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Transformation of Indian Railways

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ABSTRACT
The operation of rail services has come a long way since the first train was introduced. Railway is the preferred mode of transport for more than 70% of the population. As times have changed, train operations and services have evolved to be more customer-centric. Train management, ticketing and availability of services are now being improved to meet the needs of large customers. As the population increases, the need for railways increases, especially in countries like India where the expansion and development of railways is necessary.
In the context of India, existing railways appear insignificant, with many shortcomings in service and attention. ICT (Information and Communication Technologies) will be used more even though the technology is integrated into the system. Keywords: Indian Railways, Information and Communication Technology, IRCTC.

I. INTRODUCTION

Indian Railways plays an important role in the life of India. It was founded 165 years ago on April 16, 1853 and is headquartered in New Delhi. It is a multi-scale, multi-trip campaign spanning 115,000 kilometres with 8,613 stations nationwide. It stretches from Kanyakumari in the south to Baramulla in the north and from Okha in the west to Dibrugarh in the east. With over 1.3 million employees, it is one of the largest employers in India's corporate sector.

To facilitate its management, Indian Railways is divided into 17 districts and 68 departments. Each district is headed by a Director General (GM) and each department is managed by a Department of Justice (DRM) assisted by two Assistant Judges. Fair Rail Manager (ADRM). Indian Railways has 67,368 km. (Y.B.2016-17). It serves 22.24 million passengers by serving 13,329 passengers daily. Likewise, it carries 3.04 tons of cargo with 9,221 trucks per day.

Railroads started using minicomputers in the 60s, and in 1985 our private coaches became fully computerized. I remember when the bank started using computers in the 1990s. According to the Vision 2020 proposed by the Ministry of Railways of India, the focus is on development, environmental sustainability, expansion of railways, capacity building, safety of railways, reduction of carbon footprint, introduction of high-speed trains and efficient technology. . There's a lot of competition. United States, China etc. aims to develop a world-class railway infrastructure in countries.

TECHNOLOGY IN INDIAN RAILWAY

Information technology has begun to serve people by simplifying problems that were frustrating some time ago. It redefines the behaviour of people, families, communities, businesses and governments by providing fast and accurate services, mobile communication, rapid decision making, the use of the best resources, efficient engineering and additional services. Beginning with Indian Railways, with the establishment of CRIS in 1986, hardware and software were developed and implemented to take advantage of knowledge engineering. It revolutionized problem solving 25 years ago. Does it meet the expectations of the new generation looking for honest, fast, reliable offline internet service?

IT PROJECTS WHICH HAVE BEEN CARRIED OUT AND BENEFITING INDIAN RAILWAYS

No bus tickets: UTS began testing on Northern Railroads in 2002 and now has almost 6,000 seats and manages 90% of all ticket sales each day. This

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not only facilitates the availability of tickets to change SPTM at any time, but also facilitates the management of unsaved travel information.

Passenger Reservation System: Launched in 1988-89, the Passenger Reservation System (PRS) helped facilitate the travel of Indian Railways. PRS provides reservation services to approximately 2.2 million passengers on more than 2,500 trains nationwide every day.

The PRS CONCERT (National Computerized Advanced Reservation and Ticketing Network) application is the world's largest online reservation application developed and managed by CRIS. The fact that there are 44 quotas, 8 trains, 9 classes, 162 available and 127 instructors makes the system very difficult and makes it proud that CRIS manages the system well.

Control Center Automation: Monitor and analyse train movements of Indian Railways through control centres located in all sectors. The drawing of the train in motion has been made with coloured pencils and scale, showing time, distance, etc. not calculated manually. When automated, the controller only provides the time between stopping and image completion.

All performance parameters including punctuality, average speed, **GTKM, NTKM and PKM** are calculated instantly.

Freight Operations Information System: Indian Railways handles more than 1.1 billion metric tons of cargo every year with around 5000 trucks per day. The Freight Operations Information System (FOIS) is the first project undertaken by CRIS.

In fact, the creation of CRIS was a result of that effort in the mid-'80s. FOIS was originally designed to track and monitor the movement of wagons, locomotives and unit trains. It is now a complete management of freight trains that also work to pay and collect income.

Integrated transport management system: Approximately 50,000 passengers are lined up. ICMS makes training routine very easy and all disruptions affecting training performance are quickly calculated, facilitating improvement strategies.

National Train Inquiry System: NTES integrates with ICMS to interact with passengers and communicate important information to passengers such as current operations, timetables, departures and arrivals, and more. This gives passengers online access to train timetables and avoid wasting time waiting at late stations.

Crew management system: consists of train crew, locomotive driver, locomotive co-driver and guards. Staff oversee train operation from station A to station B and return for transfer trains with a transfer from one location to another. CMS helps to manage all the information of the system by entering records and all information with a click of a mouse.

This includes an extensive network of 10-15 local employees for each Regional Railways.

Software-Assisted Training School: No information technology can operate effectively unless users are trained to store and use assets.

SOME TECHNOLOGICAL ADVANCEMENTS CARRIED OUT BY INDIAN RAILWAYS

Over the years, Indian Railways has made many developments such as:

Electronic Ticketing: Indian Railways launched an online ticketing platform in 2002 to make ticket booking easier and more convenient for passengers.

GPS-enabled trains: Indian Railways equips some trains with GPS tracking devices, allowing passengers to track the exact location of the train and know the estimated time and departure time.

Bio-Toilet: To ensure cleanliness and hygiene in trains, Indian Railways introduced the Bio-toilet in every car, which uses anaerobic bacteria to separate human waste into water and oil.

Train Collision Avoidance System (TCAS): Indian Railways developed the TCAS system that aims to avoid train collisions by providing train operators with real-time information about the location and speed of other trains on the same route.

High-speed trains: Indian Railways launched high-speed trains such as Gateman Express, which can reach 160 km / h.

Mobile App: Indian Railways has launched a mobile app called 'IRCTC Rail Connect' where passengers can book tickets, check PNR status and access various services related to their journey routes.

Solar Power: Indian Railways has started operating some of its trains and stations using energy efficient and environmentally friendly solar energy.

Train Wi-Fi: Indian Railways has installed Wi-Fi facilities on some of its trains and stations to allow passengers to access the internet and stay connected while traveling.

These technological advances have not only made rail travel in India easier and more comfortable, but have also improved the overall efficiency and safety of railways.

SOME OF THE RECENT INNOVATIONS IN INDIAN RAILWAYS

A. Safety First

- High speed rail utilization increased from 2926km in 2013-14 to 4505km in 2017-18.

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- The number of train crashes, which was 118 in 2013-14, decreased by 62 percent to 73 in 2017-18.
- A complete change in the design of LHB (Linke Hofmann Busch) safety buses.
- Rashtriya Rail SanrakshaKosh (RRSK) has set a safety budget of Rs 1 trillion, of which Rs 16,000 has been paid.
- Pedestrian bridges (FOB) are now considered a safe product. FOBs installed increased from 23 per year in 2009-14 to 74 in 2014-18

Table 2: Effect of Technology Advancement

Technical Innovation	Freight	Passenger
High Speed Rail	Reduces freight/passenger congestion when new HSR tracks are built	Reduced weight, better aerodynamics: speed increase from 200 to 350 km/h.
Information Technology	Cargo management vastly improved. Costing systems permit better pricing. Digital Communication. Automatic equipment identification (AEI).	Efficient ticketing and reservations. Digital communications. Permits revenue maximization.
Inter modal	Rails fully participate in containerization trends.	Better connections to air and bus.
Energy Efficiency	US energy intensity reduced by half. AC traction on diesel locomotives.	AC traction, solid state controls. Shinhansen energy intensity cut by half.
Heavy Haul/ Better Infrast.	Higher axel loads, longer trains, larger locomotives, rail metallurgy. US operating cost/ tone-km reduced by 59$ 1978 to 2007	Continuous welded rail reduces maintenance and energy.
Signaling	Higher traffic density and improved safety accident rates down by 2/3.	Improved capacity and safety, especially with mixed freight and passenger traffic.

- Infrared collaborated with Army to set up 3 FOBs at Elphinstone Road-Parel, Curry Road and Ambivali in Mumbai
- All stations and trains All have CCTV and video surveillance systems installed.
- Construction of overpasses, underbridges and railways is at an all-time high with an average annual construction rate of 3x. It increased from 415 per year in 2004-14 to 1220 per year in 2014-18.
- UMLC (Unmanned Level Crossing) accidents fell from 47 in 2013-14 to 10, down 79% in 2017-18
- 5,479 UMLC removed in the last 4 years (2014-18)
- All UMLCs Wide gauge , 17 regions removed in stage 4. The combined 11,545 route KM of the West Central Railroad, Central Railroad, East Railroad and South East Central Railroad are now UMLC-free.

B. Jump in capital expenditure

- Average annual capital expenditure in 2014-19 was more than double the average for 2009-14. This is 2.

Capacity as Rs 30 trillion

C. Capacity Enhancement

- In 2009-14 compared to Rs 5.29 trillion in 2014-19 – Faster commissioning of railway lines. Average commissioning speed of new/double/third and fourth pipelines increased by 59% from 4.1km (from 2009-14 to 6km).
- 53 km per day (2014-18).

D. Act East Policy

- The entire network in the North East has been converted to Broad Gauge.
- One of the highest bridges in the world, Jiribam-Imphal project is being built on new line
- railway connecting Meghalaya (Dudhnoi-Mendipathar), Tripura
- (Kumarghat-Agartala) and Mizoram (KathakalBhairabi). In addition to this, the new 1397 km project costing Rs 51,428 is underway.

E. High-speed train

in India - Shinkansen technology will reach zero deaths in 50 years with slow trains in less than a minute.
- Travel time reduced from approximately 12 hours to 8 hours.

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- Japan Agency for International Cooperation (JICA) has signed an agreement with the Government of India to provide a development aid (ODA) loan of 10,453 billion yen (approximately INR 6 billion) to build the first learning center. Barrow, Gujarat Institute for Mumbai-Ahmedabad High Speed Rail Project. For example, ODA loan conditions are very good.
to. The interest rate for both operational and advisory services is 0.1%, with a payback period of 50 years (15 years grace period). The organization will help improve the quality and safety of MAHSR in India. The organization is developed to train efficient employees with advanced knowledge of high-speed railways and their management.
It will provide direct and indirect job opportunities.

F. Made in India
- Electric Locomotive Factory established in Madhepura (Bihar) and has recently produced 12000 hp Electric Locomotives.
- Warehouses in Nagpur (Maharashtra) and Saharapur (Uttar Pradesh) are under construction and will be used for maintenance and repair of locomotives.
- A factory for the production of Diesel Electric Multiple Unit (DEMU) rakes was established in Haldia.
- Production of wagons for suburban and metro trains will be held in La Tour, Marathwada.
- LHB transport refurbishment facility approved in Lumding, Assam - Transport construction planned in Jhansi, Benderkhand and Sonepat, Haryana.

G. Station Improvements
- As of March 2019, 68 stations will be upgraded - 60 stations will be decorated with local visuals.
- Plans to rebuild Habibganj Station in Madhya Pradesh and Gandhinagar Station in Gujarat by December 2018
- Install 100% LED lights in all railway stations
- Matungaas the first female railway station wagon.

H. Coach Upgrade
- In March 2019, the interior of 5,000 wagons will be upgraded, including mail/passenger trains. - The first local train to enter service this year is
- Tejas, Antyodaya and Humsafar trains are operational
- The double-decker UDAY (Utkrisht Double Decker Air-conditioning Yatri) rake service is already in use. - Show DeenDayalu and Anubhuti teacher with modern features.
- The "Vistadome" glass carts are open from some angles so that the tourists can enjoy the beautiful scenery.

I. Catering
- 16 central kitchens were renovated in 201718.
-
Use artificial intelligence to monitor food in the kit chen to improve quality and hygiene
-
Ecatering has been launched at 314 locations and is planned to be added to 100 more locations. Over 7, 000 meals a day on-
demand food service launched on trains
- 32 Rajdhani, Shatabdi, Duronto and Gatiman.
- 1,689 vending machines installed in 600 locations
-
488 locations integrated mechanized cleaning prov ided
-
Mechanized cleaning will be carried out in all subu rbs and large locations until March 2019
-
Mechanized laundry will be installed 3216 linen q uality:18 and 26 years 2009-
14 December 2019 100% mechanized laundry to i mprove the quality of laundry equipment in
- Vacuum biospaces such as airplanes are tested.
-
Installation of affordable tissue cleaning equipmen t at major stations in December 2018.
-
Orbital automatic dredgers started in Delhi. It is als o planned to be launched in India.
-
Pay contractors separately based on measurements provided by passengers

SOME TECHNOLOGICAL ADVANCEMENTS THAT SHOULD BE INCORPORATED TO INDIAN RAILWAYS TO MAKE THEM WORLD CLASS
This is to identify technological solutions and best practices used by railways around the world to understand how Indian Railways can improve the

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performance of their business. Here are some key insights and recommendations in these areas:

1. Enhance security. Four agreements aimed at achieving zero deaths:

a. For rail-related problems, B-scan ultrasonic line trouble detection (non-stop and stop-and-control systems) and line inspection of high-speed trains are introduced.

b. For related responses, invest in European Train Control System (ETCS) Level 2 for high-speed systems to increase network capacity and maintain required safety standards.

c. Degrees Celsius for rolling stock, rapid transfer of passengers to Linke Hofmann Busch (LHB) buses to minimize fatalities. D.

d. Enhanced personnel monitoring with video surveillance installed inside and outside the train to improve surveillance.

2. Housing reform. Our recommendations can lead to faster, more robust development:

a. Do business with pavers to learn about construction technology.

b. Increase in the cost of electricity from systems such as electric self-propelled electric trains (SPOLT).

c. Degrees Celsius Prefab houses are widely used.

3.Train work efficiency. Four recommendations to improve value and use:

a. Investing in technologies such as full-car scanners to improve diagnosis and treatment.

b. Feather uses advanced technology to control and improve the performance of trains, harrows, locomotives and workers.

c. Reduce reliance on labour-intensive processes by digitizing processes to increase efficiency and reduce costs.

d. Days to use power distribution to improve train operation and speed up and reduce coordination.

4. Passenger experience improvement.

Heal the passengers. Improving passenger traffic is essential to retain passengers from Indian Railways.Create a smart train station using control at the entrance, provide accurate information at the right time and provide interactive communication.Improve the ticketing experience with seamless cross-platform integration and open-loop smart cards.

5. Build institutional capacity.

Two recommendations to increase capacity and improve regulatory reporting:

a. Develop people's abilities with training simulators and virtual reality training.

b. Feathers Improves Decision Making by Improving Management Information Using Management Reporting Dashboards. The implementation of these technological solutions is essential for

Indian Railways to become the global standard in rail operations.

But choosing and using technology and achieving the best business results will require new production models.

INDAIN RAILWAY OPERATE ON 110V

The decision to use 110V DC is primarily for the safety of railway workers working around the tracks, as low voltage reduces the risk of electric shock. Also, the use of 110V DC has the advantages of low voltage, reduced installation and maintenance, and enough to power the electric train.

EVOLUTION OF TOILET SYSTEM IN INDIAN RAILWAYS

Previously, Indian Railways used CDTS (Controlled Evacuation Toilet System) toilets, but they had many disadvantages. The CDTS toilet is essentially a tank with waste stored in tanks under the train. When the train arrives at its destination, waste, which is a serious problem for health and the environment, is released on the road. In addition, the storage tank has to be disposed of personally, which is time-consuming and unpleasant for railway workers.

To overcome these shortcomings, Indian Railways began switching from CDTS toilets to bio-toilet toilets in 2011.

Bio-toilets are advanced devices that use anaerobic digestion to process waste and turn it into biogas and water. Biogas is used as a fuel in many applications, including electricity, heating and cooking, while treated water is released into the cycle after meeting environmental standards.

Switching to bio-toilets has many advantages, for example:

• **Better hygiene:** Bio-toilets are more hygienic than CDTS toilets because they do not release waste directly onto the road and reduce health risks for rail and rail workers. dangerous workers folk.

• **Environmental Sustainability:** Bio-toilets are environmentally friendly as they reduce pollution from untreated waste released into the world. Biogas produced during processing is a renewable energy source that reduces dependence on fossil fuels.

• **Cost Savings:** Bio-toilets reduce maintenance costs associated with CDTS toilets that require cleaning and removal from the tank.

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REPLACING SCREW COUPLING WITH CBC COUPLING

Indian Railways is gradually replacing the traditional spiral coupler with the Center Buffer Coupler (CBC) system, also known as the Center Pivot Coupler (CPC) system. The main reasons for this change are:

• **Safety:** The CBC system is a more stable and reliable system as it provides better shock and reduces the drop and the risk of collision due to link failure.

• **Interoperability:** The CBC system is used by several other countries and is considered an international standard. Therefore, the transition to the CBC system will help Indian Railways to cooperate with other railways both at home and abroad.

• **Ease of Operation:** CBC systems are easier to operate and maintain than traditional systems.Also, connecting and disconnecting wagons is faster, which reduces the turnaround time of trains.

• **Cost savings:** CBC systems reduce wear and tear on rolling stock and rail systems, resulting in savings in maintenance and replacement costs.

• **Load Capacity:** The CBC system has a higher load capacity than the helical link and allows for heavier and longer trains.Therefore, Indian Railways is phasing out the traditional spiral coupler system and promoting the use of the Center Buffer Coupler (CBC) system. The transition to the CBC system will improve the safety and efficiency of railways and help Indian Railways interact with other railways around the world

REMOVAL OF SIDE BUFFERS

The side bumper or "buckeye coupler" was a fastening system used in Indian Railways until the 1990s, however, Indian Railways gradually moved away from the side bumpers and replaced them with the Central Bumper Connector (CBC) system.

The reasons for this change are mainly security related. The side bumper coupler can easily derail in an accident, causing serious damage to the carrier and injuring occupants. Side bumper couplers also have a higher probability of disengagement, which can slow down and reduce train performance.

On the other hand, the Central Buffer Coupler (CBC) system is designed to provide better stability and safety during train operation. The CBC system has a central shaft that allows the car to turn on its own, reducing the risk of derailment in a collision. The CBC system also has greater separation protection, which reduces the risk of delays and improves the performance of the train. Another advantage of the
CBC system is that it is compatible with other international railways, which allows Indian Railways to carry trains across borders without any change.

II. CONCLUSION

The success of Indian railways is an important objective not only for the govt of India but also for the common man technology offers a unique opportunity to leapfrog the current state and move closer to best in class standards.However, the nature of the technology and product development and the complexity of the selection process make it imperative to look for new frameworks for identifying the relevant players to supply the technology Conventionally the Indian railways has used the request for proposal process to procure technologies however this has some limitations that make it difficult to acquire modern technology.

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