

Indian Railways E-Procurement Systems (IREPS)

(Group – EPS)

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I. Background & History

About the project:

IREPS provides services for E-Tender (all variants like Goods / Services / Works / Composite, Indigenous / Global, M&P tenders, Expenditure / Earning tenders etc.), E-Auction, E- Reverse Auction, Contract Tracking modules for All Indian Railways departments like Stores, Engineering, Electrical, Mechanical, Medical etc. Apart from Headquarters offices of Zonal Railways/ Production Units, services have been extended to field units of Indian Railways (Divisions, Maintenance units, Sheds, Stocking depots, workshops etc.) and other specialized units like CORE, RDSO, COFMOW etc. Other organizations like DMRC, KRCL, MRVCL, Railtel etc. are also using services available on IREPS. The system caters to a variety evaluation criteria making it more adoptable and unique e-procurement solution.

Tendering units covered are all zonal HQ, divisional HQ, all constructions units, stocking depot, maintenance units, sheds, central and divisional hospitals and workshops of entire IR.

IREPS Application has started its journey in CRIS in 2006, which was approved for its roll out in 8 Zonal railways and 05 production units only for Stores & Supply tenders. In 2008, IREPS application was launched just as a web application for e-tendering, after a decade IREPS has become a full fledged platform for e-procurement and solution for digitization of Supply chain.

The application is being used extensively and following figures demonstrate successful implementation and acceptance of the IREPS application, which makes it one of the largest e-procurement applications in India:

- Total Number of vendors/bidders/contractors registered: **1.25 Lakh**
- Total number of No. of tenders published till date : **21 Lakh+ (30,000+ per month)**
- Value of tenders published: **2.1 Lakh Crores last FY**
- Sale of Scrap till date : **18,000 crore (3500 Crore last FY)**
- Online Transaction value : **10,600 Crore (5036 Crore last FY)**
- Individual Tendering units/departments covered **2200**

Why project started:

Manual mode of procurement was inefficient, time consuming and prone to frauds. Process which was eligible for automation and can improve the efficiency and work productivity. Digitization of processes was required so that number of manpower can be decreased for new recruitment process. It was approved as a part of overall reform process in Indian Railways.

Cost estimate, sanction, O&M cost:

- IREPS – e-Tender, e-Auction, RA, CT, Project cost: Rs. 23.5 crore
- Extension of IREPS to 300 Field Units., Project Cost: Rs. 16.45 crore

- Cost Revised for extension of field units with Works tender, Project Cost: 26.98 crore
- VIMS for bill submission, LOA, Registration, LC etc - Project Cost: 24.92 crore
- IREPS O&M cost : 42.78 crore (Since 2010 to 31.05.2019)

Various Risk in the Project Life Cycle:

1. Schedule Risk-

- a. Realistic time estimation was practically not possible as original scope was defined considering all the main modules and its sub module due to non clarity on the Application development and its implementation methodology.
- b. Resources required for successful execution like staff, systems, skills of individuals etc.

2. Budget & Operational Risk

- a. Project scope expansion was unavoidable
- b. Priority Conflict and Sufficient resources allocation
- c. Changing requirements

3. Technical and implementation risks

- a. Selecting technology in initial stages
- b. Project integration, data migration
- c. Training to Railway employees and Vendors on new IT enabled system

HR - Skills: Outsource manpower and technical skills to implement features like PKI, Digital signature, encryption decryption, Sign verification, electronic tender box opening, time locking etc was a tough task. Also no such successful reference was available in this domain.

User Acceptance: All the changes was made with consultant of department and they first did trial on staging setup. After the feedback received from the user system was launched on production.

Info- security: In e-procurement application following security feature must be ensured, In IREPS all such issues are implemented since its first launch.

A. Data at Source: Authentication using DSC, PKI enable application, CRL Verification, Client end data encryption.

B. Data in transit: data transmission on SSL using 256 bit encryption

C. Data at rest: Encrypted bid data using asymmetric encryption, Firewall & IPS at network level, Time synchronization with NPL, SOD for server access and that too restricted.

D. Application level: Rule based data access, File authorization, audit trail along with IP address, passwords are hashed and login using two factor authentication mechanism.

2. Objective

Goals behind the project:

The project was designed for the purpose of extending the reach of tender invitations without boundary, resulting in improved value for money in purchase through a pan India/Global supplier community. The use of internet brings information to the attention of new suppliers. The barrier of geography is removed as all suppliers are able to register as subscribers and perform the registration, tender submission and other related activities at any time. The technology removed the limitation of physical travel to submit the tender and attend tender opening as tender opening details are made available immediately on the IREPS website.

Online finalization of tenders through processes like online preparation, digital signing and online sharing of tender committee minutes, Online Negotiation/Counter offer process, automatic generation of Letters of Acceptance, Negotiation/ Counter Offer/ TC meeting letters, Online delivery of digitally signed letters, Online tender tracking and monitoring system.

Online generation of Contracts, Modification advice, Receipt Notes, Online delivery of these to all stakeholders, Online submission of Modification advice by the suppliers. Online tracking of bills for payment submitted by the suppliers and display of the same to the suppliers and other stakeholders.

There are a large number of field units in Indian Railways, where purchases are made. So, the main goal behind the project was to ensure that any tender issued by field organizations / units is in e-mode which can be seen and responded by any bidder, situated anywhere in the country, without any problem.

Stakeholders:

- Controlling Zonal Railway HODs
- Divisional Railway Managers
- Railway's field officers and staff
- Suppliers /contractors

Benefits: The idea to introduce automation/digitization is to make the user experience as effortless as possible, by removing complexity for users both internal as well as external to understand standards and rules. The system provides solutions that have a high degree of automation of not only of procedures but also of rules and policies. While implementing the system, the existing rules and procedures were aligned with the best practices to the extent possible within the constraint of government procurement system.

Main beneficiary are organizations like Indian Railways, Delhi Metro Rail Project, Konkan Railway Corporation Limited, Mumbai Rail Vikas Corporation etc and Vendors / Contractors dealing with tenders/auctions pertaining to these organizations. Benefits can be summarized as below:

1. Empowerment of tendering department/units
2. Ease of working and transparency
3. Convenience to bidders

3. Salient Features

Most of the e procurement applications in India are limited to uploading of tender documents and submission of bids. However, IREPS provides end to end solution in the area of supply chain management which includes Demand generation, Proposals, approval workflows, tender publishing, online bids submission, online tender finalization with digital signing, Auto generated letter of acceptance, counter offer letter, negotiation letters, real-time delivery of digitally signed contracts, receipt and account of material, online bill submission by suppliers, online bill payment status to suppliers etc. in a transparent manner. IREPS is the only e-procurement applications which provide such end to end solution, no such application is known to be implemented for Government e-procurement.

3.1 Organization, Post & Profile management: Its profile management takes care of entire Indian railways department and post/designation, units, division etc. organization hierarchy has been designed in such a way that IREPS platform can be adopted by any other organization outside Railway domain.

3.2 e-Tender: Tendering process has been 100% switched to electronic mode. With tender publishing, Online bid submission, various types of evaluation criteria, and Instant availability of tabulation after online tender opening. It has option of Global tender, Reverse Auction and M&P tenders. Requirement of 'Complex Railway Board tenders' have also been provided.

3.3. e-Auction: All depots of Indian railways having offices spread across India are using the e-auction services for sale of scrap (100% e-auction). Feature includes Lot publishing, online bidding, maintaining encrypted 'Reserve price', Decryption of RP & Auto decision of Bids, preparation and signing of bid sheet, Sale Release Order, Invoice etc. Unique Lien System to accept 10% EMD from bidders.

3.4 Contract Tracking: This module provides functionality of Evaluation of technical bids, TC and Non-TC cases, technical scrutiny, letter of acceptance, negotiation, counter offer, negotiation opening, Discharge of tender, Re-tender, pass over facility. This module has been launched for Supply as well as Works tenders.

3.4 Online Payments: Through payment gateway facility of SBI, 100% online payment has been implemented in IREPS since Sep-2006. Three separate integration with SBI has been done, SBI Net banking, SBI Lien System and SBIEPay (Aggregator Module).

3.5 Online EMD refund: EMD refund can be initiated for tender which was finalized either online or manual/offline. Proposal for refund is initiated by concerned officials, Pay order is generated once it is approved in IREPS. Pay order PDF and data is shared with IPAS, IPAS takes necessary action at their end and information is updated in IREPS along with CO6 & CO7.

3.5 Online LC (Letter of Credit): Firm can opt LC option on IREPS while bidding, after that Railway executive open LC and information is shared with IPAS for further action and LC details along with LC DA PDF URL is shown to Firms.

3.6 GST Compliant: IREPS Application is one the application in CRIS which is GST compliant, GST has been implemented for Invoices of 'Balance Sale Value' in e-auction Module. All e-tendering forms have been compliant to GST.

3.7 Mobile Application: Android version of IREPS Mobile App (आपूर्ति) was launched in Sep-2018 by Minister of Railway. Before login features has been provided to search tenders, auction, user manuals, public documents etc. login feature has also been provided to vendors and Railway user with several feature to view the information and download the PDFs.

iOS version has also been launched with before login features, After login features are under development.

3.8 Online vendor registration Process: Registration process is online for registration of Vendors and bidders.

3.9 Online Web Query: For resolutions of issues faced by user.

4. Technology & Architecture

Architecture of the project and technology:

- a) J2EE based Web Application, with oracle 12C as a RDBMS
- b) PKI based Application - IREPS is first PKI based web application implemented for IR by CRIS. Innovative use of the latest technology such as PKI and digital signature certificate has helped in ensuring confidentiality and integrity of information apart from authentication and non-repudiation during the bidding process.
- c) Client Server based Architecture, Data center at CRIS HO and DR site at Secunderabad
- d) Hosting on Blade Server, **First ever blade server in CRIS was used for IREPS** to host the application in 2008.

Integration and dependence with others:

IREPS and iMMS application complement to each other and these two applications are tightly integrated with many modules to exchange the data during the e-procurement life cycle. IREPS application has been integrated within & outside CRIS with many projects and organization. Currently 15 integration is available in IREPS either completed or near completion. As per requirement of Indian Railways and its associated units, in future IREPS will become one of the critical application integrated with most of the projects which requires access to vendor master, department master, contracts, inspections, materials, bills, payments, stock position etc.

Internal Integration

- a) IREPS and iMMS is tightly integrated at DB level
- b) IPAS (using DB Links, both way data exchange)
 1. IREPS to IPAS - Vendors' online bills for payment, Pay Orders for refunds of EMD/TDC, LC opening
 2. IPAS to IMMS- Bills status for information of vendors

3. IMMS to IPAS- Contracts, Amendments and Receipt Notes for bill payment, Monthly price ledger for account current

c) SMS gateway through CMS group is integrated using web services.

External Integration

- a) With **SBI** for Online Transactions using Web Services and Server to Server communication.
- b) With **SBI** to access the e-scroll files (transactions MIS) from SFTP and uploading it into DB
- c) With **BITES** using Web Services both way data exchange for Contract details and Amendments, Inspection data and Inspection certificate (PDF)
- d) With **GeM** using Web Services both way data exchange for GeM contracts, CRAC & Bill details, Bill passing data
- e) With **W.Rly's ASRS** - Automated Storage and receipt System using Web services for Updation of receipt & issue details
- f) With **CPP** Portal using Web services, one way uploading of tenders from IREPS to CPPP
- g) **ICF** using Web services, both way data exchange for Contract and Amendment details, Demand and Stock master details
- h) Other ongoing and planned Integrations
 1. With **RWF, RCF & RDSO** using Web services
 2. **IRPSM** using DB links
 3. With **TMS** – track scrap data for e-Auction

Master data used:

Following important Master data are being used in IREPS and access to some of them like Vendor, User and Department/unit master has been provided to other projects like IPAS, IRPSM etc and they are also utilizing it.

1. Vendor Master
2. User Master
3. Post Master
4. Department/Unit Master,
5. Section Master (department's section)
6. Custom Parameters Master
7. Condition Master
8. Item Directory Master
9. Document Master
10. State Master
11. Country Master
12. Currency Master

13. Consignee Master
14. PL Master
15. DSC Master
16. CRL Master

5. Implementation Status

IREPS application was rolled out first in HQ starting from Aug 2008, Training was organized for users of all zonal HQ on training to trainers concept. A department admin from every Zonal HQ has been identified for training. User guide was made available for users, helpdesk has been setup to provide support through call and email.

Workshops cum training session were organized specially for vendors /contractors in association of zonal railways at HQ level.

Feedback also taken from discussion forums of social media and after incorporating feedback IREPS application has been extended to all field units of IR.

After Successful implementation of First phase, IREPS was approved for field units including Works tender module. This extension was rolled out in the same pattern of Training to Trainer which was very useful and currently IREPS is implemented in 2200 tendering units/departments covering entire Indian Railway.

Major milestones of rollout are mentioned below:

1. Aug-2008 : Rolled out to 8 Zonal HO and 05 PU's
2. 2009 : All Zonal Railway and 06 PU's
3. 2012: E-Auction, Global tender, reverse Auction
4. 2013: Contract Tracking
5. 2014: Extension to Depot Divisions
6. 2016- Works Tenders
7. 2017- Online tender decision system
8. 2018- Reverse auction for supply tenders and for works tenders
9. 2018 – Leasing Tenders
10. 2019 – online refund process for EMD

6. Standards Followed

a. Security Standards (Security standards followed):

IREPS application always considered security issues on top priority due to application domain (e-procurement). IREPS is the only project in CRIS which carried out Application Security Testing by STQC & obtained its closure 5 times and Vulnerability Assessment 04 times.

1. OWASP Top 10 for Application security and it is adopted by STQC also.
2. Relevant clauses of CIS (Center for Internet Security) benchmark followed by STQC during VA of EPS servers (Windows, Redhat and HP UX)

3. IT Act 2000 (relevant clauses related to Digital Signature)
4. CVC security guidelines for public procurement
5. GIGW (Under Implementation/relevant selected applicable sections)
6. ISO 27001 (Under Implementation as per scope defined by CRIS/ISG)
7. EPS application is the first application in CRIS which followed its own project level approved data centrepolicy (in 2009) and procedure for Data Center operation, even before CRIS IT policy. Since 2009 EPS group is following deployment policy, patch management, Password policy, backup policy, SOD, DC documentations etc.

b. Any other Standards followed (Development/Testing etc)

1. NIC secure code programming in Application (relevant selected clauses)

7. Roadmap Ahead

a. Technology envisaged for future

1. IREPS has started using Spring, Hibernate for development of new modules as existing IREPS application uses struts framework and struts framework is tightly coupled, less flexible, heavy weight etc.
2. R&D on Angular JS so that responsive application can be developed
3. Flutter for Mobile App so that single development framework for mobile App is implemented to avoid separate coding for Android, iOS and Windows etc.

b. Features planned for future

1. Integration with More banks/aggregators
2. All existing and planned integrations will be shifted to ESB. Data exchange using single channel i.e. all existing integration will be migrated to ESB and new integration will be through ESB only.
3. Any API exposure to external agency will be through API gateway only.

8. Learning:

1. **PKI and Client Server based Web based Application:** First in CRIS, Web based application was implemented which had two factor authentication using DSC, Hash mechanism, Encryption and decryption of data, time locking of bids, CRL, Signature verification, Audit Trail etc. In 2008 it was one of the complex applications to develop and rollout when no such successful reference was available to follow.
2. **Time Synchronization:** First time in CRIS, Indian Standard Time (IST) acquired from National Physical Laboratory (NPL, custodian of Time in India) and gets

synchronized to servers. IST time was compulsory required for e-procurement for time-stamping of bids, time lock on tender opening process and Audit trail activities. EPS Group acquired time from NPL for IREPS server and this service has been extended to all projects /application internally using NTP.

- 3. Lien Feature:** First time in CRIS, Lien Services of SBI has been integrated with any web application and SBI has also confirmed that Lien was first successful rolled out with IREPS. In Lien concept Bank account of Firm is gets mapped with user's bank account and money is blocked by user for IREPS i.e. called Marking/unmarking and user gets 10 times bidding limit. Using this method every bidder participate in Railways e-auction and once decision is taken funds gets transferred from only one bidder's account and rest are released. So there is no requirement of refund as money gets transferred only from Successful bidders.
- 4. Payment Gateway integration:** First Successful web based payment gateway implementation in CRIS, on the basis of real time response from bank with server to server verification. (It is required to mention for clarity that FOIS payment system was implemented before IREPS but it was not based on real time full fledged Payment Gateway integration on which end users can perform transactions using their credentials). It was designed and integrated in such a way that user's banking and card details are not stored at the IREPS end, which increases the overall security of the application and user's credentials.
- 5. CRL verification:** Process to download CRL (Certificate revocation list) and verification of all DSC (Digital Signature Certificate) from the revocation list is in-house developed and it is totally automated.
- 6. Secure SDLC:** During development security issues are taken care with reference to OWASP Top 10, only project in CRIS which consistently following Security best practices and periodically carried out external Audit by a Govt. of India department (STQC).
- 7. Mobile App:** IREPS Mobile App was developed in house by utilizing interns and outsource resources without any training on Android, iOS and Web services. IREPS mobile App UI is one of the best in CRIS among all App launched in CRIS.
- 8. Blade Server technology:** As IREPS was the first application which was hosted on Blade system in 2008, It was very difficult due to lack of previous reference and technical skill in such type of hardware, Network communication and firewall policy was the biggest issue which shorted out over the period of time after several rounds of R&D, discussion with CN Group and OEMs. After that EPS group's reference was very useful for other groups who opted to implement blade server for new projects and existing up-gradation.

9. Middleware Migration: Initially IREPS was launched on Broad vision application server (Middleware), due to technical issues faced in its operational and technical capabilities, It was decided that application will be migrated to Web sphere Application server. This migration was done successful by CRIS engineers.

9. Value Addition to the Indian Railways:

1. Cost, effort and time :

- a) Time & effort of Railway users has reduced substantially in tender publishing, tender opening and preparation of comparative statement, security arrangements & other preparation for conduct of auction, building and maintenance of auction halls, preparation of bid sheet for auction sale.
- b) Time and efforts of bidders has been reduced substantially for bid submission and attending tender opening process.
- c) This has resulted in direct & indirect cost savings for Railways as well as bidders
- d) Through Electronic process it saves effort of both railway user and bidder. Bidder can participate in auction from any location and no restriction of physical presence is required.

2. Efficiency of the department

- a) E-enabling of the business process has resulted in time savings which the users can utilize for other activities.
- b) Reliable information is available 24x7 which has improved speed and quality of decision making

3. Benefit to the public at large

- a) Increase overall Transparency, Global reach and time saving in entire life cycle of procurement.
- b) It has improved Railway's process transparency and reduced time for each activity. Ease availability of information.

4. To Bidders: Transparency and Trust, Reduced hassles and Entry Barriers, Ease of doing Business, Cost & Time savings , Makes it possible for the bidders to participate in more number of tenders, irrespective of distances involved ,Better Opportunities

5. To Railway's department: Reduction in Contracting Time Cycle, Increased Competition that leads to savings, Standardization / Process Control, Reduction in Complaints, High level of Automation, Better Monitoring, Ease of use and easy Access to Information.