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Futuristic Technologies for Indian Railways

August 2022

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Deepak Sood
Secretary General
ASSOCHAM

MESSAGE

Indian Railways, the country's premier transport organization, has one of the largest rail networks in the world. It plays a crucial role in developing and operating infrastructure sectors and moving millions of people back home. Indian Railways is making consistent efforts to leverage the expertise and technical knowledge available in various sectors, including the private sector, in the country to improve its operational efficiency. Technological advancements are enhancing the railway infrastructure capacity by converting to electrified routes with advanced signaling. They are being re-imagined, designed and operated using technology that brings stakeholders into collaborative partnerships, thus changing the face of Railways.

A host of challenges and opportunities exist in the capacity augmentation and creation of modern Rail infrastructure across various stages. To meet the numerous challenges ahead towards becoming Aatmanirbhar Bharat, the Indian rail sector increasingly needs to create indigenous technology and innovative potential to deliver smart solutions for safety, security, connectivity, seamless operation and sustainability. Automatic Train Protection System- Kavach, indigenously developed by Indian Railways, is one such initiative to enhance running trains' safety. Further, the Indian Railways is amongst the few Railway systems globally to have committed to achieving a net zero carbon emissions by 2030. This is an ambitious, laudable, and progressive step toward an efficient, self-sustainable, cost-effective and modern carrier of passengers and freight services providers to serve the growing needs of new India.

Strengthening railways is one of the key focus areas of ASSOCHAM, wherein we make continuous efforts to provide valuable inputs to the Government for suitable policy formulation and bring in comprehensive support to the industry. To take our initiatives forward, ASSOCHAM, jointly with Resurgent India, has prepared this report to highlight the major initiatives being taken by Indian Railways toward its modernization.

We acknowledge the efforts made by the experts in preparing the report to be presented at the International Conference' RailTech -2022: Futuristic Technologies for Indian Railways.' We hope the report will provide essential insights to policymakers, industry leaders and stakeholders and help make the Indian rail transport system compliant with international standards.

Deepak Sood

Jyoti Prakash Gadia
Managing Director
Resurgent India Limited

MESSAGE

Indian Railways is among the world's largest rail networks. The absorption of new technology in the railway network has brought it to a speeding edge: the launch of semi-high-speed rail services like Tejas Rajdhani Express and the engine-less, self-propelled Vande Bharat Express that can travel up to a top speed of 160-180 kmph are the two latest examples. Nevertheless, it faces several challenges, from overloaded infrastructure, and low internal resource generation, to stretched-out budgets that hamper its growth.

With the rise in digitalisation of the railway network, it is becoming easier to overcome these challenges. Digital technology has enhanced the operations of Indian Railways in terms of manufacturing, design, network efficiency, punctuality, infrastructure, services, consumer experience, safety and maintenance.

Indian Railways has spurred and supported interactions between the players required to transform a concept into a method or service in order to fulfil the organisation's main objectives. The Government of India has also motivated and encouraged entrepreneurs and innovators to come forward for the development of innovative technologies, products and technological solutions.

There are difficulties yet to be conquered for the complete transformation that Indian Railways is aiming for, but the progress achieved so far points to a favourable future.

I hope this report will pave the way for brainstorming creative solutions for the Indian Railways, and I wish ASSOCHAM the very best for the upcoming conference.

Jyoti Prakash Gadia

CONTENTS

CHAPTER I

INTRODUCTION OF DIGITAL TECHNOLOGY TO THE INDIAN RAILWAYS

"The vision of Indian Railways is to be a global leader in railways by making a leap as a creator and innovator of technologies and systems."

- Reform Booklet - Innovation in Indian Railways 25/02/2021

Founded in 1853, the Indian Railways has come a long way in terms of services, efficiency and safety. Digital technology has aided and guided its evolution in the last decade; modernization and innovation have received special attention from the Indian government, transforming the Indian Railways from the ground up.

The government has strived to create an enabling framework that engages stakeholders in collaborative relationships and provides a favourable environment for motivating and inspiring Indian innovators and entrepreneurs to create cutting-edge products and services.

Indian Railways is seeking to revolutionise the transportation paradigm with a focus on safety, comfort, and convenience, shifting the emphasis from infrastructure to service and from pre-made to customised solutions. In the past few years, the railway sector has changed significantly as a result of the adoption of the latest technological advancements:

Rolling Stock: The manufacture of coaches has witnessed a significant growth curve. Because parts need to be manufactured and stored before being assembled, traditional manufacturing methods result in large inventory expenses. With digitalization, platform-based 3D technologies are quickly improving and optimising the expensive traditional production.

The coach designs are accurately modelled, simulated, analysed, and improved in the virtual world to correct flaws and inefficiencies and prevent expensive mistakes. Rolling stock manufacturers use virtual 3D platforms and cutting-edge technology to incorporate subsystems, components, and assembly information.

Additive manufacturing is becoming a major game changer in the railway industry. The Railways has begun designing and printing coach components internally using a "Make in India" 3D component printer.

SMART Coaches: With the manufacturing of coaches optimised, the focus has now moved on to employing technology to enhance the passenger experience. The Indian Railways is set to introduce SMART coaches with modern technology. The emphasis is on customer-centricity, travel experience, and passenger safety.

These solutions are marked by a facial recognition capability on CCTV, an emergency talk-back system, automated plug-door and step control, and other features. Another step in the modernisation of railways is the introduction of customised coaches on the basis of train routes and passenger tiering, where coach designs reflect local aesthetics and identity.

World-Class Train Sets: The biggest success story for Indian Railways in 2020 was the launch of 'Make in India' semi-high-speed Vande Bharata Express trains. The IR has plans to introduce a number of other world-class trains this year and in the upcoming years, enhancing the country's rail connectivity, and eventually, start exporting trains.

Integrating Data Analytics: Different trains operate with different priorities, speed limitations, and stoppages on a network. The train schedules are created with these limitations, track speeds, and needs in mind in order to maximise network utilisation. Coupled with network optimization (for instance, the use of data science to streamline the routes), it can increase the train count running on the same network, boosting revenues for the Railways.

Signalling System: Technical developments such as switching to electrified routes with advanced signalling are increasing the capacity of the rail infrastructure. The European Train Control System (ETCS), which checks if the train's speed limit is compatible with the authorised speed allowed by signalling, is being implemented as part of the modernization of the signalling system to increase safety and punctuality.

Within the framework of innovation and entrepreneurship being created by the Government of India through initiatives like Startup India, Atal Innovation Mission, Make in India – Aatmanirbhar Bharat Abhiyan, Innovations for Defence Excellence, etc, the railway sector is addressing its various technological needs with great speed and efficiency.

CHAPTER II

PRESENT CHALLENGES AND KEY TECHNOLOGICAL REQUIREMENTS

Indian Railways is an avenue bursting with potential. The largest rail network in Asia and the second largest under one management in the world, it is the premier transport organisation in the country. A multi-gauge, multi-traction system, it covers a total of 1,26,611 Track Kilometres. Its vast network demands considerable infrastructure and investment. This has, nonetheless, created certain challenges for the developing economy of India.

Some of the challenges that the rail network needs to tackle include:

Infrastructure Investment: Infrastructure is overloaded, with more than 60% of routes being used at or above capacity. While passenger miles increased by 1642% and freight loading by 1344% according to a white paper published in 2015, route km have only climbed up by 23%.

Customer Focus: In addition to the money invested in infrastructure, the quality of delivery is a concern. Major customer priorities include cleanliness, promptness of services, safety, the calibre of terminals, train capacity, the quality of food, the security of passengers, and the convenience of ticket bookings.

Low Internal Revenue Generation: Though passenger trains use two-thirds of the railway capacity, they barely bring in one-third of the revenue. High freight rates have inflated the prices of several goods and commodities; inadequate carrying capacity is hurting the modal share of freight, and a massive unmet demand for passengers has been a growing concern. Negligible variety in the types of goods being used and a negligible share of "non-fare" revenues add to the problem.

Organisation Rigidity: Poor market orientation, silo-working, and slow decision-making, which leads to a protracted process for project approval – an average of 24 months – have slowed down Indian Railways.

There is a need for immediate reforms in the Indian Railways to reach its full potential. The recent alignment with advancement in technology has contributed to the resolution of a number of these issues. There are some technological gaps, however, that need to be worked upon:

- First, there is a need for increased usage of technology for crack detection without using trackmen. This is due to the fact that manual detection is rarely completely reliable, especially at night.

- Second, the railways' financial health must be improved. In the sections that are much in use, capacity utilisation is already above 100%, which causes delays in the operation of trains, denial of maintenance blocks, and difficulties in the introduction of new trains.

- Third, train operations are severely hampered in the winter due to fog. The current generation of fog-safe devices has some drawbacks because they only show the signal position and not its colour (yellow, red, or green). Loco pilots must slow down in order to inspect this. This issue can be resolved with cab signalling. The North Central Railway, which frequently experiences fog delays in the winter, is at least one zone where this technology, which is quite popular in Europe and Japan, could be implemented.

- Fourth is the poor condition and facilities in Indian trains for the passengers. The railways' efforts to date have been focussed on specifications and vendor selection, often losing sight of the bigger picture. A simpler method would entail a government-to-government collaboration on the pattern of the India-Japan rail collaboration for the high-speed train project or the dedicated freight route. For instance, a modest amount of initial funding to place an order of 1,000 coaches may be an expedient tool for improving standards of service. We need to engineer coach interiors that meet international standards and practices and will prove to be a shot in the arm for Make in India.

There is a renewed focus on cementing these gaps, and India's approach to dedicated technological transformation is extremely promising.

CHAPTER III

NATIONAL POLICIES: REFORM, PERFORM, TRANSFORM

The current national policies aim not only at identifying and resolving the issues the Indian Railways faces but also at bringing about a complete transformation in its operations.

Several industries in the country are now embracing products and business solutions created by industry and entrepreneurs using cutting-edge next-generation technological tools like IoT, big data analytics, cloud computing, drones, MEMS, composites, shape memory alloys, etc. A number of Government of India Initiatives, like Startup India, Atal Innovation Mission, Make in India-Aatmanirbhar Bharat Abhiyan, Innovations for Defence Excellence, etc., offer an enabling framework for incentivizing and encouraging Indian entrepreneurs and innovators to develop cutting-edge products, technologies, and technological solutions to meet the needs of various Indian industries.

With a view to encouraging the nation's startup culture and utilising the technological, economic, and operational advantages that next-generation innovative and emerging technologies can provide, Indian Railway plans to cooperate with startups, entrepreneurs, and technology developers to acquire affordable and dependable goods and solutions for the Indian Railways network.

The objectives of the National Policy (2022) being laid out to reform the Indian Railways include:

- To create new products, functional prototypes, and solutions that are affordable, implementable, and scalable to solve the Quality, Reliability, and Maintainability-related challenges of IR
- Making use of cutting-edge technologies created by startups and entrepreneurs to enhance operational effectiveness & safety.
- Bolstering the nation's "Innovation Culture" to foster co-creation and co-innovation in the railroad industry.

National Rail Plan: Vision 2030

The National Rail Plan (NRP) for India prepared by Indian Railways aims to have a 'future ready' system by 2030. To upgrade the railways, the Railway Ministry has announced plans to invest ₹5,000,000 crore. These upgrades would include:

- 100% electrification of railways,
- Upgrading existing lines with more facilities and higher speeds,
- Expansion of new lines,
- Upgrading railway stations,
- Introducing and eventually developing a large high-speed train network interconnecting major cities in different parts of India, and
- Development of various dedicated freight corridors to cut down cargo costs within the country.

The NRP aims to develop measures to raise the modal share of the Railways in freight to 45% based on both operational capacities and commercial policy initiatives. The plan's goal is to build capacity ahead of demand so that it can meet the demand growth through the year 2050. It also aims to raise the modal share of railroads in freight traffic to 45% and maintain it.

The National High Speed Rail Corporation Limited (NHSRCL) is in charge of overseeing the implementation of high-speed train

programmes throughout the nation, while the Dedicated Freight Corridor Corporation of India (DFCCI) is the organisation responsible for developing freight corridors across the nation, and the Indian Railway Stations Development Corporation (IRSDC) is in charge of undertaking all research, designs, and standardisation work for modernization.

Vision 2024, a part of the National Rail Plan, calls for the quick completion of a number of crucial projects by 2024, including complete electrification; multiple-tracking of congested routes; speed upgrades to 160 kmph on the Delhi-Howrah and Delhi-Mumbai routes, 130 kmph on all other Golden Quadrilateral-Golden Diagonal (GQ/GD) routes; and the removal of all level crossings on all GQ/GD routes.

CHAPTER IV

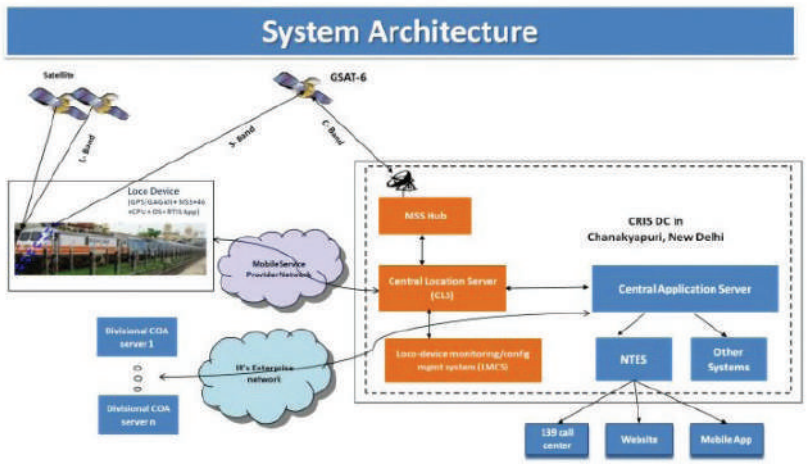
IMPROVING RAIL NETWORK EFFICIENCY THROUGH TECHNOLOGY: RTIS AND REMMLOT

Indian Railways has chosen IoT in order to run more trains. One such endeavour is a Real-Time Train Information System (RTIS), which uses GPS sensors mounted on the locomotives to track the whereabouts of trains in real time.

With RTIS/REMMLOT devices installed in around 50% of Indian Railways locomotives, 14 million 'events' are generated per day. In order to improve train operations, Indian Railways is working to install RTIS devices in all locomotives and use real-time data. This includes using AI to increase the accuracy of train ETAs, locomotive entry and exit, placement and removal of goods trains in goods sidings, and train rescheduling.

Real-Time Train Information System (RTIS)

Indian Railways has also adopted the Internet of Things (IoT) to automatically generate train arrival and departure information. Control Office Application (COA) is expected to replace the manual charting of running trains. On the network of Indian Railways, about 2,700 electric locomotives have satellite devices installed as part of the Real-Time Train Information System (RTIS) project. The indoor unit is installed in the locomotive cabin, while the outdoor unit is installed on the locomotive roof. Together, these two components make up an RTIS locomotive device. Based on pre-defined logic applied to spatial coordinates and speed data continuously received from the satellite receiver, the RTIS application software in a locomotive's device determines train movement events, such as arrival, departure, run-through (ADR) at stations and en-route location updates at 30-second intervals.



An Intel Atom processor and a Solid State Drive (SSD) are inclusive features of RTIS locomotive equipment. Updates on locomotive movements are

sent by satellite to the data centre, where they are processed and sent on to the Indian Railways' COA server. Both the 4G/3G mobile data service and the satellite communication service are used to send the ADR events and position/location updates to a Central Location Server (CLS). The incoming data is processed by the CLS, which then transmits to a train control application for automatically displaying control charts. Since the train control office application and the National Train Enquiry System (NTES) are already integrated, passengers are given precise real-time information about the status of their trains.

Remote Monitoring and Management of Locomotive System (REMMLOT)

GPS tracking systems are integrated into the new Indian Railways diesel locomotives to monitor their condition. The components of this system include an on-board sensor, a GPS receiver, a processor panel, and other components that can gather, process, and transmit data over GPRS service to a shared web server for additional processing. In diesel locomotives, REMMLOT is also used to record and send COA information about train arrivals and departures.

Future Potential of RTIS

Currently, the primary uses of RTIS entail automatic capture of the arrival and departure of trains, automatic plotting of Control Charts in COA and providing customers with real-time train status information via the NTES. The following are some other uses of RTIS data that CRIS is aiming to administer:

- Entry and departure of locomotives from maintenance depots, as well as an assessment of the output of the depots with respect to prior objectives.
- On the basis of how the train is really operating, the expected travel time (ETA) of a train can be calculated. The use of artificial intelligence (AI) capabilities is envisaged for realistic ETA estimation.
- The location where a speed limit is imposed owing to track faults can be made known to the driver in advance. If RTIS is integrated with the locomotive's braking system, should the driver operate the train faster than is permitted, the system may raise a warning and might apply the brakes automatically.
- Customers only have a set amount of time to load or unload goods in trains; if they don't, a fee (called demurrage) is charged for the goods train's continued delay. Currently, the arrival and departure schedules of freight trains on freight handling lines (also known as goods sidings) are manually entered, which occasionally causes conflicts between railroad departments and the customer.

- The skills of a train driver are a major factor in how effectively trains operate. The amount of time it takes the driver to reach the highest speed allowed, maintain it, observe speed limits, brake, etc., affects the run time of the train and, as a result, timeliness. Aside from coasting wherever possible, using the best regenerative braking, and adhering to speed limits, optimal driving can help reduce the energy consumption of the train. The effectiveness of the train driver in preserving punctuality and in terms of energy usage can both be evaluated using RTIS.

- The train running data can be used to plot the trains in advance and suggest the best, least-congested route if all the trains run in the same section.

- For announcements on trains regarding the next stop, the on-board passenger information system can be connected with the RTIS.

CHAPTER V

DIGITISATION OF SERVICES

Through the use of digital technologies, the Indian rail network is constantly improving the passenger experience. The passenger travel experience has been dramatically transformed by new features such as step control, automatic plug-doors, emergency talk-back systems and WiFi infotainment systems. Following are some examples of the digital services that have been added as a result of customer centricity becoming one of IR's primary focuses:

Trains and Stations with Wi-Fi: Wi-Fi and CCTV cameras will be placed on all trains and stations over time (announcement c. March 2018). A cooperative venture between the IR and Google to provide high-speed Wi-Fi connectivity to 400 key railway stations was launched in September 2015. By the end of 2016, the network had been established at the first 100 stations, with Mumbai Central station being the first to do so. The following are some of the locations where the Railtel-Google free high-speed public Wi-Fi service is accessible, including Mumbai Central, Chennai Central, Chennai Egmore, Madurai Junction, Coimbatore Junction, Chandigarh, Old Delhi, Pune, Bhubaneswar, Bhopal, Ranchi, Raipur, Vijayawada, Kacheguda, Ernakulam, Thiruvananthapuram, Thrissur, Jabalpur, Visakhapatnam, Jaipur, Kanpur, Lucknow, Gorakhpur, Patna, Guwahati, Ujjain, Allahabad, Howrah, Varanasi, etc.

Tickets: A limited number of verified ticket holders will now be permitted to transfer their tickets to another person. The Indian Railway Catering and Tourism Corporation (IRCTC) now allows customers to order train tickets and pay on delivery using its website and mobile application.

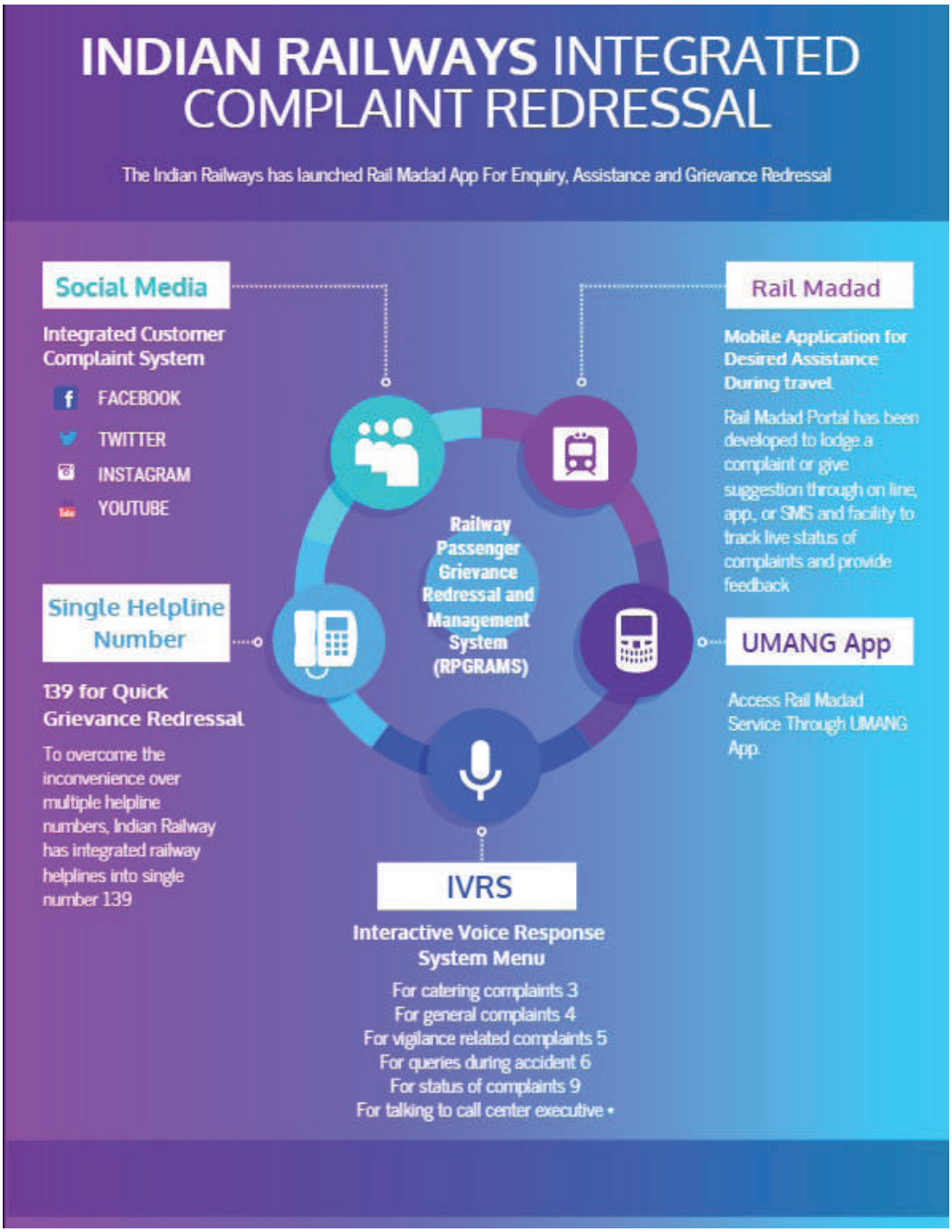
Escalators: All stations with daily foot traffic of more than 1,00,000 people will gradually have escalators built.

Connectivity Enhancement: The onboard connectivity for staff, service support for staff, onboard passenger safety monitoring, and premium mobile broadband and voice services will be put in place for consumer convenience.

Future Railway Mobile Communications System (FRMCS): India is planning to adopt 3GPP Long Term Evolution (LTE) and New Radio as a future-proof technology for railway applications, similar to many European nations. This would also make it possible for Indian Railways to incorporate many of the Future Railway Mobile Communications System (FRMCS) capabilities,

which are the global standard for rail communications and a crucial component of the railway digitization process. FRMCS was created by the International Union of Railways in collaboration with various rail industry players.

Integrated Complaint Redressal: IR has launched the Rail Madad portal, accessible through the UMANG app, for quick grievance redressal. The social media platforms have been integrated for ease of access to various consumers; multiple helpline numbers have been integrated through IVRS into a single helpline number, 139.



CHAPTER VI

INFRASTRUCTURAL EVOLUTION

Leveraging technological advancements have aided infrastructural development for the Indian Railways. The Indian Railways has adopted the following measures to benefit from the integration of technology.

Station Redevelopment: By monetizing 2700 acres of unused railway land as part of the $1 trillion initiative, 600 railway stations will be renovated. This project is being carried out by the Indian Railway Stations Development Corporation in conjunction with the Atal Mission for Rejuvenation and Urban Transformation, and the Smart Cities Mission, as well as the Ministry of Urban Development, the Rail Land Development Authority, and the National Buildings Construction Corporation. Following the monetization of the land, US$85 billion (680,000 crore) will be used for commercial development, US$35 billion (280,000 crore) for station rehabilitation and US$14 billion (110,000 crore) will be left over for the railways. A1 and A category stations will be given priority initially.

Designated Freight Lanes: There are now 4 approved DFCs and 2 that are in the process of implementation. Existing and future DFCs will be transformed into India's High-Speed Rail Corridors.

Electrification of Tracks: The electrification of all routes will help reduce the cost of imported fuel and increase running efficiency. In order to electrify the remaining 38,000 km of the broad gauge network in five years, from fiscal years 2017–18 to 2022–23, IR began "Mission Electrification" in 2017. When switching to 100% electricity, the annual fuel bill for railways will drop from 32,000 crore (USD $4.01 billion or ₹3.92 billion) to 22,000 crore (US$2.76 billion or ₹2.70 billion), saving 10,000 crore (US$1.25 billion or ₹1.23 billion).

Conversion of Track Gauge: To increase viability, Indian Railways is changing the entirety of its network (apart from heritage routes) to 1,676 mm (5 ft 6 in) wide gauge. Broad gauge rails are being added at a rate of 7.7 km per day, both new and converted. This is expected to be completed by 2022, according to IR.

Doubling of Tracks: Doubling of tracks will help increase safety while reducing congestion and delays. By 2016, there was approximately 15,000 km of double tracks, and financing for an additional 12,500 km for doubling tracks was approved in the same year.

Off-the-grid Solar-powered Trains: By installing 1 gigawatt of solar and 130 megawatts of wind power between 2017 and 2022, trains might be powered by off-grid solar energy. In addition to 50 coaches with rooftop solar farms, India introduced the world's first solar-powered train in June 2017. The first DEMU train from IR with solar-powered interior lighting, fans, and information display systems was introduced in July 2017.

Solar Power for Trains: The first train with rooftop solar panels began service in 2017. More and more trains will now run on renewable onboard solar power generation.

LED Illumination: All stations will have sustainable LED lighting to reduce electricity expenses.

CHAPTER VII

TECHNOLOGICAL TOOLS FOR SAFETY AND MAINTENANCE

With regard to everything from customer service to maintenance and repair work, the crew in the Indian rail network is adopting a variety of cutting-edge technological solutions to increase efficiency. The staff can better handle the entire workforce process by planning and scheduling processes in planner software, such as capacity planning, daily task scheduling, real-time rescheduling, routes, personnel availability, and competing time slots.

Reducing maintenance time is essential to maximising utilisation; cleaning and upkeep are essential and, in most situations, cannot be postponed. For instance, before using a wagon to transport gasoline, it must first be cleaned thoroughly to transport diesel.

Planners need an intelligent system that gives them complete visibility into which terminals, workers, and materials are available during the desired time intervals in order to clean the wagons effectively. They will be able to smoothen last-minute cleaning jobs and instantly respond to urgent order bookings.

The use of software platforms enables operators to observe all potential outcomes of decisions in real-time and act accordingly. In order to make customer-focused decisions and increase service reliability, it also provides train planners with a dynamic decision support tool that allows them to view all possibilities and consequences of decisions in real-time.

Safety Measures

Manned Level Crossings on the Broad Gauge Network to be Removed: The remaining 4,267 unmanned railroad crossings on broad gauge tracks will be removed with the use of funding given for FY 2017–18. The 2017 Union Budget included an announcement of a 100,000 crore (US$13 billion) "National Rail Safety Fund," which will be implemented by 2022 and help bolster railway safety. Among other changes, the scheme would help get rid of unmanned level crossings by March 2020.

Automated Fog Pilot Assistance System: By installing 6,095 devices in the four most impacted zones – Northern Railway zone, North Central Railway zone, North Eastern Railway zone, and

North Western Railway zone – in 2017, the practice of lighting firecrackers on train tracks to notify train divers was abolished.

Fire Alarm Automation System: The project to install improved automated fire alarm systems had begun as early as 2013 with the installation of these systems in Rajdhani Express trains. These systems will eventually be implemented in the AC coaches of all regular trains.

CCTV Systems at Stations: Wi-Fi and CCTV cameras will be placed on all trains and stations over time.

CHAPTER VIII

KEY FINDINGS: TECH ADOPTION FROM INTERNATIONAL SOURCES

The fourth industrial revolution, known as Railway 4.0, is what distinguishes the Railways' rapid digitalization. It can help improve train stock, signalling, and rail infrastructure while increasing the operational effectiveness of the assets.

Some of the important areas of digitalization in the rail industry are coach manufacture and design, signalling and traffic control, freight management, train services, personnel management, and customer management. Through the use of technology that engages stakeholders in cooperative partnerships, these facets of the IR are being reimagined, designed, delivered, and operated, transforming how the Railways functions.

This is being executed via the adoption of global technologies. It has aided in the identification of problem areas and the subsequent resolution of pertinent issues. In order to rejuvenate the old infrastructure, the government has collaborated with entrepreneurs and private enterprises who have helped in utilising the momentum of digital technology to usher in a holistic transformation.

Indian Railways needs to contend with a slew of challenges, from finding additional non-fare sources of income, creating wagon designs for loading new goods and commodities, improving transit efficiency, designing low-level platforms for easy accessibility, and increasing carriages' capacity to carry passengers, to enhancing stations' digital capabilities.

The collaboration of startups with the railways, however, has the potential to resolve several daily challenges that the Indian Railways faces. The policy takes into account the major constraint of capital inadequacy in the startup ecosystem, particularly in the seed and "proof of concept" developmental stage. This policy also aims to provide the necessary seed fund support to the startups showing capability, intent, and promise to produce functional prototypes, based on new innovative concepts for potential use on Indian Railways.

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SOURCES

- A 'Future Ready' Railway System : Indian Railways' National Rail Plan 2030. Details Inside - RailPost.in
- How digitalisation is transforming the Indian Railways - The Hindu BusinessLine
- How has technology changed the Indian Railways and made it better – Explained
- https://indianrailways.gov.in/railwayboard/uploads/directorate/works/pdf/2020/vision-2024-200121.pdf
- https://indianrailways.gov.in/Reform-Perform-Transform%202022_v10%20(2).pdf
- https://ink.library.smu.edu.sg/cgi/viewcontent.cgi?article=1135&context=ami
- https://www.thehindu.com/news/national/indias-fastest-gatimaan-express-inaugural-run-completes/article8437515.ece
- Indian Railways: The unfolding transformation | Business Standard News
- INDIAN RAILWAYS ANNUAL REPORT & ACCOUNTS 2020-21
- Indian Railways develops Automatic Fire and Smoke Detection System
- Indian Railways Innovation Policy: Launches Start-ups for Railways
- Indian Railways to transform through technology; get ready for world-class experience with these initiatives
- Innovation Policy for Indian Railways
- Leveraging state-of-the-art technology to improve the efficiency of India's rail network
- Made-in-India Rail safety system is here; Modi Minister oversees Kavach successful tests
- National Rail Plan Vision – 2030
- Need to rapidly absorb new technology in Railways: Ashwini Vaishnaw - The Economic Times
- New Technology in Indian Railways | HIGH RISE Pantograph | High Rise OHE | Electric Traction
- Public-Private Partnership (PPP) in Indian Railways: Models, Framework, and Policies
- Pune-Mumbai in 14 minutes: Firm's project report says Hyperloop transport system feasible - Hindustan Times
- Railway industry in India - statistics & facts | Statista
- Vande Bharat Express Train On Trial Run From Chandigarh

About ASSOCHAM

The Knowledge Architect of Corporate India

The Associated Chambers of Commerce & Industry of India (ASSOCHAM) is the country's oldest apex chamber. It brings in actionable insights to strengthen the Indian ecosystem, leveraging its network of more than 4,50,000 members, of which MSMEs represent a large segment. With a strong presence in states, and key cities globally, ASSOCHAM also has more than 400 associations, federations, and regional chambers in its fold.

Aligned with the vision of creating a New India, ASSOCHAM works as a conduit between the industry and the Government. The Chamber is an agile and forward-looking institution, leading various initiatives to enhance the global competitiveness of the Indian industry, while strengthening the domestic ecosystem.

With more than 100 national and regional sector councils, ASSOCHAM is an impactful representative of the Indian industry. These Councils are led by well-known industry leaders, academicians, economists and independent professionals. The Chamber focuses on aligning critical needs and interests of the industry with the growth aspirations of the nation.

ASSOCHAM is driving four strategic priorities – Sustainability, Empowerment, Entrepreneurship and Digitisation. The Chamber believes that affirmative action in these areas would help drive an inclusive and sustainable socio-economic growth for the country.

ASSOCHAM is working hand in hand with the government, regulators, and national and international think tanks to contribute to the policy making process and share vital feedback on implementation of decisions of far-reaching consequences. In line with its focus on being future-ready, the Chamber is building a strong network of knowledge architects. Thus, ASSOCHAM is all set to redefine the dynamics of growth and development in the technology-driven 'Knowledge-Based Economy. The Chamber aims to empower stakeholders in the Indian economy by inculcating knowledge that will be the catalyst of growth in the dynamic global environment.

The Chamber also supports civil society through citizenship programmes, to drive inclusive development. ASSOCHAM's member network leads initiatives in various segments such as empowerment, healthcare, education and skilling, hygiene, affirmative action, road safety, livelihood, life skills, sustainability, to name a few.

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