



THE ROLE OF DIGITALISATION IN TRANSFORMING INDIAN RAILWAYS

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Abstract

Indian Railways is the single largest employer in the country and the ninth largest employer in the world, with around 1.3 million people working for the company. It is made up of 18 different zones and has the fourth-largest amount of freight traffic in the world. Over 25 million people rely on the Indian Railways on a daily basis, making it an essential part of their lives. Digitalisation, as a continual cycle of physical and virtual world convergence, is linked to cyber-physical systems and is responsible for the creation and transformation of several economic sectors. The use of mechanized construction techniques in railway infrastructure upgrades, such as track laying and electrification, brings significant benefits in terms of speed, efficiency, cost-effectiveness, precision, and worker safety. The Indian Railway is making strides to grow both physically and digitally across the country. Overall, the digital transformation of the Indian Railways has the potential to unlock new avenues for industry-wide knowledge and business model innovation. By harnessing the power of data, advanced analytics, and smart technologies, the railways can optimize operations, enhance customer experiences, and drive growth and sustainability in the sector.

Key Words: *Digitisation, Indian Railways, Transformation, Safety, Efficiency Etc..*

Introduction

Indian Railways operates the fourth-largest rail grid in the world, coming in behind train networks of the United States, Russia, and China. Until March 31, 2022, the railways has around 7,325 stations spread out across their 68,103-kilometer route and approximately 128,305 kilometres of total track. Indian Railways is the single largest employer in the country and the ninth largest employer in the world, with around 1.3 million people working for the company. It is made up of 18 different zones and has the fourth-largest amount of freight traffic in the world. Over 25 million people rely on the Indian Railways on a daily basis, making it an essential part of their lives. One of the primary aims for expanding the world's transport system is to create an innovative environment and user-friendly mobility system. It is acknowledged that rail mobility is crucial to this process. A modernization of previous business strategies and practises utilised by rail operators is required in light of the dramatic changes in the business environment brought about by ICT technology. In today's market, developing rail transport calls for a thorough understanding of digital transformation. Digitalisation, as a continual cycle of physical and virtual world convergence, is linked to cyber-physical systems and is responsible for the creation and transformation of several economic sectors. The primary technologies and solutions that have accelerated digital transformation in the railway industry include the Internet of Things, cloud computing, advanced and extensive data analytics, mechanisation, intelligent machines, and automation.

Focus areas of digitization practices in indian railways

1.Safety Enhancements

Train operations can be made safer by using technology to identify defects in the tracks, perform remote monitoring of the tracks, digitise and automate track maintenance, and improve fundamental procedures such as welding and grinding. Errors can be minimised and the damage caused by accidents lessened if improvements are made in areas such as signalling and communication systems, the crash safety of rolling stock, and the monitoring of human activities.



2. Infrastructure Upgradation

The use of mechanized construction techniques in railway infrastructure upgrades, such as track laying and electrification, brings significant benefits in terms of speed, efficiency, cost-effectiveness, precision, and worker safety. It plays a crucial role in meeting the growing demands of the industry and ensuring the timely and efficient development of railway infrastructure.

3. Improving The Efficiency Of Train Operations

The reliability of assets, their level of utilisation, and the amount of productive effort put in by employees are the best indicators of how efficiently railway operations are managed. The use of sensors for condition monitoring and data-driven predictive maintenance are both examples of how technology may assist in making assets more reliable. It is possible for decision support systems to play a significant part in increasing asset utilisation and the productivity of workers.

4. Passenger comfort improvement

The experience of the passenger is established at each step of the journey, beginning from the planning of the trip and purchasing of the ticket and continuing through the travel to the train station, the arrival at the station, and the ride on the train itself. Each phase of the encounter is susceptible to being influenced by technology. The seamless availability of information for planning, omnichannel ticket purchase, smart railway stations, value-added services such as Wi-Fi and infotainment, and accurate train tracking based on GPS are just a few examples of how technology may improve the experience of passengers travelling by train.

5. Improvement of Organisational Capabilities

Through efficient training programmes and decision-making support, technology can have a significant impact on an organization's competence. Training has undergone a revolution thanks to the development of virtual reality (VR) and gamification, which can replicate real-life situations. Many different industries have made substantial use of IT dashboards and management information systems to facilitate data-driven decision-making.

Digitization practices pursued by indian railways

The Indian Railway is making strides to grow both physically and digitally across the country. At the moment, the primary objective of Indian Railways is to develop a mobility system that is favorable to passengers, which necessitates the use of digital technology. In the past, the Minister of Railways has acknowledged that more improvements to the railways are achievable with the use of technology advancements. Since then, there has been a significant increase in demand for digital technology inside Indian Railways. The following are some of the ways that digitization has impacted the Indian Railways.

1. Real-time train information system

The Real-Time Train Information System (RTIS) is a collaborative effort between Indian Railways and the Indian Space Research Organisation (ISRO) to leverage technology for the modernization of the railway system in India. The primary objective of RTIS is to provide real-time train information to passengers and automate various processes to enhance the overall functioning of the railway network.

One of the key features of RTIS is the provision of real-time train tracking and location updates. This enables passengers to track the exact position and movement of their trains, reducing uncertainties and improving convenience. The system uses GPS (Global Positioning System) and GAGAN (GPS Aided GEO Augmented Navigation) technology to accurately track the trains.

With real-time train information available, passengers can plan their journeys better, make informed decisions, and avoid unnecessary waiting at stations. It also helps them stay updated about any delays or changes in train schedules. This feature significantly enhances the passenger experience and makes train travel more efficient. RTIS also benefits the railway authorities and personnel by automating various operational processes. It provides centralized control and monitoring of trains, enabling officials to efficiently manage train operations and optimize resource allocation. The system helps in detecting and resolving issues promptly, such as signal failures, track obstructions, or maintenance requirements.

Additionally, RTIS enhances safety and security by enabling authorities to monitor train movements continuously. It facilitates quick response during emergencies and helps in coordinating rescue operations effectively.

2.Improved customer experience

Digitization has played a significant role in improving the customer experience with Indian Railways.

Below are some examples of how digitization has enhanced the customer experience:

- ✓ **PNR Status:** Passengers can now conveniently check the Passenger Name Record (PNR) status online from the comfort of their homes. They can obtain information about their booking status, seat allocation, and other relevant details, eliminating the need to visit a railway station or make phone inquiries.
- ✓ **Emergency Talk-Back System:** Indian Railways has introduced emergency talk-back systems in trains to enhance passenger safety. These systems allow passengers to communicate directly with the train crew in case of emergencies or any urgent assistance requirements.
- ✓ **Automatic Step Control:** To improve passenger safety while boarding and deboarding the trains, automatic step control mechanisms have been implemented. These systems ensure that the steps align properly with the platform, reducing the risk of accidents and making it easier for passengers, particularly those with mobility challenges.
- ✓ **WiFi Infotainment System:** Indian Railways has started providing WiFi connectivity in select trains, offering passengers access to the internet during their journey. This enables them to stay connected, browse the web, check emails, and access various online services. Additionally, some trains are equipped with infotainment systems that provide entertainment content such as movies, music, and TV shows.

These initiatives highlight the efforts of Indian Railways to leverage digitization and technology to enhance the overall customer experience. By providing easy access to information, improving safety measures, and offering connectivity and entertainment options, Indian Railways aims to make train travel more convenient, comfortable, and enjoyable for passengers.

2. Digilockers

Digilockers represent one of the most fruitful endeavors of digital transformation undertaken by the Indian Railways, and their presence can be seen all over the country. The customer can conveniently keep their luggage while traveling with the assistance of the digilockers, which only require the user to provide some basic information. After being introduced on the Central railway, digilockers quickly became a passenger favorite, which contributed to the concept's rise in popularity overall.

4. Common service centre (CSC) kiosks

The initiative to set up Common Service Centre (CSC) kiosks by PSU-RailTel in over 200 stations nationwide is aimed at providing convenient access to various services for railway passengers,

especially in rural areas. CSCs are a part of the Digital India program, which aims to transform India into a digitally empowered society.

Once these CSC kiosks are implemented, passengers will have the ability to avail themselves of several services, including booking different types of travel tickets, paying electricity bills, and recharging their mobile phones. These kiosks will serve as multi-purpose centers, offering a range of digital services to enhance convenience for passengers.

The emphasis on setting up these CSC kiosks in rural areas highlights the intent to bridge the digital divide and provide essential services to rural populations. By bringing these services to railway stations in rural areas, the initiative aims to enable easy access to ticket bookings and other essential digital services for the rural population, who may have limited access to such facilities in their local areas.

Overall, the introduction of CSC kiosks in railway stations aligns with the government's vision of making digital services easily accessible to citizens, promoting digital inclusion, and improving the overall customer experience for railway passengers, particularly in rural areas.

5. User Depot Module

The User Depot Module (UDM) developed by the Center for Railway Information Systems (CRIS) aims to digitize the railway supply chain and streamline its operations. By transforming manual processes into digital workflows, the UDM facilitates online information exchange, real-time transactions, and brings efficiency to the supply chain.

The implementation of UDM enables various stakeholders involved in the railway supply chain, such as suppliers, vendors, and depots, to access a centralized digital platform. This platform facilitates seamless communication, data sharing, and transaction management, eliminating the need for paper-based processes and reducing manual errors. With the UDM, stakeholders can exchange information and track real-time data related to the supply chain. This includes details about inventory, procurement, delivery schedules, and asset management. By digitizing these processes, the UDM improves transparency, accountability, and overall efficiency in managing the supply chain.

Additionally, the UDM's asset management capabilities help in tracking and maintaining railway assets, such as locomotives, rolling stock, and other equipment. This digital system enables better monitoring, maintenance planning, and utilization of these assets, ultimately leading to improved operational performance. By leveraging digital technologies and facilitating online information exchange and real-time transactions, the UDM plays a crucial role in modernizing and optimizing the railway supply chain. It enhances transparency, efficiency, and asset management, leading to improved overall performance and customer satisfaction in railway operations.

6. Unreserved Ticketing System

The Unreserved Ticketing System (UTS) is a digital initiative by Indian Railways aimed at making the process of purchasing unreserved tickets more convenient and efficient for passengers. UTS combines the Modern Train Control System (MTCS) and Long Term Evolution (LTE) based Mobile Train Radio Communication (MTRC) to enable the automatic availability of unreserved tickets to passengers at their respective stations.

Traditionally, passengers had to physically stand in long queues at railway stations to purchase unreserved tickets. With the introduction of UTS, passengers can now use their smartphones or dedicated UTS counters at stations to purchase unreserved tickets digitally.

The integration of MTCS and MTRC allows for real-time information exchange between trains and stations, enabling the automatic availability of unreserved tickets at the respective stations. Passengers can use their smartphones to book tickets through the UTS app or at dedicated UTS counters, reducing the need for physical tickets and long queues.

This digital transformation in the ticketing process brings several benefits. It enhances convenience for passengers by reducing waiting times and simplifying the ticket purchase process. It also improves the overall efficiency of ticketing operations for Indian Railways, leading to enhanced revenue generation.

By leveraging technology and enabling digital ticketing for unreserved passengers, UTS aims to streamline operations, reduce manual processes, and enhance the overall customer experience. This initiative aligns with the broader digital transformation efforts of Indian Railways to leverage technology for efficient and user-friendly services.

7. Rolling stock

The use of platform-based 3D technology in the manufacturing of railway coaches by Indian Railways is indeed a notable development. This technology allows manufacturers to create virtual models of the coaches, simulate their performance, analyze various aspects, and make improvements if necessary. By employing 3D printing technology, Indian Railways can produce different components of railway coaches as required. This approach aligns with the "Make in India" initiative, which aims to boost domestic manufacturing capabilities and reduce dependency on imports. 3D printing enables customized and on-demand manufacturing of specific coach components, reducing the cost and time associated with traditional manufacturing methods.

The advantages of utilizing 3D technology in the manufacturing process include:

Virtual Modeling: 3D technology enables manufacturers to create accurate virtual models of the railway coaches, allowing for detailed analysis and visualization.

Simulation and Analysis: Virtual simulations can be performed on the 3D models to evaluate the performance, structural integrity, and other critical aspects of the coaches. This helps in identifying and rectifying potential issues before the physical manufacturing process begins.

Cost Reduction: By employing 3D printers for manufacturing specific components, Indian Railways can potentially reduce costs associated with tooling, mold development, and material wastage.

Customization and Flexibility: 3D printing enables the production of customized components tailored to specific requirements. This flexibility allows for rapid prototyping, design iterations, and adjustments as needed.

Overall, the use of platform-based 3D technology in the manufacturing of railway coaches by Indian Railways showcases the application of advanced manufacturing techniques to improve efficiency, reduce costs, and promote domestic manufacturing capabilities.

8. Advanced signaling

The European Train Control System (ETCS) is indeed a widely adopted advanced signaling and control system used in electrified routes. ETCS provides real-time information about various parameters, including the train's speed limit, which is compared with the actual speed of the train. This comparison allows for better monitoring and control, ultimately enhancing the punctuality and safety of train operations.

By implementing ETCS, railway operators can ensure that trains operate within the designated speed limits, reducing the risk of accidents and improving overall efficiency. The system continuously communicates with the train and provides speed-related information, allowing the onboard systems to adjust the train's speed accordingly.

In addition to the adoption of ETCS, the government's plan to use Building Information Modelling (BIM) to modernize over 8,000 railway stations with railway signaling systems is a significant step toward improving infrastructure and data communication.

BIM is a digital modeling approach that enables the creation, management, and sharing of accurate information about a building or infrastructure project throughout its lifecycle. By applying BIM to railway stations, data communication between various stakeholders, such as designers, contractors, and operators, can be improved. This enhanced communication facilitates quicker problem-solving and decision-making processes, leading to more efficient station modernization.

Overall, the integration of ETCS for advanced electrified route signaling and the adoption of BIM for modernizing railway stations demonstrate the Indian government's efforts to leverage advanced technologies and data-driven approaches to enhance the efficiency, safety, and overall infrastructure of the railway system.

9. Hrms employee mobile APP

The HRMS Employee Mobile App (HEMA) available on the Google Play Store is designed to provide various benefits to the employees of Indian Railways. This app enables railway employees to access different services and conveniently contact relevant authorities for assistance. With over 1.3 million employees in the Indian Railways, HEMA serves as a digital platform to streamline employee-related services and facilitate communication.

Some of the features and benefits of the app may include:

Access to Services: HEMA allows employees to access a range of services related to their employment, such as viewing salary details, checking leave balances, and accessing attendance records. This enables employees to conveniently manage their work-related information through a mobile app.

Contacting Authorities: The app provides a means for employees to connect with relevant authorities or departments within the Indian Railways. This can include reaching out to supervisors, reporting issues, seeking guidance, or requesting assistance.

Information Exchange: HEMA may facilitate the exchange of important updates, circulars, and notifications between the railway administration and employees. This ensures that employees stay informed about the latest developments, policies, and announcements relevant to their work.

Employee Welfare: The app may also cater to employee welfare by offering access to resources, such as health-related information, employee benefits, and support services. It can serve as a platform to disseminate employee-centric information and initiatives.

By providing a mobile app specifically designed for railway employees, the Indian Railways aims to enhance convenience, improve communication, and facilitate access to important services and information. HEMA enables employees to have easy access to their work-related details and connect with relevant authorities, contributing to a more efficient and employee-friendly work environment.

10. E-catering services

By permitting digital transactions for the purchase of food goods through catering facilities located at train stations, the Indian Railways is taking steps to promote the Digital India project. Passengers will have more options for purchasing food that are both easy and do not require cash due to the 8,878 static units that will be equipped with digital payment facilities. At catering units, portable point-of-sale (PoS) machines are being made available in order to foster an atmosphere of openness and accountability and to respond to customers' claims of being overcharged. These machines will print out bills and invoices that contain all of the relevant information on the transactions that have been carried out.

In addition to the on-station facilities, Indian Railways has also introduced E-Catering Services to expand the range of food options available to passengers on trains. These services are managed by the Indian Railway Catering and Tourism Corporation (IRCTC). Passengers can pre-order meals of their choice either at the time of booking their e-ticket or while traveling on the train.

The E-Catering service is currently available at 310 railway stations through 1,755 service providers and 14 food aggregators. They supply an average of 41,844 meals per day, offering passengers a wide variety of choices and ensuring their culinary preferences are met during their train journeys.

Conclusion

By implementing these advancements, the Indian Railways aims to enhance its functional implementation, streamline processes, and ultimately improve customer satisfaction. The long-term goal of the railways is to continue embracing innovative technologies and best practices to provide a seamless and enjoyable travel experience for passengers while meeting global standards. Overall, the digital transformation of the Indian Railways has the potential to unlock new avenues for industry-wide knowledge and business model innovation. By harnessing the power of data, advanced analytics, and smart technologies, the railways can optimize operations, enhance customer experiences, and drive growth and sustainability in the sector.

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