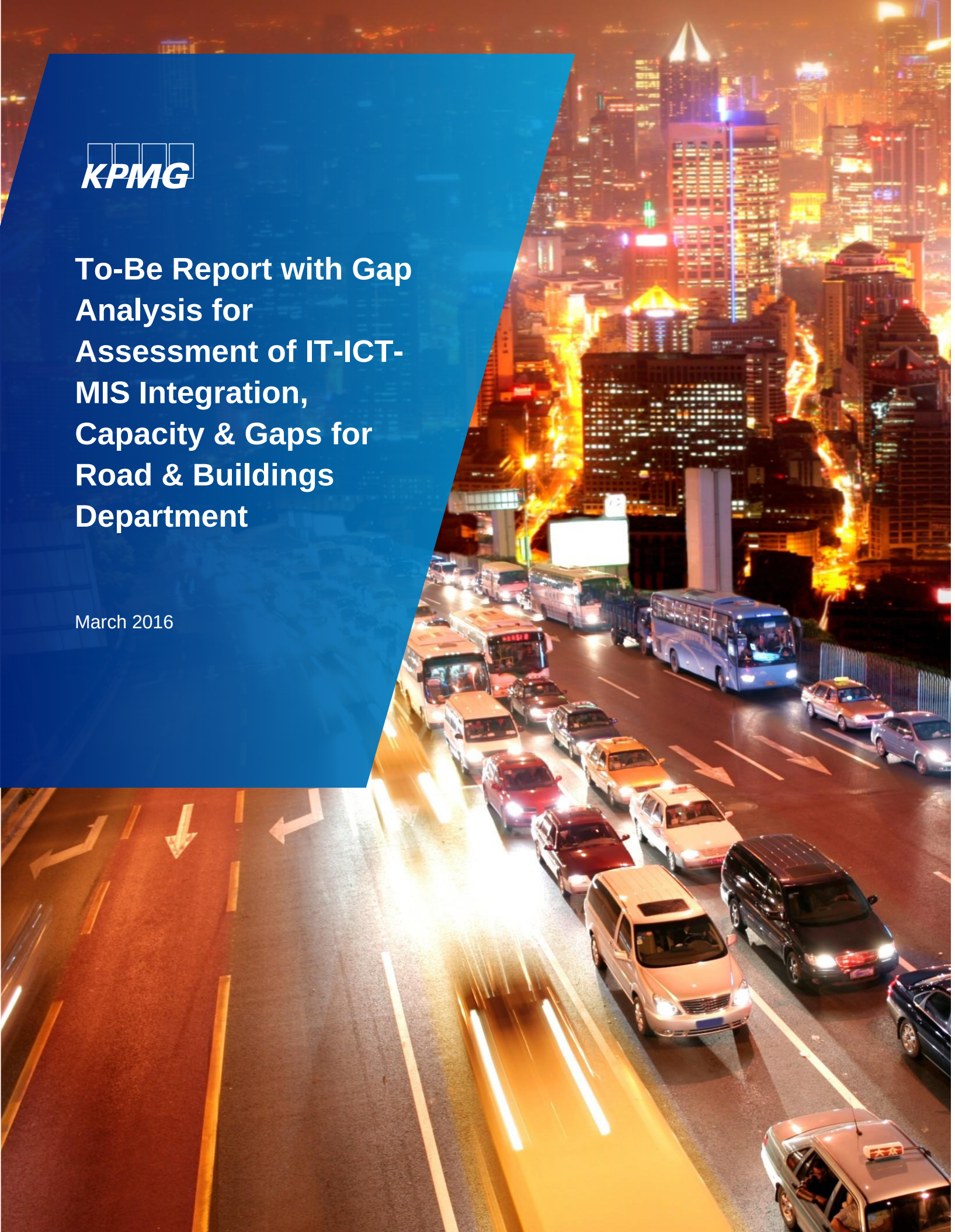

KPMG

To-Be Report with Gap Analysis for Assessment of IT-ICT-MIS Integration, Capacity & Gaps for Road & Buildings Department

March 2016

Overview	'Assessment of IT-ICT-MIS Integration, Capacity and Gaps for Road & Buildings Department' is being done for the proposed second Gujarat State Highways Project(GSHP-2) under which a new Institutional Development and Governance Enhancement (ID&GE) program is being developed. KPMG has been appointed as a consultant to carry out the assessment of existing IT infrastructure and suggest enhancements in order to integrate various software which are currently being used by the department
Document Title	To-Be Report with Gap Analysis
Document Status	Submitted for review
Abstract	This document comprises of the To-Be scenario with Gap Analysis of various IT infrastructure, software applications and operational capacity of the department

Document Publication History

Date	Author	Version	Remarks
21st July 2015	Onsite KPMG Team	1.0	Creation of draft report without cost estimates
2nd August 2015	Onsite KPMG Team	2.0	Creation of draft report including cost estimates
18th September 2015	Onsite KPMG Team	3.0	To-Be Report after incorporating comments from the department

Reviewers

Date	Reviewers	Version	Remarks
20th July 2015	Amit Saraf	1.0	
3rd August 2015	Amit Saraf	2.0	
20th September 2015	Amit Saraf	3.0	

Glossary of Terms

Abbreviation	Description
AE	Assistant Engineer
AEE	Assistant Executive Engineer
AMC	Annual Maintenance Contract
C&AG	Comptroller and Auditor General of India
CE	Chief Engineer
DPR	Detailed Project Report
EOI	Expression of Interest
GHSP	Gujarat State Highway Project
GO	Government Order
GoG	Government of Gujarat
GRMS	Gujarat Road Management System
ID&GE	Institutional Development and Governance Enhancement
ICT	Information and Communication Technology
IFMS	Integrated Financial Management System
IT	Information Technology
IWDMS	Integrated Work Document Management System
MIS	Management Information System
MORTH	Ministry of Road Transport and Highways
NeGP	National e-Governance Plan
NH	National Highway
R&BD	Roads & Building Department
SE	Superintending Engineer
SOR	Statement of Rates
SWAGAT	State Wide Attention on Grievances through Application of Technology
WMS	Work Monitoring System

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1. Executive Summary

KPMG had conducted a current state assessment of the existing IT applications and presented the findings of the same in the As-Is Report. During the assessment phase the applications were checked to see if integration is possible between them. The integration of R&BD applications is possible. The application GRMS and WMS are the most important for R&BD and they need to be technically enhanced and integrated. A new Integrated Software Application and a new app has been proposed to encompass the overall requirements of the various sections within the R&BD and integrate with the existing R&BD applications and other related Government Department applications.

It has been identified that GSWAN connectivity is technically feasible in most sub division offices. Alternate connectivity options like BSNL – Broadband, Lease Line, Wi-Max, VSATs and Private Internet Service Providers are proposed for those remote location offices where GSWAN is not feasible. A Hybrid model is proposed to enable independence from constant network availability and also as redundant option for offline data entry. As and when the network is available, data at each local server can be synchronised with the Central Server at the State Data Centre.

Adopting the application to their full potential is something which can be achieved only with dedicated change management and appropriate capacity building and creating a sense of ownership among the various stakeholders. In view of the stakeholder expectations; KPMG recommends setting up a dedicated IT Cell team which would cater to the needs of the R&BD for ICT. The Project Steering Committee headed by Secretary of the R&BD shall function as the apex unit for policy advice and strategic guidance on various project aspects. A detailed Change Management Plan is set out in this report.

The Department of Science and Technology, Government of Gujarat has allotted 1 TB space and a domain name for the Roads & Buildings Department to host the new version of the GRMS application in the State Data Centre. The new version of the GRMS application is expected to be developed in around nine months. The procurement of hardware needs to be done as per the World Bank procurement guidelines. As per the team's discussion with Gujarat Informatics Limited (GIL), there is no cost implication on

the department to host the GRMS application in the State Data Centre. Once the application is developed, a security audit is mandatory. The security audit report is required before hosting the application in the State Data Centre.

Based on the current assessment and Institutional Development Action Plan (IDAP), the following recommendations have been made:

- *Dedicated space at the data center(s) for R&BD and its supporting networks to be established within a span of two years*
- *Similarly, The lead IT cell should be operational within a span of two years which would cater to the needs of all the IT/ICT-MIS requirements of R&BD*

Currently, the integration between Works Monitoring System (WMS) and Integrated Financial Management System (IFMS) is under process.

2. Introduction

2.1. Brief about the Department

The main functions and responsibilities of R&BD are design, construction, repair and maintenance of buildings, roads, bridges and other related structures financed from the state and capital budget allocations in Gujarat.

The Department is headed by a Cabinet Minister who is a Senior Political functionary. The Administration is headed by a Secretary who is a technical person. The senior officials consists of Chief Engineers. A Financial Advisor, appointed by Finance Department, advises on financial aspects. Chief Engineers are in-charge of respective subjects like State Roads & Buildings, Panchayat Roads, National Highways, Capital Project, Expressway, Special Projects etc. The unit of Quality Control and the Engineering Staff College are looked after by separate Chief Engineers.

The main functions of R&BD are handled by the following offices/wings: State Highways and Buildings, Panchayat Highways, National Highways, Designs, Quality Control. Additional activities of R&BD are carried out by the following offices: Parks and Gardens,

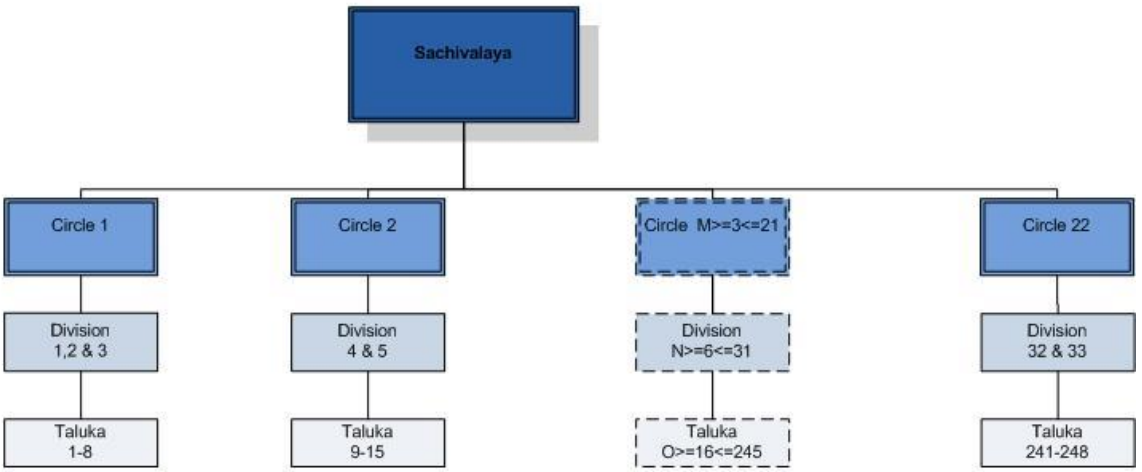
GERI (Gujarat Engineering Research Institute), Electrical and Mechanical, Town Planning, Staff Training College.

2.2. Organization Structure of R&BD

The operational units of R&BD are geographically distributed and tiered by Circles, Divisions and Sub-Divisions. The Divisions generally correspond to Districts and Sub-Divisions correspond to Talukas.

The organization structure of R&BD is represented below (with respect to no. of units):-

R&BD Organisation Structure:



Note:

Across the State of Gujarat, under Sachivalaya, there are 22 Circle offices, 33 Divisional offices and 248 taluka offices.

Approx. users:

Sachivalaya:	160
Each Circle:	45
Each Division:	5
Each Taluka:	1
Total	**1563**

Figure - The organization structure of R&BD

2.3. Functions of Roads and Buildings Department

The main activities that are undertaken within the R&BD are mainly as furnished below:

- Regular Planning and Budget control for roads and buildings within the state
- Planning, Construction and Maintenance of Roads establishment
- Technical Assistance Supervision, maintenance & monitoring for Panchayat roads & building works
- Agent to MORT&H for assigned NH road length: Design, Construction, Supervision and Maintenance
- Construction and maintenance of electrical installation in Government Buildings
- Appointments, postings, transfers, promotions, conduct, grant of leave, pension, etc. to all Gazetted Officers under the administrative control of the department
- Maintenance of government buildings and roads
- The R&B Department also looks after and liaises with Government of India with regard to the Railways, Telephones and Civil Aviation (State owned Airports)
- Proving technical assistance to other Government department

2.4. Project background, objective & outcome, scope and deliverables

The State Government of Gujarat (GoG) planned for large road development programs and various state-level initiatives to improve and upgrade the state-managed road network in order to meet the growing demand for road transport infrastructure in the state.

One of the initiatives taken by the GoG in this direction was the Gujarat State Highway Project – I (GSHP-I) which was successfully implemented by R&BD, GoG between 2001 and 2007 with the World Bank assistance. During this project, the foundations were laid for the second highway project for the state. In agreement with the World Bank, GoG finalised the Rs. 1,938 crore GSHP-II projects. It includes Two Laning, Wide Two Laning, Four Laning and Rehabilitation of prioritized road sections across the regions of the state.

As part of the preparations for the GSHP-II project, the R&BD of the Government of Gujarat (GOG), aims to build a comprehensive new Institutional Development and

Governance Enhancement (ID&GE) program. The R&BD will be both the GSHP-II executing agency and the central focus of the new ID&GE program.

The objectives of the project are mentioned below:

I. Achieving an integrated and effective agency wide decision support and Management Information System (MIS) tool with modern, effective and sustainable Information Technology/ Information & Communications Technology (IT / ICT) architecture and facilities and Support Capacity

II. Studying all the existing IT-Systems/applications and Resources available with the R&B Department, identifying the gaps if any and recommending the measures which can be applicable within R&BD domain.

III. Studying the department's own high-level 'As-Is' overview document and building upon it with the focus on the available forms of IT/ICT MIS resources and capacity

IV. Documenting the main aspects of the R&BD's policy and planning functions, technical and operational activities, administrative and financial management processes, business process and (in keeping with GOG-wide policies) its 'governance' responsibilities

V. Preparing a high level study/analysis report on:

a. The range and functionality of existing monitoring and/or MIS tools, systems and databases that enables R&BD's management with reporting and status update on activity / progress / performance data of works, operations and services under R&BD's scope

b. The IT utility/application for enabling R&BD's management and operational needs to be in sync with overall e-governance, e-procurement and financial management systems of GoG, envisioning the requirements of the entire spectrum of R&BD's operating environment between HQ and field

c. Level of integration available between the existing tools/ applications/ databases that enables providing of key pointers to the R&BD's management for validating the monitoring and reporting of various important project parameters

d. Identifying key areas where integration (system/ application/ database) has not been implemented/ identified, while considering the following parameters

   i. Technical Feasibility

   ii. Cost effectiveness

   iii. Efficacy in providing high-value results

   iv. Possible fitment in the long term IT/ ICT - MIS strategy for the R&BD

VI. The scope and benefits of introduction/development of a major 'backbone' software / system to support the integration and data sharing across various tools and applications available and/or yet to be developed for R&BD

VII. Any necessary enhancement of hardware, technology and/or physical equipment / facilities (both 'core' and 'down the line') that needs be taken up by the R&BD to achieve the expected IT/ ICT MIS capability and performance improvements

VIII. A summary/ details of probable cost estimates of the proposed medium-term scenario for the following:

a) New Software application

b) Proposed Technology enhancement

c) Proposed hardware enhancements

d) Proposed facility / resources

e) Proposed training

f) Proposed Implementation support elements

3. Key findings from As-Is Assessment

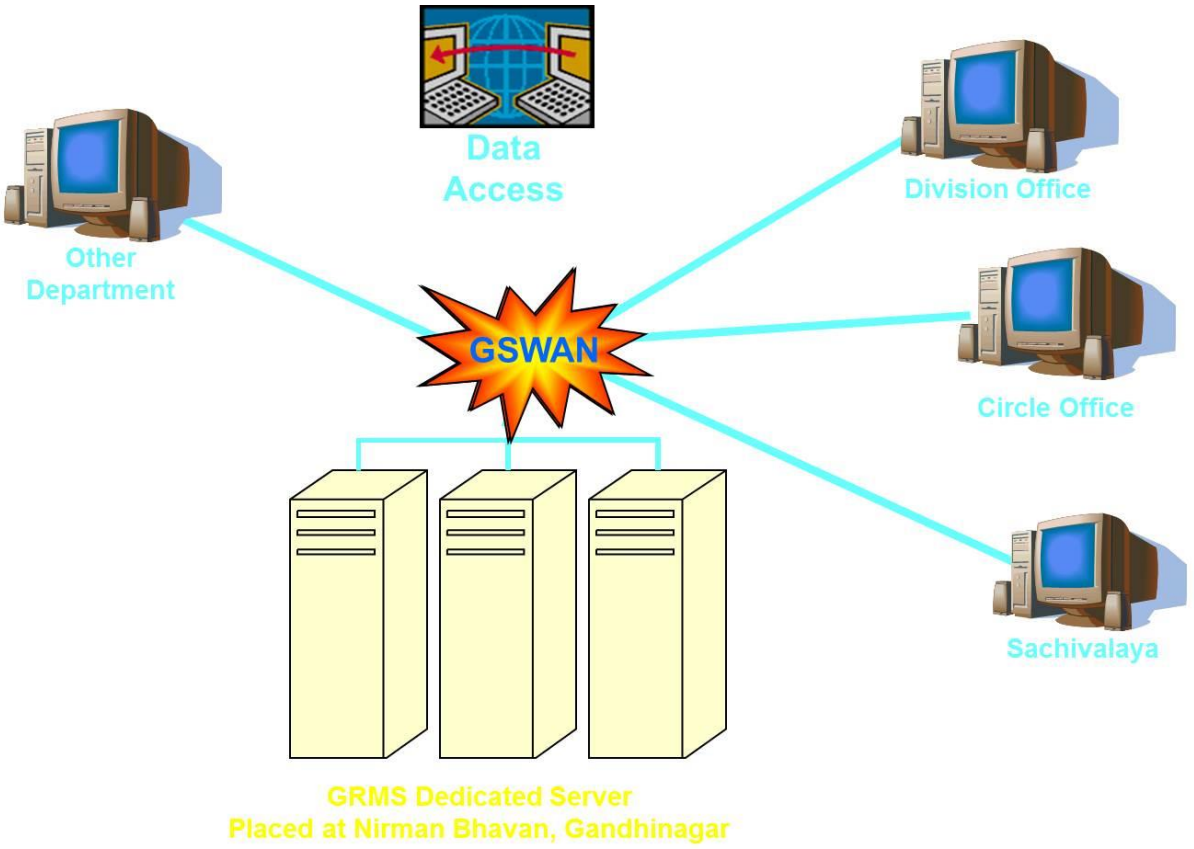
Based on the As-Is assessment the key findings which have been observed that needs immediate interventions are:

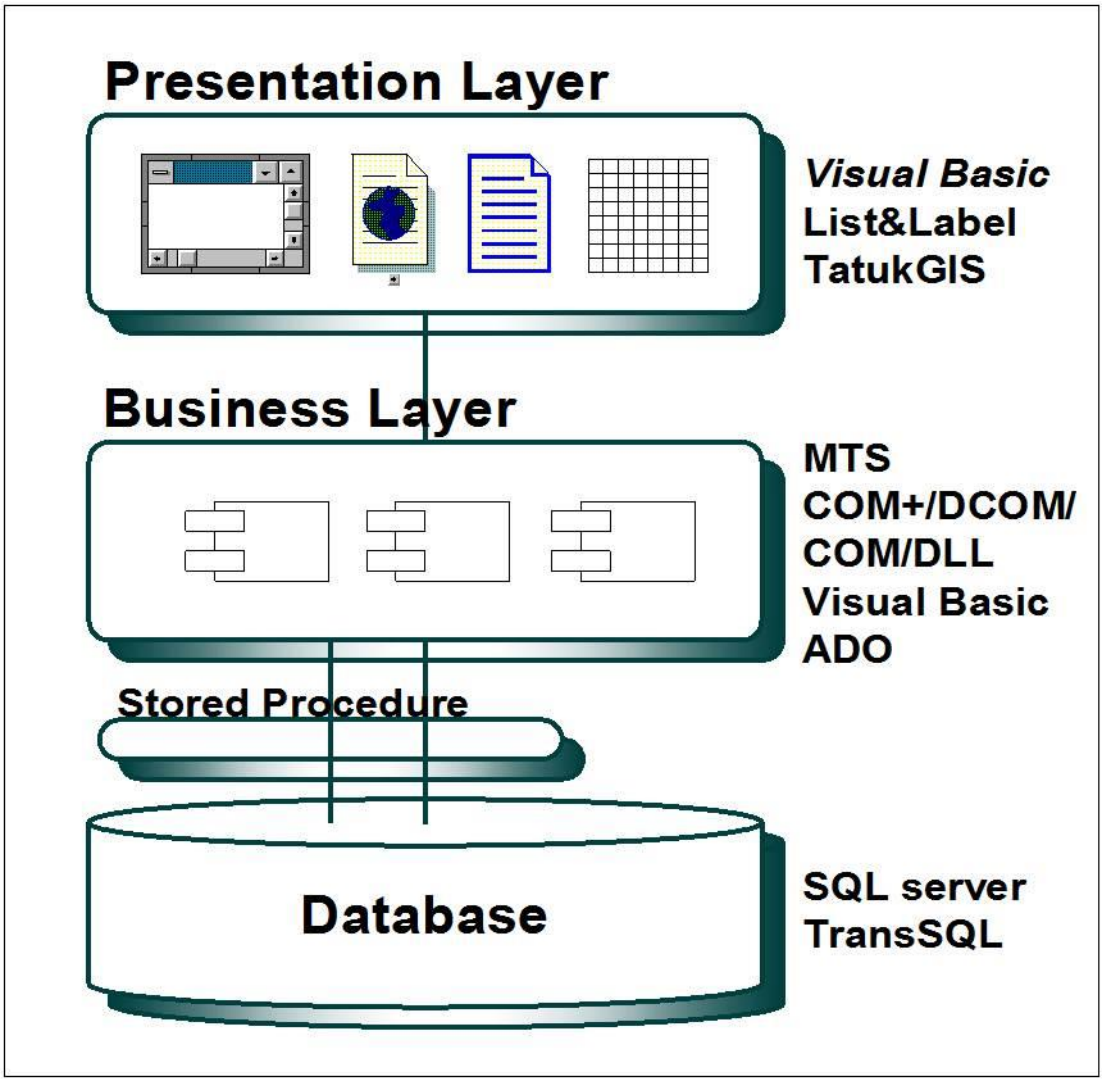
1. Absence of integrated applications
2. Absence of Integrated MIS
3. Nil or inadequately populated data
4. Outdated software
5. Lack of network bandwidth and connectivity
6. Absence of a dedicated IT Cell
7. Lack of basic IT related and application specific trainings
8. Network dependent application, etc.
9. Absence of an integrated software application

3.1. Conceptual view of As – Is ecosystem

GRMS

The GRMS has been deployed mainly on Gujarat State Wide Area Network (GSWAN), the network is maintained by the Science & Information Technology Department, Government of Gujarat. The network is well connected with the districts of Gujarat and accessible to all government offices. However, there are a few R&BD offices not having a reliable and appropriate bandwidth/connections. Hence such divisions have a standalone version of the GRMS for the purpose.





GRMS System Architecture Logical view

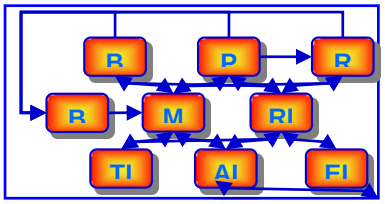
GRMS has the following key module(s):

- Road Information System (RIS)
- Traffic Information System (TIS)
- Pavement Management System (Practical)
- Routine Maintenance Management System (RMMS)
- Bridge Management System (BMS)
- HDM 4 - Pavement Management System
- Environment and Social Information System (EIS)
- Accident Information System

- Monitoring and Evaluation System
- Budgeting And Programming Module

In addition to the above key modules, GRMS also has certain support modules:

- User Administration
- Data Aggregation
- Integration Framework



However, it has been observed that GRMS application is currently not in use. The application has not been updated since the first quarter of 2012.

The previous version of GRMS was running on Windows XP platform. Microsoft has officially ended support for Windows XP support since April 2014. Therefore, the present platform faces compatibility issues with newer and other operating systems / platforms especially in absence of any official technical support from the operating system company.

WMS

The works monitoring system is developed for R&BD of Gujarat by NIC to monitor both Budgeted and Non Budgeted Works. The Budget and Work related entries are done at the R&B Secretariat and progress and expenditure related entries are done at the Circle and Division Level. This is a single integrated suite for R&B Civil Works of State, Panchayat and Capital Projects, machinery inventory and Quarters allocation and rent management. This application has the provision to maintain the quarterly returns of utilization of machinery and monthly demand and collection of Quarter's rent.

The site is functional since FY 2010-11 on the URL: http://rnbwms.guj.nic.in

Reports from the system are the basis for SE level review meetings and ministerial meetings. SOR is incorporated into the system. There is provision for rate finalization per year per division as per the existing norms. The application has been developed in PHP and PostgreSQL along with jQuery, PHPExcel and FPDF libraries. A customized forum based on PHPBB forum is incorporated for simple FAQs, Document Sharing and Knowledge Management between the offices.

The interoffice messaging is carried out electronically through the inbuilt messenger. WMS is a web based application.

NIC has provided with integration interfaces with GRMS to ensure deserving road candidates get funds. GRMS Phase 1 and 2 links are available. Interface links for GRMS phase 3 is under development for which GRMS phase 3 formats are required to be provided by R&BD. Along with formats, the master data for roads is required.

NIC has given provision for data entry as per the F1 and F2 register formats. However, R&BD staff has not yet started the entry process.

Currently there are 151 different user account/IDs active in WMS.

The features of the application include:

i. Provision to enter all Civil Work related parameters (Budget details, AA, TS, Tender, Work Order, Progress, etc.)

ii. Integrated Contractors master (with provisions to view the total works per contract)

iii. Adhoc reports can be prepared with the data exported either completely or selectively into standard excel work sheets

iv. Notices to divisions, circles can be uploaded on to the system

v. Generation of SE meeting agenda items

vi. Provision to link work with assembly/loksabha constituency, department talukas, etc. thus making easy dissemination of pending works of any of the above classification

vii. Application has the provision to maintain the inventory and quarterly returns of utilization of machinery and monthly demand and collection of quarters rent

viii. Provision to enter the progress of the work both physically and financially along with the option to upload the site photographs

ix. All activities of users are logged and complete audit trail is maintained and activities of subordinates can be reviewed by secretariat office

x. Module for data transfer of new budget book

xi. Facility to enter work wise estimate details

xii. Facility to maintain records of extra/access and time limit approvals

xiii. Facility for inputs from Architect and Design office

xiv. Facility for other state departments to access the system for review of work

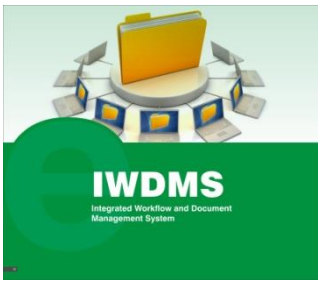
xv. Provision to map works existing in WMS to the GRMS road inventory and maintain record history of WMS works

xvi. SOR along with specifications of items are available through WMS

The system is integrated with GRMS to ensure that deserving roads get funds and GRMS is updated regularly. The GRMS works section allows the user to view the GRMS related information in WMS.

However, it has been observed that GRMS application is currently not in use.

IWDMS



Integrated Workflow and Document Management System (IWDMS) was implemented in 2005 for all departments of the Secretariat. The end to end solution has been provided by M/s. Tata Consultancy Services (TCS).

Integrated Workflow and Document Management System (IWDMS) is a multilingual solution developed for automating the functions at all levels of

the administrative hierarchy of any Governmental department/office. IWDMS provides Document Management, Workflow Management, Collaborative Environment and Knowledge Management in an integrated fashion and delivers an Electronic Workplace.

The project initially covered all employees of the Government of Gujarat at New Sachivalaya, Gandhinagar. It is now being extended to the employees of the HoDs of the departments in Gandhinagar and Ahmedabad. In order to achieve Single File Management System across the state, IWDMS will be extended to all other HoDs in Gujarat in a phased manner. IWDMS has not only helped improve the accountability, transparency and effectiveness but has also benefited the citizen's directly through applications such as Grievance Redressal, CM Relief Fund, Surat Disaster Assessment Survey, etc. and benefited the industry through applications such as Investment Monitoring System.

The services available through IWDMS can be divided in to major components as follows:

1. Core Applications
2. Common Applications
3. Departmental Applications (300+)
4. Knowledge Management System
5. File Management System
6. Workflow & Organization Model
7. Security & Access Controls
8. Dashboard
9. MIS

R&BD uses IWDMS in its day-to-day file movement which involves large size drawings and files.

Although IWDMS has an office management module to create, forward, process and close the files via application and system, all the files are still manually worked upon. This

creates redundancy and duplication of data maintenance and adds to more work load for employees.

IFMS

IFMS (Integrated Financial Management System) is at the core of all the ICT initiatives undertaken by Finance Department which encompasses all the functions of all the HoDs of Finance Department except Directorate of Insurance and Commissionerate of Commercial Tax. IFMS is integrated with the functions of these HoDs as well as with other department's system to provide Finance Department an integrated view of the state financial position in a real time manner. IFMS has been implemented in Finance Department, Secretariat (Gandhinagar), Directorate of Pension and Provident Fund (Gandhinagar), Treasury Offices (25 district offices) and Local Fund offices (7 offices).

IFMS integrates the major functions carried out by Finance Department, Directorate of Accounts and Treasuries, Directorate of Pension and Provident Fund, Local Fund, Treasuries and Sub Treasury offices spread across the state.

Features:

1. Online checking of Grant during Bill processing
2. Integrated solution which tracks budget, grant released and actual expenditure
3. Online payment of taxes (Real-time accounting of State Receipts)
4. Database consistency maintained with Centralized RDBMS
5. Data entry at source only
6. Online consolidation of accounts
7. Real-time consolidation of sub-treasury accounts with Treasury accounts

8. No need for manual data transfer as it is a centralized system with online consolidation of data of all offices

A total of 17 modules are available in IFMS. It has a graphical user interface and is a web based application running on GSWAN network. The application was developed by TCS and went live in 2008. IFMS accepts the dump files of budget prepared in IWDMS for further processing.

IFMS is developed on J2EE 1.6 platform and mysql version 5.1.31 is currently being used as the database. The application is currently hosted from state data centre on GSWAN.

R&BD uses IFMS to release grants. Through different levels of accessibility, further deliberations take place.

SWAGAT

SWAGAT which stands for State Wide Attention on Grievances by the application of Technology was started in year 2003 for redressing the long standing grievances of people with services required from the state administration. This practice has been initiated by the Chief Minister of Gujarat himself and has helped in redressing the people's long standing complaints in a short span of time.

The direct goal for SWAGAT was to improve the efficiency and effectiveness of public grievance handling in the state: both directly through SWAGAT and indirectly through the incentive effect on other grievances of staff not wishing to have to be called before the Chief Minister. Although grievances only involve a small minority of citizens, they can have a high profile within local communities and within the media. Therefore, means for dealing with them effectively can bring wider political benefits to a government, as well as providing a demonstrable example of transparency and accountability. SWAGAT was therefore identified as a potential source of politically-valuable public goodwill.

The secondary goals for SWAGAT were to provide an effective e-government application that made good use of the high-bandwidth infrastructure set up in the state, and to create a high-profile application of e-government involving the Chief Minister. Both of these were seen as potentially sending messages inside and outside government about the modernity of government, and the relevance of ICTs.

SWAGAT uses the GSWAN (Gujarat State Wide Area Network) backbone cascaded with Sachivalya Campus Area Network (SCAN) for interconnecting various offices in the Secretariat, and throughout the state for voice, video and data services. SCAN was commissioned in the year 2000 and the GSWAN/Server Farm in 2001. No special backbone infrastructure had to be created for SWAGAT.

The Web-based grievance monitoring and management application was developed in house with ASP at front end and SQL at back end. The application is hosted on a Cyrus server (RAD-1) connected to the SCAN/GSWAN.

eGRAM

Government of Gujarat under the e-GRAM Project has decided to equip all the 3 tiers of Panchayats (Local self-governments in rural areas) and in particular, each and every Village Panchayat (VP) with computer hardware & software and other necessary peripherals in a phased manner. By the end of 2008, all the VPs have been computerized and provided with broad band connectivity through VSAT.

e-Gram connects 3695 Gram Panchayats and 6000 Citizen Common Service Centres. Some features of e-Gram Project are Video conferencing facilities at all villages, issuing the documents and certificates, application forms for various development and welfare schemes. Also 7/12 certificates to the farmers from panchayats. VSAT communication technology based broadband connectivity, free of cost communication between panchayats, common service facilities, advantages of Internet and cyber connectivity and electricity-telephone bills, visa, E-postal services and many more facilities are provided through the online e-Gram project website.

Features:

i. 40 computers have been installed in each District Panchayat.

ii. All 224 Taluka Panchayats have been equipped with 2 PCs, CD writer, laser printer and a touch screen Kiosk.

iii. All 26 District Panchayats & 224 Taluka Panchayats have been connected through Gujarat State Wide Area Network and well equipped with Video Conferencing facility.

iv. All 13695 Village Panchayats have been equipped with Computer, Printer covered through VSAT Connectivity and VoIP phone along with web camera.

v. 7400 Village Panchayats are having Ku Band facility and well connected to Bhaskaracharya Institute for Space Application and Geo Informatics (BISAG), Gandhinagar for two way audio and one way video facility.

vi. Capturing accounting details of all Village Panchayats at the Taluka Panchayats with Gram Rural Accounting Management Software (GRAM).

3.2. Software systems assessment

R&BD uses many applications to carry out the technical and administrative activities. KPMG has carried out detailed assessment of these applications from a technical and functional perspective. The various shortcomings of the applications with respect to the business needs of R&BD are provided below:

S. No	Application Name	Challenges	Owner Department
1	GRMS	1) Currently GRMS does not have any up gradation support from HIMS. 2) Currently no updates are applied on GRMS. The application server is currently not live into	R&BD

S. No	Application Name	Challenges	Owner Department
		production. The architecture supports integration with any MIS system. 3) Regular update of data is not happening. Application of data is highly important. Most of the data is dynamic in nature and changes over a period of time. Hence it is prudent to use the data regularly to achieve the maximum benefits. 4) Division offices are widely spread and the lack of connectivity and bandwidth hamper the usage of the application. 5) Migration of client/ servers to Web based solution for GRMS will reduce the dependency on usage from client machines and maintenance of application will be much easier. 6) Currently Mobile App for handheld devices which can be used for data updation is not available. Provision for such apps will increase efficiency of GRMS usage. 7) R&BD staff has indicated a challenge in having the license key applied when GRMS is installed in a new computer.	
2	WMS	1) WMS has integration capabilities with GRMS. However, data is not entered in WMS regularly. 2) Integration with Phase 3 of GRMS is not yet completed. Training details of WMS are not available and it is difficult to establish the commencement and usage of WMS.	R&BD
3	IWDMS	1) Accommodates large sized files for official file movement -- hence requires high bandwidth connectivity.	State Administration department

S. No	Application Name	Challenges	Owner Department
		2) Used by R&BD. However, it is not integrated with GRMS or WMS. 3) MoU tracking and updating through Investor Monitoring System i.e. IMS. Use of www.ifpgujarat.gov.in portal for monitoring of MoUs.	
4	IFMS	1) R&BD uses IFMS for releasing grants. However, the application is not integrated with either GRMS or WMS for correlating the disbursement of grant and amount of work carried out.	State Finance department
5	SWAGAT	1) Application is run in Silo and is not integrated with GRMS or WMS. 2) The application is used by all departments and citizens for grievance redressal.	Chief minister's office

Other software systems:

a. Use of mobile application developed namely Road Mitra

b. Use of Saathi portal

c. Developing of computerize Measurement Book (underway)

d. Developing of Accounting System, Cash Book by NIC (underway)

e. Development of mobile application for monitoring and implementation of resettlement and rehabilitation process under Second Gujarat State Highway Project i.e. GSHP-II (underway)

f. Use of portal for monitoring Court Cases

3.3. Hardware Assessment

KPMG has found the following observations during the detailed assessment of Hardware of R&BD as a part of As – Is Analysis.

a) Hardware is being procured by R&BD at various levels i.e. at Sachivalaya, circle offices, division offices etc. The IT Infrastructure at each office is maintained by the respective offices.

b) Centralised asset register for tracking the assets and inventory is not available. The IT infrastructure details are maintained by the store keeper in a dead stock register with an asset ID. However, the technical configuration is not recorded in it. Few offices have AMC in place for handling hardware issues; however most of the offices call a local computer technician to fix any issue on a case to case basis.

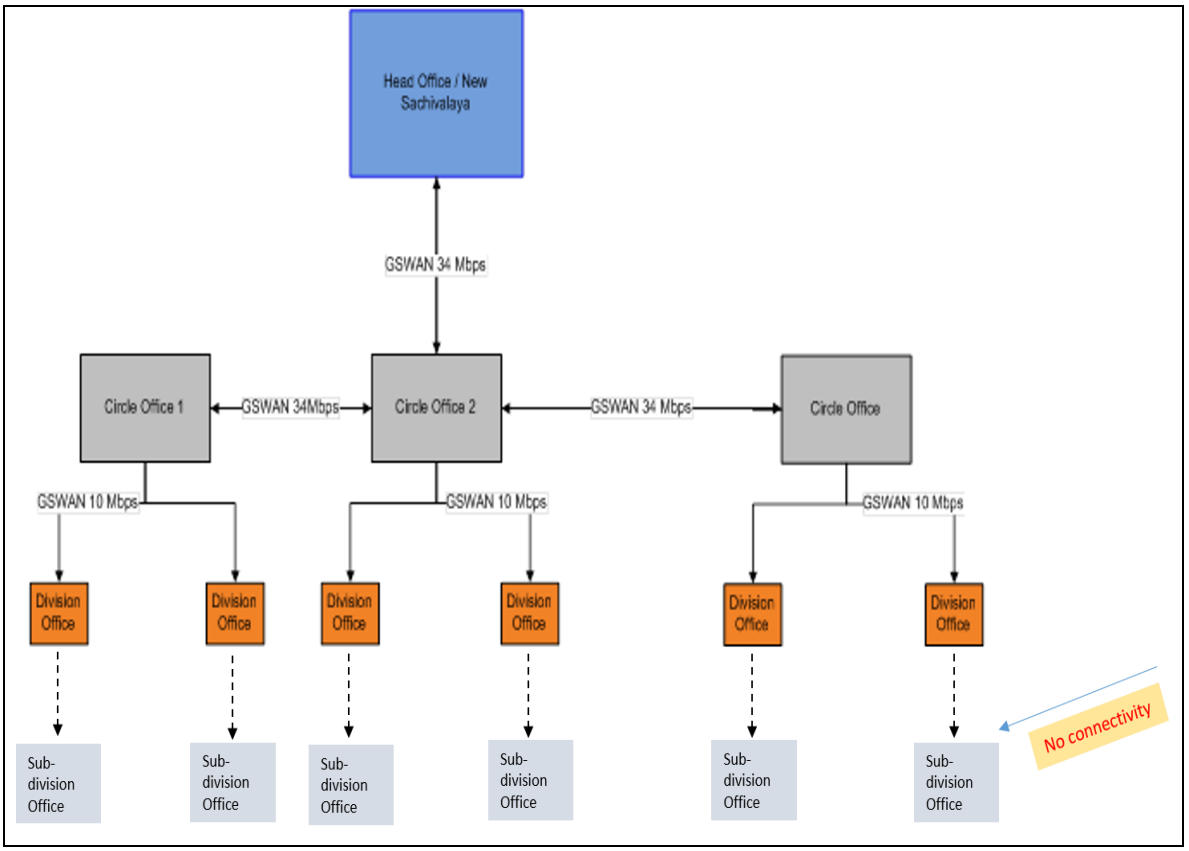
c) AMC and warranty details are not being maintained in many offices.

d) Many of the desktops are outdated i.e. purchased in 2004, 2006 and 2009. Either the AMC or warranty have expired or the department does not update their status.

e) Some desktops are running on Windows XP which is no longer in production and support has been closed by Microsoft since April 2014.

3.4. Network Assessment

Network architecture, is the logical layout of the network that may be used for connecting the various offices of R&BD. R&BD offices are currently connected via GSWAN. The connectivity of GSWAN is provided below.



GSWAN is currently not available at all sub division offices. Few subdivision offices in Gandhinagar located within the same premises as that of Division office has GSWAN connectivity. The lack of connectivity will affect the acceptance and usage of applications at various levels of R&BD offices.

Various alternate mode of connectivity like BSNL Broadband, Lease Line, Wi-Max, VSAT and other private ISP vendors have to be explored to encompass all the R&BD offices spreading across the length and breadth of Gujarat.

4. Integration Assessment

The applications that were described in earlier sections for covering the functionality of R&BD were studied extensively with regards to integration from a technical and administrative point of view.

4.1. Integration – Technology Options

Organisation's Business solution involves several levels of integration, each with its associated problems. The first level is integrating the required functionality in specifications developed by independent standards bodies. The next is combining standards-compliant component products on a single operating system and hardware platform, while preserving the required interfaces and behaviours. Third is incorporating the additional products and features necessary to develop a specific application on the standards-compliant platform. Fourth is ensuring that compliant platforms from multiple vendors can work together.

Various Integration – Technology options have been explored and are presented in this report for general understanding of all the stakeholders and for further acceptance of the most viable option. Four widely used Integration – Technology options are illustrated below:

a. Vertical integration

Vertical integration (as opposed to "horizontal") is the process of integrating subsystems according to their functionality by creating functional entities also referred to as silos. The benefit of this method is that the integration is performed quickly and involves only the necessary vendors, therefore, this method is cheaper in the short term. On the other hand, cost-of-ownership can be substantially higher than seen in other methods, since in case of new or enhanced functionality, the only possible way to implement (scale the system) would be by implementing another silo. Reusing subsystems to create another functionality is not possible.

b. Star integration

Star integration also known as spaghetti integration is a process of systems integration where each system is interconnected to each of the remaining subsystems. The cost

varies because of the interfaces that subsystems are exporting. In a case where the subsystems are exporting heterogeneous or proprietary interfaces, the integration cost can substantially rise. Time and costs needed to integrate the systems increase exponentially when adding additional subsystems. From the feature perspective, this method often seems preferable, due to the extreme flexibility of the reuse of functionality.

c. Horizontal integration or Enterprise Service Bus (ESB)

Horizontal integration or Enterprise Service Bus (ESB) is an integration method in which a specialized subsystem is dedicated to communication between other subsystems. This allows cutting the number of connections (interfaces) to only one per subsystem which will connect directly to the ESB. The ESB is capable of translating the interface into another interface. This allows cutting the costs of integration and provides extreme flexibility. With systems integrated using this method, it is possible to completely replace one subsystem with another subsystem which provides similar functionality but exports different interfaces, all this completely transparent for the rest of the subsystems. The only action required is to implement the new interface between the ESB and the new subsystem.

The horizontal scheme can be misleading, however, if it is thought that the cost of intermediate data transformation or the cost of shifting responsibility over business logic can be avoided.

d. Common data format

A common data format is an integration method to avoid every adapter having to convert data to/from every other application formats, Enterprise application integration (EAI) systems usually stipulate an application-independent (or common) data format. The EAI system usually provides a data transformation service as well, to help convert between application-specific and common formats. This is done in two steps: the adapter converts information from the application's format to the bus's common format. Then, semantic transformations are applied on this (example, converting zip codes to city names, splitting/merging objects from one application into objects in the other applications, and so on).

Based on the above Integration-Technology options, it may be proposed to opt for ESB which have more advantages as compared to others as emphasized above. The ESB Integration-Technology is the next generation of enterprise integration technology having Smarter Endpoints - enables architectures in which more intelligence is placed at the point where the application interfaces with the outside world. ESB has a Distributed Architecture unlike the EAI which is a purely hub and spoke approach. Further, ESB has No Integration Stacks and this makes deployment of a particular business process management tool easily integrated using industry standard interfaces for coordinating the business processes.

However, after a detailed study by the advisory group of the existing applications and the proposed design of the new app, integration technology would be accordingly selected on the basis of viability with each other. The detailed report on the same would be reflected on the RFP.

4.2. Integration – Administrative dependencies and challenges

The project is complex in nature due to the involvement of multi-vendors. Also, there are security and policy issues with integrating external department applications with R&BD existing applications. Apart from that, there are business and competitive aspects between vendors which present numerous challenges. Due to lack in the capacity building and mobilization, stakeholders are not having clarity on the roles and responsibilities with respect to the IT initiatives.

5. Proposed To Be Scenario

5.1. Key business requirements and constraints

Business requirements

R&BD need a robust IT system developed to improve the quality and delivery of services in the provision and management of the road system. Implementation of such a system will enhance the capabilities of the department by providing a source of readily accessible, relevant and valid information on the road system as well as improved support for decision-making by providing various modern analytical tools.

The strengthening of IT-ICT-MIS for R&BD will involve lot of Information Systems to work with functions and activities of the department. Usage of IT systems for the various functions and activities for R&BD has a huge potential to reduce cost, time, effort and increase efficiency. The primary objective would be to align IT objectives with business objectives.

To ensure that the Information Systems (Inclusive of Hardware & Software) fulfill the objectives of business to the fullest, the IT utility & application for enabling R&BD's management and operational needs to be in sync with overall e-governance, e-procurement and financial management systems of Government of Gujarat, envisioning the requirements of the entire spectrum of R&BD's operating environment between HQ and field.

Integration between the existing tools, applications, database enables providing of key pointers to the R&BD's management for validating the monitoring and reporting of various important project parameters.

There is a need of introduction and development of a major 'backbone' software and system to support the integration and data sharing across various tools and applications.

Enhancement of hardware, technology and physical equipment & facilities needs to be taken up by the R&BD to achieve the expected IT/ ICT-MIS capability and performance improvements.

The various IT related applications within R&BD and State Government are not integrated and department uses these applications in silos. The need of the hour is to have a real

time workflow level integration not only at the data level but also at the process level to achieve the desired objectives. Also an Integrated MIS and Enterprise monitoring system would assist the higher authorities in proper monitoring of work progress.

The institution strengthening program focuses on the IT-ICT-MIS integration, capacity and gaps.

5.1.1. Envisaged R&BD Integrated Software Application:

R&BD has undertaken a number of IT initiatives towards computerization in last few years. As a result of these initiatives, R&BD has its own Web portal, GRMS application, WMS application, Grievance Redressal System of GSHP II, Integrated GSWAN connectivity between offices till Divisional level. While a fair amount of progress has been made in this computerization initiative, there is ample opportunity for improvement. As a next step, R&BD IT Solution proposed would be Integrated Software Application which is a way to integrate data and processes of an organization into one single system with a modular software application. The application will integrate all divisions and their processes to increase efficiency and reduce complexity of business processes. The successful integrated application would ultimately provide the tools needed to give decision-makers seamless access to R&BD data; and allow the R&BD officials to make better use of the data, at their fingertips. R&BD requires that System Integrator proposes the system software, including the acquisition, customization, configuration, installation, implementation, hosting, training and maintenance of a new ERP system. The integrated application based e-Governance R&BD project has been envisaged with the following objectives in mind:

- Redesign processes for infusion of transparency and accountability in operations
- Enhancement of the quality of services provided to citizens
- Faster processing, monitoring and redressal of public cases / appeals / grievances with service levels
- Dissemination of information as per public requirement
- Establishment a real-time MIS system for prompt and efficient decision making

5.1.2. Current Situation:

R&BD does not have any Enterprise level solution currently implemented. Few of the applications being used are Web portal, GRMS application, WMS application, Grievance Redressal System of GSHP II for some projects of R&BD. Each division of R&BD works independently and does not interact with other divisions as far as the data and processes are concerned. The absence of an integrated system is leading towards complexity and delay in handling daily business processes.

Expected Benefits to the Stakeholders

The Key Expectations of various stakeholders from the Project are mentioned below:

Stakeholders	Expectations
Department	• System aided Assessment in decision making • Quick and easy access to accurate data through Centralized system with real-time availability of data • Single point data entry ensuring greater data integrity and 360 degree dealer profile • Automation of internal departmental workflows through system-aided record keeping, file and document management • Knowledge management – Maintaining records of historical cases enabling easier look-up and search • Shorter scalable, flexible and interoperable system
Employees	• Training for requisite skill development and enhancement • Ability to focus on core activities on account of outsourcing of non-core activities • Improved work conditions and motivated workforce

Constraints

Business requirements are often prematurely hardened due to the large stakeholder base involved in defining the requirements, where there is a potential for conflict in interests. The process of managing and building consensus can be delicate and even political by

nature. A lesser challenge, though common, is that of distributed teams with stakeholders in multiple geographical locations.

The early stage stakeholders' buy-in may be achieved through demonstration of prototypes and joint working. Stakeholder workshops are common, either as facilitated sessions or simple discussions help in achieving consensus, especially for sensitive business requirements and where there is potential conflict of interest. Complexity of a business process is a factor of such interest conflicts among stakeholders or due to an inherently complex business process, such as one where there is much specialized knowledge required to comprehend legal or regulatory requirements, internal departmental wide guidelines such as financial and social responsibility, and the like. Business requirements analysis is not just about capturing the 'what' of a business process along with its 'how' to provide context; in addition it is about how the business requirements get translated into designing and building a working system.

Lack of training to the users, monitoring and enforcing by higher authorities, connectivity issues and lack of ICT support are the reasons for non-usage of the existing application. Also, appropriate process reengineering is not being done while implementing an IT system solution, which usually contributes to it not getting used to the extent it could have been otherwise.

A custom-built IT solution may not always be required for every new set of business requirements. There are often standardized processes and products, which with some tweaking or customization, can serve to address the business requirements. Often the target business system is constrained by a specific technology choice or a budget or available IT products already deployed.

5.2. IT systems required as per business requirements

Some of the key recommendations for IT systems as per business requirements:-

- An integrated IT system comprising existing R&BD applications, the proposed new application and other Department applications
- Web-based Solution: Hybrid Model for ease of access
- Supports both vertical and horizontal scalability

- Central Data Repository for Decision Support
- Automated Workflow systems for all processes and approvals
- Automated inter-related processes
- Dash Board View for decision makers : Reports, Tables, Charts, Graphs and Alerts
- Compliance to Open Standards, Industry and Government Standards
- Integration with Payment Gateway and SMS Gateway
- Offline forms for Data reporting

5.3. Design architecture of IT systems for R&BD

Key performance considerations of IT systems for R&BD architecture are given in the table below. Design Architecture of IT systems for R&BD has been envisaged based on these performance considerations.

S. No.	Requirement	Design Strategy
1	**Performance:** System should be performing to support all the functions as per the turnaround time requirement of the business.	The solution shall be designed in a manner that the following can be achieved: • Modular design to distribute the appropriate system functions on web and app server • Increase in-memory Operations (use static operations) • Reduce number of I/O operations and N/w calls using selective caching • Dedicated schemas for each function making them independent and avoiding delays due to other function accessing the same schema • Using batch processing for resource intensive tasks which need not be done on real time bases

2	**Portability:** The system should be portable to all major platforms with minimal changes (or No changes) and appropriate testing.	Platform agnostic system to be developed with following considerations • Use a platform to make the Application Source Code Portable • Solution should support Database Access Layer Portability
3	**Scalability:** The system should be scalable in a manner that as appropriate the capacity and compute infrastructure could be added seamlessly	The design of the system should consider future proofing the systems for volume handling requirements • The application functions should be divided logically and developed as Modular solution • The system should be able to scale up both horizontally & vertically
4	**Reliability:** The system should have appropriate measures to ensure processing reliability for the data received or accessed through the application.	It may be necessary to mainly ensure the following • Prevent processing of duplicate incoming files / data • Unauthorised alteration to the uploaded data in the system should be prevented
5	**Availability:** The design of the system should have considerations impacting the availability factor	The solution should meet the availability requirements • Load Balanced across two or more Web Server to avoid single point of failure • Deployment of multiple application instances should be possible • Distributed or load balanced implementation of application to ensure that availability of services is not compromised at any instance of failure

6	**Security:** The system should be appropriately secured considering principles of defence – in – depth. Not relying only on the Network Security, the application should have its own access control security mechanism.	The application system should have the following • Role based access for all the stake holders envisaged to access and use the system • Specific components to enable data security both by professional tools and experts • Appropriate authentication mechanism adhering to industry good practice of Password Policies etc. • Ability to adopt other authentication mechanism such as Electronic Signature Certificates • Authorization validity to be ensured for the users uploading the Data into the system. Data should be accepted only from the entity authorized • Data should be visible only to the authorised entity • Audit trails and Audit logging mechanism to be built in the system to ensure that user action can be established and investigation if and when required, can be undertaken (e.g. Logging of IP Address etc.) • Data alterations etc. through unauthorized channel should be prevented • Industry good practices for developing the application so as to ensure sustenance to the Application Vulnerability Assessment exercise using professional tools and experts

7	**Cost:** The system is required to be optimized in terms of design and development to keep a check on the resource utilization etc. there by helping the overall cost reduction for the solution	• Use of existing resources such as Gujarat State Data centre, Gujarat SWAN and R&BD Infrastructure • Use of open source frameworks with commercial support availability • Solution should enable optimized processing in accordance with the chosen platform of deployment • Use of commercial license products where confidence in terms of reliability and scalability may be required. It is recommended to consider those products which confirm to Open System Standards. Further, appropriate measures should be put in place to reduce the dependency on the product specific features. • Solution should enable platform independence to enable open system deployment if required to reduce the overall cost of unit order processing

5.3.1. Project Approach

The recommended approach that could be adopted by R&BD for Implementation of the Integrated Software Application is provided below:

i. A COTS or Bespoke product based transformational approach wherein an enterprise wide solution/ system shall be developed/ customized/ configured based on functionalities proposed.
ii. The Proposed product shall mandatorily offer above mentioned modules in section 5.2. as a single integrated solution along with necessary Bolt-on applications and minimal customization as required by R&BD.
iii. This solution shall address the requirements of all key stakeholders of R&BD. The solution shall be modular in nature and can expand in capacity and functionality to meet expanding requirements.

iv. A centralized approach wherein the information available shall always be current and accessible to all stakeholders (single source of truth).

v. The solution shall be deployed centrally at the State Data Centre and shall be accessible to the concerned stakeholders via intranet (LAN/ WAN)/ Internet and from VPN.

Recommendations:

The table below highlight the summarized recommendations that needs to be build or leveraged from existing environment in order to achieve the proposed R&BD Integrated Software Application System:

Sr. No.	Description		Recommendations
1	User Interface requirements	Website	Web based solution for applications will reduce the dependency on a particular network, ease the reach to users and overcome the issues with populating data into the system.
		Mobile App	Provision for handheld devices based mobile app for spot updating/viewing of system data
		e-Tendering	Leverage the existing application nProcure of the State Government
2	Support Applications	SMS	Enable SMS services for acknowledgement and status update
		Payment Gateway	For various financial transactions, online payment is proposed to be made available in the Integrated software Application System
3	Core Applications	GRMS	Digitization of the existing data, post FY 2012-13 followed by regular updation thereon. New fields to be added to capture other vital data.

		WMS	Digitization of the existing data, post FY 2012-13 followed by regular updation thereon. Integration of GRMS and WMS.
		Proposed New App	A new application is proposed for R&BD which would cater to the following services – Finance & Account Management, HR Management & Payroll, Scheme Management and Inventory Management.
		Other Applications	• Developing of computerize Measurement Book • Developing of Accounting System, Cash Book by NIC • Routine maintenance
4	Infrastructure	Laptop	Provision of Laptop for 36 high-level employees in R&BD
		Desktop	Provision of a desktop each to the core-employee
		Network Bandwidth	Extension of network connectivity and bandwidth to all units of R&BD from Sachivalaya to Taluka level
		Data Centre	Leverage the existing State Government Infrastructure of Data Centre and its associated services
5	**Implementation Services**	Hand-holding support	Third party additional staff for hand-holding support
		Helpdesk	Dedicated helpdesk team and infrastructure for catering to various IT related issues

5.3.2. Key Features

In order to manage the functions and services of all the divisions in an efficient and integrated manner, the proposed solution envisages seamless integration amongst various components of the solution. All the external stakeholders of R&BD (citizens, consultants, clients, etc.) will access the applications through portal using internet, while all the staff members of R&BD will access the applications through LAN/ WAN/VPN.

The implementation is a large and a very important initiative aimed at automation of all the core functions and internal work flow of R&BD. The System Integrator shall need to clearly understand that the desire of R&BD is not to create a mere IT Solution but an information infrastructure that will expand, integrate and enhance the functional needs of R&BD and other stakeholders. The design of such a comprehensive solution requires the judicious use of technology combined with foresight and a desire to create a best-in-class solution.

Various technology standards that could be a part of the proposed solution have been elaborated below:

i. **Service Fulfilment** – The objective of the proposed system is to perform the internal functions and deliver the services from initiation till completion through electronic channels (as far as possible). Accordingly, processes have been reengineered so that a stakeholder is able to access the system, perform the required task which may involve single or multiple back-end application interactions and fulfil the work requirements through the integrated solution.

ii. **Single-Sign On** – The Solution shall enable single-sign-on so that any user once authenticated and authorized by system is not required to be re-authorized for completing any of the functions in the same session. For the employees of R&BD, the browser based application accessed on the LAN, through single-sign-on mechanism, will provide access to specific or all applications depending on their roles and responsibilities. Similarly, for external users, based on their profile and registration, the system shall enable single-sign on facility to apply for required information, checking details or status of applications/ projects, submit applications, make payments, submit queries/ complaints etc.

iii. Support for PKI based Authentication and Authorization – The solution shall support PKI based Authentication and Authorization, in accordance with IT Act 2000, using

the Digital Certificates issued by the Registration Authorities (RA) that are approved by the R&BD. In particular, PKI based authentication and authorization shall be implemented by the selected vendor for officials / employees involved in processing key G2B and G2C services, including issuance of notices, receipts and approvals.

iv. **Open Standards** - Keeping in view the evolving needs of interoperability like inter departmental dependency / coordination for most of the functions of the R&BD etc., it has been proposed that the solution shall be built on Service Oriented Architecture (SOA).

v. **Scalability** - One of the fundamental requirements of the proposed solution is its scalability. The architecture shall be scalable (cater to increasing load of internal and external users and their transactions) and capable of delivering high-performance for at least five years from the date of deployment. In this context, it is required that the application and deployment architecture shall provide for Scale-Up and Scale-out on the various components of the solution including Application servers, Web Servers and Database Servers.

vi. **Accessibility** - The solution shall be accessible through mobile and other handheld devices like I-pad. Tablets etc. and the pages shall adjust suitably as per the devices besides being responsive. There are certain functions within the department that may require access to the system through multiple channels like Tablets, PDA, Smart Phone, etc. The System Integrator shall design a user friendly solution which will enable such access through devices with ease. Some functions through the above mentioned devices are: Approve, View, Upload, Download, Reject, Add, Delete, Cancel, Edit, etc. Though, this is not an exhaustive list.

vii. **Native Integration –** The solution shall provide implementation, administration and operational tool seamlessly integrated with the entire solution. The solution shall have all the core functions as natively integrated applications on a single interoperable open platform and not the integration of multiple products in an overlapping middle ware.

viii. **Integration with Third Party** - The System Integrator shall integrate the application with any third party application as and when required. Further, the System Integrator shall provide complete documentation and handholding support during exit management to the incoming vendor to help them understand the integration

interfaces. The following integration related guidelines shall be followed while designing and developing the Application:

a. Use of open or industry standard based message exchange protocols to ensure interoperability between participating systems.
b. Use of portable data and exchange protocols like XML and Web Service, etc. as much as possible
c. Guaranteed delivery of messages by capturing the acknowledgment or confirmation of delivery and receipt of messages.
d. Integrity of data-in-transit through public network.
e. Proper error handling mechanism and message resend capability.
f. Ability to view failed messages and reason for their failure.
g. Ensure proper Auditability and accountability of exchange of data between R&BD and other systems.

The detailed study of each existing applications and new app proposed would be within the scope of work of the Project Advisory Group. The following will be the broad Scope of the advisor responsible for the end-to-end implementation support for the project –

- Existing System Study (AS-IS) Study & perform a detailed assessment of R&BD and its current state of IT. They would undertake Assessment of proposed HQ offices and other field offices in the state and which impact on the proposed project. The study would include existing IT and skilled manpower availability and also the current level of IT infrastructure present in the facilities under consideration.

- Study of Best Practices The best practices and experiences from other States of India and other projects involving the computerization of Department of Health Services will be utilized for the project. It will also be part of the scope of the consultant to prepare a report on the best practices from different states. Existing R&BD related applications/suits, both in Public and Private sector would be analyzed for their suitability and customization to meet requirements of the present project. This will be helpful in designing the proposed new system and reaching to a technological solution to improve the governance of the department.

- Gap Analysis & Design of Proposed System (Business Process Reengineering). After completion of the department analysis and interaction with the key stakeholders in the

department, a new system design will be proposed to blend the best practices with the objectives of the department. The feasibility of the new model of service delivery will be based upon the readiness of the department and its staff to adopt the suggested model. Business process engineering (BPR) would also need to be done so as to streamline software applications with processes. Subsequent to this there would be RFP/SRS preparation and detailed hardware specifications.

- Define Functional & Technical Requirements Based on the To-Be process models, the functional & technical architecture shall be defined including the necessary integration requirements with the existing systems and service delivery channels. The Technical requirements include the specifications of various components of the proposed IT solutions, Infrastructure requirements including the servers, network & connectivity, security, storage requirements etc.

On the basis of the above, the Request for Proposal (RFP) would be generated and in consultation with the stakeholders and incorporation of the review/feedback, the Final RFP would be flouted. The Project Advisory Group would assist in the Bid Process Management.

5.4. Conceptual view of To – Be ecosystem

Architectural Models

Different types of models are:

i. Consolidated or Centralized Model: where Central Data Repository (CDR) is shared across the enterprise and data resides only at the CDR.

ii. Federated or distributed: where Independent data repositories are managed centrally for information exchange.

iii. Switch: a service that enables the exchange of information across multiple independent data repositories through a Gateway.

iv. Hybrid: combination of any of the above models.

While there is a recent shift towards central architecture for any of the e-Governance projects, there are certain challenges in adoption of the same strategy for R&BD as enumerated below:-

- Any delays in network / non availability of network will worsen the situation.
- Some of the departmental offices in Gujarat are in very remote places without access to a robust network. Network presence is very minimal in these places. While there are plans to improve the network condition, it will take few years before the network can stabilize in these places. Hence a local application, at least for basic services would be required to provide quality services through this project.
- Change management is very crucial for any project success, especially for Government projects.

During various interactions with all the Stakeholders, it is observed that there would be a huge resistance to IT projects. Reliable IT system shall play a crucial role in the change management. If the users are forced to use manual systems due to IT system non-availability, it would impact the success of the project.

Based on the above considerations in Gujarat, **a Hybrid model** has been proposed which is a combination of Consolidated and Federated model; stakeholders and other applications use gateway and portal for information access. Data is stored locally as well as replicated to a central repository at predefined intervals of time. In this way ease of access and anytime, anywhere information availability is achieved and network dependency is eliminated for important services. However, only the basic services shall be on a local server and other services of R&BD IT system shall be hosted centrally. Even basic services shall have the capability to be migrated to central architecture in future once the infrastructural conditions further improve in Gujarat.

Basic services sufficient for sharing data among different R&BD offices across the State:

i. Registry and Directory Services

ii. Record Locator and Search Services

iii. Identity Management

iv. Consent Management

v. Secure Data Transport

vi. Data Integrity

Advanced services which will enhance utility of the IT System by the R&BD Department are given below:

i. Data Exchange

ii. De-identification

iii. Analytics and Data Warehousing

Overall solution architecture of the R&BD IT system has been built upon the above guiding principles and has two key components:

i. General Architecture Building components common to IT architecture

ii. Specific blocks pertaining to R&BD Information exchange

R&BD IT System solution architecture as depicted in the figure below follows the three Tier architecture (Presentation, Application and Data layer) supported by external interfaces and message layer. The overall architecture is governed by the standards and policies defined for R&BD & concern inter-related departments of the Government of Gujarat.

Solution Architecture:

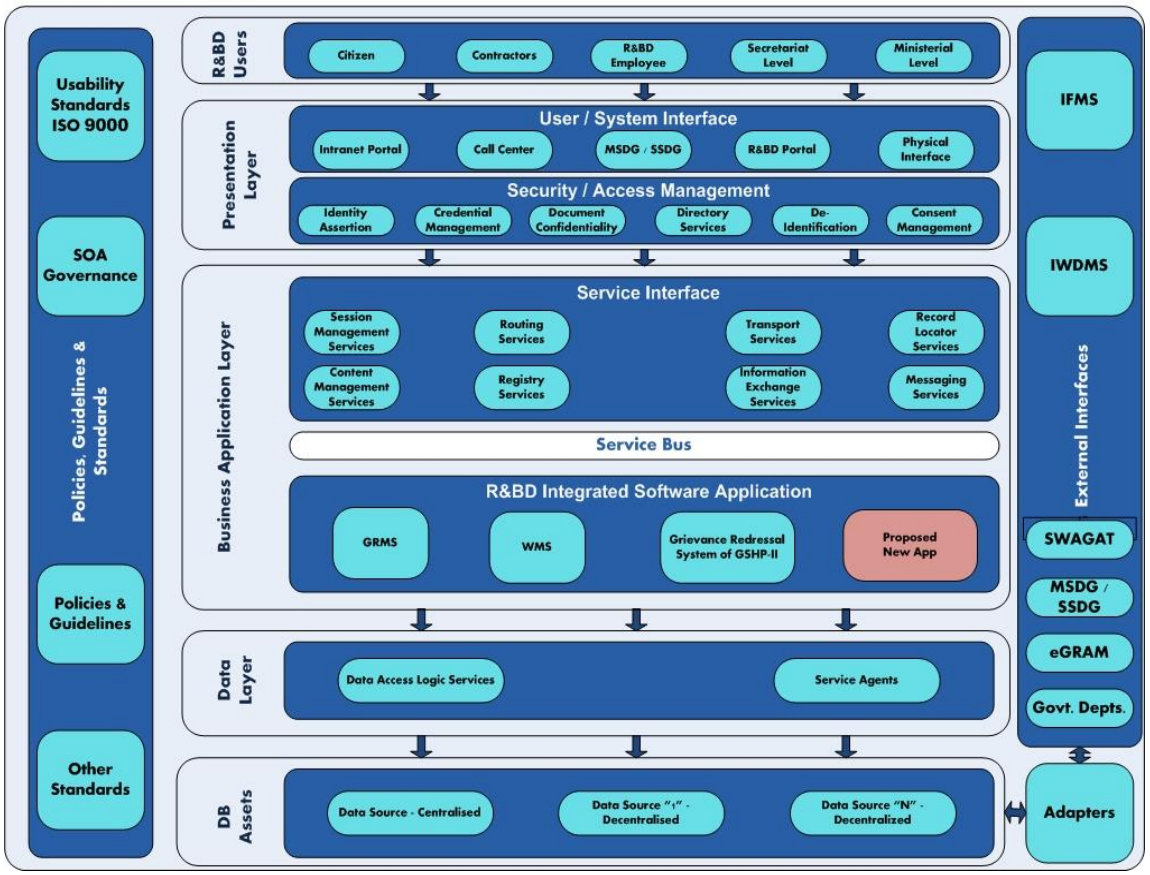


Figure: R&BD Integrated Application Solution Architecture

The schematic above represents the overall solution architecture of R&BD Application. The schematic diagram represents a comprehensive view of solution architecture which will be achieved over a period of time.

Users: R&BD users include all the Employees of the Department at Head Quarter, Divisions, Sub-Divisions, Business Community (Suppliers, Contractors, etc.), Data users (Researchers, funding agencies, etc.) and citizens.

Interfaces and Access Channels: R&BD services are accessed through these channels. Portal would be the main access channel for most of the services. It is also envisaged to provide the services through the Mobile platform.

Security and Access Management: Access management and security are the critical components of the solution architecture. Single Sign On (SSO) and Role based access

are achieved through the identity assertion, credential management and directory services components.

Service Interface: Service interface components are the middleware components which enables the successful delivery of the requested services to the users. When user puts any service request, these service interfaces invokes the respective applications and the data returned by these applications is presented to the user in a Data migration strategy readable format. Service interfaces are the infrastructure components which can easily combine and reassemble services to changing requirements without disruption to other layers.

R&BD existing applications & proposed new app: Applications are the actual implementation of business requirements. It will have actual code for the MIS, service automation, workflows etc.

Data layer: Applications and users use this layer for the actual data access. It contains the data access logic agents and service agents.

Data Assets: Data assets are the actual data used by the system for various MIS reports and automation purpose. The physical data used by the system resides in this layer.

Policies, Guidelines, Standards and Security: Policy and guidelines are the guiding principles for the overall R&BD architecture. Any component envisaged should strictly adhere to the policies and guidelines laid out. The R&BD solution should follow the open standards and other technology standards.

External Interfaces: R&BD system shall have integrations with the following external systems. The use of Adapters as shown in the technology architecture is only indicative in nature. The SI can suggest Adapters/ Connectors, APIs, ESB components or any other middleware technologies or stand-alone applications in the design that enable the integration of data points between R&BD and the existing systems. It should also support both asynchronous and synchronous access patterns of communication. The system should be able to provide a unified view of data.

The integration should be consistent without any data conflicts and data errors and there should be a two way communication between R&BD and the existing applications. The R&BD application should also be able to exchange data with any of the applications that adopt open standards.

The R&BD should easily interface with the external systems such as IFMS, IWDMS, SWAGAT, eGRAM, proposed new app and any other related government departments application.

a) The modules envisaged for the proposed ERP implementation within R&BD is as under;
   i. Finance and Accounts Management
   ii. Human Resource Management and payroll
   iii. Scheme Management
   iv. Inventory Management
   v. Services and Contracts Management

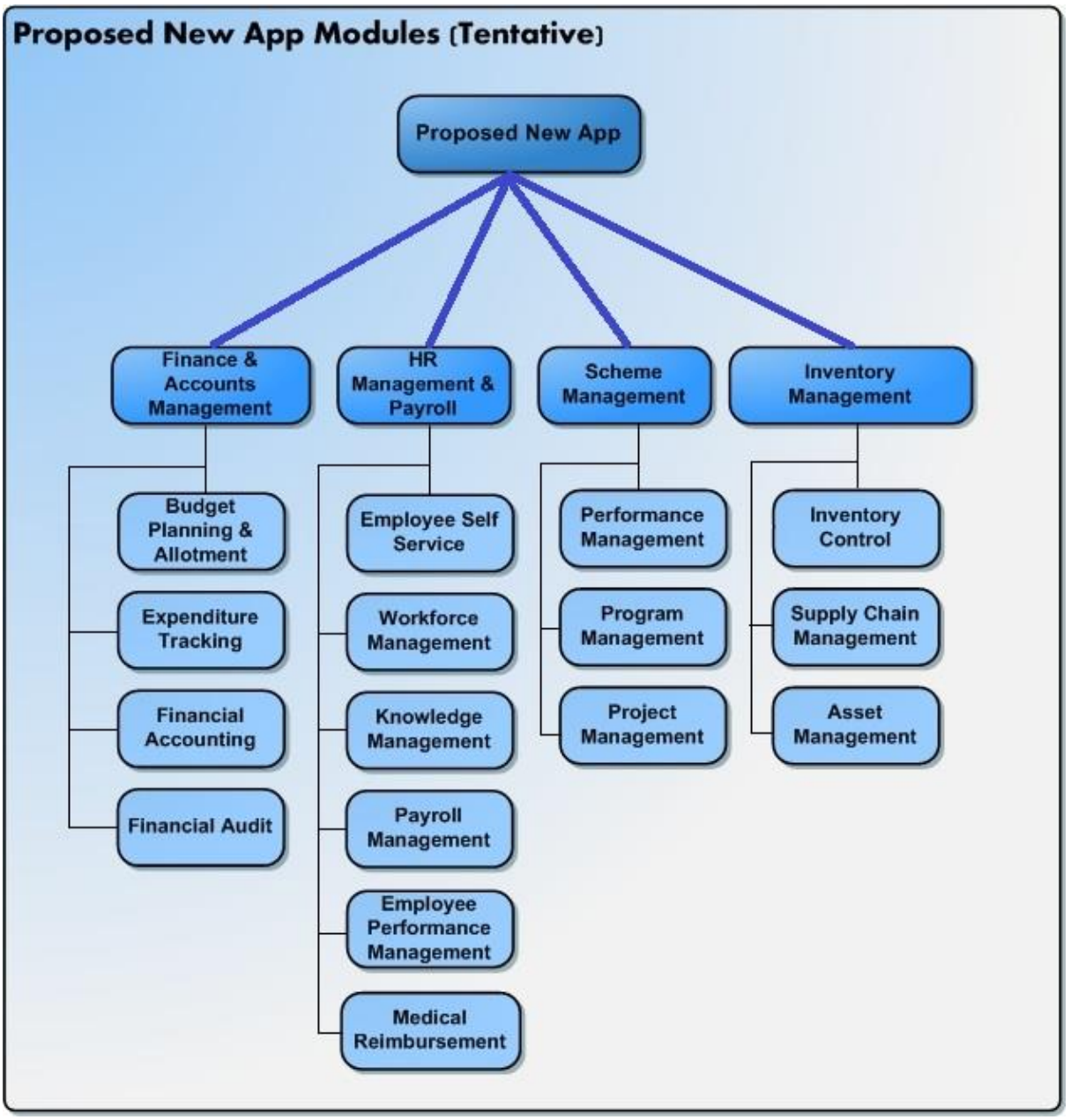


Figure: R&BD proposed new app modules

b) The technology layer will cover :

i. Enterprise wide Portal

ii. Document Management System & Workflow

iii. Dashboard and Reporting

iv. Folder Management

v. Tool for reporting purpose.

Mobile Interface

The R&BD solution system mobile interface shall be based on the mobile governance (m-Governance) strategy of Government of India. Under this strategy, Mobile service delivery gateway has been established to provide basis infrastructure support to any State/ Centre Government departments.

MSDG (Mobile e-governance Services Delivery Gateway) provides an integrated platform for delivery of government services to citizen over mobile devices using SMS, USSD, IVRS, CBS, LBS, or mobile applications installed on the mobile phones.

It is recommended that the mobile interface system should have similar functionalities as the web interface, since the user would be familiar to the web interface. Also, the mobile interface should be more user-friendly with the latest possible network connectivity in order to maximize the benefits. It should be self-explanatory such that even the first-time user would be able to update the data through the handheld device with a minimum hassle. The interface should be ready to use by the time the digitization of all the previous records is completed, so that the database remains updated once the users start using the mobile interface.

Overall application architecture for R&BD System is presented in the picture below:

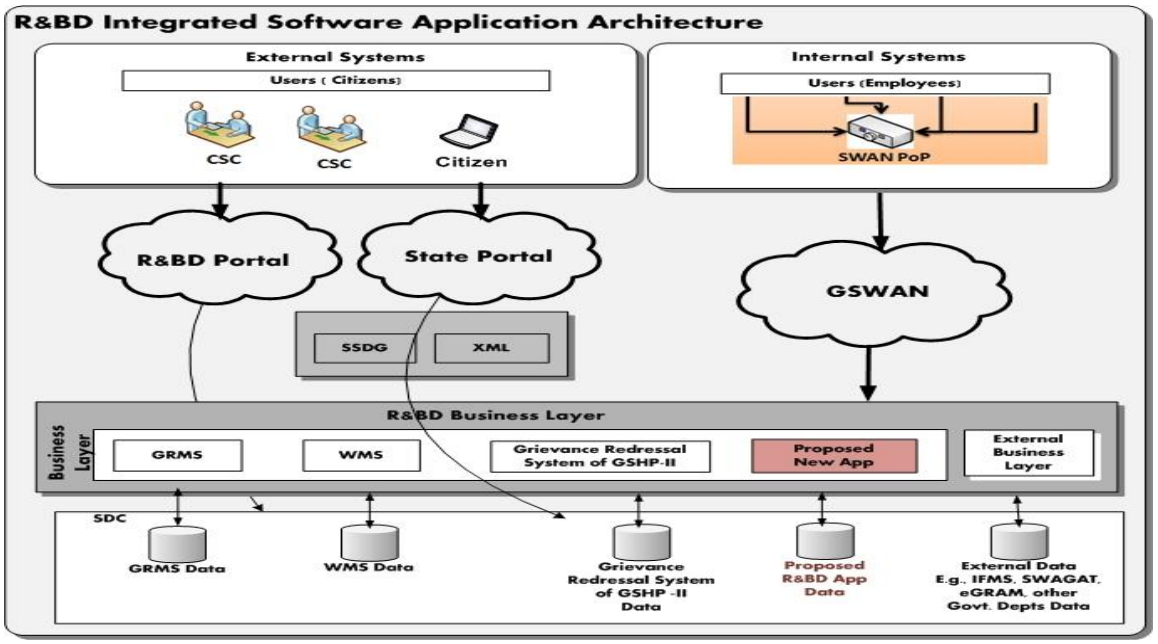


Figure – R&BD Integrated Software Application Architecture

Deployment Architecture

The diagram below gives high level deployment architecture of the application showing segregation of various layers. It is once again emphasized that the application shall be co-hosted at Gujarat SDC and hence same architecture of SDC shall be used for R&BD. The application would be hosted on a web server, industry strength application server and database hosted on Oracle/ My SQL. Web servers and Application servers would be hosted on Red Hat Enterprise Linux operating systems. Web server is placed in WEB DMZ, application server and database servers are placed in Secured Zone. Systems like Email servers would be connected to the R&BD through internal LAN network of R&BD Infrastructure and will not be directly connected to the Office LAN. SDC Operator shall perform all maintenance tasks such as regular upgrades and patches to various SDC software, hardware and service level management.

It is the responsibility of SI, to perform related migration activities of the R&BD application as per the latest upgrades done to SDC softwares.

Some of the key considerations for designing the deployment architecture based on the non-functional requirement of the architecture are given below:

Scalability

All components of the R&BD system must support scalability to provide continuous growth of the requirements and demand. A scalable system is one that can handle increasing numbers of requests without adversely affecting the response time and throughput of the system. A scalable R&BD system should be easily expanded or upgraded on demand.

- The R&BD system shall support both vertical (the growth within one operating environment) and horizontal scalability (leveraging multiple systems to work together on a common problem in parallel) by the use of Load balancers and High available servers etc. Scalability is important because new component is constantly being deployed, either to replace legacy component or to support new missions.

- Increased scalability is also provided by load balancing requests across the 'clustered' servers in future as and when required.

- Modular approach of application development for R&BD makes it scalable to future requirements.

Availability

All the components of the R&BD system must provide adequate redundancy to ensure high availability of the R&BD applications. Designing for availability assumes that systems will fail, and therefore the systems are configured to mask and recover from component or server failures with minimum application outage.

Following are the features of R&BD to make it highly available

- Load Balancing at both Web and application level

- Link Load balancing at Gateway level in future as the case may be for SDC

- Deployment of multiple application instances

- All the components of the R&BD (Both IT and Non IT) shall support Simple Network Management

- Protocol (SNMP) version 2 or higher protocol for the effective Monitoring and management
- R&BD system needs to be available as per SLA of the planned up time

Interoperability

The entire system / subsystem should be interoperable, in order to support information flow and integration.

- Operating systems and storage technologies from several suppliers shall interact well with each other
- R&BD system to support the open standards based solutions such as XML, XBRL, LDAP, SOA, etc. where information/data can be ported to any system, whenever desired

Security

R&BD would adopt the security approach of the Gujarat State Data Centre. In addition to the above R&BD shall also have application level securities such as role based access etc. to prevent misuse of the system.

The R&BD system must provide an end-to-end security blanket to protect R&BD applications, services, data and the infrastructure from malicious attacks or theft from external (through internet) and internal (through intranet) hackers.

- R&BD system shall use SSL/VPN technologies to have secured communication between Applications and its end users
- All the system logs shall be properly stored & archived for future analysis and forensics whenever desired
- Well defined access control to maintain application level security : Role based access, appropriate authentication mechanism and denial of access through unauthorized channels

Manageability

The R&BD system is designed in an efficient way to ensure an easy maintenance. R&BD system shall have following features to meet the manageability goals:

- Ease of configuration, ongoing monitoring, and failure detection that are vital to the goals of scalability, availability, and security
- Suitable design that can match the environment growth and can be managed remotely
- Ease of management by use of standard and supported tools
- Online tools for application, network and Support Desk management
- The solution shall lend itself to work closely with Support Desk systems and provide simplified means for user management, logging, and tracking

Performance

Performance is an important parameter in the overall architecture. Following are to be considered as part of performance improvement for R&BD.

- Use of Load balancers at various server levels (Web servers and Applications servers): load balancers not only improves the performance by intelligently managing load, but also tracks the server performance
- Redundant servers in active-active mode with clustering and load balancing
- R&BD being a web based solution where services are offered through internet, use of Link Load Balancers is very much essential. Link Load Balancer shall provide following advantages to R&BD system
- Can manage multiple ISP links to the data centre automatically, choosing the best-performing link to ensure compliance with service-level agreements
- Can intelligently compress traffic, reducing WAN link bandwidth for lower ISP costs--and cutting down on bandwidth bottlenecks for faster application delivery
- Can also manage the failover mechanisms for uninterrupted services

- Use of external caching Tier, which depending on the type of HTTP response being made, may decide to store the object for future use. As soon as another request is made for the same object, the Caching Tier may decide to reuse the previous object; saving a round trip to the next layer besides quickly receiving responses from the Web Tier, freeing it up very quickly, and then slowly draining that response to the user

- Usage of Gigabit Ethernet for a very fast, efficient and reliable communication amongst the devices

- Loose coupling of various layers/ tiers enabling quick recovery time in case of any failures

- Use of Internal cache tier to Caches objects closer to the Application or Web Tiers

- Clustering of servers

Considering the above, a three -tier deployment architecture is proposed which is a mix of both distributed and centralized platforms.

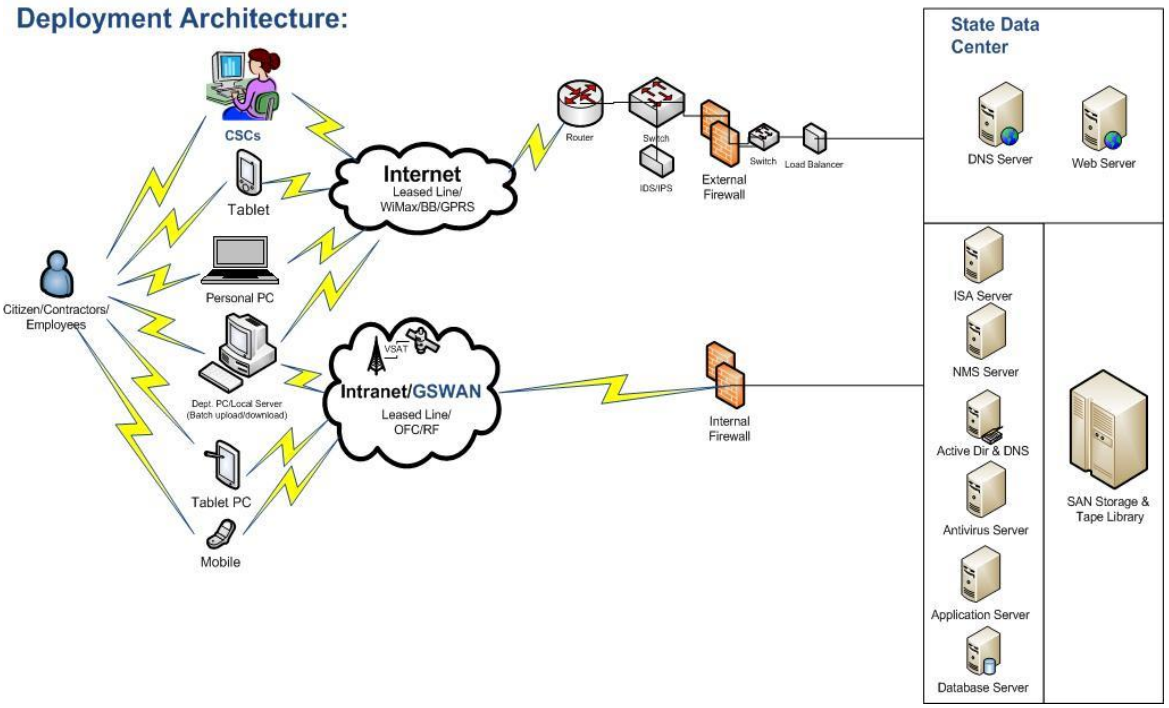


Figure – R&BD System Deployment Architecture

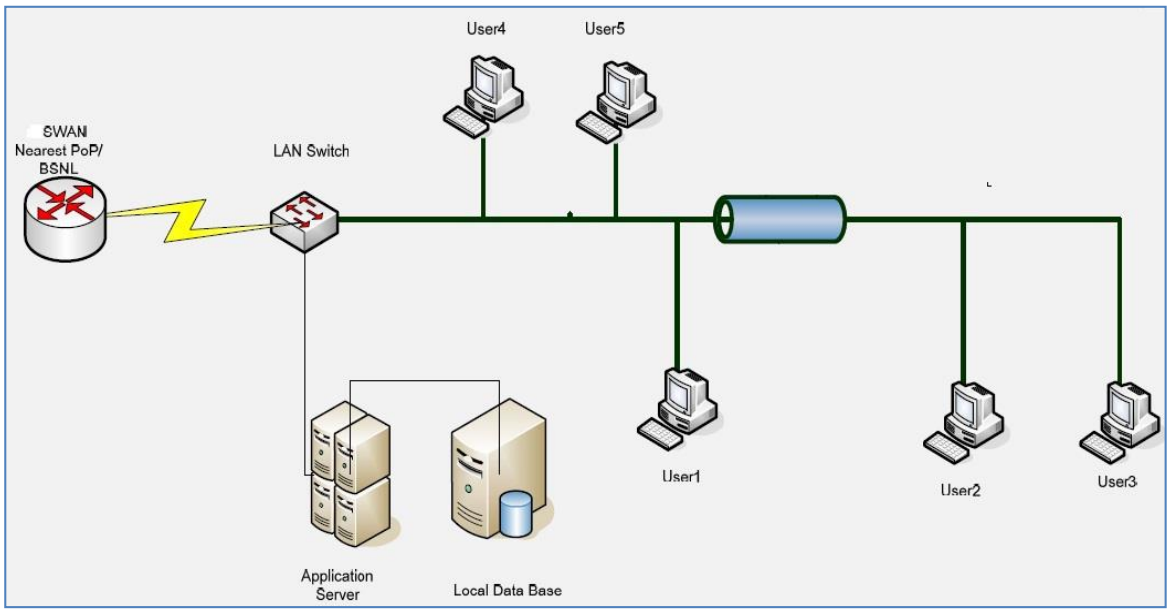


Figure – Deployment Architecture (Local)

Data Centre

As discussed in previous sections, R&BD System shall be co-hosted in Gujarat State Data Centre (SDC).

As the SDC has adequate access control mechanism, same would be followed for the security of all the R&BD data Centre equipment. The IT infrastructure for R&BD is proposed taking into consideration the IT infrastructure at SDC.

SDC will provide the following infrastructure for R&BD:

- Common infrastructure (Space, Power and cooling etc)
- Security (IPS, Firewall, Antivirus)
- Load balancers

- Presentation, Application and Data base layer infrastructure (Web servers, Application Servers, SAN, DBMS, etc.)
- Basic services: Patch upgradation, Server maintenance, backup services, etc.
- Remote Management

Provision with respect to additional hardware apart from existing infrastructure at SDC shall have to be made to provide Content Management Server and additional disks for SAN.

Disaster Recovery site:

DR site of SDC shall be used. To avoid data loss, incremental backups should be taken daily and placed in a different site. Backups should be taken on external media (tapes).

Network Architecture

It is proposed that Gujarat State Wide Area Network (GSWAN) meets the connectivity requirements of R&BD System. Remaining locations shall be connected to the nearest Point of Presence (PoP) through a last mile connectivity; Leased Line/ OFC/ RF/VSAT.

For the locations that are not feasible for connection to GSWAN, other arrangements such as BSNL Leased Line/ BSNL WiMax / BSNL VPNoBB / Private ISPs may be used for connection to SDC.

Security Architecture

R&BD System security shall be covering all aspects at all levels of entry and exit into the system to ensure that only authorized users/ authorized networks connect to the system and only legitimate traffic is allowed at the network.

While it is already mentioned that R&BD shall use the SDC security architecture, it is worthwhile to mention the various security features.

Following diagram depicts various levels of security adopted for R&BD:

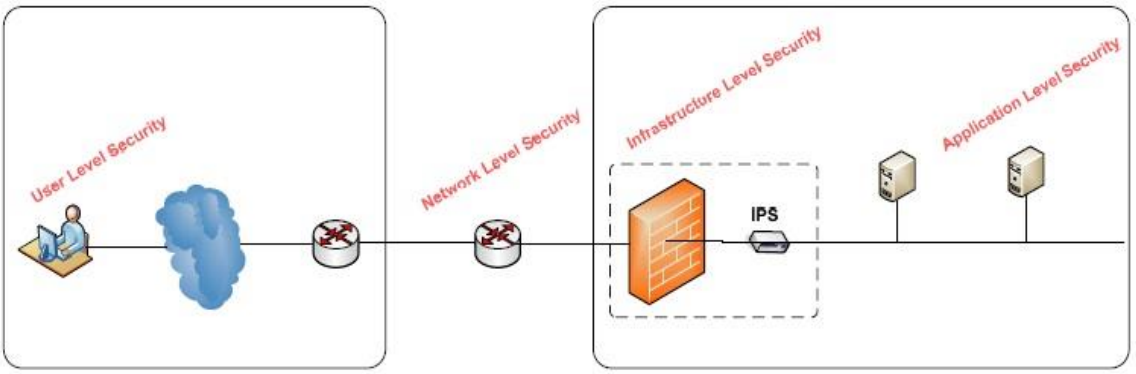


Figure – R&BD System Security Architecture

Key considerations at the user level

i. Single Sign On through user name and Password

ii. Authentication of applications and attached documents to be performed using Digital Signatures

iii. Role based access to the services, transactions and data

iv. Digital Certificate to be used for submission of applications and signing the Documents

The information assets and operations will be governed by a well-defined Information System Security policy in order to ensure confidentiality and integrity of the system.

The security architecture recommended includes the following components:

a. Authorization

Authorization is the means of establishing and enforcing user rights and privileges. Access policy needs to be in place including Access Matrix to clearly demarcate which modules/ functionalities are accessible to which set of users. During operation, the access

control rules would be applicable. The process of updating the access matrix and rules should be easy to manage as it is a continuous and regular activity in such a scenario.

b. Authentication

Authentication is the process of verifying and establishing the identity of the user. Authentication for accessing information would be of various types

i. User name and Password for basic information

ii. User name, password and Personal Data validation for particular information like Caveats

iii. Class II digital signature through USB Token for approvals and confidential data

iv. Multifactor authentication based on the eSAFE policy detailed in Technology standards section.

c. Policy

Information security policies should be well defined to safeguard the information resources. Appropriate infrastructure should be in place to support these security policies and should be diligently implemented across the system. The policies have to be regularly updated and adapted in alignment with the changing external as well as internal factors. External factors could be change in the government compliance laws whereas internal factors could be an organization wide decision of adopting a new information security standard, for example adopting ISO 27001 standards. Detailed security Policy details are mentioned in section for Technology Standards.

d. Guidelines

In addition to the established information security policy, explicit set of guidelines should also be prepared. These would include the dos and don’ts for the stakeholders using the R&BD system. The guidelines should also be regularly updated in alignment with the changing information security policies.

Knowledge Management System

Knowledge Management System is an integral part of any organization/department. Knowledge management systems refer to an IT system that could store and retrieve knowledge, locate knowledge sources, search repositories for legacy data which could be used at any instant.

Currently, the R&BD does not have a knowledge management system in place which results in a delay in case some relevant information used earlier needs to be referred to. The contact person needs to be contacted and informed about the need for a particular document. Also, the latest versions of certain documents containing vital information needs to be circulated manually amongst the key stakeholders for all to be on the same level.

Knowledge management system could help the department store its electronic documents with a facility to track them. The system could track the versioning of the documents by different users. Documents spanned across the department at different instances could be stored which could act as a repository for future reference.

The proposed system could function as follows:

- A new / changed document: A dedicated personnel could be appointed as a System Administrator. Only a System Administrator could add/delete/edit the documents and upload them with prior approval from the authorised Departmental official.

- Notification to the users: The user having an access to the document receives a notification about the change in the document

5.5. Conceptual view of MIS

Management information system, or MIS, broadly refers to a computer-based system that provides tools to organize, evaluate and efficiently manage departments within an organization. In order to provide past, present and prediction information, a management information system helps in decision making, data resources such as databases, the hardware resources of a system, decision support systems, people management and project management applications, and any computerized processes that enable the department to run efficiently.

MIS aids in building a comprehensive and integrated system for R&BD for transforming and ensure ready availability of authentic data while simplifying data collection processes, there is a need to create a consolidated and comprehensive Management Information System as a single source of authentic data.

The Conceptual figure of the R&BD – Management Information System is depicted below:

R&BD - Management Information System:

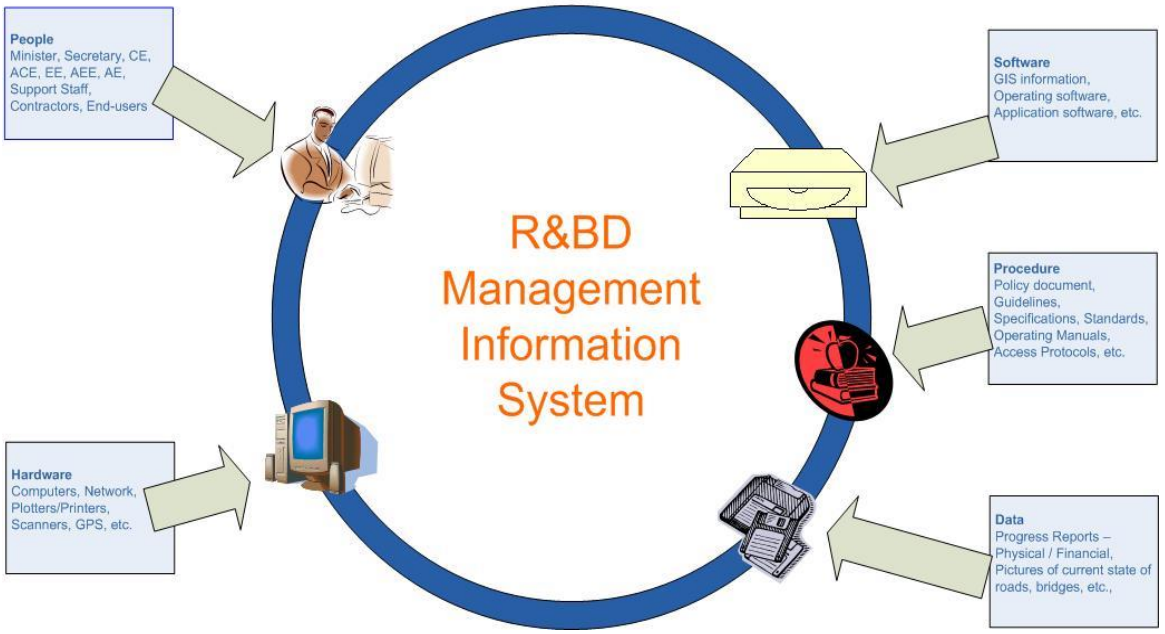


Figure - R&BD – Management Information System

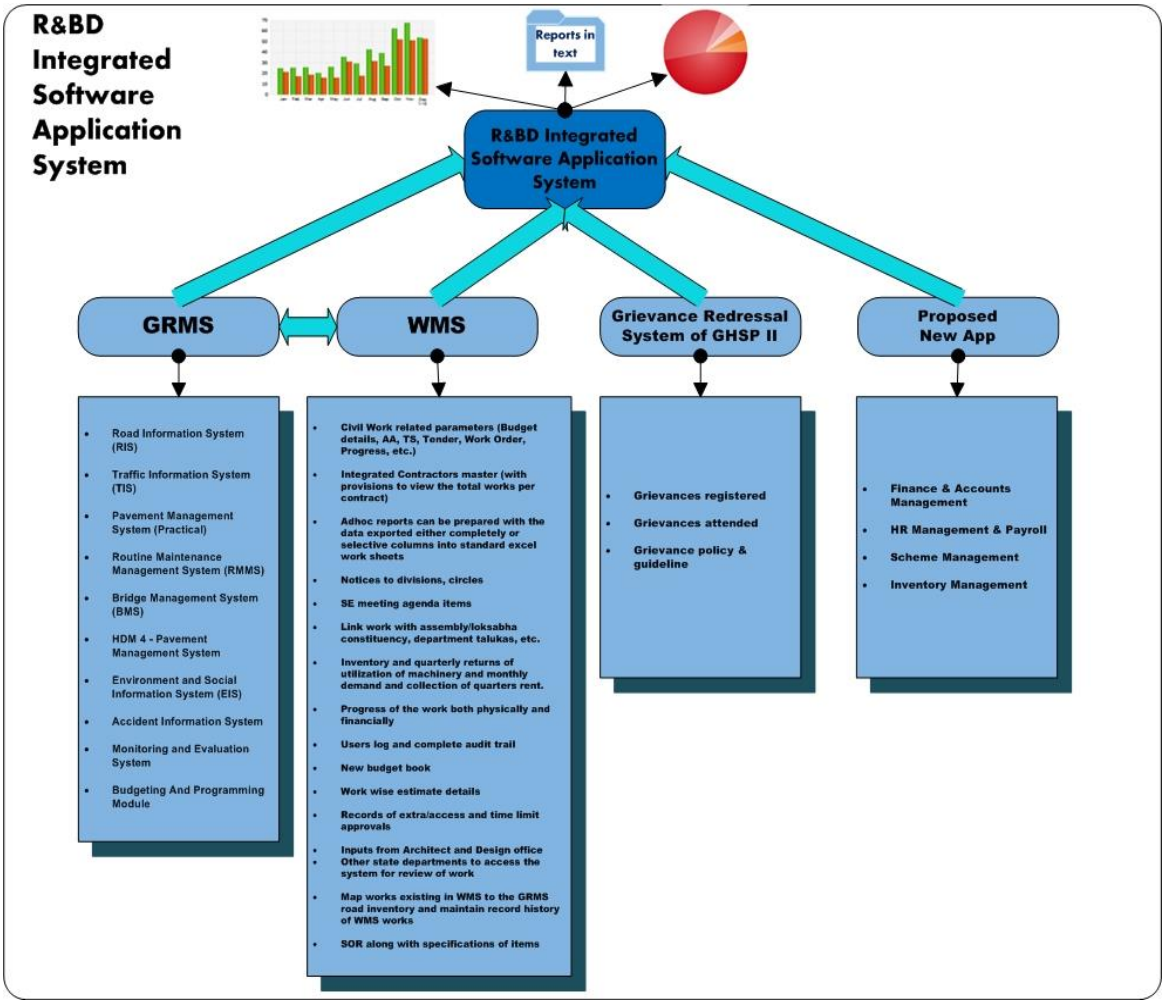


Figure - R&BD Integrated Software Application System

5.6. IT cell in R&BD

An Information Cell would plan, operate and support IT infrastructure, enabling users to carry out their roles efficiently, productively and securely. The department must meet multiple business and technical requirements, provide a secure IT infrastructure and minimize cost. The role and responsibilities of the IT Cell would be:

Planning

The IT team would work to develop an IT strategy that supports the organization's objectives and helps build a strong reliable working environment. They would

assist/coordinate software related work and other elements of the IT system to meet the needs of departments. The team also ensures that the right level of IT resources is available to meet changing levels of demand.

Network

The role of IT team would be to develop and operates a network to support effective communication and collaboration. Increasingly, they are deploying the latest Internet Protocol networks with the capability to carry all voice, data, video and Internet traffic on a single network. IP networks would enable organizations to replace their legacy telephone systems with an IP-based system, reducing complexity and providing a platform for deploying advanced unified communications tools. The IT team would develop solutions that allow external government organizations, to securely access the department's network.

Data

IT teams would develop tools to collect, store, manage, secure and distribute data to employees who need access to the latest information to make decisions about strategic, financial and operational issues. They would coordinate the storage of information from various Department offices and other related Government Departments in data centre.

Security

Information security management is now one of the most important IT functions in an organization. IT teams must protect the IT infrastructure and corporate data against attacks from viruses, cybercriminals and other threats. Attacks on the infrastructure can prevent an organization carrying out critical business operations with a consequent impact on service. Data leaks can lead to loss of confidential corporate and other relevant data.

Support

To enable employees to make the most effective use of IT resources, the IT team would provide various forms of user support. After installing new software or network facilities, the team would provide training so that employees can quickly make productive use of the new resources. The team also provides ongoing support to users through a helpdesk or self-service facilities on the organisation intranet.

Based on the current assessment and Institutional Development Action Plan (IDAP), the following recommendations have been made:

- Dedicated R&BD data center(s) and its supporting networks to be established within a span of two years
- Similarly, The lead IT cell should be operational within a span of two years which would cater to the needs of all the IT/ICT-MIS requirements of R&BD

5.7. IT Governance cell for R&BD

Putting a governance structure around R&BD's future IT implementation plan is essential to ensure that project implementation stays on track, achieve its strategies and IT goals. It acts as a mechanism to measure IT system's performance. It makes sure that all stakeholders' interests are taken into account and that new systems provide quantifiable outputs. Also IT systems today are subject to many regulations governing data retention, confidential information, financial accountability and recovery from disasters; an IT governance framework is an efficient system to ensure regulatory compliance.

Running and implementing a project would encounter many challenges. Therefore, it is imperative to create a formal Project Governance Structure taking into account the following factors:

i. Complexities of multiple sub-departments and Government entities
ii. Technology challenges
iii. Varying level of IT maturity and adaptability of technologies across users
iv. High level of interdependencies between various initiatives etc.

This would ensure the successful coordination and management of a range of project initiatives within the department and become a driving force for the broader change agenda. The intent of developing and running a suitable Project Governance Structure is to promote a sustained improvement in the delivery of services by providing a vehicle through which:

i. All stakeholders can be engaged
ii. The baseline for the programme / project(s) can be fully understood

iii. The internal project and programme management capabilities could be built

iv. Specialist expertise and knowledge can be shared

An appropriate Project Governance Structure will guarantee the long-term success of the project.

A following four-tier structure may be constituted considering the wide scope of work and large number of stakeholders in R&BD:

Project Steering Committee (PSC), the apex unit for policy advice, strategic guidance on various project aspects and responsible for all the key decisions of the project, is recommended to comprise the following members:

Proposed Position	Designation
Chairperson	Secretary, R&BD, Govt. of Gujarat
Deputy-Chairperson/Member	Chief Engineer, R&BD, Govt. of Gujarat
Member	Addl. Chief Engineer, R&BD, Govt. of Gujarat
Member	Financial Advisor, R&BD, Govt. of Gujarat
Member	Legal Advisor, Govt. of Gujarat
On requirement the committee can include any official as member.	

Project Management Group (PMG), responsible for providing the overall vision, broad policy direction and guidance to the department, allocating state level resources, setting priority amongst projects and resolving interdepartmental issues and also reviewing project progress, is recommended to comprise the following members:

Proposed Position	Designation
Mission Leader/Chairman	Chief Engineer, R&BD, Govt. of Gujarat
Nodal Officer	Addl. Chief Engineer, R&BD, Govt. of Gujarat
Member	Superintendent Engineer, R&BD, Govt. of Gujarat
Member	Executive Engineer, R&BD, Govt. of Gujarat

Nodal Officer/Member	Head of Division, R&BD, Govt. of Gujarat
On requirement the committee can include any official as member.	

Project Advisory Group (PAG), consisting of of consultants with experience in various domains ranging from Technology, Roads & Buildings, Finance, etc., would assist the PMG and would be directly responsible and accountable for project implementation, day-to-day management and coordination, and for meeting the administrative requirements of the R&BD pertaining to R&BD IT System. It is recommended to comprise the following members:

Proposed Position	Designation
Advisory Head	Project Manager, Consultancy Firm
Advisory Member	Consultant, Consultancy Firm

Project Implementation Group (PIG) is recommended to comprise the following members:

Proposed Position	Designation
Leader/IT Champion	Chief Engineer (I/c IT), R&BD, Govt. of Gujarat
Member	OSD to Chief Engineer, R&BD, Govt. of Gujarat
Member	Representative from NIC, Gujarat, Govt. of India
Member	Representative from DST, Govt. of Gujarat
Member	Representative from GIL, Govt. of Gujarat
Nodal Officer/Member organizer/ facilitator	1 representative each from SWAN, SDC, SSDG
On requirement the committee can include any official as member.	

Project Implementation Group at NIC

The implementation group within NIC would have the requisite technical resources including application specialists, network specialists, database specialists and support personnel. This team will be headed by team lead(s). An adequate number of such

resources will be required at NIC considering the size and scale of operations and the contours of the proposed system which is spread across the country. This group shall provide the on ground help and support necessary for implementing the project seamlessly.

5.8 Procurement

For a successful implementation of any project, a realistic procurement strategy is a mandate. A strategy would help in monitoring the procured equipment and in future the need for its maintenance and/or replacement. As per the assessment, the procurement needs to be done as per the World Bank procurement guidelines. The strategy has been left at the discretion of the implementation agency in collaboration with R&BD.

6. Gap Analysis

Current State	Future State	Gap	How the Gap is addressed
GRMS			
Currently, the application is not in function; Data not updated since first quarter of 2012; road data stored manually in registers	The application should be able to indicate the details of all the roads in the state	Lack of data updation resulting in non-functioning of the most important application of the department	Digitization of all the relevant data till date
Client-server based architecture	Hybrid & Web-based architecture; the application to be hosted on a web server & Local Server	Server is currently obsolete due to lack of maintenance	Users could access the application anytime and anywhere irrespective of network

Current State	Future State	Gap	How the Gap is addressed
MIS Reports unavailable	Higher management could leverage on the inputs from MIS Reports for effective decision making	Unavailability of data	Digitization of previous data and regular updation of data
Not all the relevant information about the roads is captured	New fields to be added in the application	Required scenario not available for taking decisions about the status of the roads	Addition of more number of relevant fields would enable to view a high-level dashboard with respect to the conditions of the roads
A mobile app to update data on the go is not available	Handheld device based mobile app could be useful to update the data instantaneously	Instantaneous update unavailable	Provision for such handheld devices and mobile app will increase efficiency of GRMS usage
WMS			
Data not populated in the WMS system regularly	Regular updation of data into WMS	Lack of data in WMS	Increase connectivity & bandwidth and provisioning of mobile app and mobile devices to enable instantaneous data entry
WMS is a stand-alone application	Integration with other applications	WMS data not relevant in silo	Hybrid and Web-Based integrated solution with respect to other Department applications
Infrastructure			

Current State	Future State	Gap	How the Gap is addressed
The existing application was running on Windows XP platform	Applications should be implemented with compatibility to the latest operating systems / platforms for its intended purpose	Microsoft has already closed support to Windows XP platform	The new version to be developed on Windows 8 or 10 platform
No centralized asset register	A centralized asset register	The IT asset details are recorded and kept individually at each office	Even when each office procures its own assets, the concerned person should update the details in the centralized asset register
Lack of GSWAN connectivity at the sub division offices of R&B Department	Having GSWAN connectivity at the sub division offices will help the department in achieving the necessary flexibility and ease of work for various web based applications of R&B	This limited connectivity at field offices have created a work culture which is either manual or semi-automated (with just file sharing over the email or DVD)	The data could be directly updated at the sub-divisional offices or at their local server (to be updated batch-wise as and when connectivity is established) thereby achieving the purpose of having updated data into the system and helping the application have its maximum use
Use of outdated systems having Windows XP operating system	Systems with latest configurations should be used in order to support the application versions as well as for daily activities	No support available for Windows XP operating system	Install computers with latest operating systems such as Windows 8 or 10 where possible (hardware support). Else provisioning some budget for

Current State	Future State	Gap	How the Gap is addressed
			procurement of latest hardware with updated software
Capacity Building / Trainings			
No dedicated IT cell	A dedicated IT cell	Lack of people having IT skill set; no IT support available	A team consisting of 2-3 technical people and 1-2 personnel having a functional understanding of the department headed by a higher management official
Lack of Computer knowledge amongst the staff	Increase in usage of basic computer concepts and understanding of R&BD applications	Staff unaware of simple basic computer concepts as well as not aware of the usage of R&BD applications	Regular trainings on computer basics and R&BD applications
Knowledge Management			
Absence of a knowledge management system resulting in a delay in case some relevant information used earlier needs to be referred	Central repository of Knowledge management system could help the department store its electronic documents with a tracking facility along with the versioning of the documents by different users	Any past reference material is not accessible; also circulating updated document to the relevant personnel is a hassle	Documents spanned across the department at different instances could be stored which could act as a repository for future reference. Documents could be added / modified by a single System Administrator
Data back-up and Retrieval mechanism			
Lack of data back-up and retrieval mechanism	Follow the Standard Operating Procedure for back-up and retrieval mechanism	No process to take data back-up on regular basis; in case of a system crash,	Developing the Standard Operating Procedure for back-up and retrieval

Current State	Future State	Gap	How the Gap is addressed
		chances of data getting lost	mechanism. Awareness about the need for regular back-ups and circulate the documented retrieval mechanism
Connectivity / Bandwidth issues			
Use of personal email accounts for official matters due to connectivity and bandwidth issues	GSWAN provided email accounts to be used for official purposes	Lack of connectivity and bandwidth due to administrative issues	Increasing the connectivity and bandwidth provided to the department so that the staff could use official email accounts for official matters
Not connected to GSWAN connectivity	Connected with GSWAN. Alternate connectivity where GSWAN is not feasible	Inability to access the application due to connectivity issue	GSWAN extension to the R&BD remote offices and providing alternate connectivity options like BSNL Broadband, Lease Line, VSAT, etc., where GSWAN extension is not feasible.

7. Quality assurance and Quality control

Quality assurance with in terms of development of an IT system refers to means of monitoring the software engineering processes and methods used to ensure quality. The methods by which this is accomplished are many and varied, and may include ensuring conformance to one or more standards, such as ISO 9000 or a model such as CMMI. But the proposed system is required to be tested by STQC before the rollout. The STQC testing would include both functional and non-functional tests which may also include the performance load.

Quality assurance

Adherence to Standards

The standards to be followed in SDLC (Software development Life Cycle) are mentioned below:

- Software Requirements Specification IEEE 830
- Software Design Description IEEE 1016
- Software Validation & Verification Plan IEEE 1012
- Software Test Documentation IEEE 829
- Software Project Management Plan IEEE 1058
- Software Quality Assurance Plan IEEE 730
- Software Configuration Management Plan IEEE 828
- Portal development Guidelines for Indian Government website (GIGW)
- Information access/transfer protocols: SOAP, HTTP/HTTPS
- Interoperability: Web Services, Open standards, XML Standards
- Master Data: Metadata standards
- Scanned documents: Pdf (ISO 32000)
- Digital signature: PKCS#7 (As per the IT Act 2000)
- Document encryptions: PKCS specifications
- Information Security system to be ISO 27001 certified

- IT Infrastructure management ITIL / EITM specifications
- Service Management ISO 20000 specifications
- Project Documentation IEEE/ISO/CMMi (where applicable)

Quality Control

It includes set of procedures used to ensure that the proposed IT system meets requirements related to quality. The parameters of quality control are mentioned below:

a. Application Audit

Comprehensive application audits to be conducted at regular intervals through a 3rd party to ensure application functionality and integrity.

b. Version Control

The application software shall be version controlled, adopting the industry standard practices like Version Control System (VCS), Source Code Management System and Software Configuration Management (SCM) etc.

c. Role Segregation

The roles of different personnel responsible for designing, coding, accepting the changes and authorizing the changes to be carried out into the production environment shall be clearly defined by the implementation agency.

8. System Support and Maintenance Mechanism

The system support and maintenance mechanism of the IT systems becomes a crucial aspect when there is a requirement of an optimal level of service. Technical support may be delivered by different technologies depending on the scope of the proposed solution e.g. example, basic software problems can be addressed over the telephone or, by using remote access repair services; while more complicated problems with hardware may need to be dealt with in person.

It has been observed that at the R&BD's organization, there is a need to establish a dedicated centralized IT service desk that is available 24 x 7 to provide technical support to the users and respond to all the queries and incidents pertaining to the software systems being employed. The IT service desk should be designed to function as a transparent structure and facilitate an accountable incident management mechanism that is geared up to be at the user's disposal. The service desk should be an intelligent, state-of-the-art infrastructure and should be architected to scale enormously to meet all future needs of the organization.

Advantages of establishing an IT service desk:

- Enable responsive, stable and repeatable IT Service Delivery
- Provide for improved incident and problem Management
- Status tracking of logged incidents
- Accountability of the logged incidents
- Service Level Agreement (SLA) based service
- Improved transparency in working of the IT division
- One point of contact for the users for IT related services
- Standardization of processes and better management of IT services
- Creation of a central repository of information of the type of incidents being raised

Mechanism of Working

The infrastructure and operations of the IT support mechanism can be handled in various ways and are discussed in subsequent pages.

1) The users, such as AE, SE and CE from various offices call up the IT helpdesk for

   - Raising IT incidents
   - Getting password resets
   - Raising complaints about the lack of functionality of certain systems
   - Service request for hardware failure

2) The Interactive Voice Response System (IVRS) recognizes the user's requirement

3) Based on the option selected by the user, the system transfers the call to the required personnel

4) The customer care executive, depending on the nature of the issue reported, logs the incident in a software application and provides the user a unique reference number

5) The incident raised is then allotted to the technical team for resolution. The status of the ticket can be tracked using the unique reference number

Business Model of the IT Support Desk

A very systematic approach should be taken for operating the IT service desk. Carrying out operational activities of the IT service desk would require strict tracking and monitoring to ensure that the agreed SLAs are maintained and optimum service is provided to the users. Some of the operation options for the service desk are:

- Complete in-house model
- Complete outsourcing model
- Hybrid model

Complete In-House Model

This is a complete ownership model where the O/o R&BD would keep the ownership of each activity of the support desk. In this model the hardware infrastructure, network, manpower and complete management would remain with the O/o R&BD. This will require the O/o R&BD to maintain a technical team in-house.

Complete Outsourcing Model

In this model of operation, the O/o R&BD can outsource each and every activity of the IT service desk to an external agency. Setting up of the infrastructure, managing data synchronization, managing multilingual manpower etc, all would be the responsibility of one or more external agencies. This model would save the O/o R&BD from creating a huge infrastructure asset. The external agency may charge on an annual basis or on any other transactional model. This model will pose the least number of management concerns to the government and will ensure good quality of service.

Hybrid Model

As the name suggests, this model can be a mix of the complete in-house model and the complete outsourcing model. The infrastructure setup can be owned by the government, and the operations may be transferred to an external agency. Another method can be to setup the service desk on a BOOT (build own operate transfer) model where an external agency would setup and run the service desk for few years and transfer it to the O/o R&BD.

Based on the assessment, it is suggested that R&BD should adopt the Outsourcing model since the department does not have the expertise either in setting up or maintaing the IT support desk. This should be looked as one of the most goals since IT support is the key to any successful automated solution / appliction.

Establishing the Service Desk

Achieving an optimum level of service requires certain best practices to be followed. Adopting best practices can help the service provider to create an effective service management system. Best practices in this regard can come from many different sources, including public frameworks (such as ITIL, COBIT and CMMI), standards (such as ISO/IEC 20000 and ISO 9000), and proprietary knowledge of people and organizations. As a best practice, technical support should be subdivided into a three-tier structure in order to better serve a business or customer base. The reason for providing a multi-tiered support system instead of one general support group is to provide the best possible service in the most efficient possible manner. A brief description of the each tier of the support desk is given below:

Tier / Level 1 (T1/L1): This is the initial support level responsible for basic customer issues. Tier / Level 1 (T1/L1) support shall be available 24*7. The task of the Tier I layer would be to gather the customer's information and to determine the customer's issue. Once identification of the underlying problem is established, the specialist can begin sorting through the possible solutions available. Technical support specialists in this group would handle straightforward and simple problems such as, resolving username and password problems, uninstalling/reinstalling basic software applications, verification of proper hardware and software set up, and assistance with navigating around application menus. The goal for this group is to handle 70%-80% of the user problems before finding it necessary to escalate the issue to a higher level.

Tier / Level 2 (T2/L2): This would be a more in-depth technical support level than Tier I. Tier / Level 2 (T2/L2) shall resolve incidents as per the SLA in case the incident remains unresolved at Tier / Level 1 (T1/L1). Specialists in this tier would be responsible for assisting Tier I personnel in solving basic technical problems and for investigating complex issues by confirming the validity of the problem and seeking for known solutions related to these more complex issues. Prior to the troubleshooting process, the Tier II specialist would review the work of the Tier I specialist to see what has already been accomplished by the Tier I technician and how long the technician has been working with the particular customer or user. This is a key element in meeting both the customer and business needs as it allows the technician to prioritize the troubleshooting process and properly manage his or her time to maintain the required Service Level Agreement (SLA).

Tier / Level 3 (T3/L3): This would be the highest level of support in the three-tiered technical support model, responsible for handling the most difficult or advanced problems. The individuals in this tier would be responsible for not only assisting both Tier I and Tier II personnel, but also for the research and development of solutions to new or unknown issues. The Tier III specialists would have the same responsibility as Tier II technicians in reviewing the work and assessing the time already spent with the customer so that the work is prioritized and time management is sufficiently utilized. This group would responsible for designing and developing one or more courses of action, evaluating each of these courses in a test case environment, and implementing the best solution to the problem. Once the solution is verified, it would be delivered to the customer and made available for future troubleshooting and analysis.

9. Change Management

9.1. Need for Change Management

Introducing radical reforms has to be necessarily accompanied by efforts to change the mind-sets of people – both within and outside the department. For instance, the service seekers need to know how to avail services with the new system implemented; the staff should be skilled to operate and work in a significantly newer way. A well-calculated and well-designed strategy has to be followed for staff to be trained work effectively in the new environment. It is necessary to formulate a change management plan with appropriate interventions for capacity building, training and stakeholder communications.

A successful Change Management Programme will ensure:

- A smooth transition to the new way of working
- The organization/people support the changes implemented
- Individuals know how the changes affect them and the role they have to play
- The new system and its underlying concepts are understood
- People are aware of how roles and responsibilities are changing
- Everyone is motivated and committed to the change programme
- The success and progress of the programme is monitored and measured

9.2. Key Change Management Implications

The implementation of a new IT ecosystem in the Office of R&BD will have several change implications emanating from the following changes:

- Process and procedural (necessary introduction of some new process and systems emanating from the need of changing core functional information flow in a few cases)

- Technical and technological (introduction of new technologies for enabling the new / unaddressed business requirements)

- Organizational (transformation of existing organizational structure and redefined roles and responsibilities)

The following change implications can be clearly identified at the outset of the implementation of the new system:

Change Element	Change Implication	Change Issues
Process and procedural	• Standardization of procedures • Redefined processes and new work methods • Elimination of certain activities / functions and addition of new ones • Redefined service levels • Customer centric approach • Standardized MIS reporting systems to monitor the progress	• Reorientation of staff to new processes and work methods • Reorientation of staff to any applicable service levels • Augmentation of customer focus • Loss of control over discretion on procedures by staff • Enhanced process driven systems with clear accountabilities and responsibilities • Preparation for dealing with public grievances in the defined service levels
Technological	• High usage of technology and system enabled processes • Automated controls and validation • Creation of centralized online grievance redressal mechanism • Reduction of paper work	• Work systems changed from slightly automated to highly automated work methods • Preparation for use of technology and system enabled processes • Orientation towards a paperless processing system
Organizational / People	• Some change in roles and responsibilities • New skill set requirement for staff	• Reluctance to work in tandem with external agencies involved in implementation • New work environment and changed peer relationships

	• Introduction of a incentives and reward system	

For an effective change management plan, it is necessary to categorize change issues according to the impact they might have on successful implementation of the new system and the urgency with which they need to be addressed.

Impact of issues on successful implementation is measured by the following parameters:

- Issues which are most critical for new system implementation to succeed
- Issues which are necessary ensuring present level of service will be maintained during the change phase
- Issues which if not resolved, will still be least disruptive to the new system implementation

These issues in order of their importance have been listed below in the table:

Change Issue	Impact on Implementation	Issue Resolution Time Frame
Reorientation of staff to new work methods	High	Immediate
Augmentation of customer focus	High	Immediate
Preparation for use of technology and system enabled processes	High	Immediate
Orientation towards a paperless processing System	High	Immediate
Loss of control over discretion on procedures by staff	High	Immediate
Reorientation of staff to concept of service levels	High	Medium Term
Preparation for dealing with public grievances in the defined service levels using technology	Medium	Medium Term

Process driven systems with clear accountabilities and responsibilities due to standardized MIS and reporting	Medium	Long Term
New work environment and changed peer Relationships	Medium	Medium Term

9.3. Key steps for change implementation

Interventions at various levels are needed to mitigate staff's resistance to change and facilitate an environment which encourages staff to pro-actively volunteer within the new system.

Some of the strategies to ensure quick-wins would be:

- Organizing workshops with users on
  - The proposed changes highlighting the positives in the system and creating a buy-in from them
  - Provide them with answers to key questions which users will encounter from their customers – "Helping them deal with their stakeholders"
  - Communicating to them the key requirements of the proposed system – "What we want from them"
- Creating forums for dialogue and exchange of ideas
- Exposure to other such computerization initiatives in similar set-ups worldwide
- Encourage Two-Way communication and built a system of feedback

9.4. Capacity Building

Approach to capacity building

It is important to build capacities in the R&BD office staff in terms of necessary knowledge and skills to initiate and successfully implement the new system. It is equally important to generate an attitude that is receptive to technology based operations. Merely developing and implementing a new system will not help deliver the quality results envisaged unless staff members are aligned to provide the right results with the right tools at the right time.

The nature and scale of implementation planned for the Office of R&BD processes demand a considerable enhancement in the capabilities of the organization to effectively address the objectives. For achieving this, the Change Management Team needs to provide overall direction, standardization and consistency across the implementation.

Hence, in this backdrop, R&BD staff leading the implementation initiatives and its constituent projects, needs to be adequately trained to meet the managerial and technological challenges for driving the project. However, a number of people at remote offices might not be adequately equipped to take up the challenge. Some of the real problems faced at the various levels are:

- Little knowledge of essentials of IT
- Minimum technology exposure
- Lack of in-depth understanding of the benefits
- “What’s in it for me?” factor

To address the training needs, the change management team should prepare guidelines that identify the training needs of all stakeholders and provide suggestive training curriculum to address the training needs. Such guidelines will assist local change teams to formulate their own training plans and aid the progress of the implementation of new system efficiently at local levels.

Critical capacity building needs and training

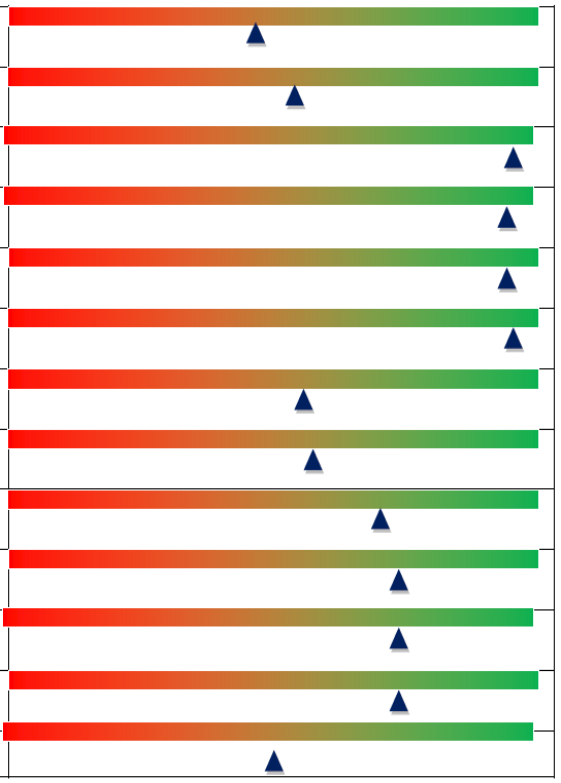
The following table illustrates the potential areas of training required for the above mentioned levels:

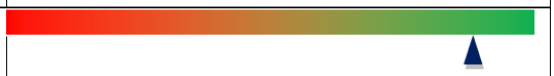
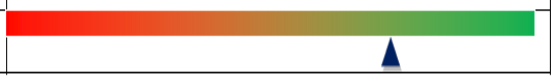
S. No.	Training Level Envisaged	Potential Areas for Capacity Building
1.	Project Steering Committee	• Policy formulation • Committing Resources • Taking Hard Decisions
2.	Project Management Group	• Preparing Roadmaps • Prioritization

S. No.	Training Level Envisaged	Potential Areas for Capacity Building
		• Framework, Guidelines • Monitoring Progress • Inter-Agency Collaboration • Capacity Management
3.	Project Advisory Group	• Conceptualization • Architecture • Definition (RFP, SLA) • Bid Process Management
4	Project Implementation Group	• Project Monitoring • Thorough knowledge about each application

Also, it is imperative to recapitulate the areas where the relevant IT training would help the users at various levels maximize the benefits of the proposed new IT systems. During the assessment phase it was found that the basic knowledge of IT systems is sufficient for daily usage of these applications and systems. However aspects pertaining to IT security, data security and backup form the key concern areas with regards to IT skill augmentation of the users.

The recommended level of skills to operate new IT systems at various user levels is given below:

Readiness to use computer for general typing work	Sachivalaya	
	Circle Office	
	Division / Taluka Office	
Readiness for Actual use of application	Sachivalaya	
	Circle Office	
	Division / Taluka Office	
Familiarity with Office Suite(MS Office)	Sachivalaya	
	Circle office	
	Division / Taluka Office	
Readiness to use internet & email facility	Sachivalaya	
	Circle Office	
	Division / Taluka Office	
Internet Banking concept / e-Commerce & e-	Sachivalaya	

Payments systems concept / awareness	Circle office	
	Division / Taluka Office	
Awareness of Digital signature & encryption concepts, Computer security & hacking concepts	Sachivalaya	
	Circle Office	
	Division / Taluka Office	
Awareness of Computer Virus concepts and protection	Sachivalaya	
	Circle Office	
	Division / Taluka Office	
Awareness of Data access policy	Sachivalaya	
	Circle Office	
	Division / Taluka Office	
Awareness of Backup & Disaster recovery concept	Sachivalaya	
	Circle office	

	Division / Taluka Office	
Readiness for Day-to- day trouble shooting	Sachivalaya	
	Circle Office	
	Division / Taluka Office	

Legend: Low  High

Within the above constraints and training requirements, the structuring of training has been left at the discretion of the implementation agency in collaboration with R&BD.

9.5. Communication Plan

Communication and Change Management

R&BD office staff may resist change for a number of reasons, including fear of losing their discretion, fear of the unknown, reluctance to make the effort involved, upsetting a well-established routine, fear of failure, lack of confidence in the change implementers, lack of proper communication but possibly, the most important reason is the fear of being worse of afterwards.

R&BD office staff (rather than IT) is the central focus of the change management and communication plan. For successful project implementation, change management interventions should particularly aim at supporting those who will be most affected by the change of systems and any associated processes / functionality.

The objectives of the communication and change management plan are to:

- Use communication mechanisms for providing the Office of R&BD staff with critical information, feedback mechanisms and support during the change of system
- Assist with the operation of the project objectives as stated within the project charter
- Ensure least resistance from staff with respect to proposed changes in the systems

Some of the key messages of the communication and change plan are:

- Uniform and simple functionality / system for staff leading to rationalization of workload and accountability
- Skill enhancement through training of the staff (functionality and technology)
- Recognition to efficient staff through a recognition program
- Low level activities being automated, hence higher growth opportunity for the staff
- Better office environment and comfortable work area due to proposed changes

Preparing Officers to be Change Agents

Office of R&BD office staff may resist significant changes. Officers should acknowledge these feelings and address them through face-to-face meetings, rather than withholding information or not acknowledging employee reactions, fears, and doubts. Officers may effectively deal with the negative effects of change if they understand how change affects their staff.

The following list in table below provides reasons staff may resist change and strategies that officers can use to reduce that resistance:

Reasons Employees Resist	Strategies for Officers
• Employees feel they will suffer from the change • Organization does not communicate expectations clearly • Employees perceive more work with fewer opportunities • Change requires altering a long-standing habits • Organization lacks adequate reward processes • Organization lacks sufficient resources • Organization has poor internal communication • Change has poor introduction	• Use communication strategy that asks for employee input • Do not send mixed signals regarding the change; this will increase employee distrust • Communicate clear vision of the change • Provide timely information on change • Identify employee concerns and unresolved implementation issues • Provide staff with a timeline and a defined approach and outcome • Communicate how staff will benefit from the change • Develop procedures to address staff who will be negatively affected by the change • Allow staff to express their grief; criticizing change creates defensiveness in those who like the traditional ways

Tips for Office of R&BD Officers to preserve employee morale during change implementation:

- Spend a day walking around subordinates to find out what their new working environment is like
- Hold routinely scheduled officer meetings to discuss implementation progress of new systems
- Publicly reward desirable staff behaviour during implementation phase
- Be open to feedback
- Keep staff in the information loop as much as possible.

Implementing Communication Plan

Communication interventions described above are to be implemented at 3 levels across various stakeholder groups. These interventions would be led by the Change Management Team and the Core Group, followed by the change champions / change agents. Listed below are some of the key roles and responsibilities of these teams / individuals at various levels.

- Central level – All central level communication will be handled by the designated officials under the guidance of the Change Management Team. The key responsibility at this level would be to generate awareness about the new channels & modes of stakeholder interaction, service delivery and service levels, and communication on use of new system.

  Also it will be responsibility of this team to ensure the heads of various offices are well equipped to implement and adopt new systems, managing resistance from staff and ensuring undisrupted services to customers. This team will provision the required toolkits, FAQs, communication toolkits for Change Agents and organize workshops with officers to sensitize them on change objectives and implementation strategies.

- Remote Office Level – Change Agents and Champions under the guidance of Change Management Teams and Core Group would be responsible for all stakeholder communication at the remote level. This would also include locally

available communication channels and communication mediums in local languages. It will ensure that all stakeholders have buy-ins for the proposed changes and ensure effective adoption of the new system.

- Individual Level – This will be driven by the individual staff of Office of R&BD through various means of communication among their peers. The key medium for this would be interpersonal communication - creating forums for dialogue and exchange of ideas, exposure to other such initiatives and encouraging two-way communication and feedback loops. Communication aids like checklists, bulletin boards, employee handbook, etc. can re-enforce the benefits of new system to the staff.

In order to maintain morale and enthusiasm during transformation, R&BD should clearly communicate the overall goals of the change so staff can see where the organization is going and can give them a sense of purpose.

Officers will need to communicate a number of vital questions during change management. Following are tactics they need to employ during the change phase:

Tactic One: Communicate Timely

- It is recommended that each office has its own well laid out communication plan which details pre-implementation messages and methods in advance and alerts staff as soon as possible so that staff will hear this information personally from their officers, not from the grapevine.

Tactic Two: Communicate Clearly

- Employees during change often have many unanswered questions, in addition to anxiety and stress regarding their future. Recommended strategies for addressing employee concerns include communicating clearly and honestly with staff throughout the change process, demonstrating continuous appreciation for each individual.

Tactic Three: Communicate Need for Change

- Employees must understand why R&BD needs to change and they must buy into the change management efforts. Communicate the "people" implications of upcoming process change, including what the changes will mean for staff' positions within the office.

Tactic Four: Communicate Personally

- Employees must be told how the change will affect them personally. Individual concerns should be addressed. Senior and middle management must be trained to ensure that they have the skills to provide essential information to staff in an effective and timely manner.

10. Project Cost Estimates

Cost references and Assumptions

Table: Cost Assumptions

S No.	Assumption I Standards used in respective areas
A	**ICT Infrastructure**
A.1	Cumulative Security Audit cost for all modules INR 500000
A.2	No of system users are as per the no of Desktop proposed e.g. if 10 Desktops are proposed at Divisional office then no. of users at Divisional office are = 10* total no of Divisional offices. This information has been used for sizing.
A.3	Internet connectivity charges for Sub-Divisional offices have been budgeted @ 600 Rs Per Month.
A.4	Earthing is proposed for all Divisional & Sub-Divisional offices as it would be difficult to assess the existing earthing at each office and its capability in bypassing the transients.
A.5	Internet bandwidth for DC not been considered as the existing SDC internet bandwidth shall be used.
A.6	Hardware prices have been arrived based on DGS&D RC and market prices
A.7	For application software the efforts for development, coding and Testing have been considered to arrive at the costing of each module. This would include the entire development activity pertaining to the module including development of Admin modules for database management
A.8	The Annual Maintenance Cost (which is a yearly cost) of a software solution is usually between 15 and 25% of the total software cost. We have considered 20% as the AMC cost.
A.9	Basic market prices have been referred for the components associated with site preparation
A.10	Maintenance cost of hardware is included in the Warranty support of 3 year including the UPS and Battery.
A.11	Intel Itanium2 Rack Server is considered while calculating the cost of CMS server.

A.12	Low end Rack servers are considered for arriving at the cost of local servers.
A.13	Inflation @8% has been considered for all ICT components
A.14	Servers shall be Co-Hosted at SDC and common infrastructure of SDC shall be utilized by the R&BD IT System
A.15	Application cost has been arrived based on the COTS cost and also the effort involved in the customization of such COTS.
A.16	Cost of Laptop, Tablet PC, Desktop includes OS, Office Tools and Anti Virus Software cost
A.17	The existing ICT infrastructure at R&BD offices shall be utilized for R&BD IT project also.
A.18	Sachivalaya, Nirman Bhavan, Circle Offices and Divisional offices are already connected through GSWAN. Hence Last mile connectivity for these offices are not considered in the costing.
A.19	Cost of SWAN Last mile connectivity for two years
A.20	10% replacement is considered for all tablets post 3 years maintenance
A.21	Hardware AMC is not considered for first three years.
A.22	Electricity provided by government shall be taken care by individual office and not considered as a cost, under this project.
A.23	Printer consumables are not considered as part of the project cost. Only one full cartridge at the time purchasing is considered.
B	**Training**
B.1	Existing Training infrastructure shall be utilized for the project and hence no separate infrastructure is proposed.

B.2	Training shall be imparted by the System Integrator for all the users and also ToT training shall also be conducted
C	**Handholding Support**
C.1	12000 is considered as man month cost of the support manpower cost
C.2	Man Month Rate of Contractual Resource with Basic IT skill set only
C.3	Sachivalaya, Nirman Bhavan shall be provided with 2 resources, Circle office, Divisional office shall be provided with one resource each.
D	**PAG**
D.1	Actual contract price of the consultancy work has been taken into consideration plus additional contingency costs
E	**Data Digitization**
E.1	Total R&BD data is to be populated based on the data available from 2012-13 onwards.

Project Cost Summary

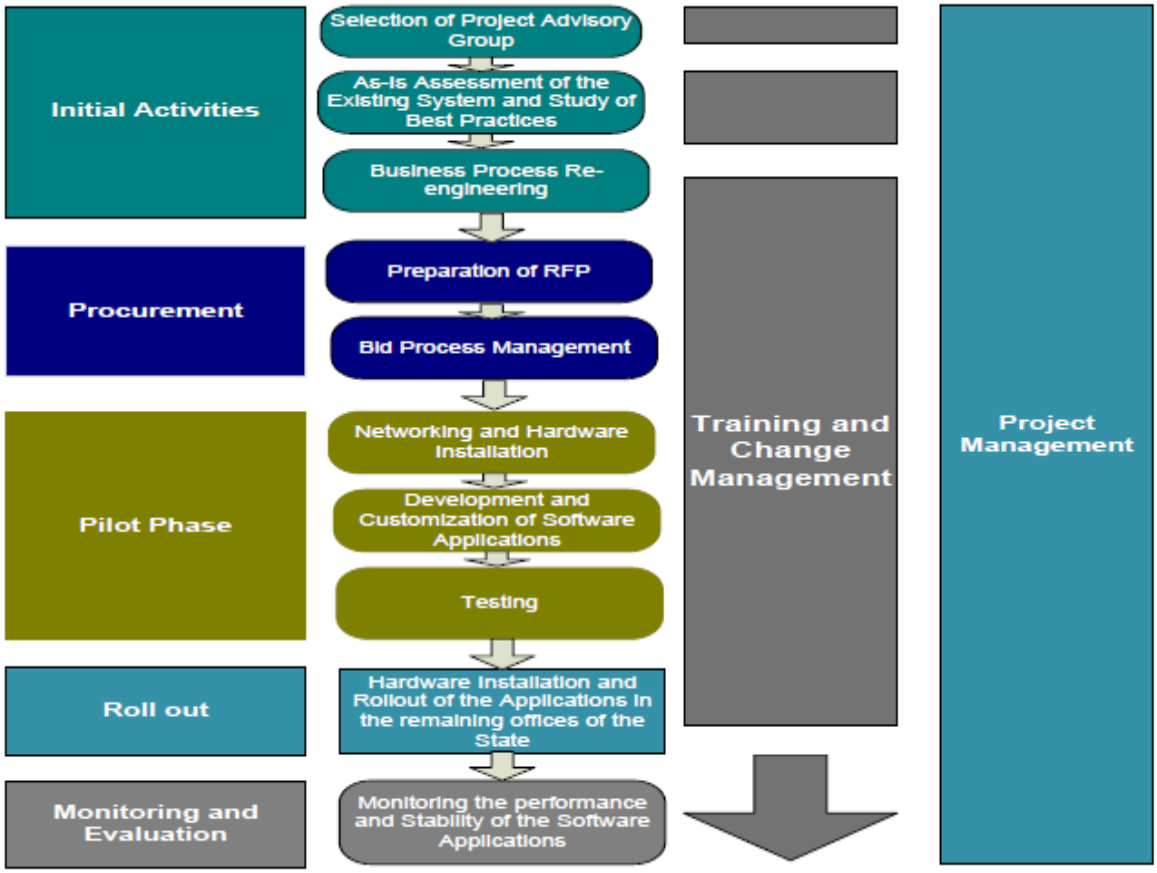
The R&BD IT project implementation is estimated to cost about 14.5 Crores over a 5 year period including the cost of provisioning the ICT infrastructure, capacity building, project management units, digitization, network and manpower support. Detailed cost components are listed in sections below:

Table: R&BD IT Project Cost Summary

Estimated R&BD IT Project Implementation Cost Break Up	
Items	**Cost (INR)**
ICT Cost	51246420
Training, Capacity Building	6677500
Digitization	2000000
Handholding Support Cost	2844000
Network Cost	32200000
Total R&BD IT Project Cost	**94967920**
Total Capital Expenditure	**91967920**
Total Operational Expenditure for 5 years	**53359434**
Total Project Cost	**145327354**

Operational expenditure comprises Handholding support cost, PAG cost, Post implementation support for R&BD IT application, Support cost for OS, SDC and also contingency cost.

Project activities and timelines: The following diagram gives a schematic representation of the broad project activities to be followed for this e-Governance initiative



The detailed cost structure for a 2 year period is given below:

Year 1

Year 1 would be stone setting year for the project. Project will be kicked off with constitution of various committees. In the first 8 months, the base layer modules shall be developed as per the suggested implementation plan. The deployment of the IT Hardware and IT manpower will begin from the 2nd month of Year 1 and it starts with DC hardware deployment and also in the Divisional office of first 5 districts out of 33 districts. Application shall be ready for go-live by the end of year 1.

Year 2

As per the implementation plan, 2nd Year (initial 6 Months) accounts for rollout of the solution in the remaining 28 districts. Also the operations for remaining 5 districts of

Gujarat shall be started. From 2nd Year 7th Months onwards all the project cost is towards the operations of the projects.

ICT Cost

ICT cost of the project consists of following components:

(I) Capital Expenditure:

i. Data Centre Cost
ii. Laptops, Desktops for entire R&BD offices
iii. Hardware & site preparation for Circle Offices
iv. Hardware & site preparation for Divisional offices
v. Hardware & site preparation for Sub Divisional offices
vi. Application development cost and Operational Expenditure

Data Centre Infrastructure Cost

As already detailed in deployment architecture section, R&BD IT may leverage the existing Government IT Infrastructure system and hence applications shall be co-hosted in the SDC. With the assumption that all required components for co-hosting the application shall be provided by SDC along with the Data Centre-Data Recovery (DC-DR), the cost of hosting servers and associated components have not been considered in the cost estimate. Please refer the table below table for the bill of material and associated costs for co-hosting.

Table: DC Infrastructure cost

Sr.	Component			
I	**Capital Cost**	**Year 1**	**Year 2**	**Total (INR)**
1	License Cost	300000		300000
2	Implementation Cost	300000		300000
	Sub-Total			**600000**
II	**Operating cost**			

3	Operating cost: Post go-live 1 year support		300000	300000
4	ERP Licensing AMC		300000	300000
5	Implementation Support Cost		100000	100000
6	Hosting Environment Maintenance		50000	50000
	Sub-Total			**750000**
	Total Implementation Cost			**1350000**

Laptops, Desktops, etc. required for entire R&BD in the State of Gujarat

Laptops shall be given to the Staff above SE and Desktops for EE and below staff. There are around 25 existing desktops with Windows 8 installed, 350 existing desktops with Windows 7 installed, 600 existing desktops having Windows XP installed which needs to be upgraded to windows 7 (with condition - provided hardware support). Table below gives the various components additionally proposed and their cost estimates.

Table: Laptops and Desktops for entire R&BD offices

Laptop, Desktop, etc. required for entire R&BD in the State of Gujarat				
		Unit Cost (INR)	**Required units**	**Total (INR)**
	Hardware			
a	Laptops	45000	36	1620000
b	Wireless controller	250000	1	250000
c	Wire Less Access Point for Laptops	10000	5	50000
d	Desktops	40000	500	20000000
	Hardware Total			**21920000**

IT Infrastructure at Sachivalaya

Sachivalaya is well-equipped with IT infrastructure such as Desktops, Printers, Scanner, Network – LAN, Switch, Rack, I/O interfaces, cables, etc. No additional hardware budget is required apart from Wireless Access Point for Laptops.

IT Infrastructure for Circle offices (22 Nos.)

Table below gives the various components proposed and their cost estimates for Circle offices.

Table: IT Infrastructure for Circle office

	Hardware and Site Preparation for Circle	Unit Cost (INR)	Required Units	Total (INR)
1	**Hardware**			
a	Low End Server for Offline Operations	300000	1	300000
b	On-Line UPS with isolation transformer suitable for single phase AC input & single phase AC output 30 minutes backup 1 KVA	50000	1	50000
c	Network Switch 32 Ports 10/100 Managed	25000	2	50000
d	OS for Server	85000	1	85000
e	Client Access License	3000	45	135000
	Hardware Total			**620000**
2	**Site Preparation**			
a	Site preparation (Electrical Cabling, Earthing & Earth Pit)	15000	1	15000
c	Wall Mountable rack	6000	1	6000
d	Patch Panel 12 Ports CAT 6	4000	4	16000
e	Information Outlet CAT 6	250	50	12500
f	Cat 6 Cable with Cabling (In Meters)	18	500	9000
g	Patch Cords 1 Mtr. CAT 6	135	25	3375
h	Patch Cords 2 Mtr. CAT 6	150	25	3750
i	PVC conduit	20	250	5000
j	Overall Site Installation Charges	22000	1	22000
	Sub-Total Site Preparation			**92625**
	Total Cost for IT Infra for one location			**712625**
	Total Cost for all Circle offices		**22**	**15677750**

IT Infrastructure for Divisional Offices (33 Nos.)

Table below gives the various components proposed and their cost estimates for Divisional office.

Table: IT Infrastructure for Divisional offices

	Hardware and Site Preparation for Divisional offices	Unit Cost (INR)	Required Units	Total (INR)
1	**Hardware**			
A	Low End Server for Offline Operations	300000	1	300000
b	On-Line UPS with isolation transformer suitable for single phase AC input & single phase AC output 30 minutes backup 1 KVA	50000	1	50000

c	Network Switch 12 Ports 10/100 Managed	10000	1	10000
d	OS for Server	85000	1	85000
e	Client Access License	3000	5	15000
	Hardware Total			**460000**
2	**Site Preparation**			
a	Site preparation (Electrical Cabling, Earthing & Earth Pit)	15000	1	15000
b	Wall Mountable rack	9000	1	9000
c	Patch Panel 12 Ports CAT 6	4000	1	4000
d	Information Outlet CAT 6	250	5	1250
e	Cat 6 Cable with Cabling (In Meters)	18	20	360
f	Patch Cords 1 Mtr. CAT 6	135	5	675
g	Patch Cords 2 Mtr. CAT 6	150	5	750
h	PVC conduit	20	250	5000
i	Overall Site Installation Charges	22000	1	22000
	Sub-Total Site Preparation		**0**	**58035**
	Total Cost for IT Infra for one location			**518035**
	Total Cost for all Divisional offices		**33**	**17095155**

IT Infrastructure for Sub-Divisional Offices/Talukas (248 Nos)

Table below gives the various components proposed and their cost estimates for Talukas.

Table: IT Infrastructure for Talukas

	Hardware and Site Preparation for Talukas	Unit Cost (INR)	Required Units	Total (INR)
1	**Hardware**			
a	Tablet	15000	1	15000
B	Multi-Function Laser Printer	12000	1	12000
C	UPS (500 VA) 30 Min Backup	4500	1	4500
	Hardware! Software Total			**31500**
2	**Site Preparation**			
A	Information Outlet CAT 6	250	1	250
b	Cat 6 Cable with Cabling (In Meters)	18	10	180
	Sub-Total Site Preparation			**430**

	Total Cost for IT Infra for one location			**31930**
	Total Cost for all Talukas		**248**	**7918640**

Application Software Cost

R&BD IT application software cost given in the table below is based on the effort estimates for each module. This cost may vary depending on the type of procurement; ERP or COTS or bespoke development.

Table: Application Development Cost

	Application Software	Cost (INR)
I	Application Development Cost	
	Finance Management	45000000
	HR Management & Payroll	
	Scheme Management	
	Inventory Management	
	Service and Contract Management	
	Business Analytics and Dash Board	
	Workflow	
	Knowledge Management	
	Identity management	
	Forms for Data Entry for field workers (Tablet/Mobile format)	
II	Application Software Cost (System Software, DB and Middleware) (for integration with existing R&BD applications)	8200000
III	Security Audit Cost	500000
	Total Cost	**53700000**

Operational Expenditure

Operational expenditure consists of application support cost, help desk cost, maintenance cost all system software and hardware at SDC, and contingency cost. Helpdesk shall have two help desk support staff to assist the users on various application related issues.

Table: ICT Opex Cost

OPEX	
Heads	**Annual Cost (INR)**

Post implementation support for R&BD IT application including support cost for OS, Database & Application servers	10740000
Miscellaneous (2% of CAPEX)	1652958.4
Help Desk	2820000
Total	**15212958.4**
Total Opex for 2 years	**30425916.8**

Table: Help Desk Cost (3rd Party)

Item	No	Per Month Rate	Year 1	Year 2
Operations Manager	1	30000	0	360000
Help Desk Resources	2	15000	0	360000
Telephone connections and exchange charges	1	10000	0	120000
Desktops	3		0	90000
Maintenance charges	1	4000	0	48000
Sub-Total			**0**	**2730000**
Desktops	3	30000	0	90000
Sub-Total			**0**	**90000**
Total				**2820000**

Training / Change Management Cost

It consists of two components:

i. Training to various Employees

ii. Change Management Cost

Training cost

Training shall be imparted to all system users. Basis orientation training is given to all users, which is a one day training. R&BD IT training for Strategic level staff will be a 3 day duration course and module training to specific users is a 5 day course.

Table: Training Cost

Training Cost			
Capacity Building & Training Component	**No. of Trainees in 33 Districts**	**Cost Per Person (INR)**	**Cost per training module (INR)**
R&BD IT training for Strategic level staff	100	1775	177500
Module Specific Training (Also Includes ToT Training for one batch at each district)	1600	3125	5000000
Training on Inventory Management			
Training on Scheme Management			
Training on Finance Management			
Training License Management			
HMIS Training			
Training on HR Management			
Total Training Cost			**5177500**

Change Management Cost

Change management cost comprises awareness creation activities such as advertisement in the pamphlets and also poster campaign.

Table Change Management Cost

Component	Quantity	Cost (INR)
Pamphlets & poster Campaigns (Rs. 250 each)	4000	1000000
Conferences	5	500000
Total Change Management Cost		**1500000**

Digitization Cost

Data in the R&BD existing IT application system is being captured. However, an additional fund may be allocated to seek third party support and speed up the process. Data digitization may be considered from the FY 2012-13 onwards.

Table: Digitization Cost

Data Digitization Cost	
Item	**Cost (INR)**
GRMS data digitization	975000
WMS Data	975000
Grievance System of GSHP II	50000
Total Cost for Digitization	**2000000**

Handholding Support Cost

Change management in R&BD IT project definitely going to be huge challenge. Hence for a smooth transition to IT enabled processes from manual, we are suggesting to have 1 resource each at Divisional office, 2 resources each at Sachivalaya, Circle office for a period of 3 months post go-live in that location.

Table: Handholding Support Cost

	Details	Remark
Per month support cost INR	12000	
Total number of support staff required	79	Sachivalaya (1 unit), Circle (22 units) shall be provided with 2 resources, Divisional offices (33 units) with one resource each.
Number of months of support for each resource	3	
Total support Cost	**2844000**	

Network Connectivity Cost

Table: Network Connectivity Cost

S.No.	Networking cost for 2 Years	Unit Cost (INR)	No of sites	Total (INR)
I	Broadband/Datacard Cost	14400	100	1440000
II	LL	125000	20	2500000
III	RF	125000	20	2500000
	Annual Network Cost			**6440000**

	Total network Cost for 2 years			**12880000**

Project Advisory Group Cost

Tentative price for the Consultancy services by the Project Advisory Group is illustrated below:

Table: Project Advisory Group Cost

No.	Items	Year 1	Year 2
1	Project Advisory Group	5000000	5000000
	Total Project Cost	**10000000**	

11. Conclusion

It has been recognized at various levels that the efficiency and performance of the R&BD need to be enhanced radically. The solution proposed in this report has been designed not only to enhance the efficiency but also the effectiveness, transparency and responsiveness by way of process redesign and application of ICT as appropriate. The system has been designed to address the problem areas and issues identified during the assessment and to augment the performance levels of department so as to provide better services to all stakeholders. An integrated application system increases efficiency and effectiveness of the project management process, ensures well regulated and controlled project approach. It also does away with the need to maintain multiple applications and reporting formats by R&BD. Most important impact of the new R&BD application system would be the facilitation of online management and monitoring of various projects.