.

The impact has been dramatic: a 99% reduction in spoofed calls with Indian CLI (Calling Line Identity), with remaining attempts blocked at international gateways. This preventive approach has proven particularly effective against fake digital arrest scams and impersonation of government officials.



B. ASTR: AI-Powered Identity Verification

The ASTR tool showcases India's indigenous AI capabilities in combating fraud. By analyzing subscriber images across different KYC submissions, ASTR identifies cases where individuals have acquired multiple SIM cards using fake or forged documents.

Processing an astounding 134 crore mobile connections, ASTR has led to the disconnection of over 87 lakh fraudulent connections after re-verification-a testament to the system's precision and effectiveness

100 SIMs: 78 names: male & female

C. Financial Fraud Risk Indicator: Real-Time Protection

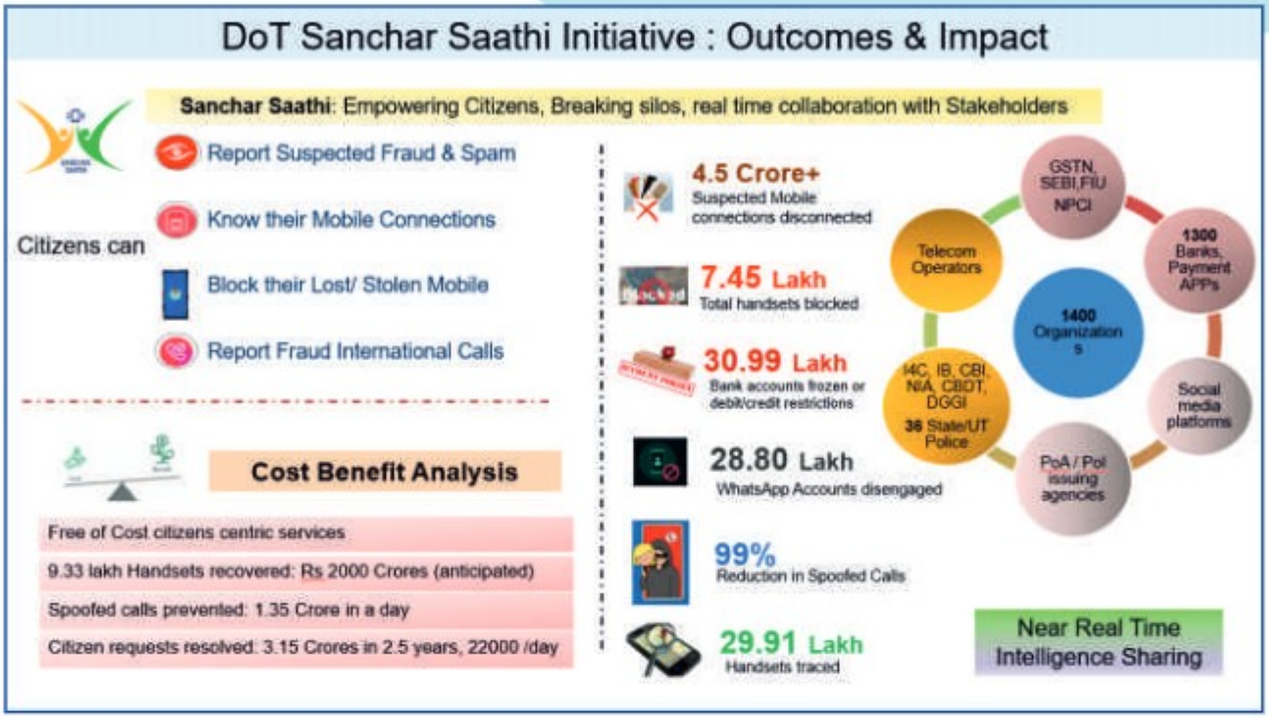
Time is the essence in preventing financial fraud and for protecting citizens from losing their hard earned money. To enable this in true spirit, DoT launched, on May 22, 2025, the Financial Fraud Risk Indicator (FRI) as a fraud prevention tool. Using multi-variate analysis, FRI classifies suspected mobile numbers based on their association with financial fraud risk levels as Medium, High or Very High.

This indicator empowers banks, NBFCs, and UPI service providers to implement real-time protective measures. Third-party payment applications like PhonePe, Paytm etc. have integrated FRI, enabling transaction declines and real-time alerts when users attempt to transfer money to high-risk accounts. Till date, using FRI, transactions have been either declined or alert/notification has been generated by banks/ UPI Service Providers resulting in financial loss prevention of **Rs. 1900 + crore.**

Impact Analysis

Measurable Impact: A Comprehensive Success Story

The quantitative results of DoT's initiatives paint a compelling picture of digital security enhancement.



Qualitative Transformation: Building Digital Trust

Beyond measurable outcomes, DoT's initiatives have catalyzed qualitative improvements:

- **Citizen Empowerment:** Users now possess tools to actively participate in their digital security, fostering a culture of cyber vigilance.
- **Preventive Action:** The shift from reactive to proactive defense has significantly reduced successful fraud attempts.
- **Stakeholder Collaboration:** Unprecedented cooperation between telecom sector and financial sector, government agencies, private sector entities, and citizens has created a robust defense ecosystem.
- **Fraud Risk Prevention:** Real-time risk assessment and response capabilities have enhanced overall telecom cyber security and is contributing significantly in rebuilding the trust of citizens in the digital space.

Universal Applications

The innovative platforms and tools developed by DoT-especially AI-driven systems like ASTR-demonstrate remarkable versatility, with applications extending far beyond telecommunications. For instance;

- **Direct Benefit Transfer (DBT) Mission:** ASTR can help prevent identity-based frauds in social welfare schemes by identifying fake or duplicate KYC profiles linked to beneficiaries, ensuring subsidies and benefits reach the intended individuals.
- **Fake Document Identification:** Fake PoI/PoA detection like Driving license through facial deduplication.
- **Banking & Financial Services:** Tools like FRI and ASTR are assisting banks, NBFCs, and UPI service providers in real-time fraud risk classification, enabling secure customer onboarding and transaction monitoring.

- **Law Enforcement & Internal Security:** DIP enables seamless data sharing across security agencies and can be adopted by state and central law enforcement bodies for tracking telecom-linked criminal networks.
- **Second Hand Mobile Marketplace:** Verification tools can help second hand mobile marketplace for checking genuineness of mobile handsets which they are selling or buying.

These tools offer a replicable framework that can be adopted across sectors-both public and private-for enhancing digital trust, improving service delivery, and minimizing fraud risks.

Way Forward

Scaling Protection, Deepening Integration: Going ahead, DoT aims to:

- Expand AI and analytics capabilities to preempt evolving tactics and new modus operandi being used by fraudsters for misusing telecom resources.
- Enhance integration of FRI with all financial institutions and digital payment platforms.
- Drive awareness among citizens and retailers on responsible telecom practices.
- Foster intetnational cooperation for tackling cross-border telecom threats.

Conclusion: A Model for Digital Security

DoT's comprehensive approach to combat cyber fraud represents more than a successful government initiative-it embodies a new paradigm for digital security in the 21st century. By combining citizen empowerment, stakeholder collaboration, and cutting-edge technology, India has created a replicable framework for protecting digital trust.

As other nations grapple with similar challenges, DoT's integrated approach offers valuable lessons in building resilient digital ecosystems. The success lies not just in technological innovation, but in creating a collaborative environment where citizens, government, and private sector work together to safeguard the digital commons.

In an era where digital trust underpins economic growth and social progress, DoT's initiatives demonstrate that with the right combination of technology, policy, and citizen engagement, even the most sophisticated cyber threats can be effectively countered. The battle against cyber fraud continues, but with these digital guardians standing watch, India's digital future looks increasingly secure.

The Department of Telecommunications continues to evolve its cyber fraud prevention strategies, with new tools and partnerships being developed to stay ahead of emerging threats. Citizens are encouraged to actively participate in this digital defense by utilizing the Sanchar Saathi platform/app.

Prevention is Better Than Cure

While a widely known Vedic story specifically for the adage "prevention is better than cure" is not readily available, the Mahabharata contains narratives illustrating this principle. For example, when Dronacharya realizes Arjuna's potential to disrupt the kingdom, he subtly trains Arjuna in all arts of warfare, but also strategically focuses on Yudhisthira's development of diplomacy and righteousness to serve as a check on the martial power of others, preventing large-scale conflict.

Dronacharya's Strategic Foresight in the Mahabharata

The story of Dronacharya and his students in the Mahabharata showcases the principle of "prevention is better than cure" through strategic foresight and preventative action.

The Problem:

Dronacharya, the royal preceptor, observed the extraordinary martial prowess of Arjuna and recognized that his immense power could be a potential source of future conflict or instability for the kingdom if not properly balanced.

Preventative Measure:

Instead of waiting for a catastrophic event or a direct challenge to arise, Dronacharya took proactive steps. He continued to train Arjuna in weaponry, ensuring his skills were unmatched.

Strategic Counterbalance:

Crucially, he also emphasized and nurtured the qualities of Yudhisthira, the eldest Pandava, focusing on his wisdom, diplomacy, righteousness, and commitment to dharma.

The Outcome:

Yudhisthira's exemplary adherence to righteousness and his diplomatic skills served as a powerful, non-violent counterweight to Arjuna's martial might. This prevented the kingdom from being plunged into chaos, as Yudhisthira's influence could guide and restrain the use of Arjuna's formidable powers.

Why This Illustrates The Principle

Dronacharya did not wait for a crisis to occur but actively worked to prevent one.

By investing in Yudhisthira's character and diplomacy, he created a system where the potential for destructive conflict was neutralized before it could manifest.

This focus on building a balanced and righteous environment, rather than just focusing on military might, is a prime example of how prevention is often more effective than trying to remedy a disaster after it has happened.

India's Telecom Shields: Sanchar Saathi and Financial Fraud Risk Indicator (FRI)

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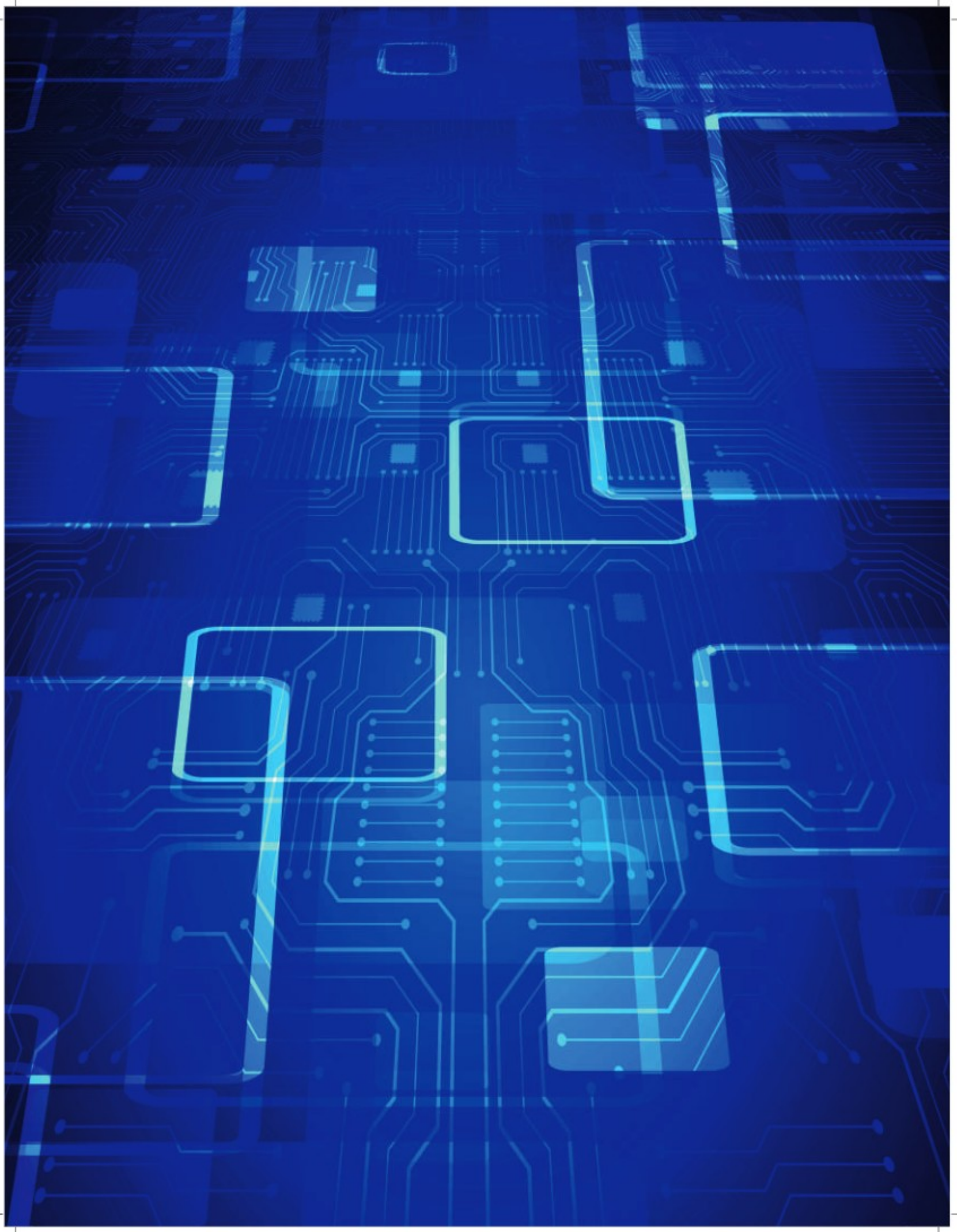

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