DOCUMENT REGISTRATION SYSTEM ENTERPRISE ARCHITECTURE FRAMEWORK

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Definitions

Term	Definition
AIRM	The Application Integration Reference Model (AIRM) provides guidelines to make architectural decisions while implementing Integration/EAI Solutions for the e-Government Programs/Projects.
ARM	Application Reference Model (ARM) provides the framework for grouping similar applications / modules to maximize re-use.
BRM	Business Reference Model or BRM is pivotal for the design of a good Enterprise Architecture, in so far as it looks at purely the business vision and the functions/ services required to fulfil that vision, but not the technologies required to be used.
DRM	Data Reference Model (DRM) provides a means for departments to consistently define data in their data architecture. It will ensure sharing of information among departments and external agencies thereby providing opportunities for improved efficiency and effectiveness in Governance.
DRS	Document registration system is a collection of people, process and technology involved in delivering the document registration services to the stakeholders.
DRS Application	Document registration system application built by NIC named National Generic Document Registration System (NGDRS) application to deliver the document registration services to citizens.
Encumbrance Certificate	Encumbrance Certificate certify that there are no dues on property both Mortgage and Legal & the title of the property is clear and marketable. It contain all the transactions in respect of the said property. Encumbrance is basically a Charge / Liability / Lien which is created on the property, which is held as a collateral or security against the debt that is not cleared / paid as on date. It contain records of last 13 / 30 years. If the property has come up recently then EC of relevant period will be issued.
GRM	It guides in establishing an institutional structure for the development, management and maintenance of Enterprise Architecture and its artefacts. GRM also defines the processes and structural relationships to ensure that the architecture is consistent with the business vision and objectives of the enterprise and is implemented in strict compliance with the architectures developed.
KPI	KPI is a metric designed to evaluate the success of an organization or of a particular activity - such as a project, program, scheme or initiative undertaken by it
PRM	Performance Reference Model (PRM) provides a uniform and consistent mechanism to measure the efficiency and effectiveness of the different sectors or domains in achieving the overall goals of the Government in a cost-effective manner.
Risk	Risk is possibility of facing losses due to an event that probably may occur.

Service	Service in the context of the public-sector environment, service is the act of fulfilment of the request made by a citizen, business or employee, by following a set of defined processes and workflows.
SRM	Security Reference Model (SRM) is a framework for developing a comprehensive and rigorous method of describing the current and future structure of the information security systems so that they align with the business strategies of the enterprise.
Threat	Threat is a possible danger that can exploit to vulnerability of the system, infrastructure or application to cause harm to the organization or system functioning. Threats are usually classified as high, medium or low.
TRM	Technology Reference Model (TRM) depicts the layout of the technology foundation of ICT-based systems to be designed for delivery of identified business services.
Vulnerability	It is the weakness in the system, process or software that can be exploited to gain unauthorized access to information or assets. The unauthorized access to the system or assets of the organization may be misused.

Acronyms

Abbreviation	Description
AIRM	Application Integration Reference Model
ARM	Application Reference Model
BPR	Business Process Re-engineering
BRM	Business Reference Model
DILRM	Digital India Land Records Modernization Programme
DoLR	Department of Land Records
DRM	Data Reference Model
DRS	Document Registration System
GRM	Governance Reference Model
IGR	Inspector General of Registrar
IndEA	India Enterprise Architecture Framework
iSarita	iStamp And Registration Information Technology Application
MeiTY	Ministry of Electronics and Information Technology
MMP	Mission Mode Project
NeGP	National eGovernance Plan
NGDRS	National Generic Document Registration System
NLRMP	National Land Records Modernization Programme
PRM	Performance Reference Model
RACI Matrix	Responsible, Accountable, Consulted, Informed Matrix
SDU	Software Development Unit
SRM	Security Reference Model
SRO	Sub Registrar's Office
TOGAF	The Open Group Architecture Framework
TRM	Technology Reference Model

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1 Foreword

For digitising the process of property and document registration, different states and union territories have been using different applications. Most of these applications have been developed in-house by NIC. These applications have evolved and matured over time. A survey by the NIC, DoLR[i] team has revealed that most of these applications need to be upgraded using modern technologies and should be hosted centrally for interoperability with the state land records systems and other intra / inter departmental applications.

Some of the drawbacks in the form of comprehensiveness, security, scalability, reusability and interoperability have been a recurrent observation across all the document registration applications developed by states / union territories. Maintenance of these applications for every state / union territory is also not sustainable.

The Digital India Land Records Modernization Programme (DILRMP) was launched by Government of India in August 2008 to modernize management of land records, minimize scope of land/property disputes, enhance transparency in the land records maintenance system, and facilitate moving eventually towards guaranteed conclusive titles to immovable properties in the country. Under DILRMP, the development of National Generic Document Registration System application was thought through, designed and developed on the principles of enterprise thinking.

Hence, it was felt that the time was right to leverage our collective experience and domain knowledge, to architect a comprehensive blueprint of the ecosystem of document registration system and it's a way forward. Document Registration System Enterprise Architecture Framework (DRS EAF) extends the vision of IndEA to architect the foundation of a national document registration system architecture which can be customised to cater to all the needs of states and union territories, and is envisaged to represent a holistic superset of capabilities required for the effective functioning of document registration which is governed by registration act 1908. This document intends to present a blueprint of the capabilities to be possessed and utilised by the states and union territories to deliver the document registration services to citizens.

DRS EAF presents building blocks of Business, Performance, Data, Application, Technology, Integration, Security and Governance for document registration system and provides a transitional process for implementing new technologies in response to the changing needs of the governance in present scenario.

Shri D. C. Misra

Deputy Director General, NIC

2 Acknowledgment

National eGovernance Plan (NeGP) and Digital India Initiatives launched by the Government of India support the aspirations to expedite eService delivery to citizens, using different channels. This demands robust, scalable and future proof architecture of business and systems for supporting unhindered service delivery. To push these initiatives, digitization of the document registration system (governed by registration act 1908) has been taken under Digital India Land Records Modernisation Programme. To aptly address the diversity and variations in document registration across states and union territories on account of languages, process, formulae and formats the need of one software, which can cater to all the states and union territories requirements was felt. This led to the development of national generic document registration system application development. While the application was built, there was a need of providing a holistic view of the registration organization, its capabilities to deliver the services from different viewpoints and to provide standards and guidelines to manage the solution built. This explicit need led to designing of the document registration system enterprise architecture framework.

To develop this document which provides the overall enterprise architecture framework for document registration system, consisting 8 reference models (business, performance, data, application, technology, application integration, security and governance) the inputs of multiple stakeholders and sincere efforts of the team were required. This document has been prepared in a time frame of about 3 months and it would not have been possible without the sincere efforts of a number of officers of National Informatics Centre and Department of Land Resource.

I would like to express my gratitude to Ms. Neeta Verma, Director General, NIC for giving us the opportunity to develop the enterprise architecture framework of document registration system. I would like to thank Sh. D.C. Misra, Deputy Director General & HoG, NIC for conceptualizing, guiding and providing multi-dimensional technical as well as administrative support, and supporting us to seek inputs from maximum number of stakeholders to improve the quality of the document.

I would also like to thank Smt. Seemantinee Sengupta, Senior Technical Director, NIC for reviewing the document and providing valuable feedback to improve the quality of the document. I would like to thank Smt. P Gayatri, Senior Technical Director, NIC for reviewing the document at every milestone and advising us on the various challenges faced during the preparation of this document.

This initiative is a collaborative effort and will be the reference document for improving the National Generic Document Registration System.

Ms K. J. Honrao

Senior Technical Director

National Informatics Centre, Pune

3 Executive summary

To serve the objective of computerization of the property and document registration processes, different states / union territories have been using multiple different applications or modules. Most of these applications are developed in-house by NIC under NLRMP. These applications have evolved and matured over time. However, a survey by the NIC, DoLR team has revealed that most of these softwares need to be upgraded using modern technologies and hosted centrally for interoperability with the state land records systems and other external departmental systems. These softwares also need easy, reliable and cost effective maintenance. In a review meeting chaired by the Secretary (DeitY), it was decided that NIC will study the feasibility of developing a single application, which will be centrally developed and maintained, for the use of all state governments.

National Generic Document Registration System (NGDRS) application has been designed and developed as one application for document registration under the computerization of registration component to deliver the services to citizens. NGDRS has been developed by NIC SDU Pune and implemented in Punjab, Manipur and Andaman Nicobar states / union territories. While designing NGDRS application and functions an enterprise thinking approach was considered and the application was built.

Need of Enterprise Architecture Framework for Document Registration System

The processes of document registration ecosystem were heavily into manual ways of working across the states and union territories. Presently, technology led reforms are taking place across the country and the awareness of the citizens has increased manifold. With this mind-set, the department started looking inwards and analysed what problems the stakeholders are facing and what can be the critical benefits derived out of enterprise architecture framework for document registration system. The document registration system enterprise architecture framework focuses towards achieving reduction in land disputes because of increased efficiency and transparency in the processes. It will also contribute to ease of doing business from the multiple stakeholders' point of view.

Along with the benefits, here are some of the major reasons and challenges faced by the stakeholders which led to document registration system enterprise architecture framework coming as an initiative:

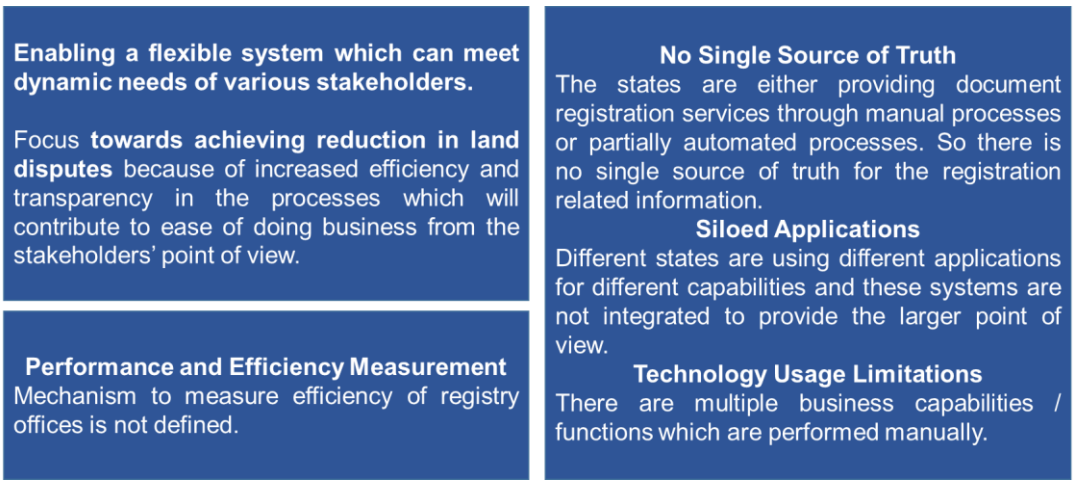


Figure 1: Why DRS EAF?

The framework is an abstract of the software product (NGDRS) that can be customised to the local needs of the respective states / union territories. The DRS Enterprise Architecture

framework will extend the IndEA Framework's objectives. It is intended to present a comprehensive blueprint of all business capabilities to be considered while developing the business layer for state specific document registration system enterprise architecture. This framework highlights the structural and functional needs towards delivering the document registration related services to citizens and government departments. The approach would help Government of India and NIC in cost reduction, technology standardization, process improvements, strategic differentiation and change management. The DRS Enterprise Architecture Framework defines the methodology for development of all 8 architecture domains adopted from India Enterprise Architecture Framework. It gives a comprehensive view of the enterprise from different perspectives and enables quick alignment of IT ecosystem to its dynamic and ever evolving demands of business.

Document Registration System Enterprise Architecture Framework Vision

The overall vision of developing DRS enterprise architecture framework is to ensure that the common, generic and comprehensive solution is implemented as an instance for the states or union territories which are interested. DRS enterprise architecture framework would help in the already developed generic solution as well as state specific solution instance implementation.

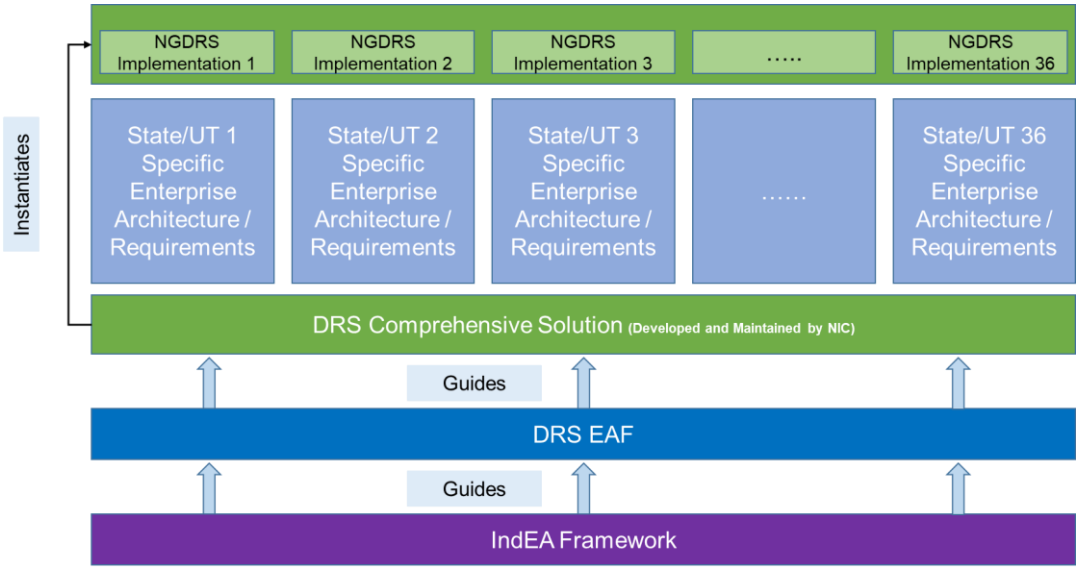


Figure 2: DRS Enterprise Architecture Framework Development Vision

Approach

IndEA is the starting reference point guide for the development of DRS EAF along with The Open Group Architecture Framework (TOGAF) which has been referred during the project. To design the document registration system enterprise architecture framework, a gap analysis done by NIC has been studied. The gap analysis report captures functions, processes and variations of document registration ecosystem from 31 different states and union territories. Along with this, the current business landscape of document registration and the NGDRS application functions have been studied. Based on the analysis of different components and inputs received during the course of the focused discussions held with NIC SDU team and other stakeholders, the DRS EAF has been designed to serve as a one stop shop for the states to customise and design their own state specific DRS enterprise architecture which will help in building and/or customizing the state specific solutions to implement for betterment of the citizens and service delivery.

Document Registration System Enterprise Architecture Framework

Document registration system enterprise architecture framework is aligned with IndEA and its 8 reference layers which contain the related artefacts of these different dimensions. Every reference model contains principles to be followed, As-Is Landscape, Transition Plan along with Transition Principles and To-Be Landscape. Below described are the details of reference models and their artefacts:

1) **Business Reference Model:** The Business Reference Model or BRM is pivotal for the design of a good Enterprise Architecture, in so far as it looks at purely the business vision and the functions/ services required to fulfil that vision, but not the technologies required to be used. The key entity in BRM is Service, be it citizen-facing or internal.

   Business reference model of DRS EAF intends to present the current services delivered to the citizens and function of the state IGRs while it provides organisational view, value stream view, business capabilities and functions view, business stakeholders and their roles and responsibilities in the To-Be landscape along-with the transition plan.
2) **Performance Reference Model:** Performance Reference Model (PRM) provides a uniform and consistent mechanism to measure the efficiency and effectiveness of the enterprise achieving the overall goals of the Government in a cost-effective manner. The principal instrument of the PRM is a set of KPIs designed rationally to measure the outputs and outcomes of the various programs, schemes, projects and activities. A prioritized and phased approach for implementation of PRM is recommended so as to avoid the situation of creating plethora of KPIs, which hide the actual performance and outcomes.

   Under DRS EAF, the as-is, to-be landscapes of the governance mechanism has been captured along with the Transition Plan and Principles. The to-be Landscape contains an indicative list of KPIs which have been identified using VPPT (Vision, People, Process and Technology) Framework. The state IGRs are required to adopt or tailor the performance management system in their respective state, define the target KPIs and measure the actuals. The variations may be analysed to identify the corrections and improvement opportunities.
3) **Data Reference Model:** DRM provides a mechanism for the departments at various levels of Government to identify, discover, describe, manage, protect, and share the data it has and reuse information consistently within and across agencies and their business partners. It is expected that the departments/agencies would use the reference model to achieve a consistent and holistic view of data across the complex Government rather than a department or agency specific view.

   DRS EAF's data reference model intends to present the as-is and to-be landscapes along with a transition plan and principles. DRS EAF contains data description (entities and attributes), data context, data stewards & data owners, data lifecycle and data hubs for DRS. Data standards to be followed have also been defined in data reference model.
4) **Application Reference Model:** The Application Reference Model provides the foundation to automate the services, which are identified as a part of the Business Reference Model. It enables government to achieve its objective of better collaboration and data-sharing between & within departments thereby providing effective business services to its stakeholders.

DRS EAF application reference model describes the as-is, to-be landscapes with the application capabilities needed to support the business capabilities / functions and deliver the services to the respective stakeholders. It also presents the application services required to fulfil the requirement. Along with this the reference model contains a transition plan and principles to follow.

5) **Technology Reference Model:** The Technology Reference Model aims to develop an interoperable and cost effective framework which could transcend, be referenced and used by Government of India, Federated states and agencies for inter-departmental discovery and digital collaboration for enriching the life of every citizen through efficient and effective service delivery.

   TRM includes the as-is technology landscape and to-be technology landscape where the 8 dimensions (access devices, peripherals, network connectivity, network infrastructure, platforms, software development, computing stack and hosting locations) have been designed. A transition plan and principle supporting the technology reference model is present.

6) **Application Integration Reference Model**: EAI acts as an integration platform to connect various systems and disparate applications of the government departments. The department has multiple processes. There are some applications used by the departments which are running in siloes. EAI Layer will connect these disparate applications. This will help to achieve seamless availability of Inter-departmental data, consistency of data, transparency etc.

   The AIRM describes about document registration system's as-is and to-be landscape along with the transition plan. The to-be landscape contains application integration levels, methods and standards to be followed while designing the application integrations.

7) **Security Reference Model:** Security Reference Model (SRM) is a framework for developing a comprehensive and rigorous method of describing the current and future structure of the information security systems so that they align with the business strategies of the enterprise.

   Under DRS EAF, the SRM intends to present the security capabilities to be followed and built-in considering 6 dimensions (application, data, client server infrastructure, digital information rights, network access and authentication) of security. Along with this SRM also emphasises upon threats & vulnerabilities, security policies and a transition plan.

8) **Governance Reference Model:** Architecture Governance Reference Model (GRM) guides in establishing an institutional structure for the development, management and maintenance of Enterprise Architecture and its artefacts. GRM also defines the processes and structural relationships to ensure that the architecture is consistent with the business vision and objectives of the enterprise and is implemented in strict compliance with the architectures developed.

   The DRS GRM describes the as-is and to-be landscapes of governance model for document registration system. To-be governance landscape intends to present the governance mechanism along with governance board and their roles and responsibilities. A governance transition plan and principles are described in the GRM. Any changes to be done in the framework should be approved by the governance board proposed in the reference model.

4 Introduction

This section gives an overview of document registration system enterprise architecture framework and describes the project background, the broad structure of India Enterprise Architecture Framework in relation to this document, the core objectives, project scope, target audience and related documents which are to be read in conjunction to this document and an overall document structure.

4.1 Project Background

The National eGovernance Plan (NeGP) initiative launched by government of India focusses on making all the government services available to the citizens of India via electronic media and channels. The government approved National e-Governance Plan, consisting of 27 Mission Mode Projects (MMPs), from which one mission mode project under the states was National Land Records Modernization Programme (NLRMP). It led to an initiative called The Digital India Land Records Modernization Programme[ii] (DILRMP) which was launched by Government of India in August 2008 and aimed to modernize management of land records, minimize scope of land/property disputes, enhance transparency in the land records maintenance system, and facilitate moving eventually towards guaranteed conclusive titles to immovable properties in the country.

The DILRMP has 3 major components –

a) Computerization of land record
b) Survey/re-survey
c) Computerization of Registration

Registration system is an integral part of revenue system of the states, which leads to registration of deed (articles as per the 1908 registration act), mutation and updation of land records. This process of registration is governed by the Registration Act 1908 except in Jammu and Kashmir. Assessment of stamp duty as per the Indian Stamp Act or the State Stamp Acts is also a core function in the property registration process.

The revolutionary growth in Information Technology has led to a smaller global world that has its people connected to each other through the internet based platforms, applications and service delivery mechanisms. India is moving towards nationwide reforms like adoption of enterprise architecture under e-governance as means to transform various departments within the country. A new United Nations report has found that e-government is an effective tool for facilitating integrated policies and public service by promoting accountable and transparent institutions, through open data and participatory decision-making, and therefore it has the potential to help support the implementation of the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs).[1] Various departments embracing e-governance, moved towards adopting Information Communication Technology in delivering services in a much better and efficient way.

In continuation to the enterprise thinking adopted while designing and developing the NGDRS application, creating an enterprise architecture framework for document registration ecosystem which is aligned with IndEA Framework has been envisioned and executed.

[1] E-government a powerful tool to implement global sustainability goals, UN survey finds

4.1.1 DRS Enterprise Architecture Framework Landscape

Document Registration System (DRS) Enterprise Architecture Framework is a key initiative of Department of Land Resources under Ministry of Rural Development, targeted at addressing diversity and variations prevailing across the states on account of various languages, processes, formulae and formats through a common, generic & configurable web-based document registration application. This application caters to the requirements of the functionaries at various levels. To achieve a sustainable document registration ecosystem for all the states and union territories of India, the enterprise architecture framework for document registration was thought and executed.

The document registration processes were heavily into manual ways of working across the states and union territories. Presently technology led reforms are taking place across the country and the awareness of the citizens has increased manifold, the department started looking inwards and analysed what problems the stakeholders are facing. Here are some of the major reasons and challenges faced by the stakeholders which led to document registration system enterprise architecture framework coming as project:

1) Single Source of Truth: The states are either providing document registration services through manual processes or partially automated processes. So there is no single source of truth for the registration related information.
2) Siloed Applications: Different states are using different applications for different capabilities and these systems are not integrated to provide the larger point of view.
3) Performance and Efficiency Measurement: Mechanism to measure efficiency of registry offices is not defined.
4) Technology Usage Limitations: There are multiple business capabilities / functions which are performed manually and can be automated to improve efficiency of the Business Processes.
5) Long waiting time for completion of the registration process at the offices of Sub-Registrar which impacted citizens (parties, identifier, witness, registry office employees).
6) Lack of adequate transparency and involvement of various middlemen dealing in land related issues which impacted the citizens, registry office employees and the department.
7) Difficulty in analysis of the transactions for any decision-making.
8) Scope for wrong valuation because of the manual processes involvement which impacted the citizens.
9) Difficult to find the transaction history of a property due to increased number of transaction after the economic reform of 90’s. Manual system was not able to cope up with such higher number of records.
10) Takes a lot of time to search and possibility of missing some transactions were there.

4.1.2 Enterprise Architecture and IndEA

Enterprise Architecture provides a framework for conducting analysis, design, planning and implementation of the vision, goals, strategies, functions, activities and desired outcomes of an enterprise, using a holistic approach. Over the last decade, Enterprise Architecture has seen greater adoption by central ministries, state governments & their departments in India. These institutions have utilized it to leap from traditional to a modern approach of governance centred on citizens, for explaining the relationships among the projects, managing change, increasing the potential for cross-public sector reuse of applications, thereby reducing duplication and hence costs.

TOGAF and IndEA

TOGAF (The Open Group Architecture Framework)[iii] and IndEA (India Enterprise Architecture Framework) were utilized as the enterprise architecture frameworks in developing Document Registration System Enterprise Architecture Framework. TOGAF is a widely used framework that provides a tested and iterative process, well-structured methodology and extensive guidance for developing enterprise architecture. IndEA is the enterprise architecture framework developed by Government of India which provides a contextualized framework for the government institutions of the country.

India Enterprise Architecture (IndEA)

IndEA, a catchy acronym for the India Enterprise Architecture, is a framework for developing a holistic architecture treating the Government as a single enterprise or more realistically, as an Enterprise of Enterprises, which are functionally inter-related. IndEA is a structured combination of several Reference Models that, together, enable a boundary-less flow of information across the length and breadth of the government and facilitate the delivery of integrated services to the stakeholders, namely, the citizens, businesses and employees. Strictly speaking, IndEA is not an Enterprise Architecture as its name seems to connote. It is a comprehensive and convenient framework for developing Enterprise Architectures by governments to support ICT enabled transformation across governments. It can be adopted and used successfully, by the Central, State and Local Governments alike, irrespective of their size and current status of technology implementation. It can also be used by large departments and agencies of the Government to derive the envisaged benefits.

The vision of IndEA is to **enable ONE Government** – a Government that is least visible but is most effective, a Government that is 'not fragmented by narrow domestic walls' but presents a single interface to the constituents, a Government that is citizen-centric, efficient, transparent and responsive[2].[iv] IndEA is an authoritative reference providing an integrated, consistent and cohesive view of strategic goals, business services and enabling technologies across the entire organization. It is a framework that enables the development and implementation of Enterprise Architectures independently and in parallel by all governments and their agencies across India, conforming to the same models and standards.

IndEA framework comprises of 8 Reference Models[3], represented graphically in diagram below. In addition to the 4 dimensions that TOGAF describes, namely, Business, Application, Data and Technology, IndEA Framework consists of 4 more Reference Models, namely, Performance, Security, Application Integration and Architecture Governance.

[2] [3] Source: IndEA Framework [Part I]

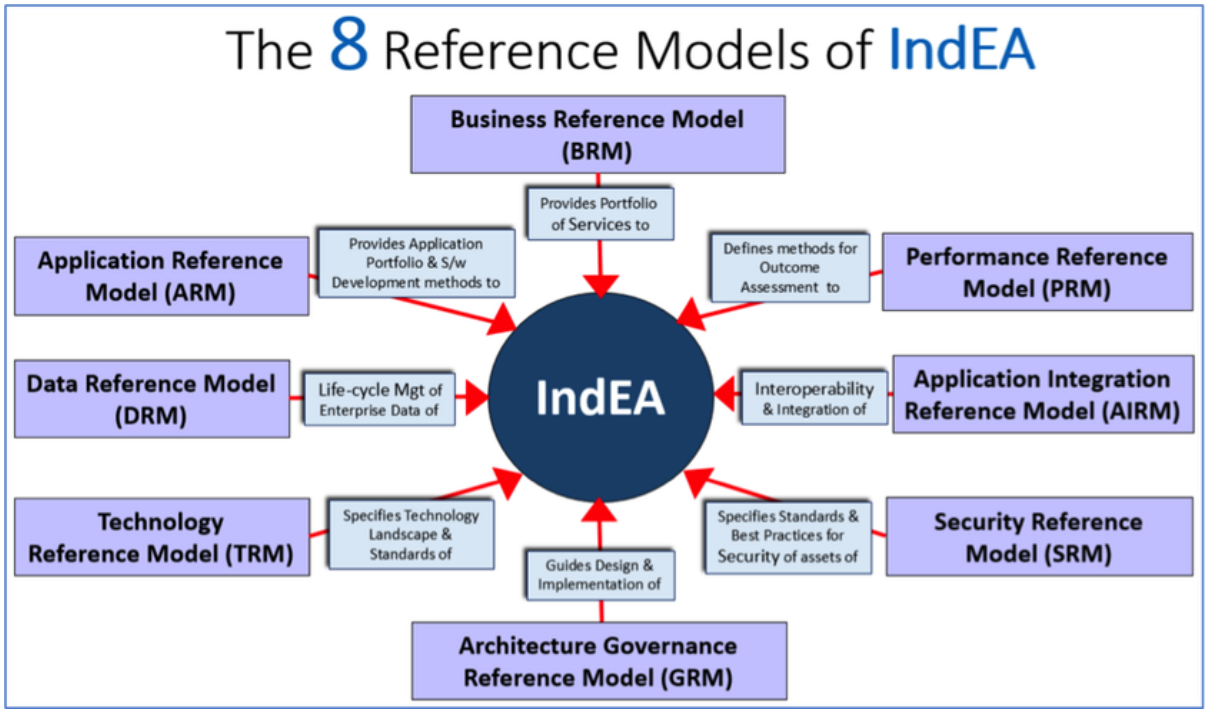


Figure 3: IndEA Reference Models

4.2 Project Purpose and Scope

This section describes the project objective, scope and outcomes of the enterprise framework exercise.

4.2.1 Objective

The key objective of this project is to create an enterprise architecture framework for document registration system which is aligned to IndEA. This will help creating a common document registration system enterprise architecture and application which can be used by the states and union territories of India.

4.2.2 Purpose

The purpose of enterprise architecture framework document is to use it as a super-set of document registration ecosystem and develop state / union territory specific document registration system enterprise architecture.

4.2.3 Scope

The document registration system enterprise architecture framework would be aligned to IndEA and cover the 8 reference models, principles, guidelines and tools as per applicability. The reference models would be developed at a conceptual stage. The physical implementation designs would be catered to during the implementation phase.

The scope of this project would not be aligned to any state / union territory process specific but a generic enterprise architecture framework which can be utilized by any of the states / union territories to cater to its needs.

This current scope as per the components identified in this report has been developed in three months duration and it is expected to be a continuously evolving document based on reviews and inputs gained during the course of architecture development work.

4.2.4 Outcome

The DRS EAF outcome is an abstract model and building blocks required for document registration of all the states and union territories to support the operations for document registration.

4.3 Intended Audience

The target audience of the enterprise architecture document are:

- Central ministry (Ministry of Rural Development and Department of Land Resources) who oversee the document registration and mutation of land related operations.
- State IGRs who manage the document registration operations for their state, registrar's office (state headquarters and district level registrar's / sub-registrar's office) who are responsible for operationalising the document registration system.
- Implementing organizations like NIC would be referring to the overall architecture framework to develop the core platforms and as per applicability.

4.4 Document Structure

The remaining sections of the document are described as follows:

1) **Section 5 –** Describes the approach taken to create the document registration system enterprise architecture framework.
2) **Section 6 -** Describes the overview of document registration system enterprise architecture framework and details out the fundamental organization blueprint and the corresponding business capabilities and functions. As per the IndEA framework, it presents a conceptual view of the business, performance, data, application, technology, application integration, security and governance reference models.
3) **Section 7 -** Describes the adoption guide for DRS EAF where the steps/ methodology to be followed to create Enterprise Architecture for the states / union territories using DRS EAF have been mentioned.
4) **Section 8 -** Annexure section contains the core concepts of Enterprise Architecture, Difference between Enterprise Architecture and Enterprise Architecture Framework and details about other supporting templates, documents, gap analysis reports used or can be used in future for further phases.

4.5 Related Documents & Information

This document is to be read in conjunction with the following:

- [Part I] IndEA Framework
- [Part II] IndEA Adoption Guide
- 1908 Registration Act[v]
- Gap Analysis Report

5 Approach to create DRS EAF

IndEA Framework has been chosen as a reference framework to create DRS EAF, which will be tailor made to adapt to the specific requirements of the states and union territories of India. The document registration system enterprise architecture framework is created based on series of discussion with the National Informatics Centre, Pune team and by analysing 3 components:

1) DRS business landscape
2) Gap analysis conducted for the 31 states/union territories of India
3) Generic DRS solution built (NGDRS)

Along with understanding the business landscape by conducting the interviews with NGDRS management and development teams, the gap analysis report prepared by the team helped in understanding the state-wise processes followed for document registration. The gap analysis done by NIC was evolved from the enterprise thinking approach taken while designing the NGDRS system. This gap analysis report involved the questionnaires filled up by 31 states and union territories, which helped in capturing the processes followed by these states and union territories and the variations among the processes, languages, measurement units, functions, organisation structure etc. The NGDRS application built helped in understanding the business functions and services delivered to citizen and different steps involved in it.

Activities undertaken to analyse, design and develop the DRS EAF has been depicted using the diagram below:

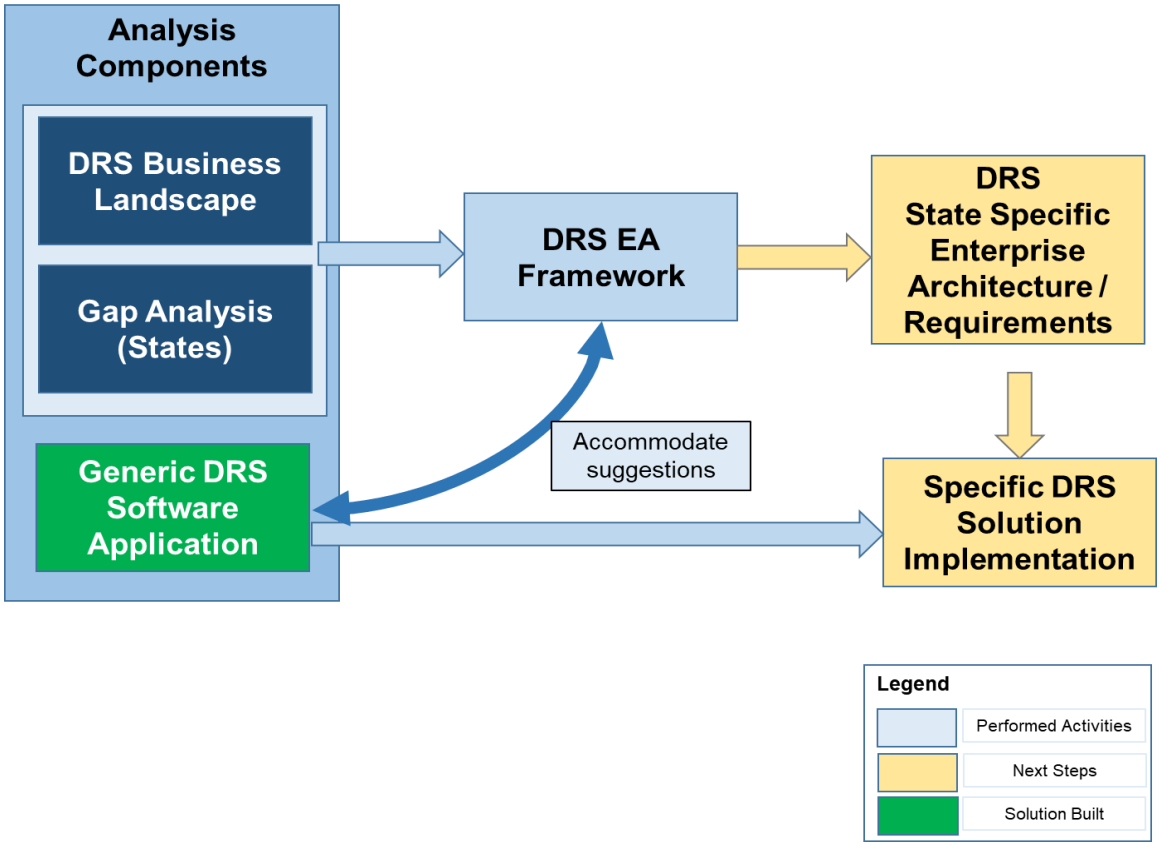


Figure 4: Approach to create DRS EAF

After analysing the differences and variations in organisation structure, service delivery, processes for 31 states and union territories and other components, the DRS EAF has been designed to serve as a one stop shop for the states to customise and design their own state specific DRS framework which will help in building and or customizing the state specific solutions to implement for betterment of the citizens.

DRS enterprise architecture framework is aligned with IndEA which intends to present the principles, as-is landscape, to-be landscape and transition plan for all the 8 reference models (business, performance, data, application, technology, application integration, security and governance) described in IndEA framework along with an adoption guideline.

6 DRS Enterprise Architecture Framework

DRS EAF as a framework will help the State IGRs or departments to build and customize their own enterprise architectures as per their state's document registration laws and policies which are compliant to the standards and guidelines of Registration Act 1908 and Department of Land Resources. In a broader sense the framework will work as a superset of structures, functions and business services and states can then customize it as per their need.

The different states and union territories may design the state specific architecture as an instance of DRS EAF created. The states may tailor the framework to suit their state's requirements.

The NGDRS application is already developed and the DRS EAF has been developed studying it. Though the suggestions provided by the DRS EAF will be accommodated in NGDRS application in the next phases if required by the state IGRs. The DRS solution has been developed as a generic, configurable, reusable and modular solution. It has been contemplated that the instances for different states and union territories will be implemented with customizations and required set of state specific requirements to ensure sustainability and maintainability.

It is known that all the states and union territories of India have different processes, handling techniques, languages to operate in but the major building blocks (structures, functions, value streams, and capabilities) would be common, reusable and configurable across the states and union territories. If in case a totally new requirement comes in for any particular state it should be adaptable and be able to cater to it.

Citizen focused Business Footprint diagram below depicts the integrated view covering all the eight architecture domains (reference layers). The scenario covers citizen as a stakeholder who triggers the service, KPIs addressed, business and application capabilities utilised to deliver the services, core data hubs participation, technology and security components used with integration of inter departmental applications and the governance board defined.

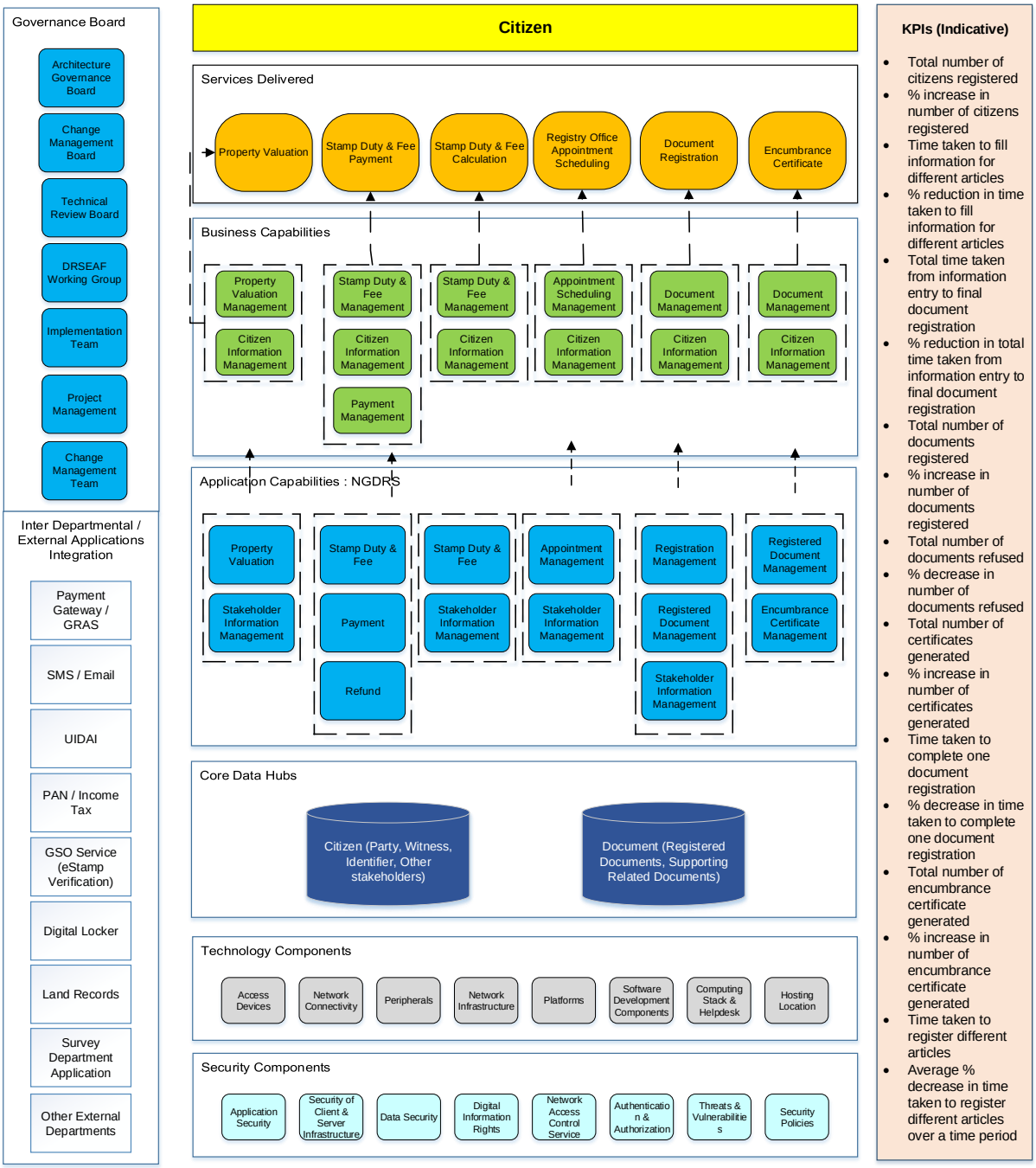


Figure 5: Business Footprint Diagram

6.1 Business Reference Model

The objective of business reference model is to provide an understanding of organization's vision, mission, goals and how they are fulfilled by utilizing the functions or services. Business reference model also reflects alignment of strategic objectives and demands for the organization. How business reference model drives other reference models and components is depicted in the diagram below:

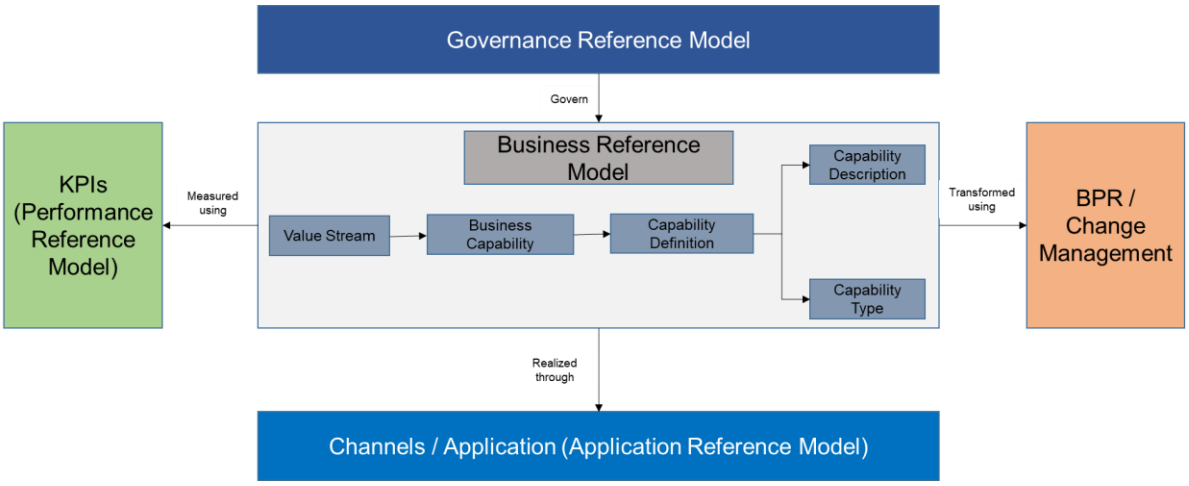


Figure 6: Business Reference Model's Impact on Other Reference Models & Components

Business reference model is one of the most crucial and important layers in the organisation's enterprise architecture framework as all the other layers are built considering business layer as the base. Business reference model describes the following components:

- **Principles**: A set of principles that inform and guide the architecture development process.
- **Vision & Mission**: It defines the purpose of existence of the organization, what it wants to achieve and organisation's focus.
- **Organization**: It describes how the organisation is structured.
- **Value Streams**: The collection of end-to-end activities performed by the organisation to deliver the value to its stakeholders.
- **Business Capability**: Organization's unique ability to achieve a specific purpose or outcome is described by business capability.
- **Stakeholders:** Collection of people/entities who would be affected by actions, and policies of the organization are described as stakeholders.
- **Information Required:** Information required to deliver the value to the stakeholder by the business at different stages of the value stream.

Registration is the process of recording a document with a recognized officer and to safeguard its original copies. Any document whether binding or non-binding shall be registered in a required manner. Registration of every document is not necessary but doing so affirms the authenticity and helps in avoiding legal process. There are two kinds of registration according to The Registration Act, 1908 namely "Mandatory Registration" and "Optional Registration" which have been explained below.

1) **Mandatory Registration:** Section 17 of the Indian Registration Act, 1908 provides for mandatory registration of certain documents. Those are as follows:
    - Gift deed related to an immovable property
    - Non-testamentary instruments:
        a) purporting to creation, assignment, declaration, extinguishing of any interest in any immovable property worth rupee 100 and above
        b) which acknowledge receipt or payment of any consideration for creation, assignment, declaration or limitation of any right, title or interest
    - Lease of immovable property for any term exceeding one year or reservation of yearly rent
    - Contracts for transfer of immovable property for a consideration for purpose of Section 53A of Transfer of Property Act, 1882 is executed on or after the inception of Registration and Other Related Laws (Amendment) Act, 2001

    Failing to do so will result in transfer being invalid.

2) **Optional Registration:** But not all documents have to be registered. Section 18 provides for optional registration of some documents such as:
    - Adoption Deed
    - Instrument relating to shares in joint stock company
    - Debentures issued by joint stock company
    - Will
    - Lease of immovable property not exceeding 1 year
    - Document of a past transaction
    - Power of Attorney with respect to movable property
    - Decree or order of court comprising an immovable property valued below rupee 100
    - Certificate of Sale granted
    - Agreement of Mortgage
    - Promissory note
    - Instrument of partition by Revenue Officer
    - Grant of immovable property by Government

Citizen Centric Service:

The main aim of DRS is to provide transparent information and convenient services to the citizens and other stakeholders. The citizen centric services enabled by DRS is represented in the following diagram:

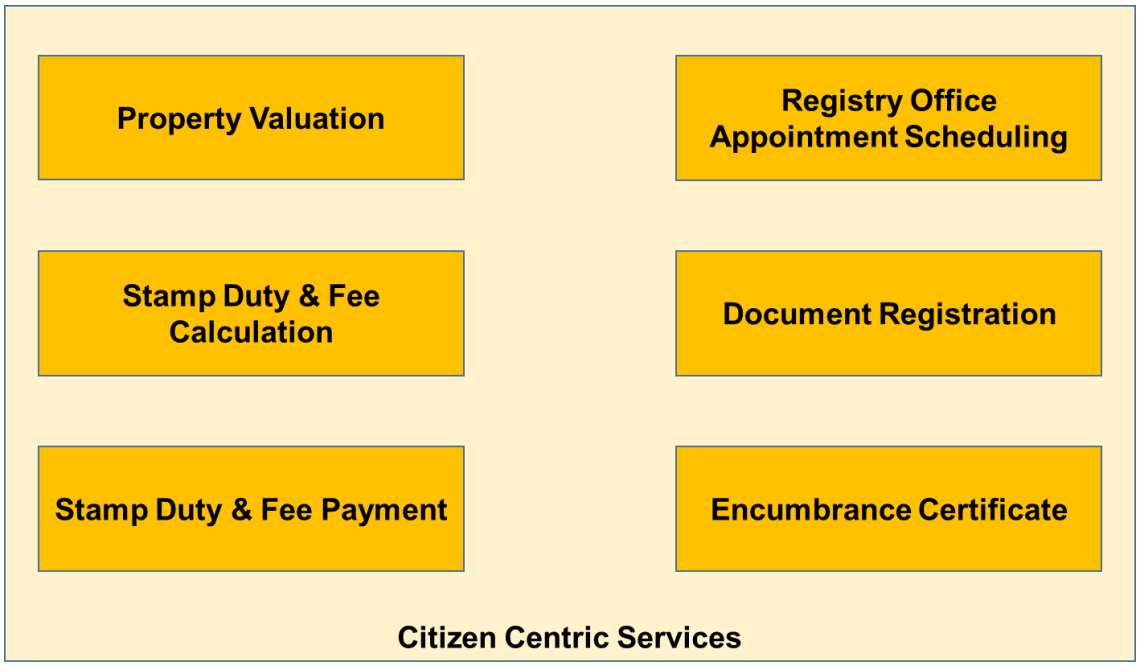


Figure 7: Citizen Centric Services

6.1.1 Business Reference Model Principles

While architecting the business reference model, following principles and statements have been found suitable to the business landscape of document registration system, from the IndEA's business reference model principle's repository. However the rationale, implication and consequences of not following the principle organisation-wide has been customized to cater to document registration system's needs.

Table 1: Business Reference Model Principles

Principle	Description
Integrated Services	**Statement** • Integrated services that cut across agency-silos are identified, designed and delivered through multiple delivery channels, to realize the vision of DRS (one nation one software). **Rationale** • States/UTs are developing and/or using different solutions/applications or to fulfil their IT requirements. These solutions have been developed/implemented in silos and are not interoperable. **Implications** • Business services are required to be designed across all the functions and enable shared data access with the stakeholders of the document registration system. **Consequences** • Registry offices/IGRs working in silos would lead to delay in service delivery to the stakeholders.
Process Re-engineering	**Statement** • Existing document registration processes are re-engineered to eliminate non-value-adds and to make the services citizen / employee centric. **Rationale** • Business processes should be reviewed and re-engineered so that the business process transformation decisions can be taken. **Implications** • This will enable state registry offices to avoid redundancy in their existing processes and would ensure that the services are user centric. **Consequences** • Without BPR, state registry offices would not be able to identify and eliminate the inefficient processes leading to inefficiencies, non-citizen centric services.
Prioritize	**Statement** • Prioritize core business processes and their needs over others for document registration domain.

	Rationale • Enterprise architecture provides maximum benefit if aligned with organisation's (document registration domain) business strategy. **Implications** • Registry office can clearly prioritize the core business functions which can be analysed and handled efficiently as per the business strategy. **Consequences** • If the core business functions are not prioritized to make it efficient then it would be difficult for the registry offices to improve the service delivery.
Maximization of benefit	**Statement** • Information Management decisions are made to maximize the benefit to DRS stakeholders. **Rationale** • Business services should be identified and designed in a way that the stakeholders get maximum benefit and value. **Implications** • The apex departmental users of document registration domain (department) should contribute in the enterprise planning and decision making. **Consequences** • Business service, if not designed in keeping the interest of stakeholders, it will lead to dissatisfied stakeholders and inefficient processes.

6.1.2 Vision and Mission

Vision and mission of the organisation typically provide a strategic intent that provides a purpose and drives the organisation. Based on the aspiration the role of document registration system as an organisation and with the appreciation of the Registration Act 1908 by which document registration system is governed, we have defined the DRS mission and vision statements as follows:

Vision: To provide “One Nation One Software” for document registration services under Digital India Land Records Modernization Programme.

Mission: The mission of the DRS is to provide document registration services with effective use of modern technology to the people using well defined procedures, with right means, in specific time frame and the transparent manner.

6.1.3 As-Is Landscape

After studying the current landscape of 31 states / union territories it was identified that the states / union territories either use manual process, physical document store to keep the records or use modules, applications etc. for different purposes to fulfil their need. Almost each state / union territory is using different methods, systems for the document registration service.

States / union territories use their own methods, techniques and processes for property valuation, stamp duty calculation, accepting payments, registration and final storage of information, documents or certificates.

Most of the states cover the following functions

1. Document submission
2. Document verification
3. Property valuation
4. Payment calculation
5. Payment online
6. Registration
7. Certified copy delivery

The table below describes citizen centric services of document registration process, service delivery mechanism and service delivery channels in the as-is landscape:

Table 2: As-Is Services, Delivery Mechanism and Delivery Channels

#	Services Delivered	Delivery Mechanism	Channels / Location
1	Property Valuation	Partially Automated / Manually performed by registry office	Citizen to approach and visit Registry Office
2	Stamp Duty & Fee Calculation	Partially Automated / Manually performed by registry office / advocates	Citizen to approach and visit Registry Office / advocates
3	Stamp Duty & Fee Payment	Manually performed by citizen & registry office	Citizen to visit Registry Office and make the payment through DD, Cash, Bank Challan
4	Registry Office Appointment Scheduling	Partially Automated / Manually performed by citizen & registry office	Citizen to visit registry office and seek for appointment, Registry office to check register and schedule an appointment
5	Document Registration	Partially Automated / Manually performed by registry office	Registry office to record the information, scrutiny and register the document, create copies to store and share with the citizen
6	Encumbrance Certificate	Manually performed by registry office	Registry office to search and generate the encumbrance certificate, create

			copies to store and share with the citizen

6.1.3.1 Organisational View

After studying the organisation charts of 31 states and union territories we found out that almost every state has a different organisation structure at different levels. The range of office levels in these states and union territories range between 2 levels to 10 levels. Number of sub-registrars offices vary from 1 office to 504 offices.

Based on the study conducted below depicted is a generic organisation structure created which reflects the different levels of the organisation:

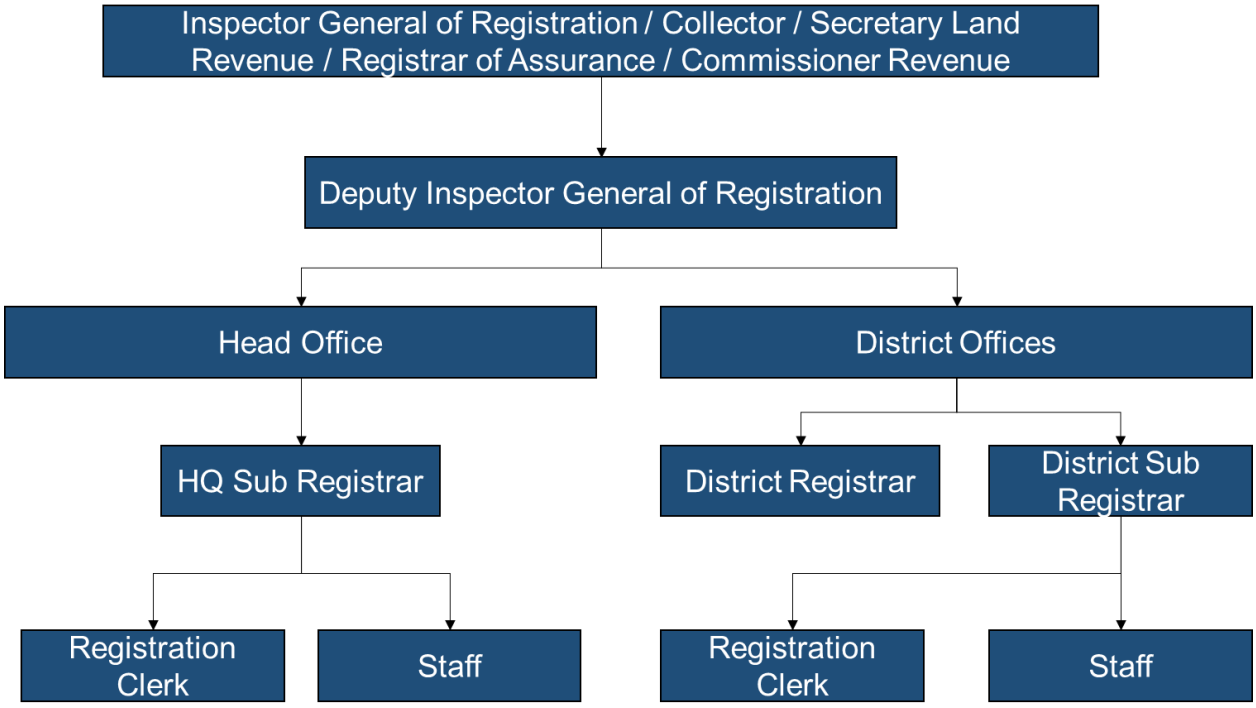


Figure 8: Organisation Structure As-Is

There are 6 business roles or stakeholders involved in the processes of the document registration system and described in the following table:

Table 3: As-Is Business Roles and Description

#	Business Role / Stakeholders	Description
1	Central Ministry / DoLR	Central Ministry / Department of Land Resources
2	State IGR	State Inspector General of Registration / Collector / Secretary Land Revenue / Registrar of Assurance / Commissioner Revenue
3	Registry Office	Registrar's Office, Sub-Registrar's Office
4	Citizen	Citizens of the state
5	Advocate / Deed Writer	Advocates and deed writers who would submit the information on behalf of the citizen
6	External Department	Any external department which provides or requests a certain information or is involved in the registration process

As-Is High Level Process

The analysis of as-is landscape for document registration, steps of the registration process has been depicted below:

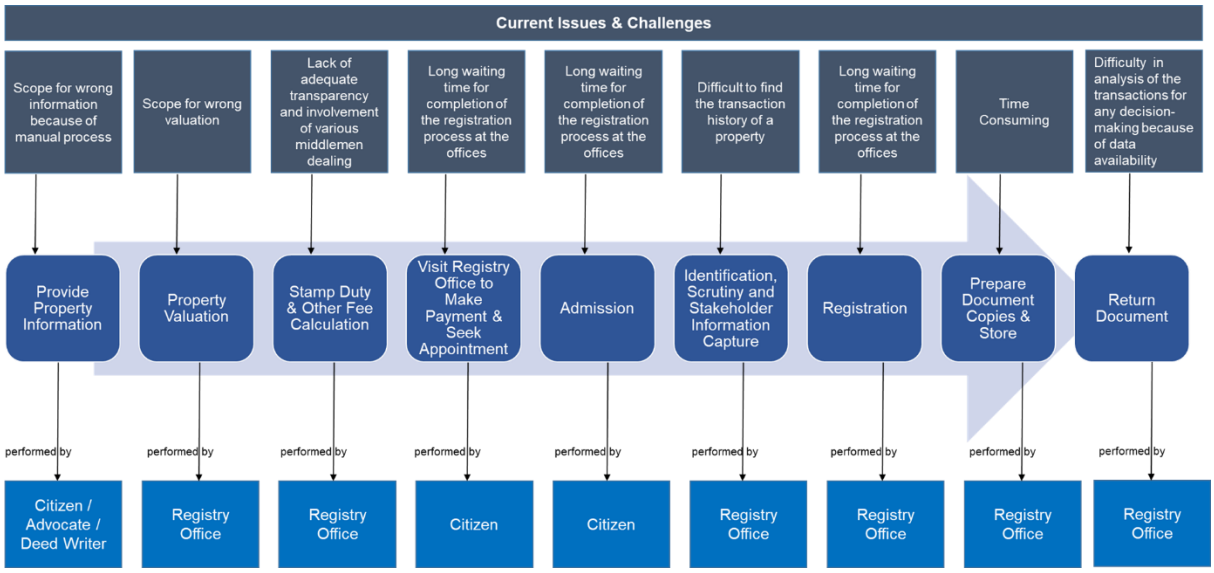


Figure 9: As-Is Process Flow - Document Registration

The manual process of document registration comprises of providing property or document information by the citizen, property valuation by the registry office, stamp duty and other fee calculations by the registry office, citizen to visit the registry office and make the payment, seek an appointment and then provide the related documents to the registry office. Registry office to identify, scrutinize the papers and capture the stakeholder's (party, identifier, witness) final information, register, prepare registration document copies, store and handover it to the citizen. The figure below depicts the citizen centric services mapping to the stages of the process when it is actually delivered to the citizen:

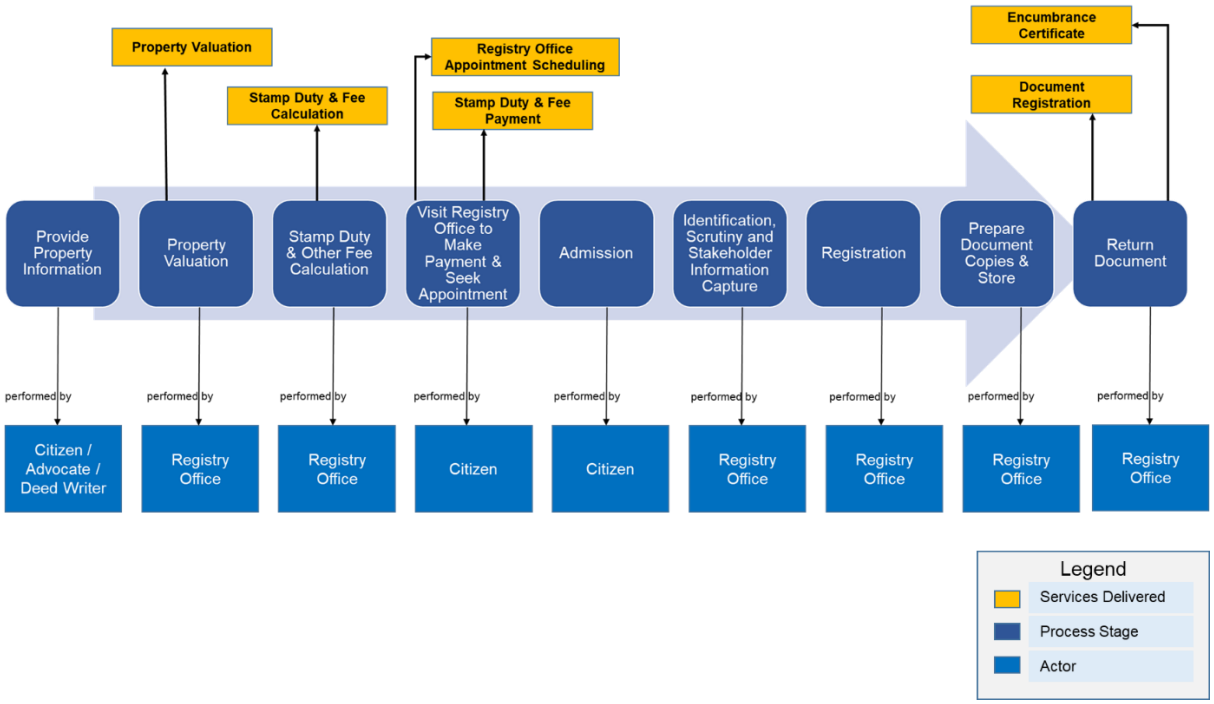


Figure 10: As-Is Process Stages Mapping with Services Delivered to Citizens

Most of the states have automated these functions and some of the states do it manually. The swim-lane diagram below depicts the high level process among the different stakeholders which is being followed in the as-is landscape:

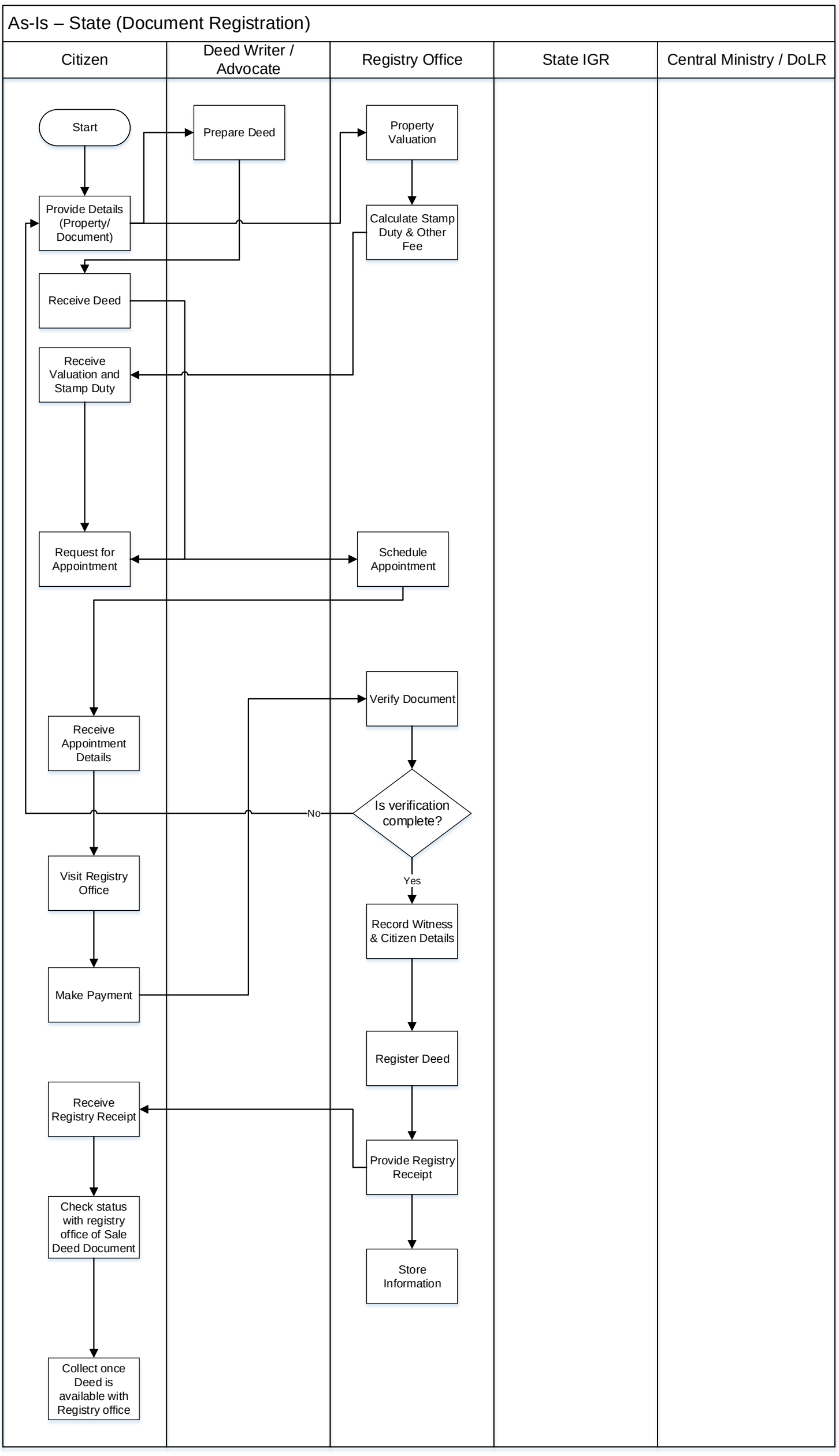


Figure 11: As Is Landscape – Document Registration

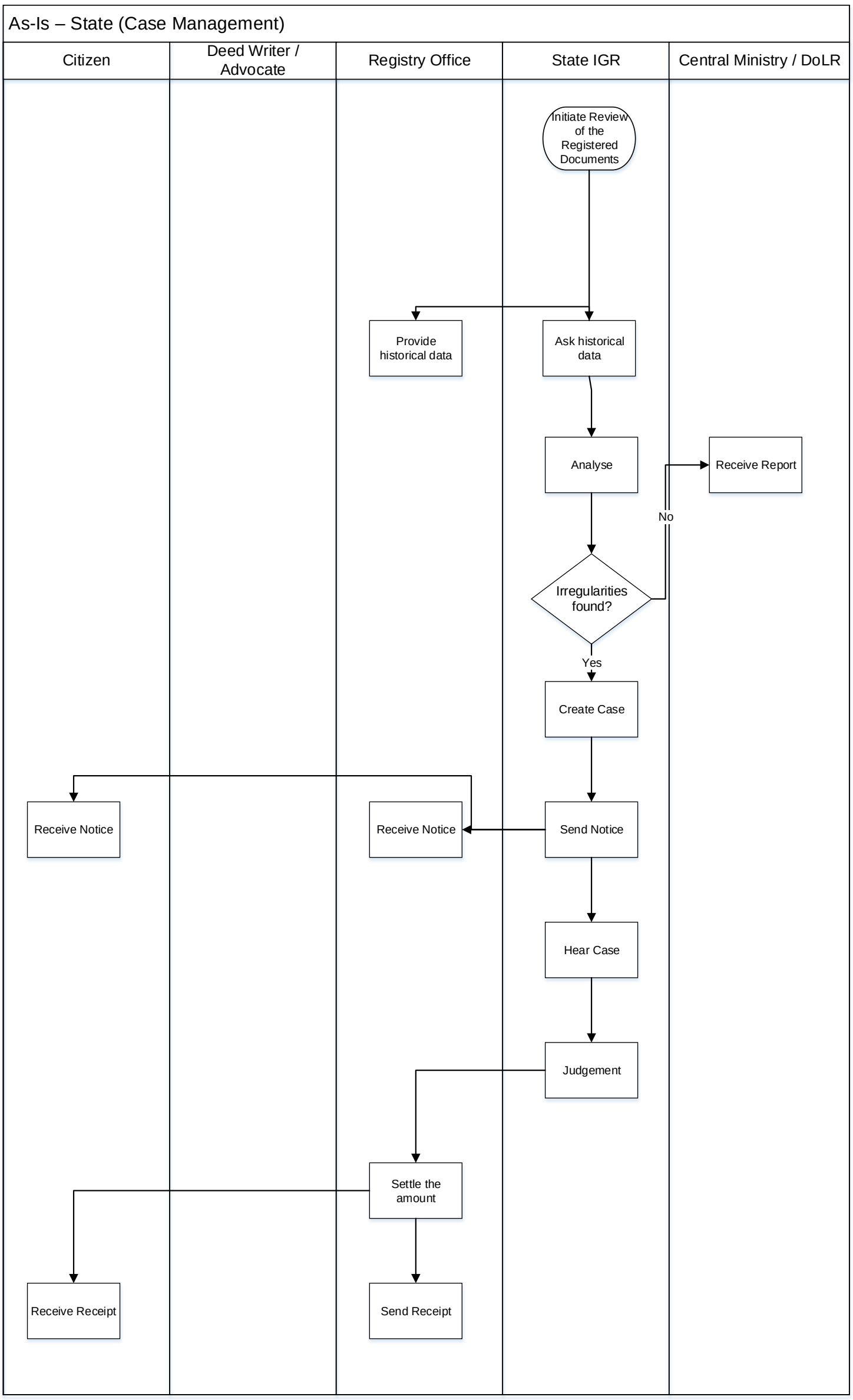


Figure 12: As Is Landscape – Case Management

6.1.4 Transition Plan

Identification of the state / union territories specific requirements would help in the transformation plan for the document registration system. From the gap analysis conducted for the 31 states and union territories we understand that states have moved towards the automated systems, modules to perform the registration activities. Some of the states / union territories have adopted COTS solutions, developed modules in their already built systems or the whole system for registration process.

The instance of state specific DRS To-Be system will be the aim for the states and union territories to move towards which will help in improving the efficiency of business processes, ease of accessibility and delivery of services at one place for all the services to be delivered to the citizens. It will focus upon the transformation of the existing automated systems to more advanced automated systems with integration, delivery of services to the citizens at the doorstep through mobile applications or other service delivery channels identified by the states in the later phases.

The table below depicts the value streams and how are they being performed in as-is state and how will it be performed in to-be state on basis of automated and manual process on a scale of – Manual, Partially Automated and Automated:

Table 4: Value Streams in As-Is and To-Be States

#	Value Stream	As-Is	To-Be
1	Citizen Registration to Identifier Details Submission	Manual	Automated
2	Valuate Property to Payment	Partially Automated / Automated	Automated / Value Addition
3	Document Submission to Appointment Schedule	Manual	Automated
4	Admission to Payment Verification	Partially Automated	Automated / Value Addition
5	Payment Acceptance to Document Handover	Partially Automated	Automated / Value Addition
6	Case Admission to Monitoring	Manual	Automated
7	Rule Creation to Rule Amendment	Manual	Automated
8	Grievance to Redressal	Manual	Automated
9	Monitor to Report	Manual	Automated

The states where values streams have been automated can be enhanced along with some value added functionalities like automation with integration and mobile interface. Along with this a detailed BPR template has been defined (added to the annexure section) to be used by the teams for any of the BPR recommendations service wise / process wise changes assessed, suggested, prioritised and approved. Also, a heat map template to assess the services delivered by the document registration function of the states has been added in the annexure which may be used by the states to assess the maturity and digital maturity of the services delivered by them.

Transition Principles:

1) Focus on Citizen Centric Services – Focus of the registration capabilities and processes should be towards citizen centric services to be delivered. The addition or upgradation of capabilities should be around citizen centric services first.
2) Focus on efficient service delivery with low cost and low maintenance service delivery channels.
3) Focus on ease of business or service delivery ecosystem and better experience for stakeholders of document registration system.
4) Registration and Payment process improvement – Stamp duty payment and registration are the main services delivered to the citizens. The processes for stamp duty payment and registration should be improved to increase the efficiency and towards providing a hassle free service to the citizens.

6.1.5 To-Be Landscape

The To-Be landscape of DRS has been thought through by studying the different states, the variations followed by states and union territories. It also provides direction for the states to perform business process re-engineering such as simplification of deed formats and availability of sample deed formats electronically. To-be landscape of document registration system has been captured in the business layer in the form of:

1) Organisational View
2) Values Stream View
3) Business Capabilities / Function View
4) Cumulative functions
    i. Standardization of glossary/Metadata
    ii. Appointment schedule
    iii. Proactive filling of forms
    iv. Self-valuation
    v. Self-payment
    vi. Party Admission
    vii. Party Verification
    viii. Payment verification & defacement
    ix. Document Registration
    x. Encumbrance certificate
5) Universal coverage

6.1.5.1 Citizen Centric Services

The table below describes citizen centric services of document registration process, service delivery mechanism and service delivery channels in the to-be landscape:

Table 5: To-Be Services, Delivery Mechanism and Delivery Channels

#	Services Delivered	Delivery Mechanism	Channels / Location
1	Property Valuation	Calculated and Delivered by the DRS system	Web Portal, Mobile App
2	Stamp Duty & Fee Calculation	Calculated and Delivered by the DRS system	Web Portal, Mobile App, Kiosks
3	Stamp Duty & Fee Payment	Online Payment, Registry Office Payment	Web Portal, Mobile App, Kiosks, At Registry Office Different modes – online payment, e-challan, DD, bank challan, cash
4	Registry Office Appointment Scheduling	Delivered by the DRS system	Web Portal, Mobile App, Kiosks
5	Document Registration	Registry office to capture details, biometrics, photo, scrutiny documents online, registration online, generate certificates,	Web Portal

		scan, store and handover to citizen	
6	Encumbrance Certificate	Registry office to do authentication and document identification, scrutiny, generate certificates, scan, store and handover to citizen	Web Portal, Kiosks

6.1.5.2 Services Provided to Government Departments

Document registration system provides “Registered Documents Data Sharing with Government Department” service as a government to government service. Other information exchange between inter and intra departments have been detailed out in the application integration reference model.

#	Services Delivered to Government	Delivery Mechanism	Channels / Location
1	Registered Documents Data Sharing with Government Department	Delivered by the DRS system	Integration

6.1.5.3 Organisation Structure

Similar organisation structure extracted from the as-is landscape has been carried forwarded in to-be landscape and no organisation structure changes or update has been suggested in the to-be landscape.

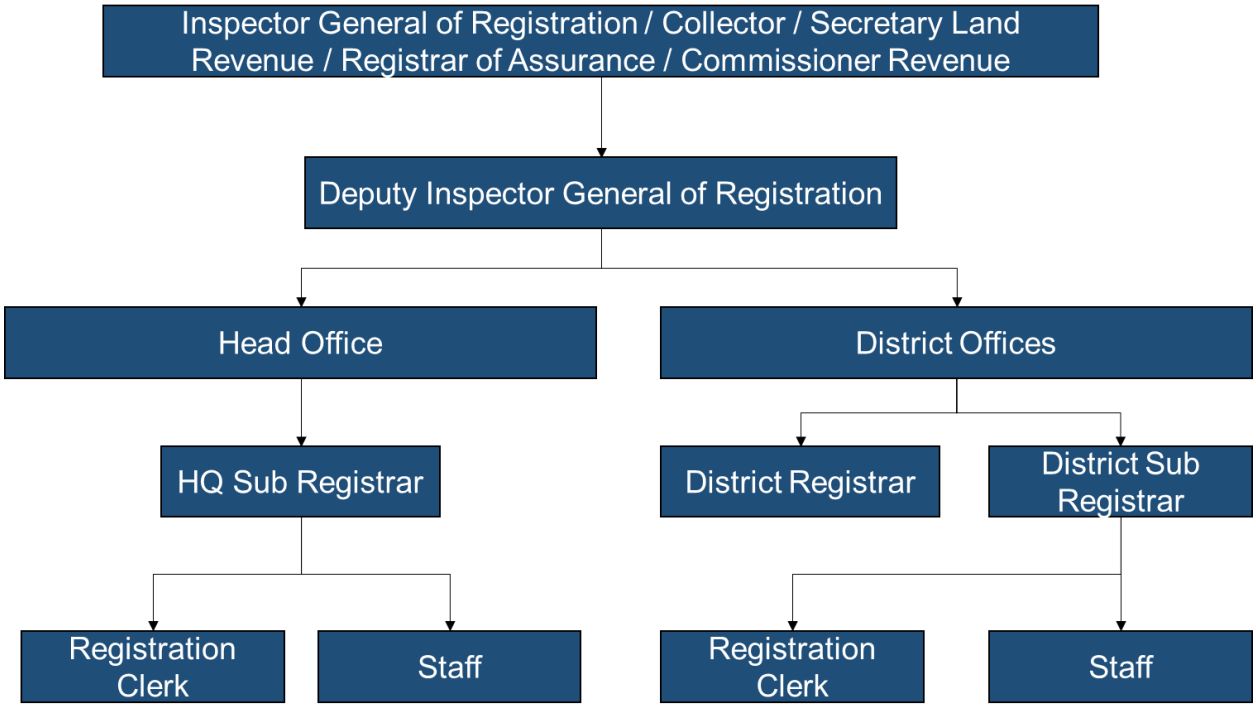


Figure 13: Organisation Structure To-Be

6.1.5.4 Business Roles / Stakeholders

There are 6 different types of business roles or stakeholders involved in the processes of the document registration system. Similar business roles extracted from As-Is have been carried forwarded into To-Be Landscape. The business role / stakeholder and their description has been mentioned in the following table:

Table 6: To-Be Business Roles and Description

#	Business Role / Stakeholders	Description
1	Central Ministry / DoLR	Central Ministry / Department of Land Resources
2	State IGR	State Inspector General of Registration / Collector / Secretary Land Revenue / Registrar of Assurance / Commissioner Revenue
3	Registry Office	Registrar's Office, Sub-Registrar's Office
4	Citizen	Citizens of the state
5	Advocate / Deed Writer	Advocates and deed writers who would submit the information on behalf of the citizen
6	External Department	Any external department which provides or requests a certain information or is involved in the registration process

Detailed departmental stakeholders and their duties (responsibilities) have been added in the annexure.

6.1.5.5 Business Capability / Function View

A business capability defines what a business does. It does not communicate or expose where, why, or how something is done - only what is done. Specifically, the business capability is "a particular ability or capacity that a business may possess or exchange to achieve a specific purpose of outcome."[4] There are 11 major business capabilities / functions identified for the document registration system and are depicted in the figure below and described in this section:

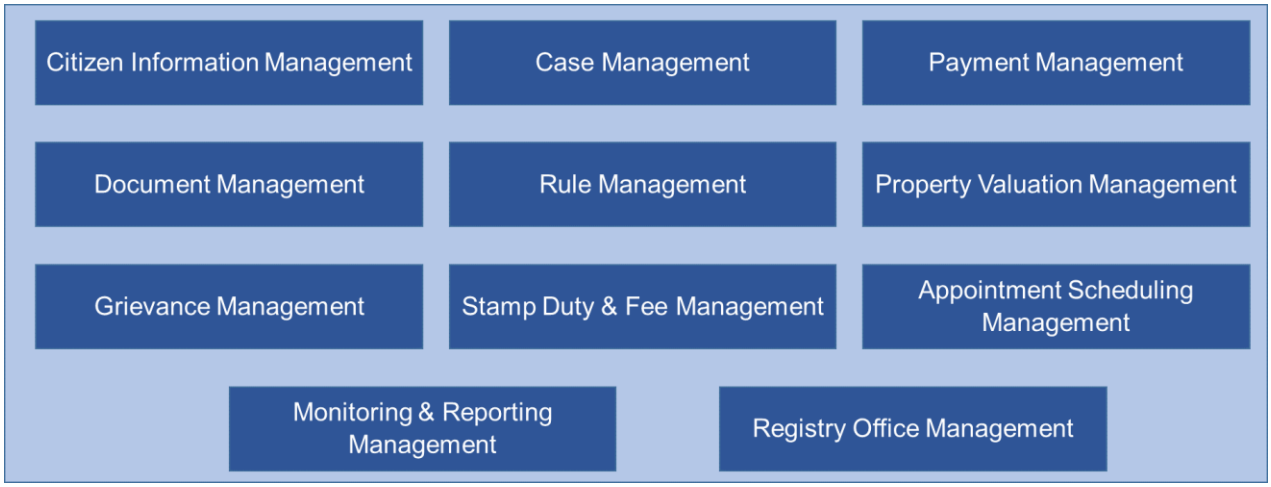


Figure 14: Business Capabilities / Functions

Below is the collection of business capabilities / business functions and their description of DRS as an organisation:

Table 7: Business Capabilities / Function and Description

#	Business Capability / Function	Description
1	Citizen Information Management	Ability of the DRS to capture the required information of the citizen
2	Document Management	Ability of the DRS to capture the required information of the document, property and article. This capability will be responsible for managing the registration of the documents as well as its information.
3	Grievance Management	Ability of citizen to log grievance against the service delivered and get redressal
4	Property Valuation Management	Ability of the DRS to provide valuation of the property and online verification of the ownership to stakeholders
5	Appointment Scheduling Management	Ability of the DRS to let stakeholders schedule and manage the registry office appointment
6	Case Management	Ability of the DRS to manage the case against the services provided to stakeholders
7	Rule Management	Ability of the DRS to manage the rules to be used in different processes and working of the registry offices and IGRs.
8	Stamp Duty & Fee Management	Ability of the DRS to be able to manage the stamp duty and other fee required for services
9	Payment Management	Ability of the DRS to manage the payments related processes and activities

[4] Source: BIZBOK Guide version 6.5

10	Registry Office Management	Ability of the DRS to manage the registry offices information
11	Monitoring & Reporting Management	Ability of the DRS to monitor and report

Classification of DRS capabilities into different types has been depicted in the table below:

Table 8: Business Capability Type

#	Business Capability / Function	Type
1	Citizen Information Management	Government to Citizen
2	Document Registration Management	Government to Citizen
3	Grievance Management	Government to Citizen
4	Property Valuation Management	Government to Citizen, Government to Government
5	Appointment Scheduling Management	Government to Citizen
6	Case Management	Government to Citizen
7	Rule Management	Government to Citizen
8	Stamp Duty & Fee Management	Government to Citizen
9	Payment Management	Government to Citizen
10	Registry Office Management	Government to Government
11	Monitoring & Reporting Management	Government to Government

Stakeholders Accountability / Responsibility Mapping

The table below depicts the mapping of business functions against the business roles. The table lets us know which role is accountable and responsible for a function

Responsible: The department / function head who performs the function.

Accountable: The department / function head who oversees the function.

Table 9: Business Function - Responsible / Accountable Matrix

#	Business Capability / Function	Responsible	Accountable
1	Citizen Information Management	Inspector General of Registration / HQ Sub Registrar/ District Registrar/ District Sub - Registrar	State IGR
2	Document Registration Management	HQ Sub Registrar/ District Registrar/ District Sub - Registrar	State IGR
3	Grievance Management	Inspector General of Registration / District Registrar/ District Sub - Registrar	State IGR
4	Property Valuation Management	District Registrar/ District Sub - Registrar	State IGR
5	Appointment Scheduling Management	District Registrar/ District Sub - Registrar	State IGR
6	Case Management	Inspector General of Registration / District	State IGR

		Registrar/ District Sub - Registrar	
7	Rule Management	Inspector General of Registration / Collector / Secretary Land Revenue / Registrar of Assurance / Commissioner Revenue / HQ Sub Registrar/ District Registrar	State IGR
8	Stamp Duty & Fee Management	Inspector General of Registration / Collector / Secretary Land Revenue / Registrar of Assurance / Commissioner Revenue	State IGR
9	Payment Management	HQ Sub Registrar/ District Registrar/ District Sub - Registrar	State IGR
10	Registry Office Management	Inspector General of Registration / HQ Sub Registrar/ District Registrar	State IGR
11	Monitoring & Reporting Management	Inspector General of Registration / Collector / Secretary Land Revenue / Registrar of Assurance / Commissioner Revenue	State IGR

These business capabilities needs to be orchestrated to deliver the services to the citizens. The following section describes the high level to-be process flow of document registration, in which stage of the process these services are being delivered and what capability is being utilised to deliver these services.

To Be – High Level Process

Steps of the registration process in to-be state has been depicted below:

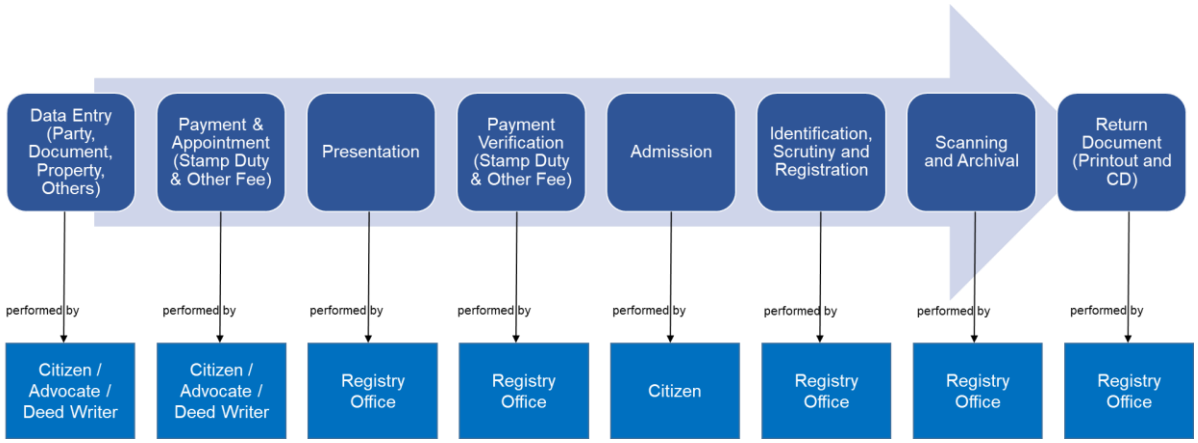


Figure 15: To-Be Process Flow - Document Registration

In the to-be state the steps of document registration are data entry by the citizen, calculation of property valuation, stamp duty and fee to be done by the system and made available to the citizens to pay it through different modes of payment. Post which the citizen can schedule an appointment of registry office and visit it. Once the presentation is complete, registry office will verify the payment and admission will be done. Registry office then identify, scrutinize the information and register the document. Post registering the document, registry office will scan and archive the data as well as handover the document to the citizen.

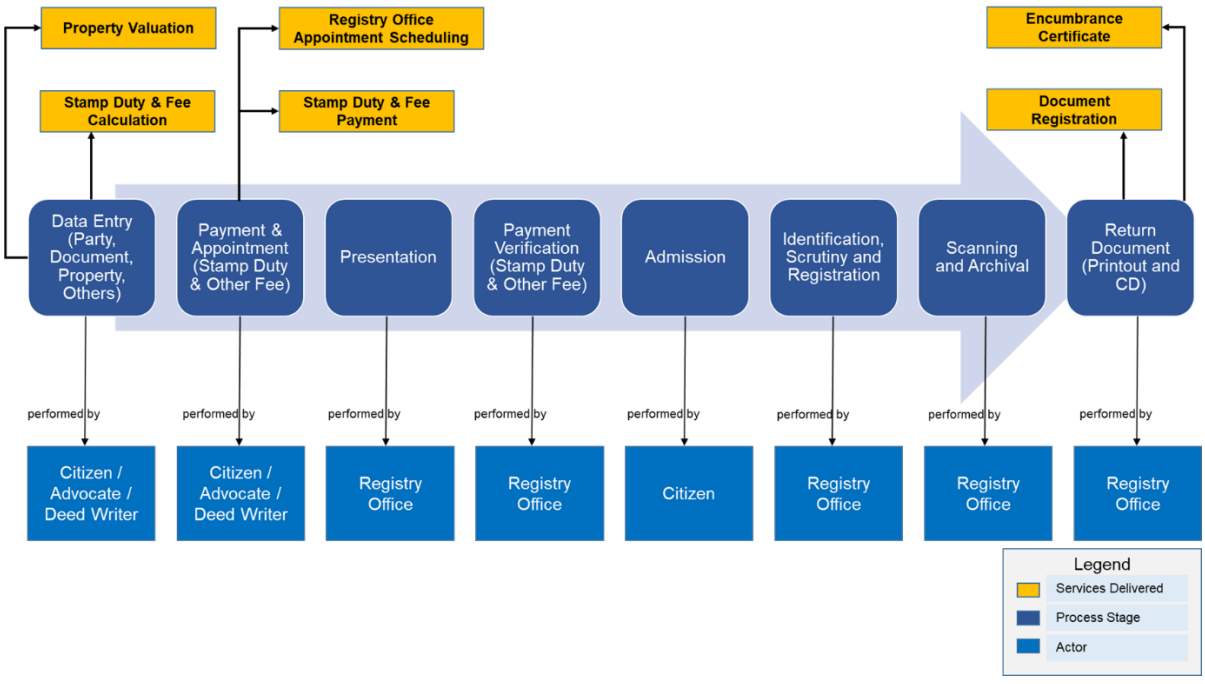


Figure 16: To-Be Process Stages Mapping with Services Delivered to Citizens

To Be Registration Process and Capabilities Utilised

The registration process in the to-be landscape addresses the issues faced by the stakeholders in the as-is landscape like scope for wrong valuation, too time consuming, dependency on the manual process, involvement of middlemen etc. The diagram below depicts service delivery process, stages & utilised capability mapping in the registration process:

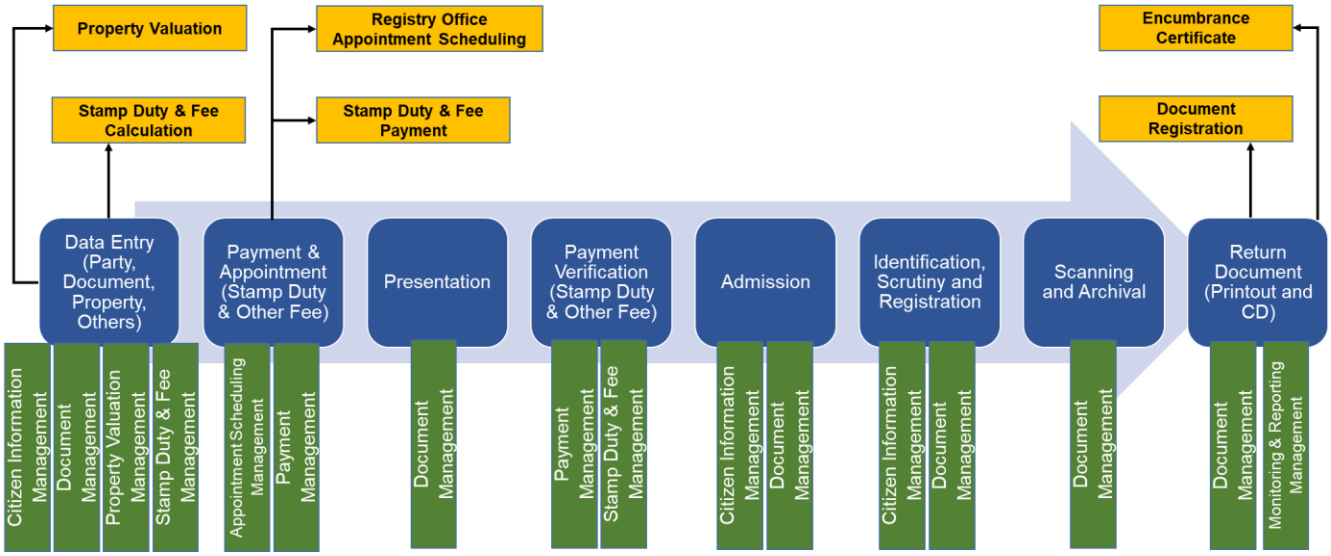


Figure 17: Service Delivery Process and Capabilities Utilised Mapping

Exceptions that might occur in document registration process:

1) Incomplete information availability
2) Unverified information
3) Updation / correction of land records completion
4) Disputed ownership

Below depicted is the target state document registration process flow among the stakeholders:

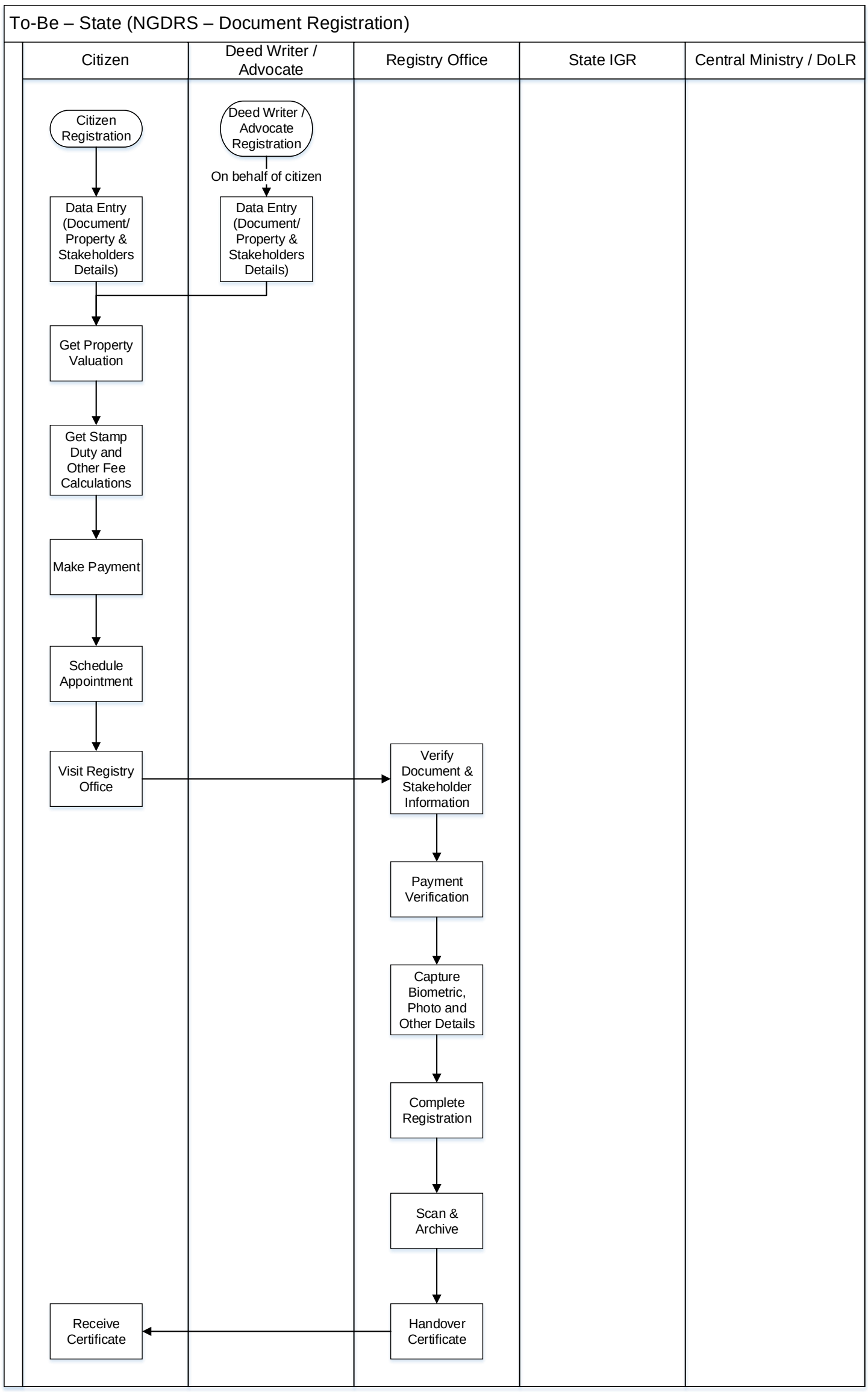


Figure 18: To Be Landscape – Document Registration

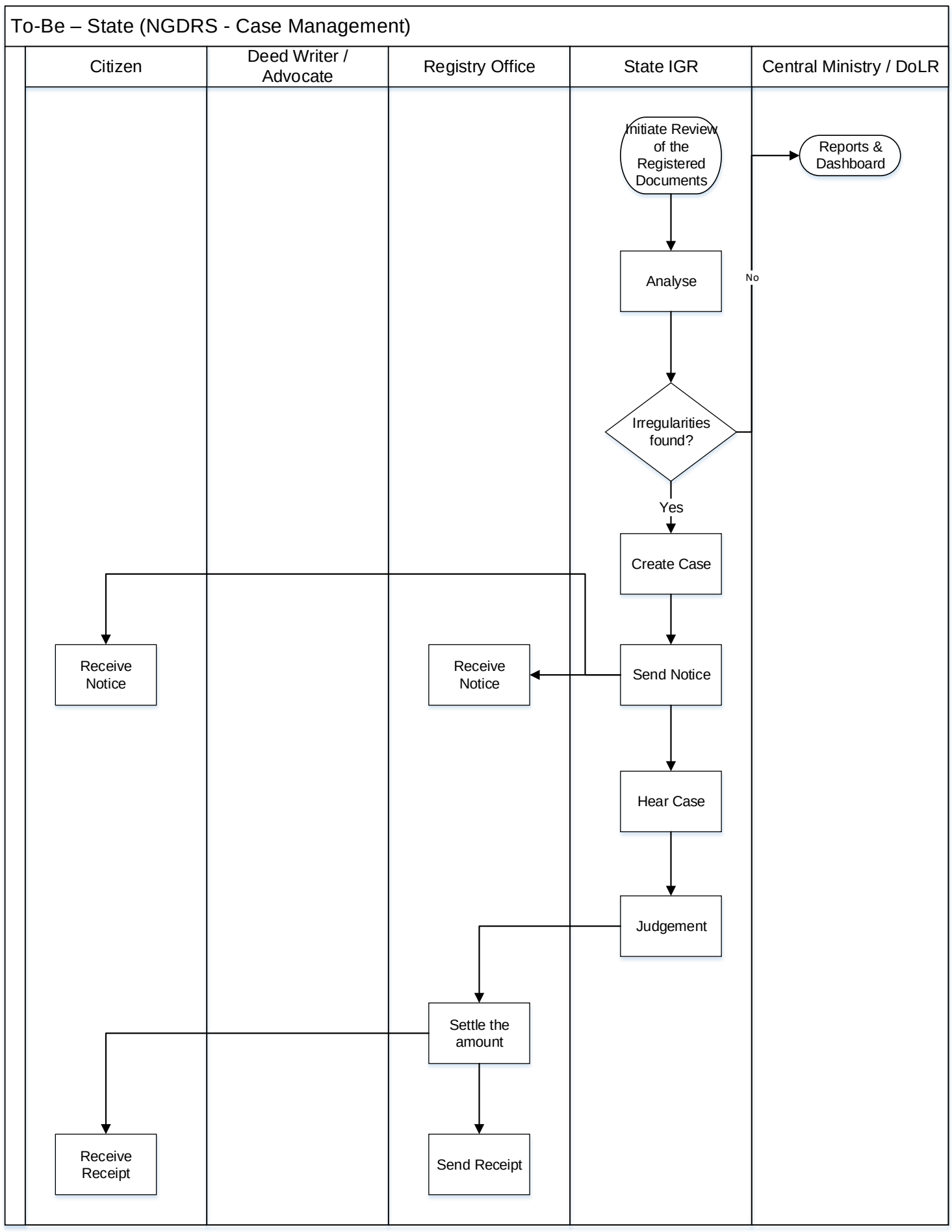


Figure 19: To Be Landscape - Case Management

6.1.5.6 Value Stream View

This section demonstrates a collection of end-to-end activities performed by the State's IGRs and registry offices to deliver the value to its stakeholders. Set of value generating activities and stakeholders are depicted in the diagram below:

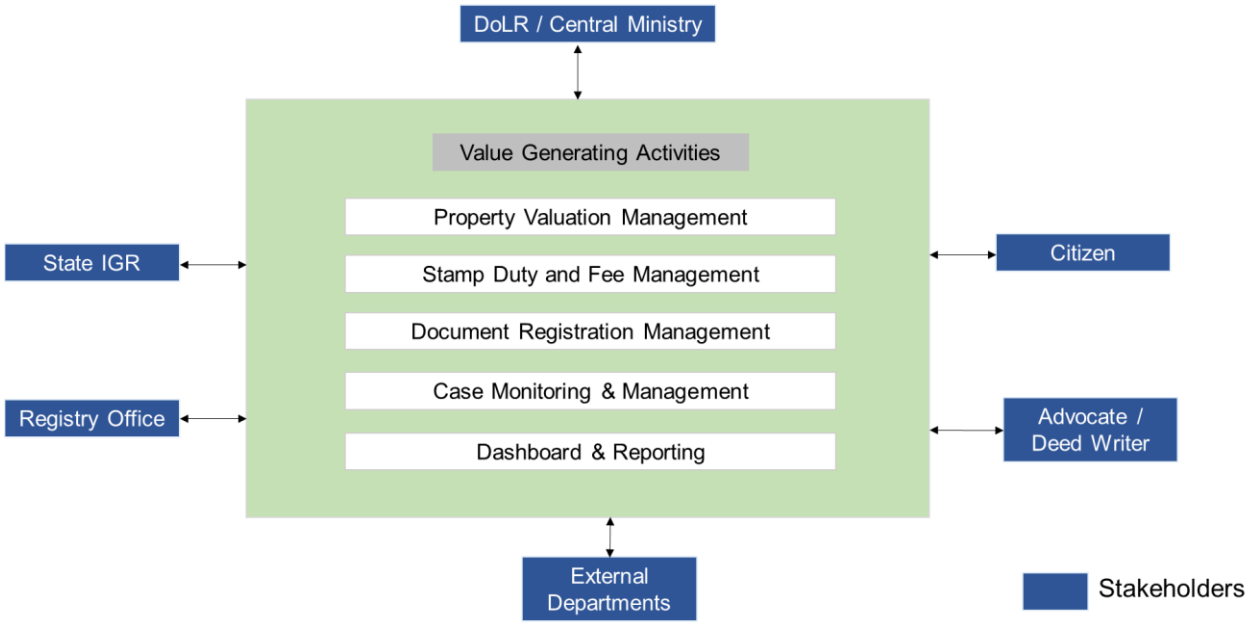


Figure 20: Value Generating Activities and Stakeholders

From the diagram we can categorise the stakeholders into two types:

Internal Stakeholder

1. Registry Office
2. State IGR

External Stakeholders

1. DoLR/Central Ministry
2. External Departments
3. Citizen
4. Advocate/Deed Writer

State IGRs and Registry office utilise these value streams to deliver value to its stakeholders:

Table 10: Value Streams and Participating Stakeholders

#	Value Stream	Stakeholders	Functions / Capabilities
1	Citizen Registration to Identifier Details Submission	Citizen (Advocate, Deed Writer)	Citizen Information Management
2	Valuate Property to Payment	Citizen (Advocate, Deed Writer)	Property Valuation Management, Payment Management
3	Document Submission to Appointment Schedule	Citizen (Advocate, Deed Writer)	Document Registration Management, Appointment Scheduling Management
4	Admission to Payment Verification	Citizen (Advocate, Deed Writer), Registry Office	Document Registration Management, Payment Management
5	Payment Acceptance to Document Handover	Citizen (Advocate, Deed Writer), Registry Office	Document Registration Management, Payment Management
6	Case Admission to Monitoring	State IGR, Citizen, Registry Office	Case Management
7	Rule Creation to Rule Amendment	State IGR	Rule Management
8	Grievance to Redressal	Citizen, Registry Office	Grievance Management
9	Monitor to Report	Central Ministry/DoLR, State IGR, Registry Office, External Departments	Monitoring & Reporting Management

6.1.5.6.1 VS 01 “Citizen Registration” to “Identifier Details Submission”

Citizen registration to identifier details submission value stream includes capturing the citizen details, property or other article details, witness information and identifier information. This is the initiation point (initiating value stream) of citizens as a stakeholder of DRS. This value stream supports document registration, stamp duty & fee calculation and payment business services to help the citizens in good governance.

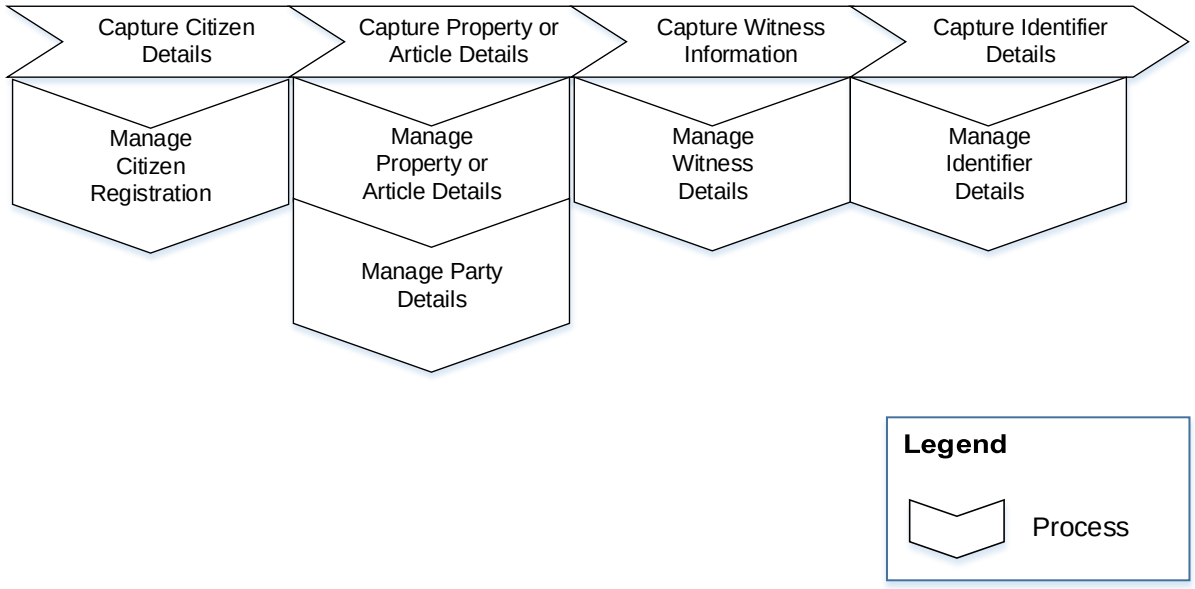


Figure 21: VS 01 Citizen Registration to Identifier Details Submission

Stages, entry criteria, exit criteria, value generated and stakeholders of citizen registration to identifier details submission value stream are as follows:

Table 11: VS 01 Citizen Registration to Identifier Details Submission

“Citizen Registration” to “Identifier Details Submission”				
Stage	**Entry Criteria**	**Exit Criteria**	**Value Generated**	**Stakeholder**
Capture citizen details	New citizen account creation	Citizen account request approved / rejected	A new citizen is on boarded	Citizen, Registry Office
Capture property or article details	New citizen registered	Property/article information created	Updated property/article information available	Citizen
Capture witness information	New property/ article information captured	Witness information created	Updated witness information available	Citizen

Capture identifier Information	New witness information captured	Identifier information created	Updated identifier information available	Citizen

6.1.5.6.2 VS 02 “Valuate Property” to “Payment”

Valuate property to payment value stream includes managing the valuation of property basis certain rules, calculation of stamp duty and other fee, capturing the payment and processing it for the citizen. This value stream supports stamp duty & fee calculation and payment business services to help the citizens to deliver the services.

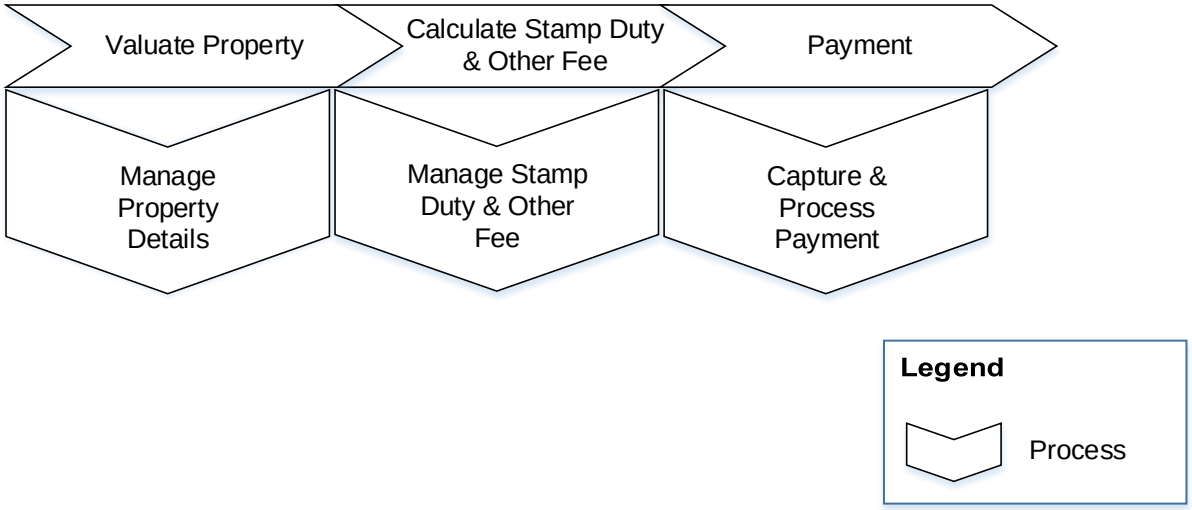


Figure 22: VS 02 Stamp Duty Calculation to Payment

Stages, entry criteria, exit criteria, value generated and stakeholders of stamp duty calculation to payment value stream are as follows:

Table 12: VS 02 Stamp Duty Calculation to Payment

“Valuate Property” to “Payment”				
Stage	**Entry Criteria**	**Exit Criteria**	**Value Generated**	**Stakeholder**
Valuate property	Property details created	Property valuation calculation completed	Stakeholders aware of current valuation of the property	Citizen
Calculate stamp duty & other fee	Property valuation created	Stamp duty and other fee calculated	Stakeholders aware of stamp duty and other fee to be paid	Citizen

Payment	Stamp duty and fee awareness	Payment completed	Stakeholder is able to use different modes of payment	Citizen

6.1.5.6.3 VS 03 “Document Submission” to “Appointment Schedule”

Document submission to appointment schedule value stream includes capturing of the pre-registration summary, document submission and scheduling appointment of the registry office by the citizen. This value stream supports registry office appointment scheduling business service for the citizens.

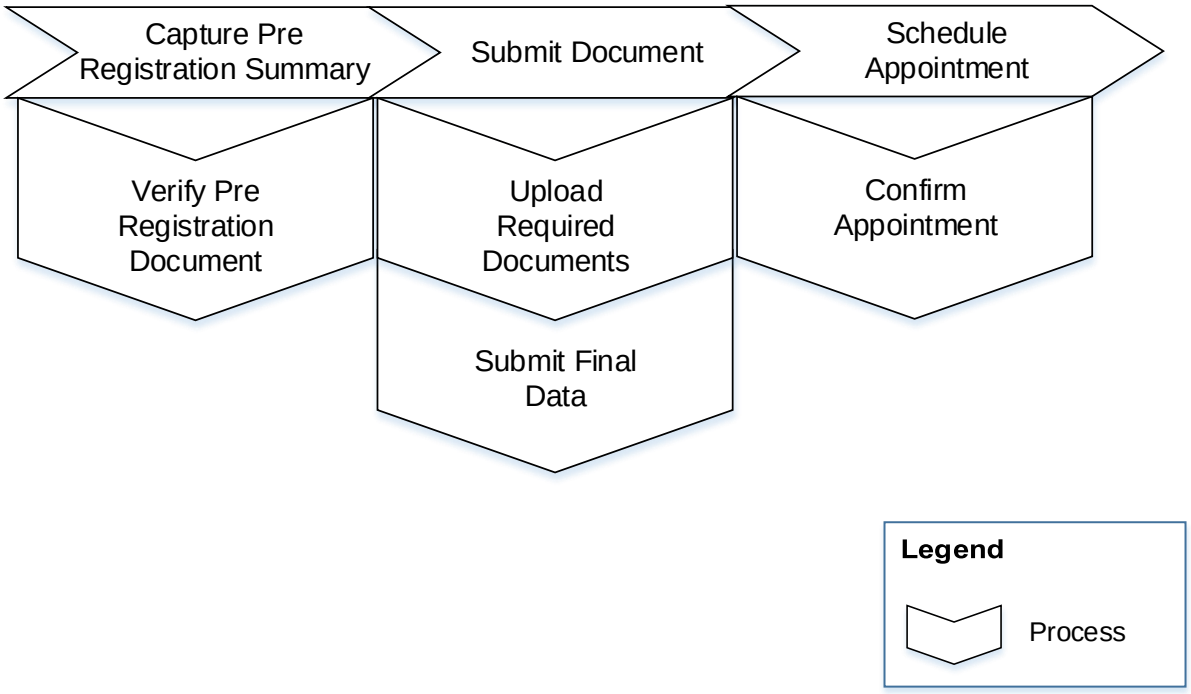


Figure 23: VS 03 Document Submission to Appointment Schedule

Stages, entry criteria, exit criteria, value generated and stakeholders of document submission to appointment schedule value stream are as follows:

Table 13: VS 03 Document Submission to Appointment Schedule

“Document Submission” to “Appointment Schedule”				
Stage	**Entry Criteria**	**Exit Criteria**	**Value Generated**	**Stakeholder**
Capture pre-registration summary	Stamp duty and fee payment completed	Pre-registration summary finalised	Up-to date information available	Citizen

Submit document	Pre-registration finalised	Final documents submitted	Up-to date information available	Citizen
Schedule appointment	Final document submitted	Appointment scheduled	Registry office notified of the appointment scheduled	Citizen

6.1.5.6.4 VS 04 “Document Verification” to “Payment Verification”

Document verification to payment verification value stream includes checking in document, accepting documents, verification and management of payment by the registry office. This value stream supports document registration business service for the citizens.

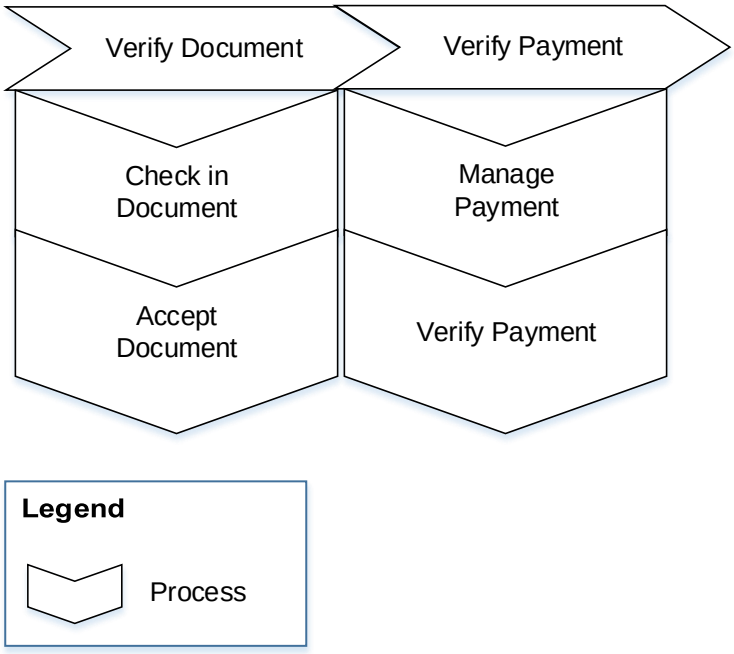


Figure 24: VS 04 Document Verification to Payment Verification

Stages, entry criteria, exit criteria, value generated and stakeholders of admission to payment verification value stream are as follows:

Table 14: VS 04 Document Verification to Payment Verification

‘Document Verification” to “Payment Verification”				
Stage	**Entry Criteria**	**Exit Criteria**	**Value Generated**	**Stakeholder**
Verify document	Documents checked-in	Documents accepted	Documents accepted by registry office to proceed	Registry office

Verify payment	Document accepted	Payment verified	Payments verified by registry office to proceed	Registry office

6.1.5.6.5 VS 05 “Payment Acceptance” to “Document Handover”

Payment acceptance to document handover value stream includes manage payment, capture stakeholder details, register document and handover document to the stakeholder. This value stream supports document registration business service provided to the citizen.

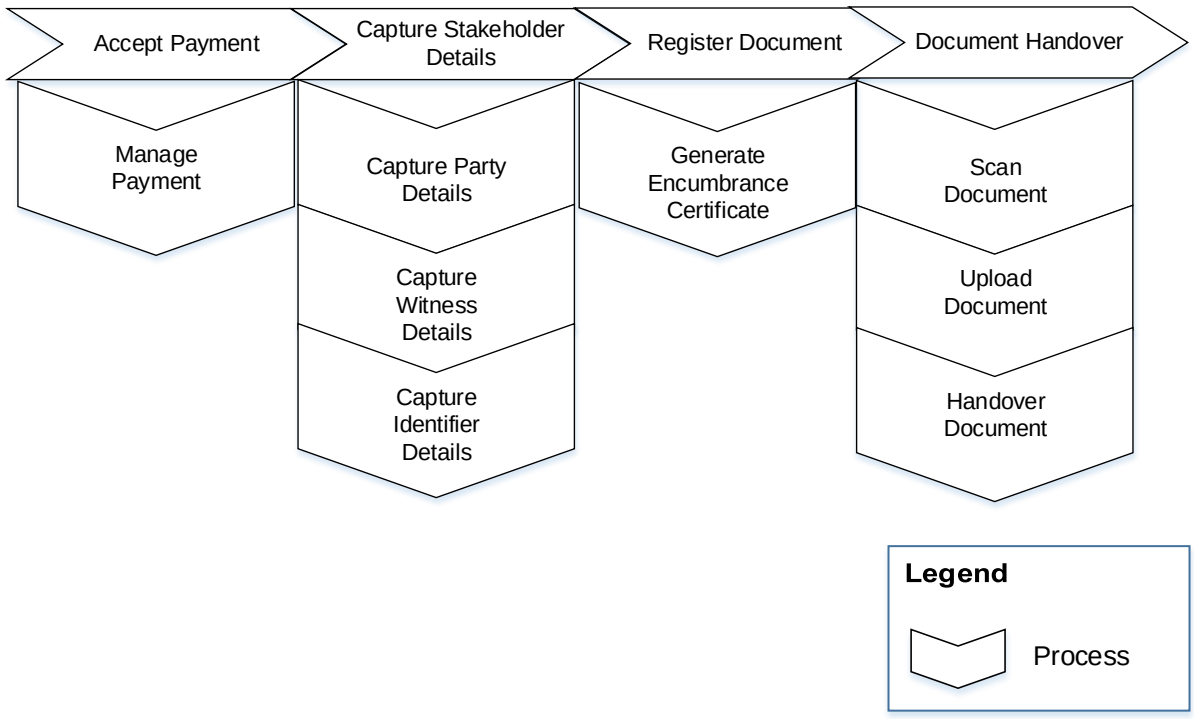


Figure 25: VS 05 Payment Acceptance to Document Handover

Stages, entry criteria, exit criteria, value generated and stakeholders of payment acceptance to document handover value stream are as follows:

Table 15: VS 05 Payment Acceptance to Document Handover

“Payment Acceptance” to “Document Handover”				
Stage	**Entry Criteria**	**Exit Criteria**	**Value Generated**	**Stakeholder**
Accept payment	Payment verification completed	Payment completed	Stamp duty and other fee paid by the citizen	Registry office, Citizen
Capture stakeholder details	Payment completed	Stakeholder details captured	Up-to date information about stakeholders available	Registry office, Citizen

Document Registration Management	Citizen details captured	Encumbrance certificate generated	Document registration completed	Registry office, Citizen
Document handover	Document registered	Document handover	Registered documents available to the stakeholders	Registry office

6.1.5.6.6 VS 06 “Case Admission” to “Monitoring”

Case admission to case monitoring includes identification of case, case hearing, case judgement, case disposal and case monitoring. The lifecycle of a case under registration is managed via this value stream and processes of this value stream. This value stream supports in finding out any irregularities or mistakes in the document registration process for a given scenario.

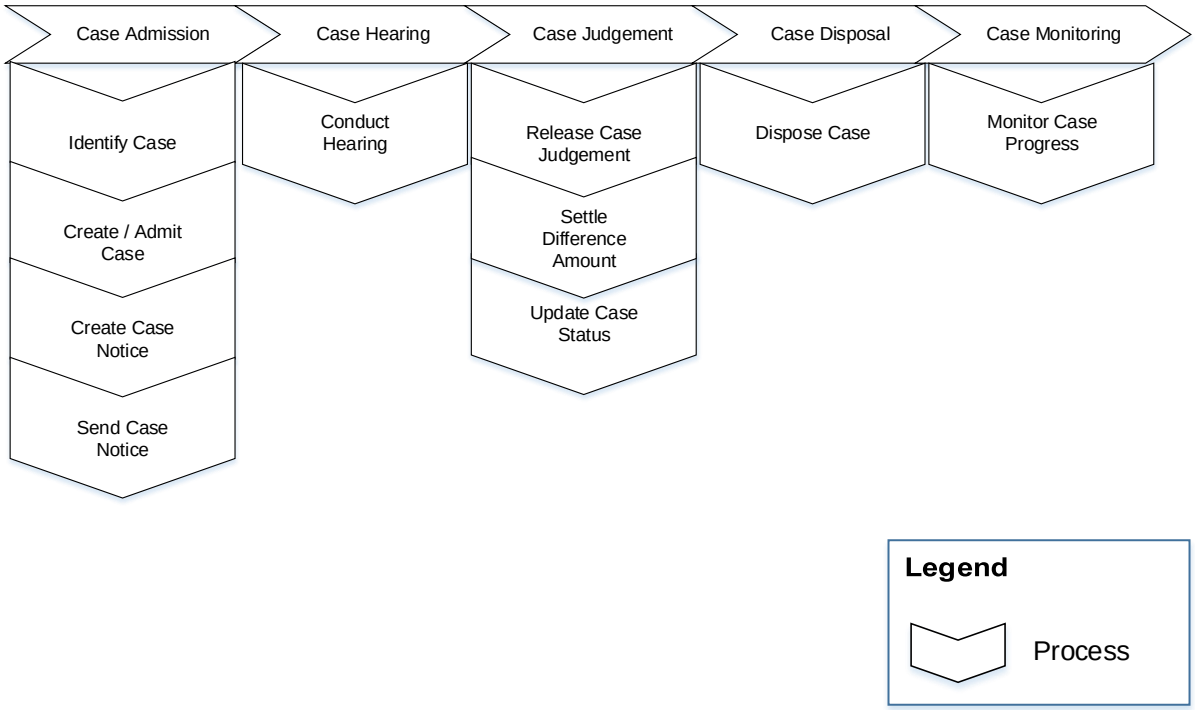


Figure 26: VS 06 Case Admission to Monitoring

Stages, entry criteria, exit criteria, value generated and stakeholders of case admission to monitoring value stream are as follows:

Table 16: VS 06 Case Admission to Monitoring

“Case Admission” to “Monitoring”				
Stage	**Entry Criteria**	**Exit Criteria**	**Value Generated**	**Stakeholder**
Case admission	Irregularity identified	Case admitted	Irregularities found	State IGR
Case hearing	Case created	Hearing conducted	Case hearing for fair judgement	State IGR, Citizen, Registry Office
Case judgement	Hearing conducted	Case judgement released	Case judgement released for further action	State IGR
Case disposal	Case judgement released	Case disposed	Case handled	State IGR
Case monitoring	Case created	Case disposed	Cases being monitored	State IGR

6.1.5.6.7 VS 07 “Rule Creation” to “Rule Amendment”

Rule creation to rule amendment includes identifying and creating the rules and amendment in the rules which will be used in different activities of the registration process or functioning of the registration department.

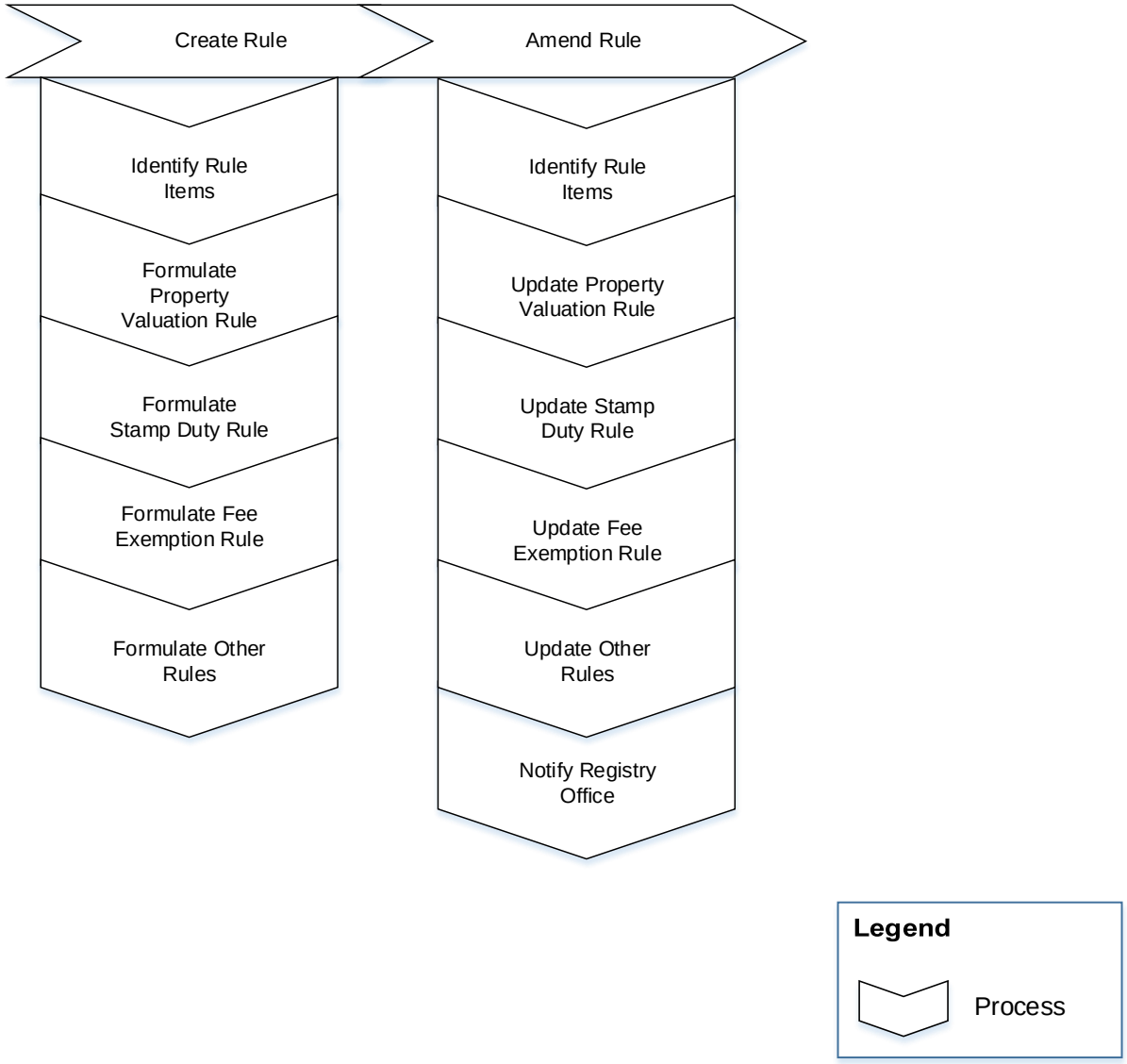


Figure 27: VS 07 Rule Creation to Rule Amendment

Stages, entry criteria, exit criteria, value generated and stakeholders of rule creation to rule amendment value stream are as follows:

Table 17: VS 07 Rule Creation to Rule Amendment

"Rule Creation" to "Rule Amendment"				
Stage	**Entry Criteria**	**Exit Criteria**	**Value Generated**	**Stakeholder**
Create rule	Rule items identification	Rules created	Rules created according to state's registration laws	State IGR
Amend rule	Rules identified	Amend rules, Notify registry office	Rules updated according to accommodate changes	State IGR

			in state's registration laws	

6.1.5.6.8 VS 08 "Grievance" to "Redressal"

Grievance to redressal value stream includes receiving a grievance request, analysing it and providing the response to the stakeholders to ensure transparency and good governance in the system.

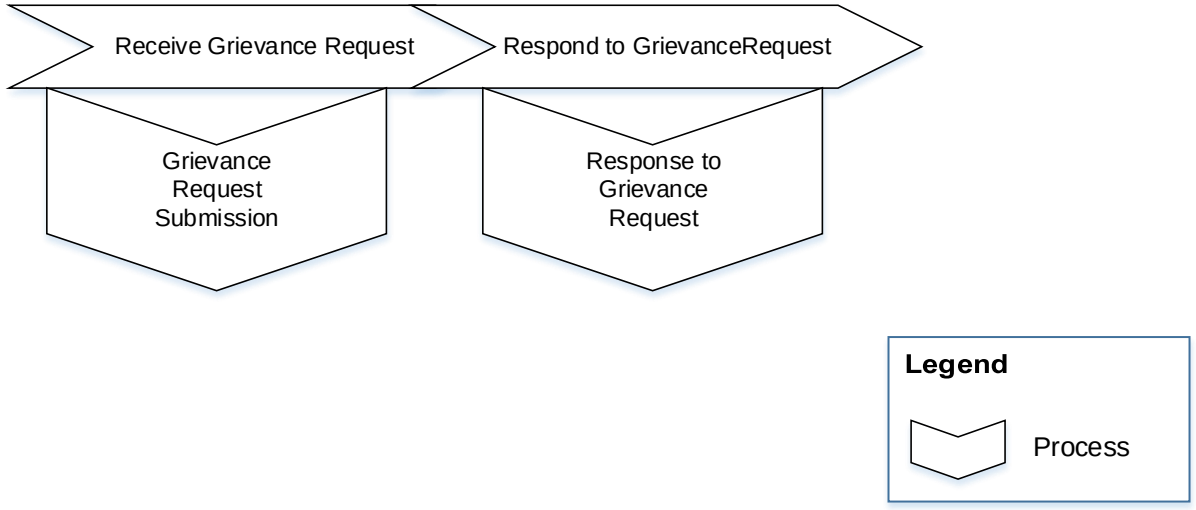


Figure 28: VS 08 Grievance to Redressal

Stages, entry criteria, exit criteria, value generated and stakeholders of grievance to redressal value stream are as follows:

Table 18: VS 08 Grievance to Redressal

"Grievance" to "Redressal"				
Stage	**Entry Criteria**	**Exit Criteria**	**Value Generated**	**Stakeholder**
Receive grievance request	Grievance request received	Grievance analysed	Citizens' issues are being managed	Citizen, Registry Office, State IGR
Respond to grievance request	Grievance analysed	Grievance response submitted	Citizens' issues are managed	Registry Office, State IGR

6.1.5.6.9 VS 09 “Monitor” to “Report”

Monitor to report value stream includes receive an enquiry and respond to the enquiry to the stakeholders to ensure transparency in the system and registration process as well as reporting to central ministry and other external departments on need basis.

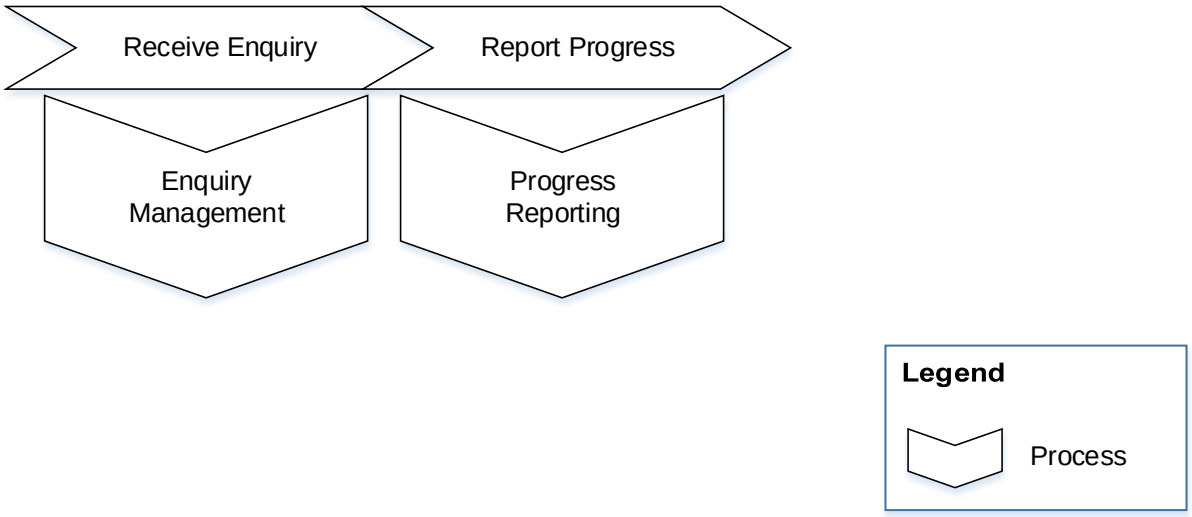


Figure 29: VS 09 Monitor to Report

Stages, entry criteria, exit criteria, value generated and stakeholders of monitor to report value stream are as follows:

Table 19: VS 09 Monitor to Report

“Monitor” to “Report”				
Stage	**Entry Criteria**	**Exit Criteria**	**Value Generated**	**Stakeholder**
Receive enquiry	Enquiry received	Enquiry analysed	Updated information availability check	Central Ministry/DoLR, State IGR, Registry Office
Report progress	Enquiry analysed	Progress reported	Stakeholders awareness	State IGR, Registry Office

Stakeholders and Information Concepts:

The context diagram below represents the stakeholders, information which is getting created or used by the stakeholders and how they are linked to each other on a very high level. The diagram also depicts the most used type of the interaction between stakeholder and the information (if an information is being read or created by the stakeholders and the inter-relationship between them.

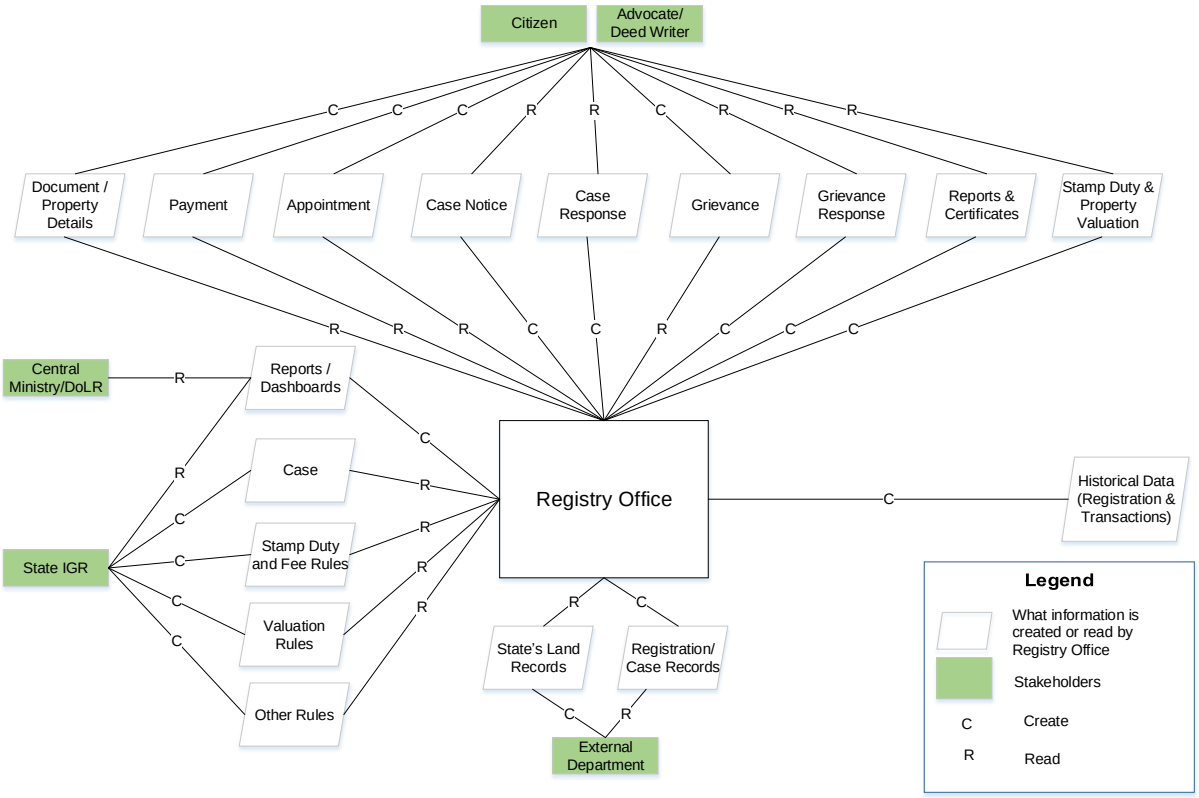


Figure 30: DRS High Level Context Diagram

The table below depicts the information being exchanged between stakeholders:

Table 20: Stakeholders Information Exchange Matrix

Stakeholders	Registry Office	State IGR	DoLR/Central Ministry	External Departments	Citizen	Advocate/ Deed Writer
Registry Office		Reports & Certificates, Case, Stamp Duty & Fee Rules, Valuation Rules, Other Rules		Registration Records, Case Records, Land Records	Document/ Property Details, Payment, Grievance, Certificates, Registered Document, Appointment	Document/ Property Details, Payment, Stamp Duty & Other Fee
State IGR	Reports & Certificates, Case, Stamp Duty & Fee		Reports & Certificates	Registration Records, Case Records,	Case	Case

	Rules, Valuation Rules, Other Rules			Land Records		
DoLR/Central Ministry		Reports & Certificates				
External Departments	Registration Records, Case Records, Land Records	Registration Records, Case Records, Land Records				
Citizen	Document/ Property Details, Payment, Grievance, Certificates, Registered Document, Appointment	Grievance, Case				
Advocate/Deed Writer	Document/ Property Details, Payment, Grievance, Certificates, Registered Document, Appointment					

Sections marked in yellow do not exchange any information to each other directly.

6.2 Performance Reference Model

The performance reference model provides a mechanism to measure the performance (efficiency and effectiveness) of the organisation and this chapter will describe the performance measurement criteria for Document Registration System.

Performance Reference Model (PRM) provides a uniform and consistent mechanism to measure the efficiency and effectiveness of the different sectors or domains in achieving the overall goals of the Government in a cost-effective manner. The principal instrument of the PRM is a set of KPIs designed rationally to measure the outputs and outcomes of the various programs, schemes, projects and activities. A prioritized and phased approach for implementation of PRM is recommended so as to avoid the situation of creating plethora of KPIs, which hide the actual performance and outcomes[5].

PRM will enable DRS to define performance mechanism across the value chain, measure the performance in terms of qualitative and quantitative parameters and analyse the performance.

The PRM consists of three stages as follows:

- **Define**: The state IGR identifies key performance indicators across the value chains and services provided to the citizens and employees which are aligned with vision and goals which should be measured.

- **Measure**: In this stage IGRs should establish a system to set a target against each KPI and measuring it against the achieved target.

- **Analyse**: The variations between the target and achieved KPIs are analysed to identify improvement areas. This stage will give the analysis of the major focus areas to improve the service delivery of the system.

[5] Source: [Part I] IndEA Framework – Performance Reference Model Definiton

Conceptual Performance Reference Model

Document Registration System enterprise architecture framework will drive the efforts of the organization / state IGRs / department of land records towards a better performance, which will be measured along multiple complementary dimensions. These multiple dimensions include results in the four measurement areas – Vision, Citizen, Processes and Technology[6] considered in IndEA framework.

The figure below represents the approach to measuring the performance of the Document Registration System along these areas and the measurement categories in each area:

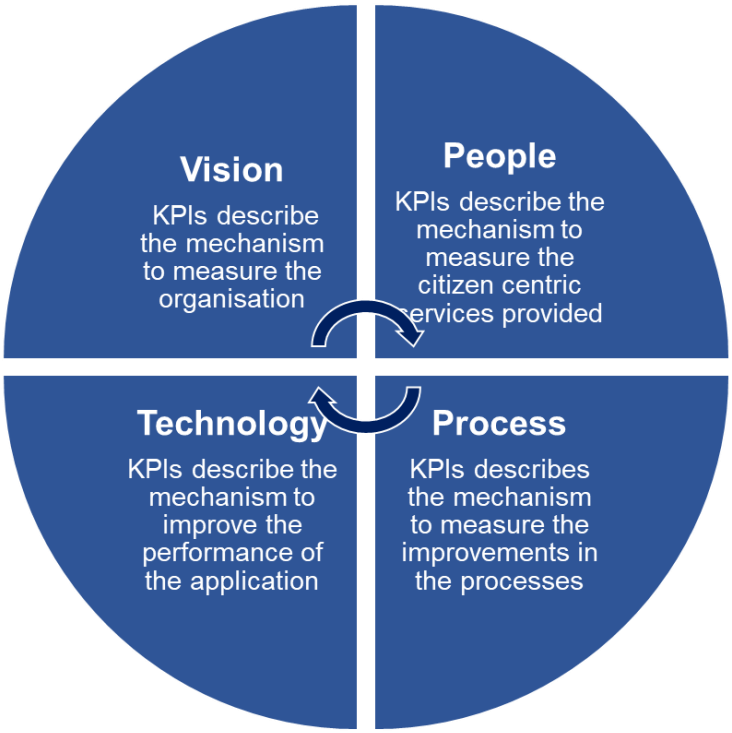


Figure 31: DRS Performance Management Dimensions

This chapter covers the principles, objectives, indicative KPIs and measurement system.

[6] Source: IndEA [Part I] Performance Reference Model

6.2.1 Performance Reference Model Principles

While architecting the performance reference model, following principles and statements have been found suitable to the document registration system, from the IndEA's performance reference model principle's repository. However the rationale, implication and consequences of not following the principle organisation-wide has been customized to cater to document registration system's needs.

Table 21: Performance Reference Model Principles

Principle name	Description
Identifying Performance Categories through Value-Chain	**Statement** • Performance Measurement Categories must be identified throughout the Value Chain **Rationale** • Performance should be measured across each business function and capabilities. **Implications** • This would allow the apex stakeholders to measure performance across the ecosystem of services offered by the DRS. **Consequences** • Without considering the core value chain the performance would be ignored for key services to be delivered to the citizens or other stakeholders.
Measure Quantitative & Qualitative Parameters	**Statement** • It must measure quantitative & qualitative Parameters to perform a better analysis of the actual output & outcome. **Rationale** • Both qualitative and quantitative parameters drive towards capturing the performance of department. **Implications** • Qualitative and quantitative parameters help to measure the performance of the related department. **Consequences** • Without identifying both types of KPIs / parameters the department may miss out on required analysis needed to measure the performance.
KPIs Alignment with Vision of the Government	**Statement** • KPIs in PRM must be linked to the Goals & Objectives defined by Government Rationale • KPIs defined to measure the document registration system as an organisation should be derived from the vision of the government

	Implications • KPIs linked to the vision of the government will participate in achieving its objectives and goals. Consequences • If the KPIs defined to measure the performance of document registration system are not vision focused then it will not help in achieving the goals of the government.

6.2.2 As-Is Landscape

Due to variations in the languages, processes, formulae, measurements and formats the monitoring of performance of KPIs for the registry offices has not been a norm. Although, MIS reports and its elements have been used by the department to validate the processes and working of the offices but it does not exhaustively caters to improving the performance. For this, the KPIs will be a necessary indicators to measure the performance of the registry offices, department and registration process. When the processes were manual or partially automated the document registration's focus was not to explicitly define their KPIs.

KPIs have been defined centrally at a state's IGR and communicated to the registry offices at districts (in the To-Be state). The registry offices may define their own KPIs and measure the performance to improve the citizen service delivery.

6.2.3 Transition Plan

The DRS needs to adopt KPI's to measure it efficiency operationally and monitor how successful it has been in achieving its objectives. The adoption of KPI's will also provide the stakeholders parameters to judge the performance of the department, specific registry offices and systems.

6.2.3.1 Transition Principles

- **Monitoring Performance** – The performance of registry office needs to be monitored on the defined parameters based on objectives of department. These KPI should be published for citizens and other stakeholders to see the performance of the government departments.
- **Focus on** reducing time spent by citizens in submitting documents and other registration related activities, citizen feedback, improving channels of delivery of deeds, financial metrics to determine user charges, citizen charter, training to stakeholders, transparent procedures, minimal human intervention and EODB ranking of World Bank.

6.2.4 To-Be Landscape

The below tables give indicative KPI's for DRS. These KPI are generic for DRS as an organization and the services provided by KPI. The KPI's may not be applicable to all the states and union territories right now but these KPI's are designed keeping in mind that the 1908 Registration Act is the baseline for all the states and union territories to provide document registration services to the citizens.

1) Key Performance Indicator or KPI is a metric designed to evaluate the success of an organization or of a particular activity - such as a project, program, scheme or initiative undertaken by it.
2) Output is a measure of the quantity of goods and services produced by an organization in a given period of time.
3) Outcome is a measure of the impact produced by the output of a project, program, scheme or initiative undertaken by an organization.[7]

[7] Source: IndEA [Part I] Performance Reference Model Definitions

6.2.4.1 Organizational KPI's

The DRS as an organization has some goals in mind which they would like to achieve in a given time frame. To monitor the progress of DRS against the set goals some KPI's have been defined in the below table. These KPI's are classified as Outcome KPI's they measure the impact of the initiatives taken up the DRS. These KPI can be same at the Centre / State and Registry Office level:

Table 22: Organisational KPIs

Goals	KPI	Description	KPI Type	Dimension
Ensuring Access to efficient, easy to use, consistent and stable Document Registration Services to Citizens	• % increase in registered properties in the state • % increase in registered documents (other articles) in the state • % increase in usage of NGDRS by citizen count	These KPIs will help in determining the overall vision, goals and the performance of document registration system as an enterprise.	Outcome KPI	Vision

6.2.4.2 Operational KPI's

These KPI's are designed to measure the efficiency of the operations of the DRS. These KPI's can be modified based on the state's requirements, new goals. These KPI's are linked to the Business Capabilities and Business Functions of DRS. The assumption here is that all the states and union territories follow 1908 Registration Act (with some variations) for providing the document registration services.

Table 23: Operational KPIs

Citizen Centric Services	Business Capability / Function	KPIs	Description	KPI Type	Dimension
Document Registration, Encumbrance Certificate	**Citizen Information Management**	• Total number of citizens registered • % increase in number of citizens registered	These KPIs will help understand the traction generated from the new citizen registered in a given time-frame and also how much	Output KPI	Process

		• Time taken to fill information for different articles • % reduction in time taken to fill information for different articles • Total time taken from information entry to final document registration • % reduction in total time taken from information entry to final document registration	time is being taken by the citizen to fill the information about all the articles.		
Document Registration, Encumbrance Certificate	**Document Management**	• Total number of documents registered • % increase in number of documents registered • Total number of documents refused • % decrease in number of documents refused • Total number of certificates generated • % increase in number of certificates generated • Time taken to complete one document registration • % decrease in time taken to complete one document registration • Total number of encumbrance certificate generated • % increase in number of encumbrance certificate generated • Time taken to register different articles	These KPIs will help in understanding performance of the registry offices. How many documents registered, refused, certificates generated in a timeframe?	Output KPI	Process

		• Average % decrease in time taken to register different articles over a time period			
Grievance	**Grievance Management**	• Total number of grievance logged by citizens • % decrease in number of grievance logged by citizens • Total number of grievance resolved • % increase in number of grievance resolved • Total number of grievance pending • Total number of grievance resolved within SLA • % increase in number of grievance resolved within SLA	These KPIs will help in better understanding of the grievance management of the registry offices.	Output KPI	People
Property Valuation	**Property Valuation Management**	• Total number of citizens used property valuation • % increase in number of citizens used property valuation • Total number of stakeholders used property valuation (citizen, business) • % increase number of stakeholders used property valuation (departments, business)	These KPIs will help in understanding the property valuation service usage.	Output KPI	People
Registry Office Appointment Scheduling	**Appointment Scheduling Management**	• Total number of appointments booked • % increase in number of appointments booked	These KPIs will help in understanding the traction among citizens for registry offices. Which registry office is preferred by the citizens?	Output KPI	People

		• Total number of appointments cancelled • % decrease in number of appointments cancelled • Total number of tatkal appointments booked • % increase in number of tatkal appointments booked • Total number of appointments not turned up(no show) • % decrease in number of appointments not turned up(no show) • Total number of tatkal appointments cancelled • % decrease in number of tatkal appointments cancelled • Total number of tatkal appointments not turned up(no show) • % decrease in number of tatkal appointments not turned up(no show)			
Grievance	**Case Management**	• Total number of cases created • % decrease in number of cases created • Total number of case hearing done • % increase in number of case hearing done in a time frame • Total number of case judgements provided	These KPIs will help in understanding the quality service delivered to the citizen which will be reflected by the number of cases and handled cases.	Output KPI	People

		• % increase in number of case judgements provided in a time frame • Additional revenue earned per case • % increase in revenue earned per case • Total number of appeals filed • % decrease in number of appeals filed • Total number of revisions filed • % decrease in number of revisions filed • Total number of other cases filed • % decrease in number of other cases filed • Total number of cases disposed • % increase in number of cases disposed in a time frame • Total number of cases disposed in SLA time • % increase in number of cases disposed in SLA time • Total number of cases pending • % decrease in number of cases pending			
Stamp Duty & Fee Payment	**Payment Management**	• Total number of payments done online • % increase in number of payments done online • Total number of payments done through bank draft	These KPIs will help in understanding the payment method preference, how is the payment methods working for citizens.	Output KPI	Process

		• % increase in number of payments done through bank draft • Total number of payments done through bank challan • % increase in number of payments done through bank challan • Total number of payments done by cash • % decrease in number of payments done by cash • Time taken to generate receipts • % reduction in time taken to generate receipts over the period • Total number of failed payment verification • % decrease in number of failed payment verification			
	Registry Office Management	• Total number of registry offices • Total number of registry employees • Number of registry offices closed • Number of registry office holidays	These KPIs will help in better managing the registry offices.	Output KPI	Process
Performance Monitoring	**Monitoring & Reporting Management**	• Frequency of reports generated	These KPIs will help understand the reports and its usage. Which report is being preferred by the stakeholders?	Output KPI	Process

Below table describes a high level technology KPIs related with the DRS application:

Table 24: Technology KPIs

Application	KPIs	Description	KPI Type	Dimension
NGDRS	• System uptime • System downtime • Results of penetration testing for applications • Antivirus and firewall update schedule • Data archival schedule • Password reset schedule • Audit schedule • Role based access • Application audit trail • Network traffic • Data security • Data privacy • Availability of internet connectivity	These KPIs will help understand the application's performance, based on which the decisions to make application perform better form the technology perspective can be taken.	Output KPI	Technology

Along with this an exhaustive KPI & Measurement Template has been defined and attached in the annexure for the states to use and facilitate performance management (mentioning KPI, Baseline, Target, Actual, and Time Period).

6.3 Data Reference Model

The data reference model intends to present a conceptual framework covering the core information entities which would form a core data layer for Document Registration System. The data reference model also describes the information that will be generated and processed by the DRS application. States and union territories may adopt and tailor the framework as per their specific need in order to have a consistent and comprehensive view of data across the different states.

Conceptual Data Model

A high level conceptual data model for Document Registration System describes the relations between the different information concepts used/generated by the stakeholders and utilised by the business capabilities and functions described above and relations with the primary stakeholders.

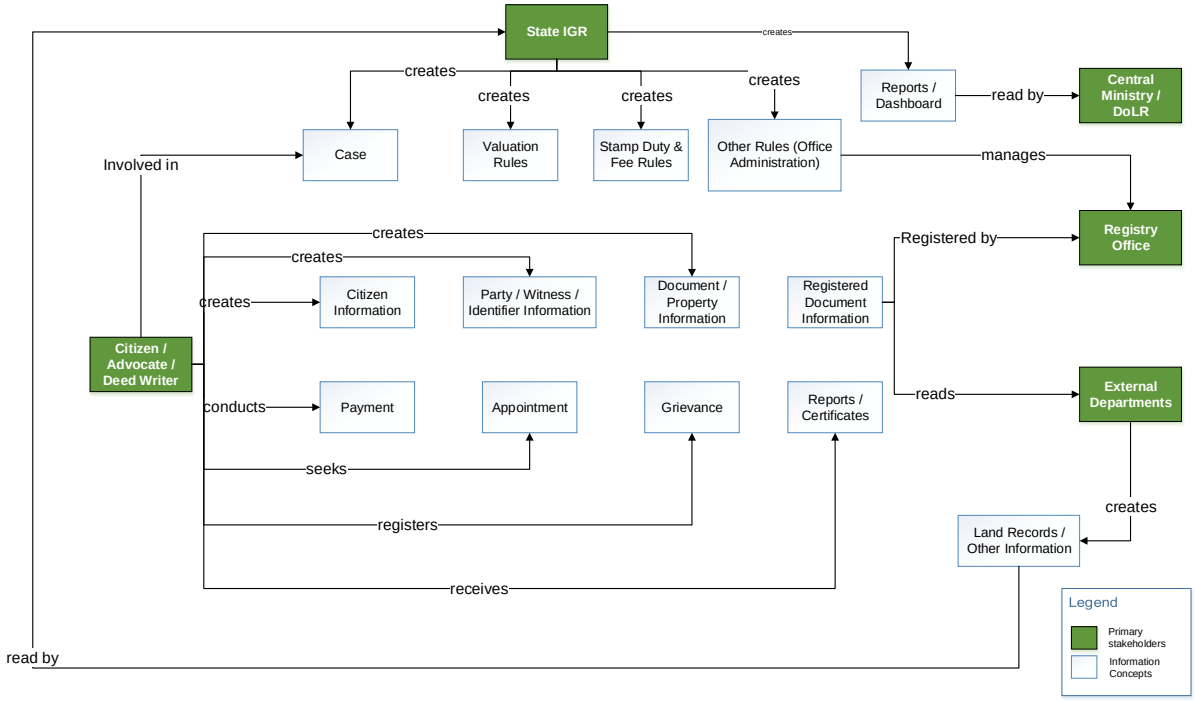


Figure 32: High Level Conceptual Data Model

This along with the as-is, to-be and transition plan, this section intents to present the following sections:

- Data reference model principles
- Data description (core data entities and attributes):
- Data context (entity association with business function / capability)
- Data stewards and data owners,
- Data lifecycle and
- Core data hubs for DRS

6.3.1 Data Reference Model Principles

While architecting the data reference model, following principles and statements have been found suitable to the document registration system, from the IndEA's data reference model principle's repository. However the rationale, implication and consequences of not following the principle organisation-wide has been customized to cater to document registration system's needs.

Table 25: Data Reference Model Principles

Principle name	Description
Data-sharing	**Statement** • Each data set has a trustee accountable for data quality, preservation, accessibility, availability and security. **Rationale** • Data integrity and origin should be tracked and managed, while ensuring the quality of data, its security, its accessibility and availability. **Implications** • Data sharing methods and protocols are to be defined and implemented within the DRS which provides authentic information to be used across agencies. **Consequences** • Data sharing will lead to efficient and improved business process in the overall DRS eco-system. Data shared with un-authorised resources might lead the inspector general of registration office or a registry office into a lawsuit.
Data Security	**Statement** • Data is protected from loss and unauthorized use. With adoption of international standards and best practices, duly protecting the privacy of personal data and confidentiality of sensitive data. **Rationale** • Data has to be insulated from leakages and unauthorised access especially in case of registered documents preservation • Existing laws and regulations require the safeguarding of security and the privacy of data, while enabling transparency and accessibility **Implications** • Security must be designed into data elements from the beginning; it cannot be added later. • Systems, data, and technologies must be protected from unauthorized access and manipulation at all level of enterprise. • Well defined access controls and access constraints must be designed into the centralized metadata repository based on the

	need of business services owned **Consequences** • Any breach in data security of a state might lead to a lawsuit against the state department.
Common Vocabulary and Data Definitions	**Statement** • Data is defined consistently in DRS enterprise and external entities, and the definitions are understandable and available to all stakeholders. **Rationale** • The data that will be used in the development of application must have a common definition throughout the DRS eco-system to enable sharing of data • A common vocabulary will facilitate communications and enable dialog to be effective. In addition, it is required to interface systems and exchange data. Enterprise Meta Data and Data Standards (MDDS) should be available for reference and use by all stakeholders **Implications** • DRS core team must establish the initial common data vocabulary for the business. Definitions will be used uniformly throughout the eco-system **Consequences** • Without a common vocabulary and data definition, data or the information can be duplicated leading to redundancy in the process, and services.
Data Asset	**Statement** • Data is an asset that has a specific and measurable value to the national document registration system and is managed accordingly **Rationale** • Data is a valuable resource; it has real, measurable value. Data accuracy is critical to provide quality and right services to the stakeholders. **Implication** • The states must build a capacity to ensure that they understand the relationship between value of data and its accuracy, sharing of data, and accessibility to data. **Consequences** • If not being done correctly, the states' document registration system might not be able to utilise the data sets as an important asset.
Data Trustee	**Statement**

	• Each data set has a trustee accountable for data quality and security. **Rationale** • Data integrity and origin should be tracked and managed to ensure the data is accessible and available. **Implications** • Data is used for undertaking management and strategic decisions for which data quality is important. Data trustee role will help ensure the data is governed and managed appropriately. **Consequences** • If data is not managed appropriately, it may be manipulated by un-authorised resource.

6.3.2 As – Is Landscape

The study performed for understanding the as-is landscape of the states or union territories provided a view that the data architecture for different states and union territories vary and is dependent on the kind of processes and mechanisms a state or a union territory follows.

Data Handling

Data handling and data management channels is one of the major parameters of accessing the current data architecture followed in the registration process by the states and union territories. Data his being stored as:

1) Files stored manually in records room
2) Some states are using own developed applications or modules which leads to data being stored at multiple places
3) With the different processes and applications used there are different data standards being followed at various levels
4) Data is being stored in distributed mode in various registry offices (SROs) in different locations and in different type of databases where the existing systems are computerised
5) Data being created at registry offices (SROs) is not being shared with other departments electronically
6) Metadata standards may not be in place. There may be duplication of efforts in capturing the same data
7) Data exchange formats may not be defined for the states / union territories

6.3.3 Transition Plan

To ensure that right information which has been generated, updated or read is available with business users and stakeholders, the following steps need to be taken:

1. **Creation of Data Hubs** which will provide better integration for different data sources, reduce data movement and data latency which can cause bottlenecks
2. **Creation of Data Standards** – Data standards are mechanism to manage the data which should be created to achieve interoperability within domain applications. It will also help in reducing the data redundancy in the systems.
3. **Strict adherence to data quality**
4. **Regulatory mechanism** such as data protection and privacy act, Aadhaar act, any other statutory mechanism adherence should be followed.

Data Standards are accepted ways of representation, format, definition, structuring, tagging, transmission, manipulation, and use of data. Data Standards enable reliable recording of information and are fundamental to efficient sharing and exchange of information. They provide the rules for structuring information. Metadata takes its importance once the Data Standards are in place. Metadata i.e. data about data defines and describes data or information. It is used to manage data, information and knowledge. Metadata is the structured information that describes, explains, locates or otherwise makes it easier to retrieve, use or manage an information resource[8].

Table 26: Data Standards

Publication name	Purpose	Publisher	Website
eGov Standards	To make available standards to be followed in different sectors or the Indian Government and departments towards a better service delivery to citizens and other stakeholders	Ministry of Electronics & Information Technology	http://egovstandards.gov.in
Local Government Directory	To make available Standard location codes with a mechanism for dynamic update of create / split / merger of villages/ blocks / districts / states and local governments (panchayats and municipalities)	Ministry of Panchayati Raj, Government of India under e-Panchayat Mission Mode Project (e-Panchayat MMP)	http://lgdirectory.gov.in
Study of Uniform Coding Scheme For Computerisation of Land Records	Formulation of a Uniform Coding Scheme/Standards to be followed by all the states to facilitate collaboration and interoperability.	Land Records Information Systems Division National Informatics Centre Department of Information Technology	http://dolr.gov.in/documents/study-of-uniform-coding-scheme

[8] Source: IndEA [Part I] Framework – Data Reference Model: Data standards

		Ministry of Communications & Information Technology	
National Data Sharing and Accessibility Policy (NDSAP) – 2012	To make data available to public for access, for enabling rational debate, better decision-making and use in meeting civil society needs	Ministry of Science & Technology (Department of Science & Technology)	https://data.gov.in http://dst.gov.in

Transition Principles:

1. Developing standard and common understanding of registration specific information across the horizons. – A uniform definition of business information needs to be developed to define the information needed, origination of information and sharing of information.
2. Data security and privacy should be the major focus during transition to prevent from the information miss-use.

6.3.4 To – Be Landscape

To-be data reference model for the DRS has been defined below and contains data description (data entities, data attributes), entity relationship with the business layer, data stewards and data owners, data lifecycle and data hubs. Detailed description of these components are presented in the next sections:

- **Data Handling**

  Since the document registration process has been automated, the information will be stored in the electronic form which will be easy to be referred to in the future by either of the citizen, registry office, state IGR office, DoLR, central ministry or any other authorised external stakeholder.

- **Data Description & Context**

  The core data entities associated with business capabilities / functions identified and the data attributes associated with the data entity has been identified at a conceptual level.

- **Data Stewards and Data Owners**

  Each of the data entity is associated with data stewards and data owners.

- **Data Lifecycle**

  The various stages of data life cycle and how each one of them are managed is described in the data lifecycle section.

- **Data Hubs**

  The to-be landscape of data reference model contains the data hubs to be created and managed in the process of managing the data available.

6.3.4.1 Data Description

This section defines the core data entities associated with business capabilities / functions identified. The data defined in this section is at a conceptual stage which can be used by a specific state or union territory to create their own specific data definitions. The definition of entity and attribute is as follows:

Entity[9] - It is an abstraction for a person, place, object, event, or concept described (or characterized) by common Attributes. For example, “Employee” and “Department” are Entities. An instance of an Entity represents one particular occurrence of the Entity, such as a specific employee or a specific department. An entity has one or more attributes. An entity may have relationships with one or more entities.

Table 27: Data Entities and Description

Sr #	Entity	Description
D.01	Citizen	Defines citizen of India who wants to execute an article’s registration or is registering on some other party’s behalf
D.02	Party	Defines the party involved in the registration. For example: Seller, Purchaser, Buyer, Confirming Party, Presenter, Power of Attorney Holder, Borrower, Guarantor, Donor
D.03	Witness	Defines a person who observes (witnesses) the execution of a legal document
D.04	Identifier	Defines a person who acts as an identifier for the document registration between parties
D.05	Property	Data associated with a specific property which consists of different attributes about the property
D.06	Document	Defines the specific document attributes for the registration for different types of documents needed/created in the registration process (registered documents, uploaded documents, other documents)
D.07	Address	Data associated with the address of the registry office, property, citizen or any other stakeholders
D.08	Registry Office	Data associated with the registry office/state IGR office/district registry office of the state or union territory (all the organisational information, rules etc.)
D.09	Registry Office Employee	Data associated with the employee of the registry office, location, address etc.
D.10	Article	Data associated with a legal term under which stamp duty is chargeable or in general sense a category of document is registered. For example – Certificate of sale, will, power of attorney, agreement etc.
D.11	Stamp Duty	Data associated with the duty levied on the legal recognition of documents
D.12	Property Valuation	Data associated with an estimated market value which is the most probable price of the property as

[9] Source: IndEA [Part I] Framework: Data Reference Model - Definitons

		per the government rates, in the open market (valuation rules, property rate charts etc.)
D.13	Fee	Defines other fees applicable for registration of a document, also the exemption of the fees applicable
D.14	Appointment	Data associated with the schedule and appointment (normal or tatkal) of the registry office for the parties to be physically present to execute the registration
D.15	Case	Data associated with the cases admitted/created
D.16	Grievance	Data associated with grievance requests raised by a citizen
D.17	Certificate	Defines the different types of certificates generated (encumbrance certificate)
D.18	Report	Defines different reports involved in the registration process. For example – summary reports, index reports

Attribute[10] - It is a property or characteristic of an Entity. Different instances of an entity may have different values for an attribute. For e.g., “Name” may be an attribute of the entity “Employee”. Two employees may have different values for the “Name” attribute. Every attribute has an associated data type which defines the values the attribute can hold.

The table below defines the attributes of the entities described above. The attributes represent metadata captured / generated by the business functions.

Table 28: Entities and Associated Attributes

Sr #	Entity	Attributes
D.01	Citizen	Registration id User name Password First name Middle name Last name Address Email id Mobile number ID type ID number Hint question Hint answer
D.02	Party	Party type First name Middle name Last name Address Identification mark ID type ID number Thumb Impression Photo

[10] Source: IndEA [Part I] Framework: Data Reference Model - Definitons

D.03	Witness	First name Middle name Last name Address Identification mark ID type ID number Thumb Impression Photo
D.04	Identifier	First name Middle name Last name Address Identification mark ID type ID number Thumb Impression Photo
D.05	Property	Property type Property usage Property location Address Area Area unit Floor Circle id Local governing body type Developed land type Valuation zone Property age
D.06	Document	Document id Document type Article type Presentation date Execution date Number of pages
D.07	Address	Address Building Street Taluka District City Pin code
D.08	Registry Office	Type (IGR / SRO) Name Address Opening time Closing time Working days
D.09	Registry Office Employee	Employee type Employee ID First name Middle name Last name

		Designation Email ID Password Mobile number Office Address
D.10	Article	Article type Article name
D.11	Stamp Duty	Article Document type Location Calculation Rule Property type Property address
D.12	Property Valuation	Land type Depreciation Construction type Usage type Valuation item Rate Road vicinity Address Property age Local governing body type Developed land type Valuation zone Dependency Prohibition status
D.13	Fee	Registration fee Handling charges LBT fee Cess Other fee
D.14	Appointment	Registry office Slots availability Booked slots Cancelled slots Blocked slots
D.15	Case	Case type Objection type Case status Case number Competent authority Original document number Original document date Respondent details Advocate details Stamp duty paid Case notice Hearing date Party name Party details Remark Next hearing date

		Final judgement Judgement date Judgement venue Difference amount
D.16	Grievance	Grievance type Grievance description Submitted on Submitted by Assigned To Resolution
D.17	Certificate	Certificate type Certificate name Certificate generation date Certificate validity Certificate generation authority
D.18	Report	Registration report Case report Revenue report Registry office performance report

6.3.4.2 Data Context

This section describes the data entities and their association with the business capabilities / business functions defined in business reference model. States or union territories can identify the variations based on their state specific requirement and the application information needed.

Table 29: Entity Association with Citizen Centric Services and Business Function / Capability

Sr #	Entity	Associated Citizen Centric Services	Associated Business Function / Capability
D.01	Citizen	Property Valuation, Stamp Duty & Fee Calculation, Stamp Duty & Fee Payment, Registry Office Appointment Scheduling, Document Registration, Encumbrance Certificate	All
D.02	Party	Document Registration	Document Management
D.03	Witness	Document Registration	Document Management
D.04	Identifier	Document Registration	Document Management
D.05	Property	Property Valuation, Stamp Duty & Fee Calculation, Stamp Duty & Fee Payment, Document Registration, Encumbrance Certificate	Document Management, Property Valuation Management
D.06	Document	Property Valuation, Stamp Duty & Fee Calculation, Stamp Duty & Fee Payment, Registry Office Appointment Scheduling, Document Registration, Encumbrance Certificate	All
D.07	Address	Property Valuation, Stamp Duty & Fee Calculation, Stamp Duty & Fee Payment, Registry Office Appointment Scheduling, Document Registration, Encumbrance Certificate	All
D.08	Registry Office	Property Valuation, Stamp Duty & Fee Calculation, Stamp Duty & Fee Payment, Registry Office Appointment Scheduling, Document Registration, Encumbrance Certificate	All
D.09	Registry Office Employee	Document Registration	All
D.10	Article	Property Valuation, Stamp Duty & Fee Calculation, Stamp Duty & Fee Payment, Document Registration, Encumbrance Certificate	Document Management, Property Valuation Management, Case Management, Rule Management, Stamp Duty & Fee Management
D.11	Stamp Duty	Property Valuation, Stamp Duty & Fee Calculation, Stamp Duty &	All

		Fee Payment, Document Registration	
D.12	Property Valuation	Property Valuation, Stamp Duty & Fee Calculation, Stamp Duty & Fee Payment, Document Registration	Document Management, Property Valuation Management, Case Management, Rule Management, Stamp Duty & Fee Management
D.13	Fee	Stamp Duty & Fee Calculation, Stamp Duty & Fee Payment, Document Registration	Payment Management , Document Management, Property Valuation Management, Case Management, Rule Management, Stamp Duty & Fee Management
D.14	Appointment	Registry Office Appointment Scheduling	Appointment Scheduling Management
D.15	Case	Document Registration	Case Management
D.16	Grievance	Document Registration	Grievance Management
D.17	Certificate	Encumbrance Certificate	Document Management , Monitoring & Reporting Management
D.18	Report	Document Registration	Monitoring & Reporting Management

6.3.4.3 Data Stewards and Data Owners

This section covers the custodian of the information generated or used by the business functions / capabilities of Document Registration System.

Data Steward[11]**:** A data steward is a person responsible for managing a data asset. Ideally, it should be a person belonging to the department which manages the data asset.

Data steward is responsible for the correctness and security of the data generated / captured or shared with the third party and they will define the data quality rules by which the data is measured.

Data Owner: Data owner is the final approver of the rules created/updated by the data steward.

Table 30: Data Steward and Data Owner

Sr #	Entity	Data Steward	Data Owner
D.01	Citizen	IT Head	State IGR
D.02	Party	IT Head	State IGR
D.03	Witness	IT Head	State IGR
D.04	Identifier	IT Head	State IGR
D.05	Property	IT Head	State IGR
D.06	Document	IT Head	State IGR
D.07	Address	IT Head	State IGR
D.08	Registry Office	IT Head	State IGR
D.09	Registry Office Employee	IT Head	State IGR
D.10	Article	IT Head	State IGR
D.11	Stamp Duty	IT Head	State IGR
D.12	Property Valuation	IT Head	State IGR
D.13	Fee	IT Head	State IGR
D.14	Appointment	IT Head	State IGR
D.15	Case	IT Head	State IGR
D.16	Grievance	Registry Office	State IGR
D.17	Certificate	IT Head	State IGR
D.18	Report	IT Head	State IGR

[11] Source: IndEA [Part I] Framework: Data Reference Model - Definitons

6.3.4.4 Data Lifecycle

Once we start treating data as an asset, it becomes imperative that data is managed effectively during the various stages of its life. The various stages of data life cycle are depicted in the following diagram[12]:

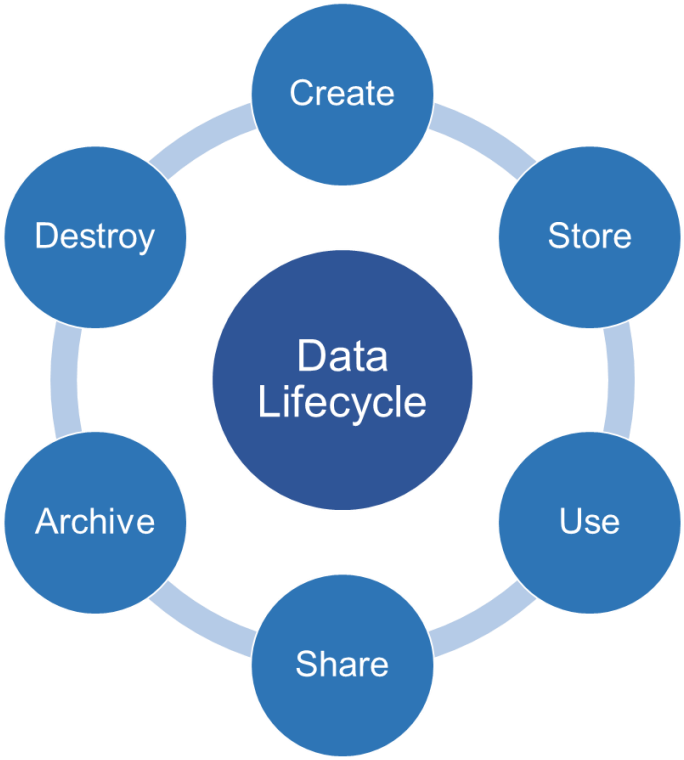


Figure 33: Data Lifecycle

Overview of stages involved in data management, ensuring the right and re-use of the data generated or captured by the Document Registration System is depicted in the table below:

Table 31: Entity, Source Function, Use and Shared With Matrix

#	Entity	Source Function	Stored At (Options)	Use	Shared With
D.01	Citizen	Citizen Information Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For citizen information management for registration	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.02	Party	Citizen Information Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For party information management for registration	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments

[12] Source: IndEA [Part I] Framework: Data Life-Cycle Management

D.03	Witness	Citizen Information Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For witness information management for registration	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.04	Identifier	Citizen Information Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For identifier information management for registration	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.05	Property	Property Valuation Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For property details and valuation management	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.06	Document	Document Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For details of the document to be registered	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.07	Address	Citizen Information Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For details of addresses of all the stakeholders and document registered	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.08	Registry Office	Registry Office Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For registry office functioning	Registry Office, State IGR, Central Ministry/DoLR
D.09	Registry Office Employee	Registry Office Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For registry office functioning	Registry Office, State IGR, Central Ministry/DoLR
D.10	Article	Document Management	Data Centre In House, Cloud Service Provider, Data	For article information management to be	Citizen, Registry Office, State IGR, Central Ministry/DoLR,

			Centre of State IGR	used in registration	External Departments
D.11	Stamp Duty	Stamp Duty & Fee Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For stamp duty calculation and payment	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.12	Property Valuation	Property Valuation Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For property valuation creation	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.13	Fee	Stamp Duty & Fee Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For other fee calculation and payment	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.14	Appointment	Appointment Scheduling Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For appointment scheduling at registrar's office	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.15	Case	Case Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For managing the cases created	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.16	Grievance	Grievance Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For handling the grievance requests	Citizen, Registry Office, State IGR, External Departments
D.17	Certificate	Document Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For creation of the certificates during registration	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments
D.18	Report	Monitoring & Reporting Management	Data Centre In House, Cloud Service Provider, Data Centre of State IGR	For creation of MIS reports and dashboards	Citizen, Registry Office, State IGR, Central Ministry/DoLR, External Departments

6.3.4.5 Data Hubs for DRS

From the data components identified above, the Document Registration System core data hubs have been identified in this section. The basis of identification of data hubs is – common requirements of the data entities which will play a key role among the document registration process and capabilities.

Data hubs are information entities which are required by core business functions and capabilities of the organization and it has been depicted in the below figure – Core data hubs for DRS:

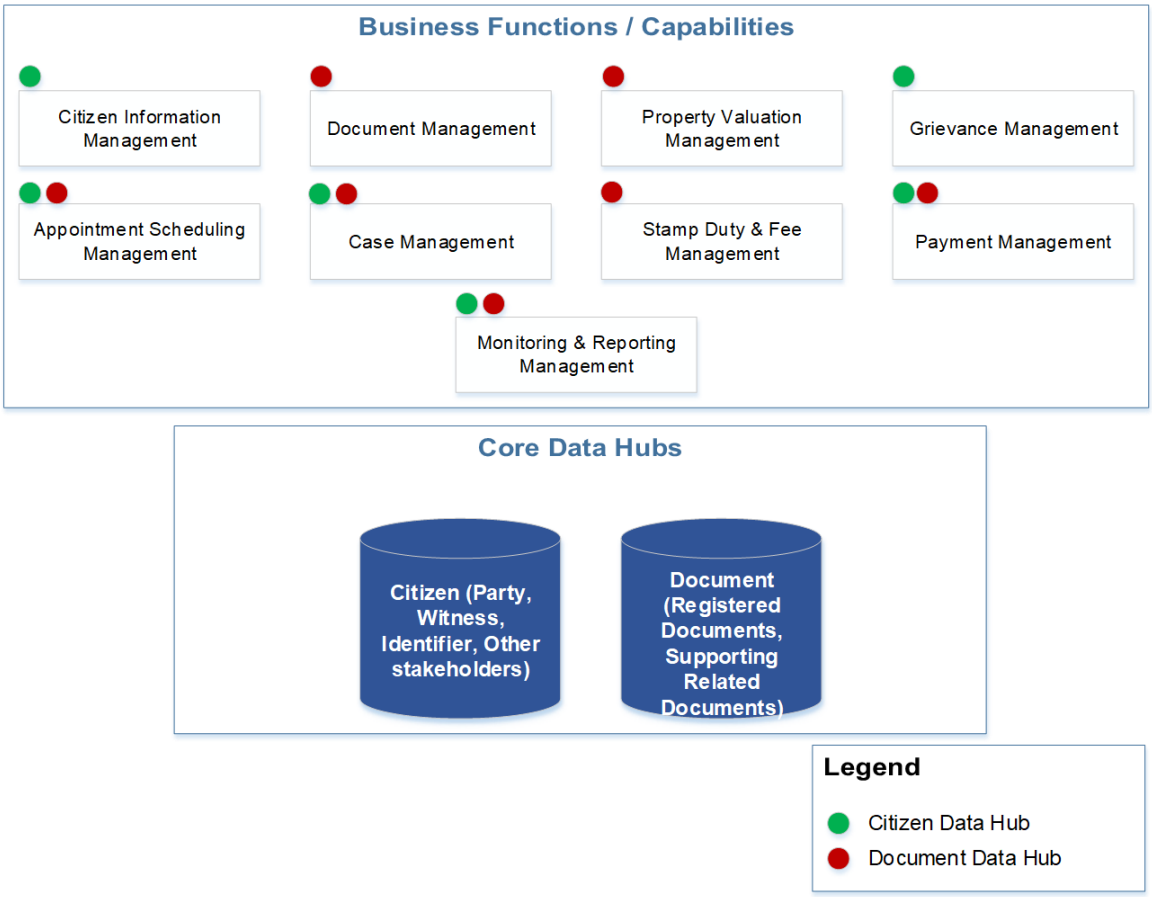


Figure 34: DRS Core Data Hubs

The types of information contained by these data hubs and business functions / capabilities served are described in the table below:

Table 32: Data Hubs Description

Data Hub	Description
Citizen	Citizen data hub will contain the information related to citizen information, property, stamp duty and applicable fee, grievance, appointments, case and payment. Business functions / capabilities served by Citizen Data Hub: 1) Citizen information management 2) Property valuation management

	3) Grievance management 4) Stamp duty and fee management 5) Case management 6) Payment management 7) Appointment scheduling management
Document	Document data hub will contain the information related with document, registration, certificates, property valuation, stamp duty and fee applicable, appointment, cases and payments. Business functions / capabilities served by Document Data Hub: 1) Document management 2) Property valuation management 3) Appointment scheduling management 4) Case management 5) Stamp duty and fee management 6) Payment management

6.4 Application Reference Model

Application reference model describes the current, to-be and transition landscapes of the application capabilities of Document Registration System. It provides a core foundation to automate the business functions / capabilities required for the document registration, identified in business reference model.

IndEA promotes the adoption of Federated Enterprise Architecture. In document registration eco-system there are set processes, data-elements and services which are common across states and union territories. Application reference model specifies the data and integration standards, policies and guidelines which must be adhered by application. DRS being one application which is integrated with / uses multiple third party applications or different external departmental applications (i.e. state land records), it is necessary to adhere to the standards to ensure seamless interoperability. According to IndEA the ARM definition is as follows:

Application Reference Model (ARM)[13] provides the framework for grouping similar applications to maximize re-use. To this end, a concentric layered ARM Meta-model is prescribed for IndEA.

This chapter covers the application reference model principles, application capabilities, application capabilities and business functions / capabilities mapping, application services, application services and business processes mapping, as-is application landscape, to-be application landscape and transition plan.

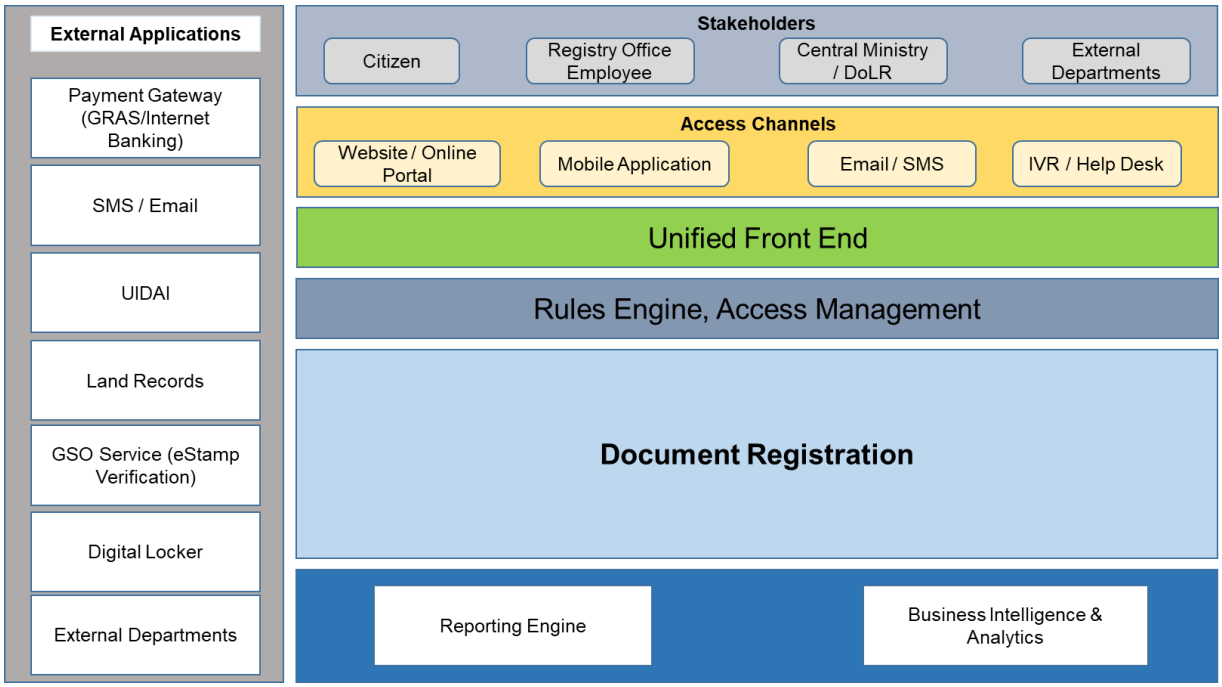


Figure 35: Application Reference Model

[13] Source: IndEA [Part I] - Definitions

6.4.1 Application Reference Model Principles

While architecting the application reference model, following principles and statements have been found suitable to the document registration system, from the IndEA's application reference model principle's repository. However the rationale, implication and consequences of not following the principle organisation-wide has been customized to cater to document registration system's needs.

Table 33: Application Reference Model Principles

Principle	Description
Service Oriented	**Statement** • Creation of services which mirror the document registration business process. Services should use open standards to ensure interoperability and transparency. **Rationale** • Services will enable seamless exchange of information within departments and application. **Implications** • This will help enable the eco-system to enable seamless exchange of information. **Consequences** • Business services which do not mirror business processes and do not use open standards would lead to in efficiencies in document registration process.
Ease of Use	**Statement** • Applications should be easy to use for users (citizen, advocate, deed writer, registry office). **Rationale** • The user should be able to concentrate on work instead of worrying about the technology and application. The training requirements should be minimum to use the application. **Implications** • This will reduce change management and facilitate faster understanding and adoption. **Consequences** • Complex applications would lead to stakeholder's time consumption in understanding and adopting the system.
Stakeholder Self Service	**Statement** • The stakeholder should be able to help themselves as much as possible to resolve their queries **Rationale** • Improving service delivery demands real time 24/7 service availability. **Implications**

	• By removing human dependency, users would be able to independently use applications and services thereby improving service delivery time. **Consequences** • Having a higher employee dependent system increases the service delivery time and reduces the efficiency of whole system.

6.4.2 As-Is Landscape

The states and union territories of India can be categorised as below in using the applications for document registration in the as-is scenario:

1) Manual - Some states are achieving entire registration procedure manually
2) Partially Automated - Some states are using client server based local system for some of the functions (i.e. property valuation, receipt generation). Some states are using internet based central system.
3) Manual and Automated - When there is no connectivity limited functionality can be achieved manually

Based on the gap analysis conducted we found out that these states / union territories have been using an application or a module for property valuation calculation –

1. Maharashtra
2. Bihar
3. Gujarat
4. Haryana
5. Himachal Pradesh
6. Meghalaya
7. Madhya Pradesh
8. Rajasthan
9. Daman
10. Jharkhand
11. Rajasthan
12. Odisha
13. West Bengal
14. Dadra and Nagar Haveli
15. Uttarakhand
16. Karnataka

Based on the gap analysis conducted we found out that these states / union territories are **not using** an application or a module for property valuation calculation –

1. Andaman and Nicobar Islands
2. Arunachal Pradesh
3. Assam
4. Chandigarh
5. Delhi
6. Kerala
7. Lakshadweep
8. Manipur
9. Punjab
10. Sikkim
11. Tripura
12. Nagaland

Below listed are some of the states and applications used by them for document registration:

Name of State/UT	Name of Property Registration Software
Andhra Pradesh	CARD
Assam	Panjeeyan
Bihar	SCORE
Chhattisgarh	e-Panjeeyan
Delhi	DORIS
Gujarat	Garvi
Haryana	HARIS
Himachal Pradesh	HIMRIS
Kerala	OPEN PEARL
Maharashtra	iSarita
Sikkim	ORCHID
Tamil Nadu	STAR
Tripura	TORS
Uttar Pradesh	PRERNA
West Bengal	CORD

Major features in Property Registration application(s) used by various States/UTs:

Table 34: As-Is Functions Implemented and States Mapping

Functions / Features	Maharashtra	Delhi	Haryana	Kerala	Gujarat	Andhra Pradesh	Uttar Pradesh	Tripura	West Bengal	Bihar	Rajasthan	Goa	Himachal Pradesh	Chhattisgarh	Tamil Nadu	Uttarakhand	Karnataka
Online appointment of Sub Registrar (SRO) through appointment module	✓	✓	✓	✓													
Implementation of FIFO basis for registration	✓		✓														
Reduction in Turnaround time **of document. registration within 30 minutes**	✓	✓	✓														
Simplified deed formats available on Portal for public usage			✓		✓	✓	✓										
Centralized architecture- **All data (meta data and image data) on central server instead of on SRO servers. Assets at SRO guarded electronically**	✓		✓		✓	✓		✓	✓								
SMS based alerts **for online appointment seeking, registration status**	✓				✓			✓	✓								

Functions / Features	Maharashtra	Delhi	Haryana	Kerala	Gujarat	Andhra Pradesh	Uttar Pradesh	Tripura	West Bengal	Bihar	Rajasthan	Goa	Himachal Pradesh	Chhattisgarh	Tamil Nadu	Uttarakhand	Karnataka
Reverse page endorsement	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Hardware on hire **with vendor management system by monthly charges based on tender**										✓							
Registration anywhere within the registration districts	✓					✓					✓						
e-Payment enabled **Stamp duty can be paid through e-stamping or bank challan or bank demand draft**	✓	✓	✓	✓	✓	✓				✓		✓					
Enterprise level information system-MIS to supervise and keep track of transactions in each SRO	✓					✓											
Authentication through UIDAI permitted. **SRO authentication through AUA (Authentication User Agency) of UIDAI.**	✓	✓		✓		✓		✓					✓				
Local Language enabled**. Registration software preserves party and property data in both**	✓	✓	✓	✓	✓	✓							✓	✓	✓	✓	

Functions / Features	Maharashtra	Delhi	Haryana	Kerala	Gujarat	Andhra Pradesh	Uttar Pradesh	Tripura	West Bengal	Bihar	Rajasthan	Goa	Himachal Pradesh	Chhattisgarh	Tamil Nadu	Uttarakhand	Karnataka
local language and English languages.																	
Disaster Recovery enabled through both SYNC and ASYNC modes of replication.	✓																
Interlinking with Land Records – **1) Access of Ownership details from Land Records Database at time of Registration** **2) Generation of Mutation Notices** **3) Blocking of particular Survey No from further Transactions till mutations are done**	✓		✓		✓	✓		✓	✓								✓
Services to the Public – • **Encumbrances Certificate** • **Certified Copies of Deeds**	✓		✓	✓	✓	✓											

6.4.3 Transition Plan

The as-is scenario in all the states and union territories for document registration system is different. Some of the states and union territories using multiple modules or applications for different functions, some using manual processes and some states using one module or application for one function and other functions are being achieved manually. No state has a system which contains all the application capabilities fully which are needed to support the business functions of document registration system. This transition plan describes the set of application capabilities available, partially available and to be added in the To-Be state of document registration system:

Table 35: Application Capability Availability

Application Capability	Available in Silo for some States	To Be (NGDRS)
Stakeholder Information Management	Partially	Yes
Registration Management	Partially	Yes
Registered Document Management	Partially	Yes
Encumbrance Certificate Management	No	Yes
Grievance Redressal	No	Yes
Property Valuation	Partially	Yes
Appointment Management	Partially	Yes
Case Management	No	Yes
Rule Management	Partially	Yes
Stamp Duty & Fee	Partially	Yes
Payment	Partially	Yes
Registry Office Management	Partially	Yes
Reporting and Analytics	Partially	Yes
Refund	No	Yes

Micro Services: Each application capability of document registration system can be deployed as a micro service. Micro service tackles the problem of complexity by decomposing application into a set of manageable services which are much faster to develop, and much easier to understand and maintain. Micro service architecture enables each micro service to be deployed independently.

Micro service is an application architectural style [14]in which an application is composed of many discrete, network-connected components called micro services:

1) Large monolithic applications are broken into small services.
2) A single network-accessible service is the smallest deployable unit for a micro services application.
3) Each service runs in its own process. This rule, sometimes stated as "one service per container," might be a container or any other lightweight deployment mechanism.

[14] Microservices for fast time to market and improved app quality : IBM Garage

Transition Principles:

1) DRS Application should be designed with the focus of automating the capabilities and processes to reduce the time-frame to deliver a service to the citizen as well as to increase the efficiency.
2) The application should be easy to use for the users so that they do not have to put in extra time in understanding the application. Since the dependency is on bulk information provided by the citizen, applications should be easy to understand as well as user experience should be better.
3) Addition of new channels to access the services (i.e. Mobile App) should be considered while designing the applications for Document Registration System.

6.4.4 To-Be Landscape

Based on the current landscape and requirements analysis, the To-Be application reference model captures and describes the following components:

1. Application Capabilities
2. Application Capability and User Access
3. Application Services
4. Application Service and Business Process Mapping

Detailed description of these sections are provided in the following sections:

6.4.4.1 Application Capabilities

Application Capability is the capability of the application to perform a unique task towards delivering the services to the stakeholders. Application Capability may support a Business Function, deliver a service to its stakeholder and manage the data associated with it. For Document Registration System the following application capabilities are required:

Table 36: Application Capabilities and Description

#	Application Capability	Description
1	Stakeholder Information Management	Ability to manage the stakeholders (citizen, witness, identifier, party) information which will be used in the document registration
2	Registration Management	Ability to manage the document registration process
3	Registered Document Management	Ability to manage the registered documents making it available locally and centrally
4	Encumbrance Certificate Management	Ability to provide encumbrance certificate generation based on the citizen's request
5	Grievance Redressal	Ability to address the grievance of the stakeholders
6	Property Valuation	Ability to provide property valuation based on the different parameters and information entered by the citizen
7	Appointment Management	Ability to allow citizens to schedule an appointment of registry office
8	Case Management	Ability to manage the departmental case lifecycle for the discrepancy found in assessment & levy of stamp duty & registration fee
9	Rule Management	Ability to manage the different rules: Configuration (local languages, administration blocks, property usage etc.) and administration (year initialization, land type, party type etc.)
10	Stamp Duty & Fees	Ability to calculate and provide the stamp duty and other fees to the citizen
11	Payment	Ability to provide different payment methods and receipt of payment to the citizen
12	Registry Office Management	Ability to manage the registry offices and employees (registry office working time, leaves etc.)
13	Reporting and Analytics	Ability to generate insights for apex users to make decisions based on information provided, ability to provide generic business reports for all the stakeholders
14	Refund	Ability to refund the excess fee paid by the citizen

Application Capability to Business Capability / Function Mapping

The table below depicts application capabilities mapping with the business capabilities / functions defined in the business reference model:

Table 37: Application Capability to Business Capability Mapping

Application Capability	Business Capability / Function
Stakeholder Information Management	Citizen Information Management
Registration Management	Document Management
Registered Document Management	Document Management
Encumbrance Certificate Management	Document Management
Grievance Redressal	Grievance Management
Property Valuation	Property Valuation Management
Appointment Management	Appointment Scheduling Management
Case Management	Case Management
Rule Management	Rule Management
Stamp Duty & Fee	Stamp Duty & Fee Management
Payment	Payment Management
Registry Office Management	Registry Office Management
Reporting and Analytics	Monitoring & Reporting Management
Refund	Payment Management

Application Capability to Data Entity Mapping

The table below depicts application capabilities mapping with the data entities utilised:

Table 38: Application Capability to Data Entities Mapping

Application Capability	Data Entities Utilised
Stakeholder Information Management	Citizen, Party, Witness, Identifier
Registration Management	Citizen, Party, Witness, Identifier,
Registered Document Management	Citizen, Party, Witness, Identifier, Property, Document, Address, Registry Office, Registry Office Employee, Article, Stamp Duty, Property Valuation, Fee, Appointment, Certificate, Report
Encumbrance Certificate Management	Citizen, Party, Witness, Identifier, Property, Document, Address, Registry Office, Article, Report
Grievance Redressal	Citizen, Property, Document, Address, Registry Office, Registry Office Employee, Article, Stamp Duty, Property Valuation, Fee, Appointment, Case, Grievance, Certificate
Property Valuation	Citizen, Property, Document, Address, Registry Office, Registry Office Employee, Article, Property Valuation
Appointment Management	Citizen, Document, Address, Registry Office, Registry Office Employee, Appointment
Case Management	Citizen, Party, Witness, Identifier, Property, Document, Address, Registry Office, Registry Office Employee, Article, Stamp Duty, Property Valuation, Fee, Appointment, Case

Rule Management	Registry Office, Registry Office Employee, Article, Stamp Duty, Property Valuation, Fee, Appointment
Stamp Duty & Fee	Citizen, Article, Stamp Duty
Payment	Fee, Stamp Duty, Citizen
Registry Office Management	Registry Office, Registry Office Employee
Reporting and Analytics	Citizen, Party, Witness, Identifier, Property, Document, Address, Registry Office, Registry Office Employee, Article, Stamp Duty, Property Valuation, Fee, Appointment, Case, Grievance, Certificate, Report
Refund	Fee, Stamp Duty, Citizen, Registry Office, Registry Office Employee, Article, Stamp Duty, Property Valuation

Defining Common and Department Specific Application Capabilities:[15]

i) **Common Applications:** The Common Applications are domain-agnostic but government-specific functionalities required and used by all departments. These are also built and maintained centrally.

ii) **Department Applications:** Department Specific Applications have functionality that is specific to a department.

The table below depicts the common and department specific application capabilities of Document Registration System:

Table 39: Common and Department Specific Application Capabilities

#	Application Capability	Common / Department Specific	Description
1	Stakeholder Information Management	Department Specific	Information of the stakeholders are specific to states. For example, some states may have identifier and witness details and some may only have witness details to manage.
2	Registration Management	Department Specific	To handle variations in processes registration management as a capability has been kept as department specific.
3	Registered Document Management	Common	Registered document management is a capability with more of same processes across states and union territories.
4	Encumbrance Certificate Management	Common	Encumbrance certificate management is a capability with more of same processes across states and union territories with a minimal variation.
5	Grievance Redressal	Common	Grievance Redressal is a capability with more of same

[15] Source: IndEA [Part I] – ARM Concepts & Definitions

			processes across states and union territories.
6	Property Valuation	Department Specific	Property valuation as a capability has variations across states hence it is a department specific capability.
7	Appointment Management	Common	Appointment Management is a capability with more of same processes across states and union territories with a minimal variation.
8	Case Management	Common	Case Management is a capability with more of same processes across states and union territories with a minimal variation.
9	Rule Management	Department Specific	States and union territories have different set of rules required in the document registration process.
10	Stamp Duty & Fee	Department Specific	Stamp duty and fee is dependent on the states / union territories.
11	Payment	Common	Payment is a capability with more of same processes across states and union territories.
12	Registry Office Management	Department Specific	Registry office management has variations across states and union territories.
13	Reporting and Analytics	Common	Reporting and Analytics is a central capability to generate insights about the performance of the document registration system.
14	Refund	Common	Refund is a capability with more of same processes across states and union territories with a minimal variation.

6.4.4.2 Application Capability and User Access

The following table presents an indicative access list for the users to the Document Registration System:

Table 40: Application Capability and User Access

#	Application Capability	Users					
		Citizen	Advocate	Deed Writer	Registry Office Employee	External Department	Central Ministry / DoLR
1	Stakeholder Information Management	Yes	Yes	Yes	Yes		
2	Registration Management	Yes	Yes	Yes	Yes		
3	Registered Document Management	Yes			Yes	Yes	Yes
4	Encumbrance Certificate Management	Yes			Yes		
5	Grievance Redressal	Yes			Yes		
6	Property Valuation	Yes	Yes	Yes	Yes	Yes	
7	Appointment Management	Yes	Yes	Yes	Yes		
8	Case Management	Yes			Yes	Yes	
9	Rule Management				Yes		
10	Stamp Duty & Fee	Yes	Yes	Yes	Yes		
11	Payment	Yes	Yes	Yes	Yes		
12	Registry Office Management				Yes		
13	Reporting and Analytics	Yes	Yes	Yes	Yes	Yes	Yes
14	Refund	Yes			Yes		

6.4.4.3 Application Services

Application services are logical components which are combined together to provide application capabilities. Application services are supported by one or multiple business processes.

Table 41: Application Capability and Application Service Mapping

Application Capability	Application Services
Stakeholder Information Management	Citizen registration and approval (citizen, advocate, deed writer)
	Submission of property/document information
	Submission of party information
	Submission of identifier information
	Submission of witness information
Registration Management	Management of document scrutiny
	Management of admission & identification
	Certificates generation
	Scan and preserve
	Document correction
Registered Document Management	Management of supporting document
	Management of registered document
	Management of certificates generated
Encumbrance Certificate Management	Document search request creation
	Make payment
	Document search request assignment
	Document search request assessment
	Document search request status update
	Encumbrance certificate generation
Grievance Redressal	Submission of grievance request
	Assessment of grievance request
	Grievance request status update
	Address grievance
Property Valuation	Property inspection
	Property valuation
Appointment Management	Management of slots
	Request to book a slot
	Manage appointment
Case Management	Case identification
	Case creation / admission
	Case notice
	Case hearing
	Case judgement
	Difference amount payment
	Difference amount receipt generation
	Case disposal
	Case monitoring
Rule Management	Create state configuration rules
	Manage state configuration rules
	Create administration rules
	Manage administration rules
Stamp Duty & Fee	Calculate stamp duty

	Calculate other fee
Payment	Make payment
	Receive payment
	Generate receipt
Registry Office Management	Create registry office
	Manage registry office
	Create registry office employee
	Manage registry office employee
	Manage registry office rules
Reporting and Analytics	Generation of mandatory reports
	Operational reports
	Analysis of data and insights
Refund	Assess and identify refund
	Make refund
	Refund receipt

6.4.4.4 Application Services and Business Process Mapping

These business processes (L3 level, L2 level being the stages in value streams) are supported by application services which is depicted in the table below:

Table 42: Application Services and Business Process Mapping

Business Process	Application Services
Register as a citizen/advocate/deed writer	Citizen registration and approval (citizen, advocate, deed writer)
Submit citizen information	Submission of citizen information
Submit of property/document information	Submission of property/document information
Submit party information	Submission of party information
Submit identifier information	Submission of identifier information
Submit witness information	Submission of witness information
Enquire document details	Management of document scrutiny
Capture admission and identification	Management of admission & identification
Generate certificate	Certificates generation
Scan and save	Scan and preserve
Submit correction request	Document correction
Submit supporting documents	Management of supporting document
Assess supporting documents	Management of supporting document
Generate registered document	Management of registered document
Handover registered document	Management of registered document
Generate certificates generated	Management of certificates generated
Handover certificates generated	Management of certificates generated
Create document search request	Document search request creation
Assign document search request	Document search request assignment
Assess document search request	Document search request assessment
Update document search request	Document search request status update
Generate encumbrance certificate	Encumbrance certificate generation
Handover encumbrance certificate	Encumbrance certificate generation
Submit grievance request	Submission of grievance request
Assess grievance request	Assessment of grievance request
Update grievance request	Grievance request status update
Process grievance request	Address grievance
Inspect property	Property inspection
Valuate property	Property valuation
Create appointment slots	Management of slots
Update appointment slots	Management of slots
Request appointment	Request to book a slot
Process appointment request	Manage appointment
Identify case	Case identification
Admit case	Case creation / admission
Send case notice	Case notice
Hear case	Case hearing
Provide case judgement	Case judgement
Pay difference amount	Difference amount payment
Generate receipt	Difference amount receipt generation
Dispose case	Case disposal
Update case status	Case monitoring
Create state configuration rules	Create state configuration rules
Update state configuration rules	Manage state configuration rules

Create administration rules	Create administration rules
Update administration rules	Manage administration rules
Calculate stamp duty	Calculate stamp duty
Calculate fee	Calculate other fee
Make payment	Make payment
Receive payment	Receive payment
Create receipt	Generate receipt
Create registry office	Create registry office
Update registry office	Manage registry office
Create employee	Create registry office employee
Update employee	Manage registry office employee
Update registry office rules	Manage registry office rules
Generate mandatory report	Generation of mandatory reports
Generate operational report	Operational reports
Generate insights	Analysis of data and insights
Assess and identify refund	Assess and identify refund
Refund payment	Make refund
Generate refund receipt	Refund receipt

6.5 Technology Reference Model

The Technology Reference Model aims to develop an interoperable and cost effective framework which could transcend, be referenced and used for inter-departmental discovery and digital collaboration for enriching the life of every citizen through efficient and effective service delivery.

Technology Reference Model (TRM) [16]depicts the layout of the technology foundation of ICT-based systems to be designed for delivery of identified business services. TRM lists all the components of the technology system in an end-to-end basis, including IT Infrastructure, Applications, Access Devices, Communication Systems and Service Delivery modes. TRM defines the currently applicable open standards for all the solution building blocks and components and identifies the Open Source Products for each technology component.

Technology components are combined together in 8 layers and this chapter emphasises upon these components of the technology reference model. These technology components have been described in the sections ahead:

- Access devices
- Peripherals
- Network connectivity
- Network infrastructure
- Platforms
- Software Development
- Cloud computing stack
- Hosting locations

[16] Source: IndEA [Part I] Definitions

6.5.1 Technology Reference Model Principles

While architecting the technology reference model, following principles and statements have been found suitable to the document registration system, from the IndEA's technology reference model principle's repository. However the rationale, implication and consequences of not following the principle organisation-wide has been customized to cater to document registration system's needs.

Table 43: Technology Reference Model Principles

Principle	Description
Mobility first	**Statement** • The technology solution should focus on mobility solutions as it brings in more convenience for citizens. This will allow citizens to access the information and services from anywhere, anytime **Rationale** • Solution developed should be compatible with the mobile devices **Implications** • This will contribute towards e-governance and Digital India initiatives. **Consequences** • Citizens would be restricted in using the desktops and laptops to access the information or services.
Cloud adoption	**Statement** • Cloud infrastructure is chosen by default for deployment of applications and on-site option is resorted to only with strong justification. **Rationale** • Use of cloud services would ensure that the management of Data Centre and Hosting of Application is handled by the Cloud Service Provider leading to reduction in cost, timeline and risk. **Implications** • States / Union Territories can adopt cloud services which are being offered by NIC, State Governments and empanelled cloud vendors. **Consequences** • States / Union Territories will have to set-up on premise data center which would lead to additional cost, increased time, maintenance and difficult to manage.
Open standards	**Statement** Open Standards are adopted in the design and implementation of all greenfield systems. Legacy systems are incentivized to migrate to open standards, where required.

	Rationale Document registration system needs to adopt open standards for interoperability among inter and intra departments. **Implications** Adoption of open standards would help in facilitating seamless exchange of information inter and intra department in the document registration ecosystem. **Consequences** Without adopting open standards, data sharing and application integration with other departments / systems will be a challenge.
Shared infrastructure	**Statement** IT Infrastructure is shared to ensure optimal utilization and effective maintenance **Rationale** IT infrastructure like networks and data center stacks are costly components and require expertise to manage the same. **Implications** Sharing IT infrastructure would lead to optimization of cost and sharing of knowledge. **Consequences** Dedicated infrastructure is a huge investment and would require more effort and cost to maintain and scale.

6.5.2 Technology Capabilities

This section describes the technology capabilities required for the document registration system. The following diagram depicts all the technology capabilities required:

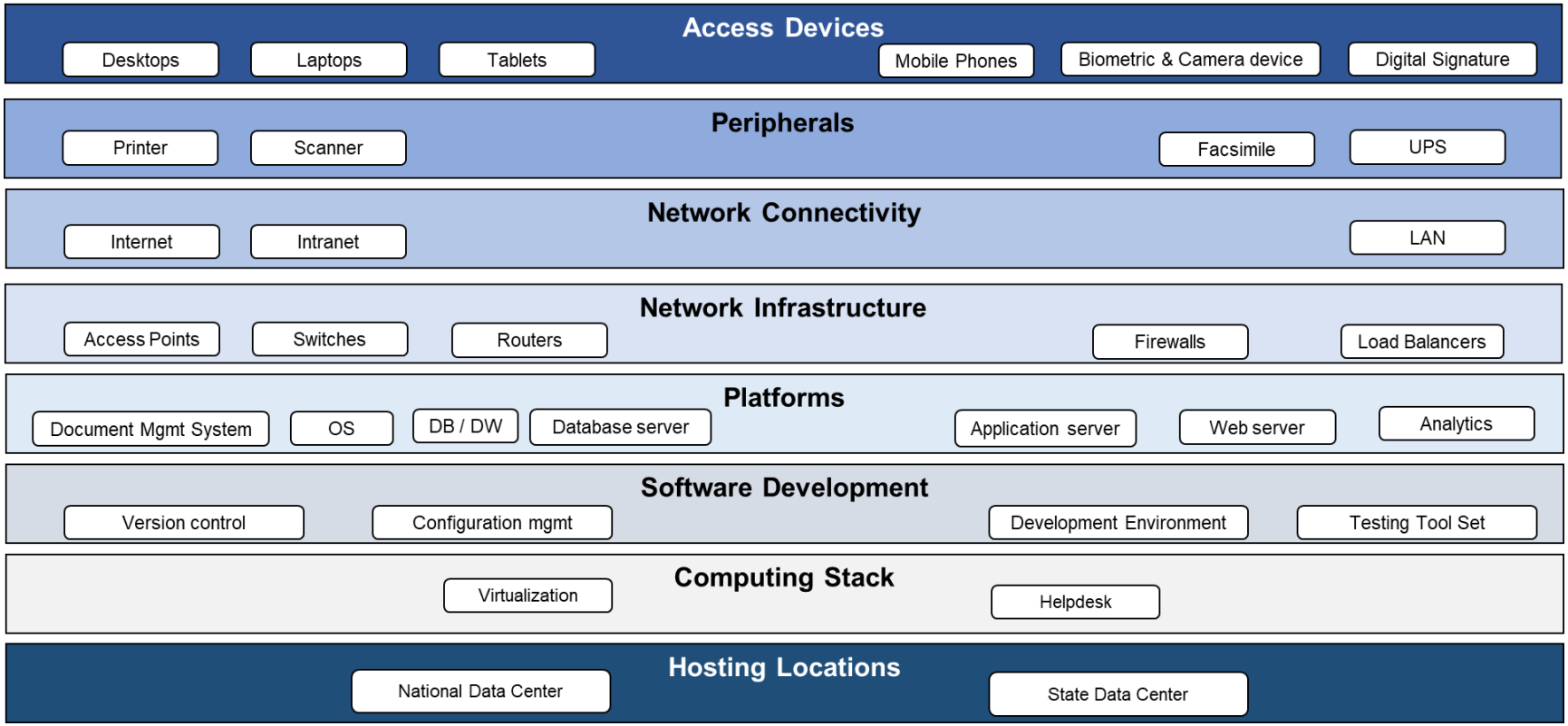


Figure 36: Technology Capabilities

6.5.2.1 Access Devices

Different input and access devices used to access the application are the access devices:

Capability	Description
Desktop / Laptop / Mobile/ Tablet	Application or modules used in document registration should be accessed using any of these devices.
Biometric, Camera Devices	These devices are used to identify the individual who are responsible to provide a government service or are availing a government service. The biometric device can use IRIS, face recognition and fingerprints to identify the individual. Biometric for registry office employees as well as the citizens (party, witness, and identifier) should be used for document registration.
Signature Pad	These devices can be used for capturing the signatures of the involved stakeholders
Digital Signature	Digital Signature is used to validate the authenticity of the digital documents (registered documents) which prevents forgery and helps in identifying and certifying the person/document. The certificate contains the name of the certificate holder, a serial number, expiration dates, a copy of the certificate holder's public key (used for encrypting messages and digital signatures) and the digital signature of the certificate-issuing authority so that a recipient can verify that the certificate is real.

6.5.2.2 Peripherals

A set of all the peripheral devices required for the document registration system:

Capability	Description
Printer	Device which allows users to copy and print documents.
Scanner	Device which allows users to scan documents.
Facsimile	Device which allows transfer of scanned copies of text or images through a telephone system to another receiving fax machine.
UPS	An uninterruptible power supply, also uninterruptible power source, UPS or battery/flywheel backup, is an electrical apparatus that provides emergency power to a load when the input power source, typically mains power, fails.

6.5.2.3 Network Connectivity

Different types of network connectivity capabilities needed by the document registration system application:

Capability	Description
Internet	Document registration system's application or a module used in it by a state, which is hosted in data centres would be accessed using internet along with VPN
Intranet	Registry office / state IGRs may establish their own infrastructure
LAN	Registry offices would be connected over LAN.

6.5.2.4 Network Infrastructure

Infrastructure to provide a seamless connectivity to the document registration system application so that the application can be used to deliver the services:

Capability	Description
Access points	Registry Offices which have Wi-Fi campuses are required to plan and implement access points to allow employees to connect to the internet / intranet.
Switches	Registry Offices are required to implement switches to connect computers, printers and servers within a building or campus.
Routers	Routers are used by Registry Offices to connect a LAN hub or Switch to a WAN
Firewalls	State IGRs should implement firewalls to monitor traffic to or from network. It allows or blocks traffic based on a defined set of security rules.
Load Balancer	Load balancing aims to optimize resource use, maximize throughput, minimize response time, and avoid overload of any single resource.

6.5.2.5 Platforms

Platforms and servers used to develop, test, and host the document registration system application:

Capabilities	Description
OS	Operating systems for the server and client.
DB / DW	The RDBMS and unstructured databases to store and manage data.
Application server	In an n-tier environment, a separate computer (application server) performs the business logic, although some part may still be handled by the user's machine. Business Rules Engine are software systems that executes one or more business rules in a runtime production environment.
Web server	The computer that provides world wide web services on the Internet. It includes the hardware, operating system, web server software, TCP/IP protocols and the website content (web pages).
Database server	Some examples of proprietary database servers are Oracle, DB2, Informix, and Microsoft SQL Server. Examples of GNU General Public Licence database servers are Ingres and MySQL.
Document Management System	Platform that can scan, track and store images of paper documents as well as check-in, check-out, store and retrieve electronic documents often in the form of word processor files

Analytics Platform	Platform perform analytics – Predictive / Descriptive / Diagnostic on the data generated, operations performed by DRS application

6.5.2.6 Software Development

Components which help in software development of the document registrations system:

Capabilities	Description
Version control system	Used to store, track, maintain versions for the source code and associated documentation.
Configuration management system	Manages the configuration of software deployed
Development Environment	Provide an integrated development environment to the developer/ team to write the source code of the application and use the visual frameworks to design the application interface. It also allows the team of developers to collaborate their work and test the application
Testing tools	Provide a collaborative environment that is intended to make test automation efficient, traceable and clear for stakeholders.

6.5.2.7 Computing Stack & Helpdesk

Software to support the application development:

Capabilities	Description
Virtualization	Software is used to emulate hardware, platform and network to create a virtual machine that acts like a physical machine
Helpdesk	It allows users to log complaints and administrators to track and resolve complaints.

6.5.2.8 Hosting Location

Data centres where the application and data can be hosted:

Capabilities	Description
State Data Centre	State Departments have established DC for government organizations to host their systems.
National Data Centre	NIC has established NDC for central government requirements.

6.5.3 As-Is Landscape

After studying the gap analysis conducted, it is evident that most of the states use application / modules for property valuation, receipt generation only. For example, the below listed states use application / modules for property valuation calculation:

1. West Bengal: Web Based (Microsoft)+ Ms-SQL
2. Odisha: Web based
3. Meghalaya: Web Based, Postgres 9.0
4. Madhya Pradesh: Web based, Oracle 11
5. Himachal Pradesh: web based , SQL Server
6. Gujarat: Client server , SQL server (module in Garvi)
7. Daman and Diu : Client server , SQL server (Module in Garvi)
8. Bihar : Web based, Oracle
9. Rajasthan: Web Application with framework 2.0 Postgres 9.2 (Database)
10. Karnataka: Web application

Technology used in Property Registration software in various States/UTs

SR. #	Name of State/UT	Name of Registration Application Used	Application platform	Database
1	Andhra Pradesh	CARD	Forms, Java	ORACLE 11g
2	Assam	Panjeeyan	.NET	SQL Server
3	Bihar	SCORE	.NET	ORACLE
4	Chhattisgarh	e-Panjeeyan	.NET	SQL Server
5	Delhi	DORIS	.NET	SQL Server
6	Gujarat	Garvi	.NET	SQL Server
7	Haryana	HARIS	.NET	SQL Server
8	Himachal Pradesh	HIMRIS	.NET	SQL Server
9	Kerala	OPEN PEARL	Java	Postgre SQL
10	Maharashtra	iSarita	.NET	Postgre SQL
11	Sikkim	ORCHID	.NET	SQL Server
12	Tamil Nadu	STAR	.NET	SQL Server
13	Tripura	TORS	.NET	SQL Server
13	Uttar Pradesh	PRERNA	.NET	SQL Server
14	West Bengal	CORD	.NET	SQL Server

Sr. #	Name of State/UT	Name of Property Registration software	Application Platform	Database	Approx Year of launch	BPR done before/ during project execution	Web enabled	Centralised installation used by all SROs	Cloud infrastructure	Aadhaar enabled	Local language enabled	e-stamping	e-payment	SMS	email
1	Andhra Pradesh	CARD	Forms, Java	ORACLE 11g	1999	Yes	Yes	Yes	No	In process	Yes	no	No (done through SSDG and MeeSeva)	No	Yes
2	Assam	e-Panjeeyan	JEE	MySQL	2007	Yes	Yes	No	No	No	No	yes	No	No	No
3	Bihar	SCORE	.NET	ORACLE 11g	2005	Yes	Yes but due to connectivity problem it is working in isolation	No	No	No	No	No	No	No	No
4	Chhattisgarh	e-Panjeeyan	.NET	SQL Server	2008	NO	NO	No	No	No	Yes	No	No	No	No
5	Chandigarh	PRISM	Visual Basic	SQL Server	2005	No	no	No	No	no	No	No	No	No	No

6	Delhi	DORIS	.NET	SQL Server	2002	No	No	No. Data transferred to central server every hour	In Process	Yes	Yes	Yes	No	Yes but sent to officials only, not the applicant	No
7	Gujarat	Garvi	.NET	SQL Server	2010	Yes. Major BPR-SRO sits in o/o tehsildar	Yes	Yes	No	No	Yes	In process	No	Yes	No
8	Haryana	HARIS	.NET	SQL Server	2010	No	Yes	Yes	No	No	Yes	No	No	--	--
9	Himachal Pradesh	HIMRIS	.NET	SQL Server	2005	No	No	No	No	Yes optional	Yes	Yes	No	No	No
10	Kerala	OPEN PEARL	Java	Postgre SQL	Latest version 2011	No	Yes	No	No	Optional	Yes	No	No	No	No
11	Maharashtra	iSarita	.NET	Postgre SQL	2012	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No
12	Manipur	CORD	Visual Basic	SQL Server	2007	Yes	No	No	No	No	No	No	No	No	No
13	Sikkim	ORCHID	.NET	SQL Server	2008	No	No	No - due to connect	No	No	No	No	No	No	No

								ivity problems							
14	Tamil Nadu	STAR	Visual basic	SQL Server	2000	Yes	Partially	Patches downloaded through central server	No	No	Yes	Yes-10 locations	Testing and audit completed with 7 banks. Ready for launch	No	No
15	Tripura	TORS	.NET	SQL Server	2004	No	Yes	Yes	No	Yes	No	No	No	Yes	Yes
16	Uttar Pradesh	PRERNA	Visual Basic	SQL Server	2004	Yes on 2012	No	No. Data transferred to central server EOD	No	No	No	Yes	No	No	No
17	Uttarakhand	CRS	.NET	SQL Server	2013	Yes	No	No	No	No	Yes	Yes	No	No	No
18	West Bengal	CORD	.NET	SQL Server	2007	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes

Still not all the states have been using all the technology capabilities required for document registration system. The below section describes all the technology capabilities and their usage is current system:

6.5.3.1 Access Devices

As-is access device capabilities:

Capability	Usage
Desktop / Laptop / Mobile/ Tablet	At present, different applications or modules used by different states and union territories can be accessed using these devices.
Biometric & Camera Devices	Biometric devices are being used to capture thumb impressions, photo and IRIS of the stakeholders for some of the states / union territories.
Digital Signature	Digital signature is being used by some of the states / union territories for generating digital signature certificates, verification and validation.

6.5.3.2 Peripherals

As-is peripheral capabilities:

Capability	Usage
Printer	Printers and scanners are available and used by the states or union territories where the processes are not handled manually.
Scanner	
Facsimile	Use of facsimile varies from registry office to registry office. Whether some of the district offices use it but some office do not use it because of availability.
UPS	Use of UPS by registry office varies.

6.5.3.3 Network Connectivity

As-is network connectivity capabilities:

Capability	Usage
Internet	The current state of Internet connectivity varies across the country therefore some registry offices might have high speed connectivity where some might have a slow speed internet. This depends on the infrastructure availability.
LAN	
Intranet	Only used for testing instance not production instance

6.5.3.4 Network Infrastructure

As-is network infrastructure capabilities:

Capability	Usage
Access points	The current state of Internet connectivity varies across the country therefore some registry offices might have high speed connectivity where some might have a slow speed internet. This depends on the infrastructure availability.
Switches	
Routers	

Firewall	Variations present for different states and union territories but no standards are followed across.

6.5.3.5 Platforms

As-is platform capabilities:

Capability	Usage
OS	Variations present for different states and union territories but no standards are followed across as states use different applications or modules
DB / DW	
Application server	
Web server	
Database server	

6.5.3.6 Software Development

As-is software development capabilities:

Capability	Usage
Version control system	Variations present for different states and union territories but no standards are followed across as states use different applications or modules
Development Environment	
Testing tools	

6.5.4 Transition Plan

Transition principles which have been kept in mind while designing the To-Be technology capabilities. Along with the transition principles the capabilities which will be needed in the To-Be state of document registration system.

Along with all the capabilities described in To-Be section, major capabilities to be added in and focused upon:

Capability	Description
Signature Pad	These devices can be used for capturing the signatures of the involved stakeholders
Document Management System	Platform that can scan, track and store images of paper documents as well as check-in, check-out, store and retrieve electronic documents often in the form of word processor files
Analytics Platform	Platform perform analytics – Predictive / Descriptive / Diagnostic on the data generated, operations performed by DRS application
Version control system	Used to store, track, maintain versions for the source code and associated documentation.
Configuration management system	Manages the configuration of software deployed
Helpdesk	It allows users to log complaints and administrators to track and resolve complaints.

6.5.4.1 New Technology Solutions

This sections describes the new technology solutions / areas which can be introduced in the document registration ecosystem for better service delivery.

1) **Blockchain:** Along with the technology capabilities described, Blockchain as a technology capability can be adopted for open and distributed ledger of registered documents. Blockchain provides a shared ledger technology that participants in a business network can use to record the history of business transactions that cannot be altered. Blockchain provides a single point of truth: a shared, tamper-evident ledger. This approach changes transaction tracking from a siloed model, where multiple ledgers are maintained separately, to one that provides a common view across the entire network[17].
2) **Cloud Computing:** Cloud computing enables the user to store and retrieve information irrespective of where she is located. The Indian government plans to use cloud for seamless integration between various departments and with citizens. It will provide a centralized data storage facility that will help in dissemination of information at a much faster pace. For example, the DigiLocker is a cloud service launched by the Indian government to provide its citizens with a shareable cloud space to store and share documents such as certificates, PAN card, voter ID, etc.
3) **Mobility:** Mobility enables availability of information on the go through devices such as smartphones, tablets, laptops, etc. It can be coupled with cloud to enable sharing

[17] Blockchain for trusted transactions: IBM Cloud Garage

of documents or information with other users. Citizens can communicate with the government regardless of their physical location. Apex users of the department can gather information and take decisions on the move, which allows for faster and easier decision making.[18]

4) **Analytics:** Analytics relies on collection of large amounts of data and drawing out actionable insights. Government departments across the states and union territories are moving towards using the power of analytics to better serve citizens. The Indian government has a data repository called e-taal[19] (Electronic Transaction Aggregation & Analysis Layer), which provides real-time transaction data of citizen with various departments and agencies of the government, and quick analysis of the information in graphical and tabular form.

Open Source Software: All applications must comply by the "Policy on Adoption of Open Source Software for Government of India".

6.5.4.2 Transition Principles

1. Focus of mobility- Focus on Mobile interface of Application as penetration of mobile phones and smart phones in the country is increasing
2. Future proof architecture – Adding the required capabilities would help us follow the future proof architecture principle.

[18] E-governance and Digital India Empowering Indian Citizens Through Technology
[19] Electronic Transaction Aggregation & Analysis Layer

6.5.5 To-Be Landscape

The following technology capabilities can be added to enhance the document registration system and current application:

6.5.5.1 Access Devices

To-be access device capabilities:

Capability	Usage
Desktop / Laptop / Mobile/ Tablet	DRS web application should be accessed using these devices.
Biometric, Camera Devices	Biometric devices should be used to capture thumb impressions, photo and IRIS of the stakeholders.
Signature Pad	Signature pads can be used for capturing the signatures digitally
Digital Signature	Digital signature should be used by the registry office employee for generating digital signature certificates, verification and validation.

6.5.5.2 Peripherals

To-be peripheral capabilities:

Capability	Usage
Printer	Printers and scanners should be available and used by all the registry offices where DRS has been implemented.
Scanner	
Facsimile	Use of facsimile should be standard across the state and registry offices
UPS	Use of UPS by registry office should be there.

6.5.5.3 Network Connectivity

To-be network connectivity capabilities:

Capability	Usage
Internet	This depends on the infrastructure availability in the states but should be standard across the states.
Intranet	
LAN	Should be used across the offices.

6.5.5.4 Network Infrastructure

To-be network infrastructure capabilities:

Capability	Usage
Access points	This depends on the infrastructure availability in the states but should be standard across the states.
Switches	
Routers	
Firewalls	IP to IP (source to destination for specific ports)

Load Balancer	Load balancer modules

6.5.5.5 Platforms

To-be platform capabilities:

Capabilities	Usage
OS	Server – Linux Client - Microsoft
DB / DW	Postgres
Application server	Linux OS, PHP
Web server	Apache Web Server and Add-on Modules
Database server	Postgres
Document Management System	Open source tool like OpenKM or DSpace should be used.
Analytics Platform	Generate and analyse the insights to provide better services to citizens and government departments.

6.5.5.6 Software Development

To-be software development capabilities:

Capabilities	Usage
Version control system	SVN like version control system should be used.
Configuration management system	SVN like version control system should be used.
Development Environment	NetBeans
Testing tools	Mantis

6.5.5.7 Computing Stack

To-be computing stack capabilities:

Capabilities	Usage
Virtualization	VMs
Helpdesk	Helpdesk can be used to help the registry office employees to log and fix the technical issues by the specialised team.

6.5.5.8 Hosting Location

To-be hosting location capabilities:

Capabilities	Usage
State Data Centre	Dedicated servers / VMs at State Data Centre.
National Data Centre	Dedicated servers / VMs at National Data Centre.

6.5.5.9 Technology Standards

This section lists down the technology standards which may be adopted for document registration system:

Technology Standards	
Internet Protocol – 32 bit	IPv4
Internet Protocol – 128 bit	IPv6
Wireless LAN -Implementation	IEEE 802.11ac
Authentication and Authorization Data Exchange	SAML 2.0
Hypertext Transfer E-mail Transport	HTTP/2 Extended SMTP additions by RFC 5321
Directory Access	LDAP V3/ X.500 lite
Domain Name services	DNS
Document type for Simple Hypertext Web Content	ISO/IEC 15445:2000 (HTML 5)
Document type for Complex, Strict Hypertext Web Content(XML or non-XML Style Sheets (to define Look & Feel of Web-page)	XHTML v5 CSS 3
Extensible Style Sheets(to transform format and addressing parts of documents)	XSL 1.1
Content for Mobile Devices – Hypertext Mark-up Language	XHTML Basic v1.1
Document Type for Editable documents (with formatting)	ISO/IEC 26300-1:2015 (ODF – Open Document v1.2)
Document Type for Presentation	ISO/IEC 26300-1:2015 (ODF – Open Document v1.2)
Document Type for Spreadsheet	ISO/IEC 26300-1:2015 (ODF – Open Document v1.2)
Document type for Non-editable documents	ISO 32000-1:2013 (PDF 1.7)
Graphics–Raster Image – Exchange format for restricted memory devices	JPEG2000 /JP2 Part 2
Graphics – Raster Image– Exchange Format for Normal cases (like Web, Desktop applications	JPEG
Secure Electronic Mail	S/MIME 3.1 / 3.2 latest
Hypertext Transfer Protocol over Secure Socket Layer, or HTTP over SSL	HTTPS
Secure Socket Layer	SSL 3.0
Transport Layer Security for Server and Web Browser	TLS 1.2/ 1.3 Latest
Digital Signature Algorithms	DSA (FIPS 186-4) 2013
XML Signature for XML Message signing	XML Signature
Wireless LAN security	IEEE 802.11 ac
Data Description Language (for exchange of data)	XML 1.0

Data Schema Definition	XML Schema (XSD)
Data Transformation for Presentation	XSL 1.1
Data Transformation for conversion from XML schema format to another format	XSLT 2.0 */ 3.0*
Content Searching and navigation in XML document	Xpath 3.0
XML vocabulary	XSL 1.1
Meta data elements for contents	ISO 15836: 2009/2012
Web Services Description Language	WSDL2.0
Web service request delivery	SOAP1.3
Web Services Security - Basic Security Profile	Basic Security Profile V1.1
Web Services Security – SOAP message security	SOAP message security V1.1.1
Web Services Security – Username Token Profile	Username Token Profile V1.1.1
Web Services Security -X.509 Certificate Token Profile	X.509 Certificate Token Profile V1.1.1

6.6 Application Integration Reference Model

The Application Integration Reference Model (AIRM) provides guidelines to make architectural decisions while implementing Integration Solutions for the document registration system.

Integrations of document registration business processes and services across the breadth of the document registration ecosystem is required for delivering the benefits on a sustainable basis to the citizens of India. Integration of application(s), business processes, services are important because it results in major value-for-money benefits, in the form of increased efficiency, cost savings and improved services for citizens. Integration of multiple government services, departmental applications will result in feeling of ONE Government, thereby, it will enhance the citizen satisfaction with Government services. This will provide the integrated services to the citizens, which may reduce the number of visits to Government offices/multiple departments for availing the same. Moreover, Integration will help to achieve the centralized management.[20]

The objectives of the AIRM are as follows:

- To provide guidance for seamless availability of information among the stakeholders
- To provide guidance to DRS stakeholders for creating or evaluating architectures
- To identify different building blocks (architectural layers, services, components) for integrating elements of DRS solution blocks
- To communicate the key architectural decisions relevant for creating or evaluating integration layer for DRS ecosystem

[20] IndEA Frameowork: AIRM Objectives

6.6.1 Application Integration Reference Model Principles

While architecting the application integration reference model, following principles and statements have been found suitable to the document registration system, from the IndEA's application integration reference model principle's repository. However the rationale, implication and consequences of not following the principle organisation-wide has been customized to cater to document registration system's needs.

Table 44: Application Integration Reference Model Principles

Principle name	Description
Loose Coupling	**Statement** • Design of Application Integration is based on loose-coupling. **Rationale** • Systems which are loosely coupled allows flexibility and modularity. Each system exists independent of other systems and continues to function as per its design principle. **Implications** • This helps in enabling changes within an enterprise without causing large scale disruption. **Consequences** • If the applications are tightly coupled then change in one application or replacement of an application will have an impact on other applications in the ecosystem which will lead to increased development and testing effort.
Security in Integration	**Statement** • All application interfaces and transmissions of data are secure by design. **Rationale** • Secured integration would enable seamless exchange of information without a risk of data being stolen or misused. **Implications** • Information exchange must be secured during a transaction between two different systems. **Consequences** • Data theft can happen.
API Gateway-based integration	**Statement** • API-based integration is adopted in document registration ecosystem **Rationale** • Standardization and metadata will help enabling seamless exchange of information between stakeholders. **Implications**

	• This will help in promotion of data standards and enable exchange of information between stakeholders. **Consequences** • Data exchange, management and application integration would require huge investment and time if the system is integrated without API Gateway-based integration.

6.6.2 As-Is Landscape

The states and union territories of India have been using applications / modules of an application in silo to fulfil their requirements. There are 2 broader categories of the states / union territories using applications / modules for document registration which are listed below:

1) Partially Automated - Some states are using client server based local system for some of the functions (i.e. property valuation, receipt generation). Some states are using internet based central system.
2) Manual and Automated - When there is no connectivity limited functionality can be achieved manually

Since the usage of modules and applications vary across India as some states using self-developed application for some of the functions, some states using centrally available modules (like payments, receipt generation) and some states are still doing the document registration manually it is not a norm to integrate with the third party applications as yet.

1) **Maharashtra** as a state has been pioneer in the document registration domain as it has been using one of the most sophisticated systems among all the states named i-Sarita (Stamp and Registration Information Technology Application). This application has been integrated with some of the e-services and third parties which are listed below:
    a. Public Data Entry - Online Data Entry system built-in and integrated with iSarita
    b. e-Stepin - Online time slot booking system
    c. e-Payment - Online payment of stamp duty and registration fees, integration with the e-Payment gateway of State of Maharashtra
    d. Introduction of UID integration for authentication as well as for fetching demographic details
2) **Madhya Pradesh** as a state has integrated with two third parties / applications listed below:
    a. Certified copy module is integrated with treasury for payment preview (eSearch Function)
    b. Integration with Satellite imagery for (Indore, Bhopal, Gwalior, Jabalpur, and Ujjain) districts in first phase, the area on the map is zoomed based on the entries made by the user in the system. Queue Management/ token system is implemented In 19 Major office.

6.6.3 Transition Plan

With the adoption of DRS application, it should be able to scale quickly. To achieve this the DRS Application should be loosely coupled so that business can achieve agility and scalability. To achieve this micro service architecture could be adopted. Each micro service is a small application that has its own hexagonal architecture consisting of business logic along with various adapters. Some micro services would expose a REST, RPC or message-based API and most services consume APIs provided by other services. Other micro services might implement a web UI. It should also focus upon single point of interface for the Citizen to avail the services related with document registration system.

Transition Principles:

1) Agility – Application integration architecture should ensure that while integrating document registration system or any module of it with other intra departmental application or module should not lead to reassembly of entire application. Agility with the intra departmental application or modules integration should be very well thought through and implemented.

2) Efficiency in service delivery - Allow seamless delivery of document registration related services to citizens so that they do not have to visit the registry office multiple times for availing services.

6.6.4 To-Be Landscape

To Be Integration Methodology suggests – using integration at different levels along with different integration methods instead of using single data base and direct queries to database.

Two types of integration described as follows:

1) **Intra-departmental Application Integration:** This section describes a high level view of the DRS application capabilities and its integration with intra departmental applications or services which may be integrated with the document registration system. Along with these identified applications / functions the department can identify other functions / applications which might be integrated with DRS in the next phases.

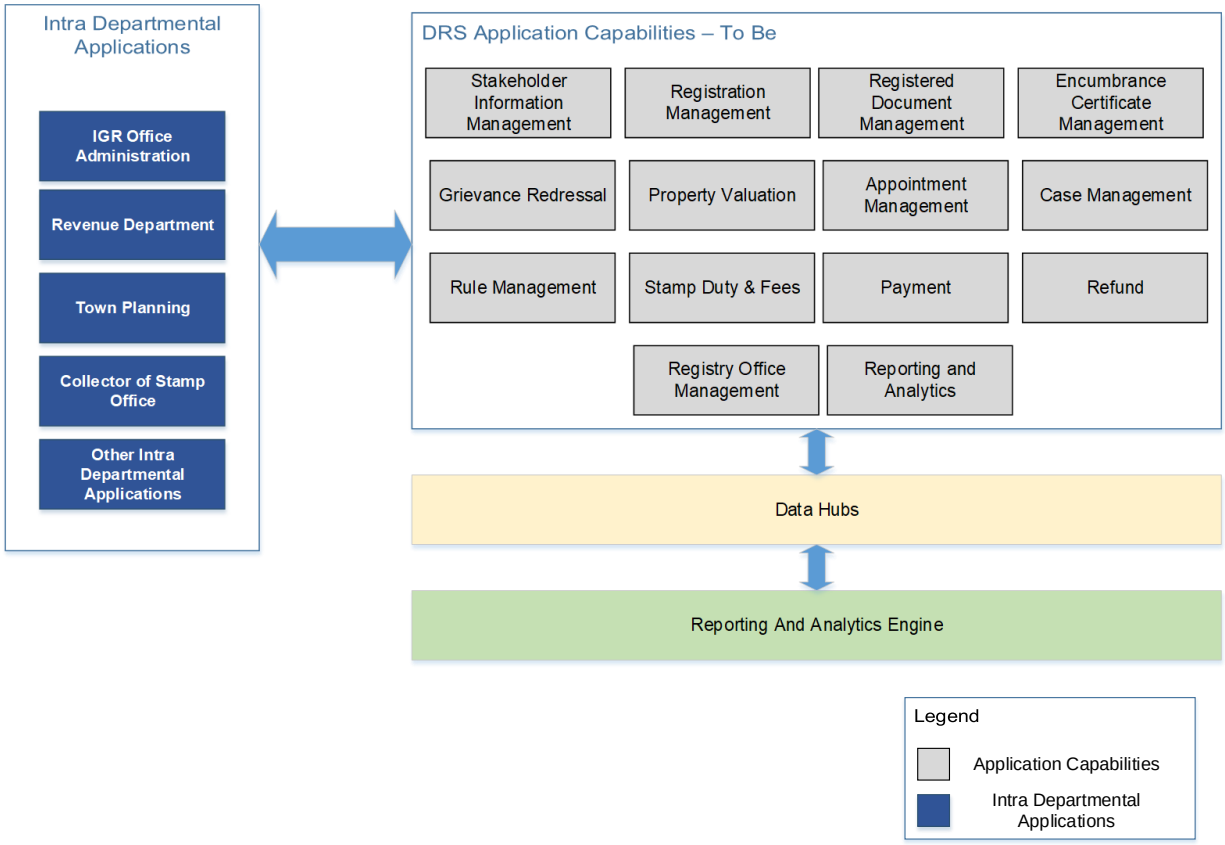


Figure 37: To-Be Landscape - Intra Departmental Applications Integration

The below diagram intends to present what types of information may get exchanged between intra departmental applications and DRS application:

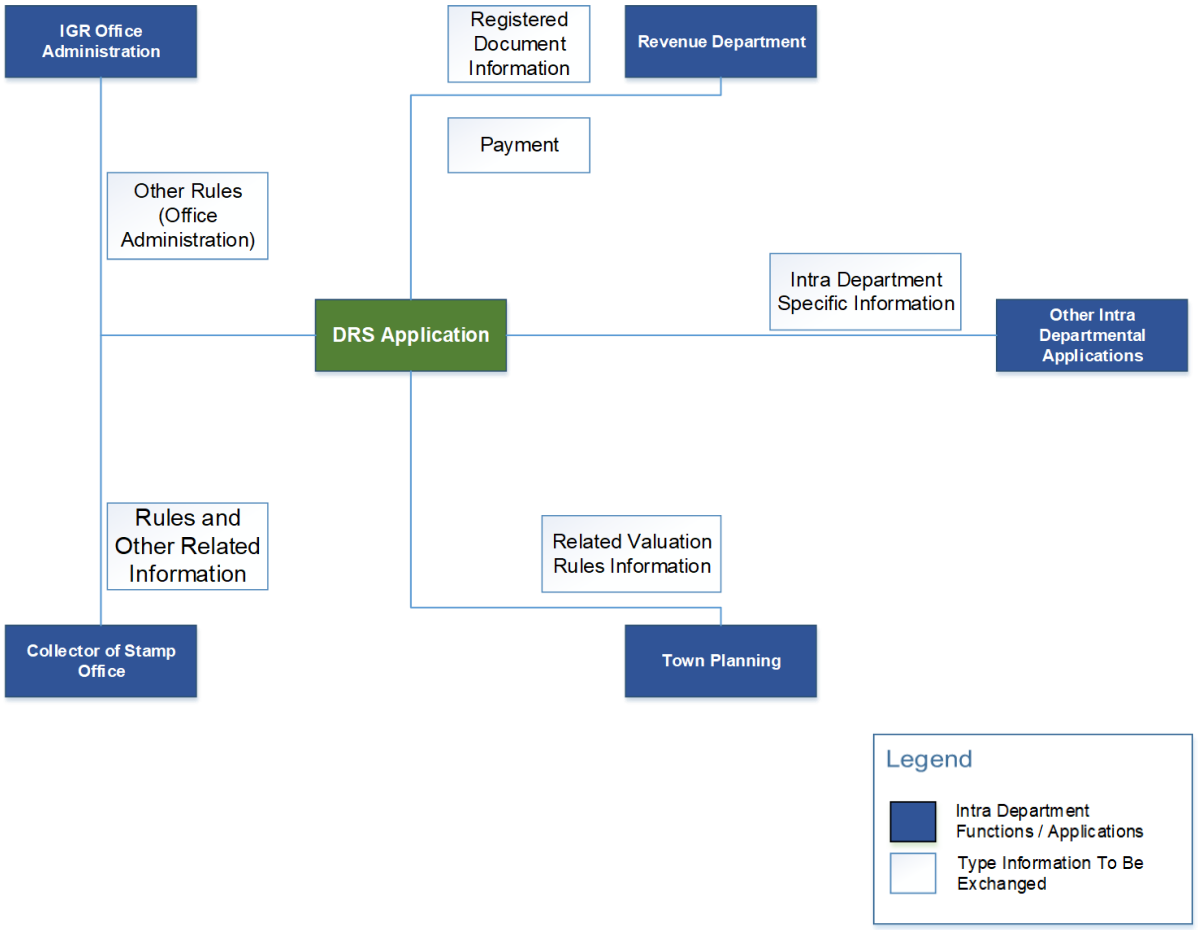


Figure 38: Information Exchange between DRS and Intra Departmental Applications

Table 45: Information Exchange between DRS and Intra Departmental Applications

Source Application	Destination Application	Exchanged Information
IGR Office Administration	DRS	Other Rules (Office Administration)
Collector of Stamp Office	DRS	Rules and Other Related Information
Revenue Department	DRS	Registered Document Information, Payment
DRS	Revenue Department	Registered Document Information, Payment
Town Planning	DRS	Related Valuation Rules Information
Other Intra Departmental Applications	DRS	Intra Department Specific Information
DRS	Other Intra Departmental Applications	Intra Department Specific Information

2) **Inter-departmental / External Application Integration**: This section describes a high level view of the DRS application capabilities and its integration with inter departmental / other external applications or services which may be integrated with the document registration system.

   For ex: Land Records can get integrated with DRS for Land Mutation; Survey Department can integrate with DRS for Land Sub-division etc. Depicted below in the diagram:

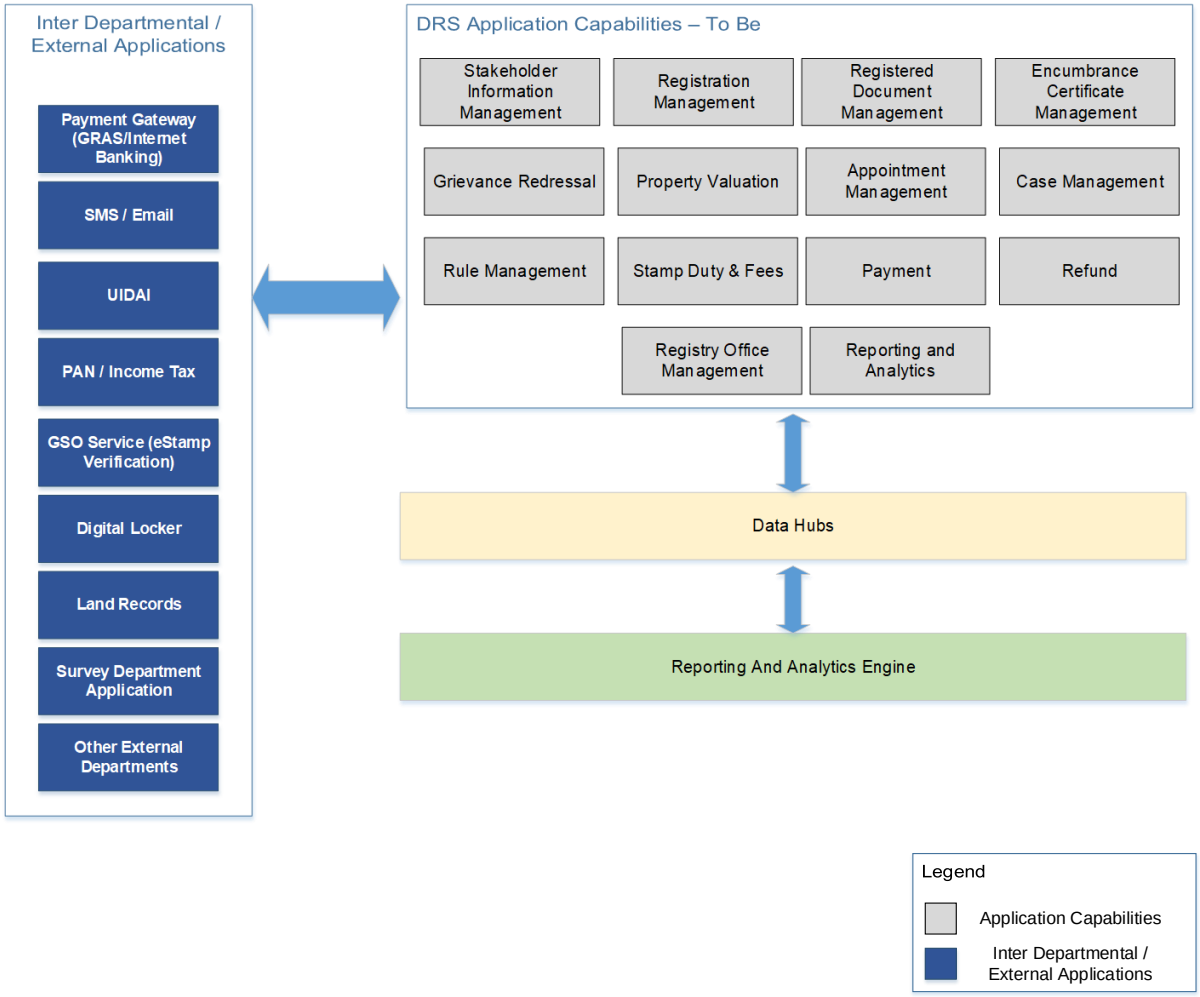


Figure 39: To-Be Landscape - Inter Departmental / External Applications Integration

The below diagram intends to present what types of information may get exchanged between inter departmental / external applications and DRS application:

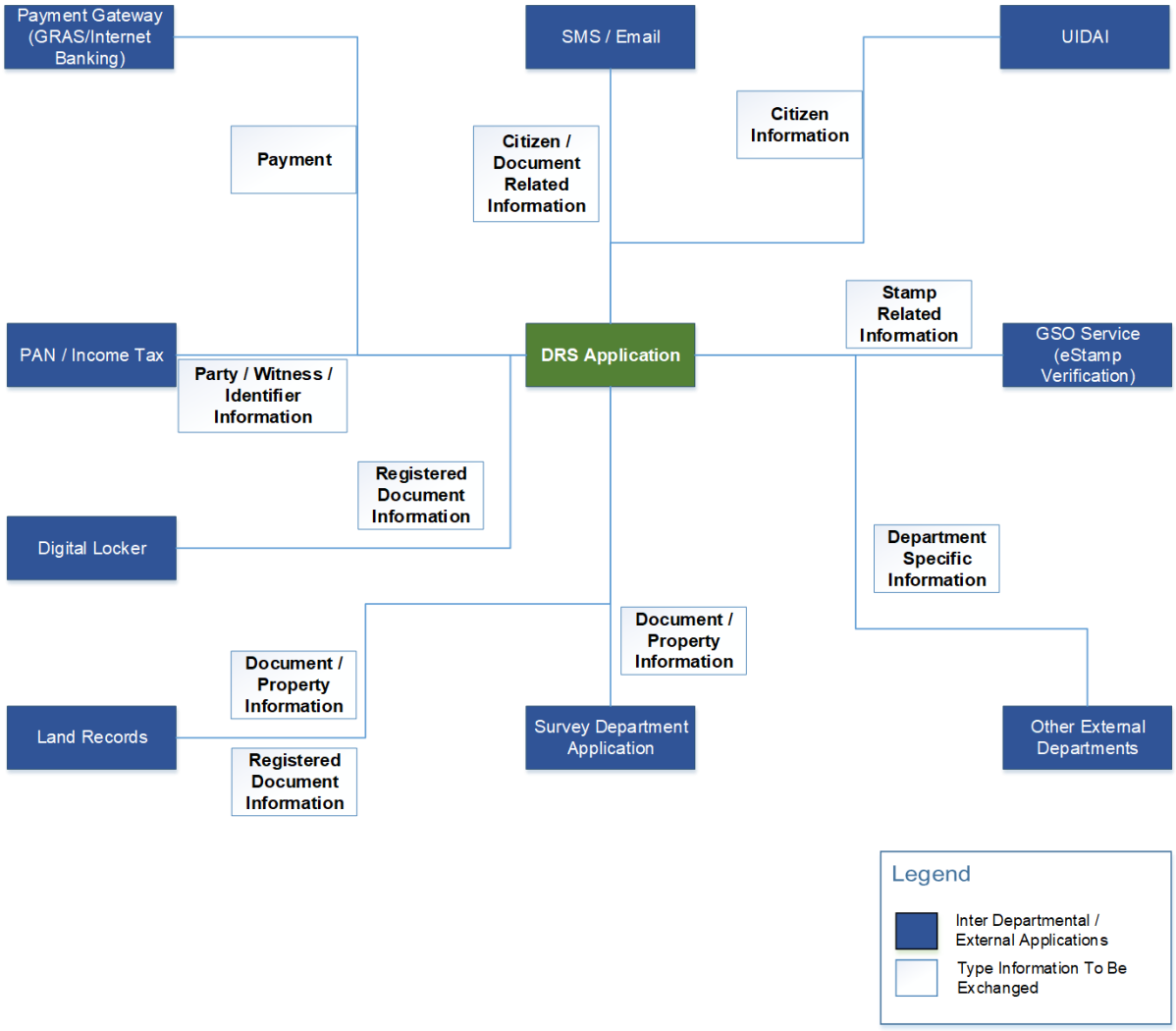


Figure 40: Information Exchange between DRS and Inter Departmental / External Applications

Table 46: Information Exchange between DRS and Inter Departmental / External Applications

Source Application	Destination Application	Exchanged Information
Payment Gateway (GRAS/Internet Banking)	DRS	Payment
DRS	Payment Gateway (GRAS/Internet Banking)	Payment
PAN / Income Tax	DRS	Citizen / Document Related Information
DRS	PAN / Income Tax	Registered Document, Citizen/Stakeholder Information
Land Records	DRS	Property Information
DRS	Land Records	Registered Document Information
DRS	Survey Department Application	Document / Property Information

GSO Service (eStamp Verification)	DRS	Stamp Related Information
DRS	Digital Locker	Registered Document Information
Digital Locker	DRS	Registered Document Information
UIDAI	DRS	Citizen Information
DRS	Other External Departments	Registered Document Information, Citizen Information, Department Specific Information

6.6.4.1 To Be Integration Levels

Integration needs to happen at 3 levels as per mentioned below[21]:

Application Level Integration: Application Level Integration offers the basic features and capabilities required to integrate and connect departmental applications reliably and securely. Application integration is the process of exchanging data between two applications.

Data Level Integration: It is about taking data from many disparate sources (such as files, various databases, applications etc.) and combining that data to provide a unified view of the data for business intelligence (BI). Data integration is important when state IGR decides to implement a new application and migrate its data from the legacy systems into the new application.

Process Level Integration: High level business or system process that pulls together a number of basic service level interactions into a coordinated sequence of events (a technical workflow). The technologies that deliver process-level integration include business process management for handling automated (and sometimes manual) processes, workflow management for manual processes, groupware or collaboration platforms.

6.6.4.2 To Be Integration Methods

Typically, there are two types of Integrations:

Point to Point Integration: This type of Integration is suggested where only few applications need to be integrated.

Middleware based Integration: A middleware solution is a layer between two systems/Applications that makes it easy for the two to communicate. It can be considered the glue that holds together applications, making seamless connectivity possible without requiring the two applications to communicate directly.

Hybrid Integration: Used for the platform which can integrate applications hosted on cloud with on premise applications. It provides the best fit solution to the Enterprise for seamless exchange of information between on premise legacy applications and cloud based applications.

[21] IndEA Framework - AIRM

An abstract level of integration methodology which can be followed for the different reference models is described in the following table:

Table 47: Integration Methodologies

Layers at which integration is done	Guidelines for integration	Integration methods
Business	Study business processes , Conduct gap analysis and recommend suggestions	Business Process reengineering
Application	Identify application level integration points	Application Level Integration (APIs and Web Services)
Data	Data Sharing – ETL (legacy) Data Sharing – through real time integration (Transactional)	Data Level Integration
Technology	Understand the technology infrastructure of the related systems to be integrated	Establish network and infrastructure capabilities to integrate with systems
Performance	Monitor the performance of the services inclusive of the vision, stakeholders, services and technology	Detailed Key performance indicators
Governance	Identifying key areas for betterment of services provided	Set up internal committees for business decisions

6.7 Security Reference Model

Currently governments are providing their services online accessible through web and mobile interfaces for a better and quick service delivery to the citizens, businesses and governments. This opens up an avenue for multiple threats to access the information, systems, and assets to be viewed and/or altered unauthorized to harm the services, applications or the organization. This poses a serious threat to e-Governance activity and points out to the importance of defining and implementing policies, processes, controls for information security.

Online security is of the prime importance and it should be considered even while conceptualizing any development. 'Secure by Design' should be the motto of document registration system. Security is not confined to a single level but needs to be addressed at business (defining security policies), infrastructure (appropriate configurations at network, data center, and hardware), application (Application deployment, OS hardening) and data (storage, access) levels.

Security Reference Model (SRM) [22]is a framework for developing a comprehensive and rigorous method of describing the current and future structure of the information security systems so that they align with the business strategies of the enterprise.

SRM specifies all the entities, policies and procedures, and their relationships. Integrity, privacy, confidentiality, and availability of information / IT systems are the key concerns addressed by SRM.

SRM adopts a layered approach for identifying and meeting the information security needs of the enterprise. The model identifies the security controls to be applied at 6 layers, namely, the Business Layer, Data Layer, Application Layer, Perimeter Layer, Network Layer and the End Point Layer. SRM also touches upon the manner of designing Security Policies and Standard Operating Procedures.

Security Conceptual Model

IndEA security reference model[23] describes the security architecture development process in terms of the following layers:

Table 48 - Security layers and description

Layer	Description
Business	This comprises of asset discovery, identification, analysis and management of the risk, security policy and controls
Perimeter	It includes the controls that are to be implemented on the infrastructure that is used to deploy the application or service along with its data.
Network	It captures the security aspects from channel and network perspective
End point	The security of devices accessing services or applications such as laptops, desktops, tablets, biometric devices, mobiles are considered
Application	It contains the security controls related to the application deployment and its technology stack. The controls at this layer thus include the code security, precaution at the application layer, doing vulnerability assessment on time to time basis. Appropriate session management, best coding practice, use of secured channel for data transfer are some of the important controls that are to be implemented at this layer. Appropriate authentication mechanism based on the sensitivity of the

[22] Source: IndEA [Part I] - Definitions
[23] Source: IndEA [Part I] – Security reference model

	application and authorizations are major features related to access control for application layer.
Data	The storage, integrity, availability and access control are the important features related to the data layer. Security and privacy are the important aspects of enterprise security. Security becomes important due to privacy.

The business layer allows an organization to identify the assets, define the policies and establish controls on the policies. The perimeter, network, end point, application and data layers are responsible for adhering to the security policies and managing security of the associated components considered under their layers.

This chapter is intended to present the indicative list of security policies, and security components, capabilities which are applicable for document registration system in the sections ahead.

6.7.1 Security Reference Model Principles

While architecting the security reference model, following principles and statements have been found suitable to the document registration system, from the IndEA's security reference model principle's repository. However the rationale, implication and consequences of not following the principle organisation-wide has been customized to cater to document registration system's needs.

Table 49: Security Reference Model Principles

Principle name	Description
Data Integrity	**Statement** • Data is correct, consistent and un-tampered. **Rationale** • Data should be reliable for the information consumers to take action. **Implications** • Without data integrity, data is of no use considering that the data cannot be trusted. **Consequences** • Wrong or manipulated data will be available if the data integrity is compromised.
Data Privacy and Confidentiality	**Statement** • Data is shared on a need basis and is collected/accessed/ modified only by authorized personnel. **Rationale** • Due policies are to be established to ensure data is not misused. **Implications** • Unauthorized use or access of data should not be allowed and controls should be in place. **Consequences** • Unauthorised use or access of data would lead registry offices into legal challenges or lawsuits.

6.7.2 As Is Landscape

In the current state, every state / union territory is not at the same level of maturity in the document registration domain perspective. Different states / union territories are using different processes, application, modules for different functions and requirements.

Different states / union territories use different security policies and standards required for the security of data and assets which makes the interoperability difficult. One of the examples is iSarita used by Maharashtra:

In iSarita all the documents are scanned and stored in the central server, there is always an apprehension about data loss due to corruption of software or data theft due to different reasons. Security standards used by iSarita are:

i. VPN/ MPLS network

ii. Authorized users only shall access the software. Users cannot access the database directly.

iii. Direct access rights to the Database given to only the department authorities

iv. User Id, password, captcha, and fingerprint should be required for accessing the application. Depending on the privileges assigned to each user, specific menu options/ modules shall be available to them.

v. Security audit

6.7.3 Transition Plan

The transition plan for security architecture involves the security policies to be created and followed, security capabilities should be added which will ensure the security of data and other assets required by document registration system are in-tact.

6.7.3.1 Transition Principles

1. **Multilayer Security Capability** – To protect the citizen and government related data the security should be introduced as multi-layered approach and should not only focus on one dimension.
2. **Rights Management** – Providing role based access to business users and development teams and ensuring and ensuring no leakage of private information.

6.7.4 To Be Landscape

In the target state security architecture we will define the security capabilities needed for document registration system for the states / union territories of India. The states may adopt the capabilities based on their requirements and do the modifications to it. Along with the use of application capabilities in document registration system, following section describes security capabilities to be adopted in the target state.

6.7.4.1 Security Capabilities

Security of document registration system is critical as it deals with citizen, property and government data. Therefore security is needed at multiple layers of the technology stack and throughout the entire IT lifecycle:

6.7.4.1.1 Application Security

1. Encryption – Transport layer security – Ensuring privacy and data integrity between two communicating applications over a network
2. Request Filtering
3. URL Authorization - URL authorization maps users and roles to pieces of the URL namespace. By using this authentication, we can selectively allow or deny access to certain sets, users, or roles
4. Automatic Website Isolation -Site Isolation reduces the amount of valuable cross-site information in a web page's process, and thus helps limit what an attacker could access
5. Digital Certificate and Code Signing - Code signing is the method of using a certificate-based digital signature to sign executables and scripts in order to verify the author's identity and ensure that the code has not been changed or corrupted since it was signed by the author

6.7.4.1.2 Data Security

1. Database Encryption- Converting data stored in database to cipher text using an algorithm
2. Database Logging- History of actions executed by database management systems

6.7.4.1.3 Security of Client & Server Infrastructure

1. Malware Protection
2. Disk Encryption
3. IPv6
3. File Classification Infrastructure- system administrators can set up rules that automatically classify files based on various factors, such as location or content. Once files have been classified, FCI can perform specified actions on them, such as moving them to a specified directory or encrypting them.
4. Trusted Platform Module - A trusted platform module (TPM) is a type of secure crypto processor, which is a specialized chip used to carry out cryptographic operations like the storing of encryption keys to secure information which is usually used by the host system to authenticate hardware. The information stored does not always have to be encryption keys; it may also include passwords and certificates
5. Security Analyser – Security Analyser can perform local or remote scans on desktops and servers identifying any missing service packs, security patches and common security misconfiguration

6.7.4.1.4 Digital Information Rights

1. Rights Management Services - RMS can control what a user can do with a document after it has been accessed. This control will last regardless of where the user

might store the document and you can even have time limits associated with the document so that, after a specified period of time, the document is no longer accessible.

6.7.4.1.5 Network Access Control Service

1. Secure Browsing – Secure browsing makes web browsing more protected from various kinds of cyber attacks
2. VPN/ Remote Access – VPN allows secure access to organizations resources over the internet
3. Network Access Protection - the ability of a company's network to prevent authorized users from remotely logging into the office network using computer systems that have not been through a security vetting in accordance to the company's network security policies.
4. Firewall- As the firewall at the network level failed to do content filtering of encrypted communication over the https, so WAF must be rolled out at the Application layer

6.7.4.1.6 Authentication & Authorization

1. Federation Services - allows sharing of identity information outside a company’s network. It authenticates users with their usernames and passwords. Users can access some applications without being prompted to provide login credentials again. These applications can be local or on the cloud
2. Certificate Services- allows building of public key infrastructure (PKI) and provide public key cryptography, digital certificates, and digital signature capabilities of organization
3. Domain Services- Stores information about user accounts, such as names, passwords, phone numbers, and so on, and enables other authorized users on the same network to access this information.
4. Authentication Services- Authentication Service facilitates username/password validation using your on-premises Active Directory/LDAP server. Authentication Service is installed as a virtual appliance and communicates with your local directory using LDAP over SSL.

6.7.4.2 Threats & Vulnerabilities of DRS

According to 1908 Registration Act, state IGRs deal with sensitive information like Citizen Details, Property Details, Property History and physical assets as well. State IGR needs to make sure that these information and assets are secured. With increasing cybercrime in the world it is necessary to protect the citizen information and assets information at any cost.

The following information and assets need protection:

1. Data Protection – DRS needs to ensure that sensitive information like citizen details, property details information, revenue information and bank account details are not leaked and are dully protected.
2. Access Control – Access control needs to be established for business application so that authorized business users only access the applications and systems.

Open Web Application Security Project (OWASP) Standard

Sr. #	Vulnerability and Description	Impact	Security Capabilities Utilised
1	**Injection Flaws** Injection flaws, particularly SQL injection, are common in web applications. Injection occurs when user-supplied data is sent to an interpreter as part of a command or query. The attacker's hostile data tricks the interpreter into executing unintended commands or changing data.	Injection can result in data loss or corruption, lack of accountability, or denial of access. Injection can sometimes lead to complete host takeover.	Application Security
2	**Broken Authentication and Session Management** Account credentials and session tokens are often not properly protected. Attackers compromise passwords, keys or authentication tokens to assume other users' identities.	Such flaws may allow some or even all accounts to be attacked. Once successful, the attacker can do anything the victim could do. Privileged accounts are frequently targeted.	Application Security, Digital Information Rights, Authentication & Authorization
3	**Cross Site Scripting (XSS)** XSS flaws occur whenever an application takes user supplied data and sends it to a web browser without first validating or encoding that content.	Attackers can execute scripts in a victim's browser to hijack user sessions, deface web sites, insert hostile content, redirect users, hijack the user's browser using malware, etc.	Application Security
4	**Insecure Direct Object Reference** A direct object reference occurs when a developer exposes a reference to an internal implementation object, such as a file, directory, database record,	Such flaws can compromise all the data that can be referenced by the parameter. Unless the name space is sparse, it's easy for an attacker to access all available data of that type. Attackers can manipulate	Application Security, Security of Client & Server Infrastructure

	or key, as a URL or form parameter.	those references to access other objects without authorization. Attackers can manipulate those references to access other objects without authorization.	
5	**Security Mis-Configuration** Security mis-configuration can happen at any level of an application stack, including the platform, web server, application server, framework, and custom code. Attacker accesses default accounts, unused pages, un-patched flaws, unprotected files and directories, etc. to gain unauthorized access to or knowledge of the system.	Attacker accesses default accounts, unused pages, un-patched flaws, unprotected files and directories, etc. to gain unauthorized access to or knowledge of the system.	Application Security, Security of Client & Server Infrastructure, Authentication & Authorization
6	**Sensitive Data Exposure** Applications frequently fail to encrypt network traffic when it is necessary to protect sensitive communications.	Such flaws expose individual users' data and can lead to account theft. If an admin account was compromised, the entire site could be exposed. Poor SSL setup can also facilitate phishing and Man-In the-Middle attacks.	Application Security, Data Security
7	**Missing Function Level Access Control** Frequently, an application only protects sensitive functionality by preventing the display of links or URLs to unauthorized users. Attackers can use this weakness to access and perform unauthorized operations by accessing those URLs directly.	Such flaws allow attackers to access unauthorized functionality. Administrative functions are key targets for this type of attack.	Application Security, Digital Information Rights
8	**Cross Site Request Forgery** A CSRF attack forces a logged-on victim's browser to send a pre-authenticated request to a vulnerable web application, which then forces the victim's browser to perform a hostile action for the benefit of the attacker. CSRF can be as powerful as the web application that it attacks.	Attackers can cause victims to change any data the victim is allowed to change or perform any function the victim is authorized to use.	Application Security, Security of Client & Server Infrastructure

9	**Using Known Vulnerable Components** Components, such as libraries, frameworks, and other software modules, almost always run with full privileges. If a vulnerable component is exploited, such an attack can facilitate serious data loss or server takeover. Applications using components with known vulnerabilities may undermine application defences and enable a range of possible attacks and impacts.	The full range of weaknesses is possible, including injection, broken access control, XSS, etc. The impact could be minimal, up to complete host takeover and data compromise.	Application Security, Security of Client & Server Infrastructure
10	**Un-validated Redirects and Forwards** Web applications frequently redirect and forward users to other pages and websites, and use un-trusted data to determine the destination pages. Without proper validation, attackers can redirect victims to phishing or malware sites, or use forwards to access unauthorized pages.	Such redirects may attempt to install malware or trick victims into disclosing passwords or other sensitive information. Unsafe forwards may allow access control bypass.	Application Security, Security of Client & Server Infrastructure

6.7.4.3 Security Policies

For software assets of document registration system the security and controls needs to be established at the all the layers of technology and application. IndEA recommends a security policy should have:

- Password policy
- Email policy
- Acceptable user policy
- Access Control Policy
- Wi-Fi Policy
- Third party connection policy
- Mobile device usage policy
- Confidential data policy
- Data Classification
- Back up policy
- Retention policy
- Physical security policy
- Virtual private network (VPN) Policy
- Network security policy
- Encryption policy
- Outsourcing policy
- Antivirus policy
- Information classification policy

A detailed generic security policy template document has been attached in the annexure.

The following table presents a broad spectrum of policies which should be considered and developed by state IGRs for different layers.

Table 50 - Security layers and policy mapping

Policies	Layers						
	Business	Data	Application	Endpoint	Network	Perimeter	Cloud / DC / DR
Password policy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Email policy	Yes		Yes				
Acceptable user policy	Yes	Yes	Yes	Yes			
Access Control Policy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wi-Fi Policy				Yes	Yes		Yes
Third party connection policy		Yes	Yes	Yes	Yes		
Mobile device usage policy	Yes		Yes	Yes	Yes		
Confidential data policy	Yes	Yes	Yes				Yes
Data Classification	Yes	Yes					Yes
Back up policy	Yes	Yes					Yes
Retention policy	Yes	Yes					Yes
Physical security policy					Yes	Yes	Yes
Virtual private network (VPN) Policy					Yes	Yes	Yes
Network security policy				Yes	Yes	Yes	Yes
Encryption policy		Yes	Yes	Yes			Yes
Outsourcing policy	Yes	Yes	Yes				Yes
Antivirus policy							
Information classification policy	Yes	Yes					

The security policy should also include standard operating procedures that needs to be followed in case of incidents. The below table is a representation of SOP that should be focused while defining the security policy:

Code	Description
Blue Code	1 In case of repetitive failed attacks have been detected 2 If the vital resources are below critical level 3 Unexpected traffic has been detected etc.
Pink Code	1 Replication server goes down 2 Malware in the internal network is detected 3 SMS/email bombing generated from the server through gateway etc.
Orange Code	1 In case of the DDoS attack has been initiated 2 URLs having low reputation index is requested from server 3 In case of web site defacement is noticed
Red Code	1 In case of the data has been compromised 2 In case data has been evidently stolen 3 Physical security of the server is compromised

6.8 Governance Reference Model

Governance reference model supports in establishing an institutional structure and governance body for the development, management and maintenance of Enterprise Architecture and its artefacts. Governance reference model also ensure the consistency of the architecture with vision and objectives of document registration system. Effective and efficient EA Governance ensures that priorities are based on broad consensus across the enterprise. EA is a continuous activity and governance is an integral part for its successful implementation and maintenance.[24]

The Objectives of the EA Governance are[25]:

- To ensure the effective introduction, implementation, and evolution of architectures within the organization
- To ensure compliance with internal and external standards and regulatory obligations
- To establish processes that support fulfilment of the above objectives
- To develop practices that ensure accountability to a clearly identified stakeholder community, both inside and outside the organization

[24] Source: IndEA [Part I] – GRM Definition
[25] Source: IndEA [Part I] – GRM Objectives

6.8.1 Governance Reference Model Principles

While architecting the governance reference model, following principles and statements have been found suitable to the document registration system, from the IndEA's governance reference model principle's repository. However the rationale, implication and consequences of not following the principle organisation-wide has been customized to cater to document registration system's needs.

Table 51: Governance Reference Model Principles

Principle name	Description
Primacy of principles	**Statement** • Principles of enterprise information management apply to all organizations, stakeholders. **Rationale** • The only way we can provide a consistent and measurable level of quality information is if all functions abide by the principles. **Implications** • Without this principle, exclusions, favouritism, and inconsistency would rapidly undermine the management of information. **Consequences** • Non adherence to the architecture principles would lead to non-compliant solution.
Discipline	**Statement** • All the stakeholders should ensure that the governance mechanism established is followed **Rationale** • Governance body plays a very vital role in ensuring that the standards defined in the Enterprise Architecture document is followed **Implications** • If the governance mechanism is followed the solution that would be built would meet the requirements of DRS, would be scalable, robust and secure **Consequences** • If the governance mechanism is not followed the solution built would be non-compliant

Accountability	**Statement** • Governance body should take ownership of the areas assigned to them and be accountable for the decisions **Rationale** • Stakeholders, including service providers are accountable for the responsibility assigned to them in the Architecture Development and Implementation, and in strict adherence to these principles **Implications** • Assigning accountability of members of governance body will lead to more efficient and empowered governance body for DRS **Consequences** • Not having accountability creates a team where there is a lack of trust and support and the decisions taken would not be impactful

6.8.2 As-Is Landscape

The current state of applications and processes used for document registration system across the states and union territories are different and being used in silos, developed and managed by states as per their requirements. There has been no official governance body defined to manage the changes that come as a result of business requirements, adoption of new channels and service delivery mechanism etc. Also, in some States/UTs, registration is generally with Revenue Department and in some states/UTs it is with finance, law and justice, home, commercial tax.

6.8.3 Transition Plan

Since in the current state, states and union territories have been using different processes, applications, modules for document registration purpose there was no defined centralised governance body to handle and manage the changes suggested. To-be state of the governance has been defined where we have governance mechanism, governance body and their roles & responsibilities defined. Transition plan describes the principles that need to be kept in mind while creating the governance body. Along with this a detailed BPR template has been defined (added to the annexure section) to be used by the governance team for any of the changes assessed, suggested, prioritised and approved.

6.8.3.1 Transition Principles

1. **Communication Mechanism**: The governance body should establish a strong communication mechanism amongst themselves and their stakeholders so that the decisions taken by the governance body is communicated timey and clearly to all the stakeholders
2. **Focus on Principles & Standards:** The governance body should always keep in mind the principles and standards using which the solution is designed if any change request violating these standards and principles should be rejected

6.8.4 To-Be Landscape

E-Governance perspective have made a significant impact on the states and union territories of India which are now more focused towards delivering the services to the citizens with different and multiple channels. With this document registration system is moving towards having centralised application with instances created for the different states and union territories to provide seamless services to the stakeholders and better integration with other systems as well. Therefore any changes to be made in to the architecture has to be brought before an established EA Governance body, so that a full impact analysis of the change suggested can be taken into consideration and appropriate decision is taken before going through the changes. A change management board will look into the effects on DRS by any amendment in the Acts which govern the document registration system. All the 7 reference models will have to be taken into consideration for the change management lifecycle. This section describes a governance mechanism (Governance body and their roles and responsibilities:

The composition of the governance groups is as follows:

Table 52: DRS EAF Governance Group and Roles

Group	Composition
Architecture governance board	• Chief Enterprise Architect • DoLR / Central Ministry Representative • IGR Representative
Change management board	• Chief Enterprise Architect • State IGR Representatives
Technical review board	• Enterprise Architect • State IGR Representatives • IT Implementation team lead • Solution architect
DRS EAF working group	• Chief Enterprise Architect • Enterprise Business Architect • Enterprise Application Architect • Enterprise Data Architect • Enterprise Security Architect • Enterprise Technology architect • DoLR Representatives • State IGR Representatives
Implementation team	• Enterprise Architecture Team • NIC State Unit • IT team
Project management	• NIC headquarters • NIC State Units • State IGR Representatives
Change management team	• State IGR Representatives • NIC State Unit

6.8.4.1 Governance Mechanism

The members of the governance body will be assigned the following roles

Table 53: Governance Team Roles and Description

Role Name	Description
Chief Enterprise Architect	Holds the complete ownership of the Document Registration System Enterprise Architecture Framework
Enterprise Business Architect	Ownership of Business Reference Model defined in DRS EAF
Enterprise Application Architect	Ownership of application(s) developed as per the DRS EAF and ownership of integration methods
Enterprise Technology Architect	Ownership of the Technology Reference Model defined in DRS EAF
Enterprise Data Architect	Ownership of Data Reference Model, Data Standards defined in DRS EAF
Enterprise Security Architect	Ownership of the Security Capabilities and Security Policies defined in DRS EAF

Table 54: Governance Roles and Location

Role Name	Location
Chief Enterprise Architect	State IGR / Department / NIC Headquarters
Enterprise Business Architect	State IGR / NIC Pune
Enterprise Application Architect	NIC Pune
Enterprise Data Architect	NIC Pune
Enterprise Security Architect	NIC Pune
Enterprise Technology Architect	NIC Pune

The below table describes the RACI (Responsibility, Accountability, Consulted, Informed) matrix of the above roles

Table 55: Governance Roles RACI Matrix

Governance Areas	Principles & Guidelines	Reference Models	Data Standards	Applications	Technology	Security
Chief Enterprise Architect	A	A	I	I	I	I
Enterprise Business Architect	R	R	I	I	I	I
Enterprise Application Architect	R	R	I	A / R	I	I
Enterprise Technology Architect	R	R	I	I	A / R	I
Enterprise Data Architect	R	R	A / R	I	I	I

Enterprise Security Architect	R	R	I	I	I	A / R

- R - Responsible – Those who do the work to achieve a task. There is typically one role with a participation type of Responsible.
- A - Accountable – Those who are ultimately accountable for the correct and thorough completion of the deliverable or task, and the one to whom Responsible is accountable. Typically, the Process Owner is Accountable for a process, and there must be only one Accountable specified for each task or deliverable.
- C - Consulted – Those who are not directly involved in a process but provide inputs and whose opinions are sought.
- I - Informed – Those who receive outputs from a process or are kept up-to-date on progress, often only on completion of the task or deliverable.

6.8.4.2 Communication in Architecture Governance

Critical to the success and effectiveness of EA Governance, is a communication plan that lays down the processes relating to Why, How, When, and with whom communication need to take place. EA communication objectives are as follows[26]:

- To build the awareness about the significance and vision of EA among all the participants/stakeholders
- To obtain feedback on specific aspects of EA artefacts
- To provide a clear, consistent representation of Enterprise Architecture
- To facilitate collaboration
- To educate all stakeholders on their roles and responsibilities
- To educates all stakeholders on the EA metrics on a monthly, quarterly or as needed basis

Tools used for EA communication are listed below:

Table 56: Communication Tools and Description

Sr #	Communication Tools	Description
1	Knowledge Management Portal	Knowledge Management (KM) Portal is used to illustrate linkage of Government objective to EA. It demonstrates the linkage of IT projects to EA. KM Portal communicates EA Processes, Standards, and Reference Models etc.
2	IndEA Repository	IndEA Repository acts as the central repository for EA artefacts such as: • Reference Models • Principles and Policies • Business Architecture • Application Architecture • Data Architecture • Technology Architecture • Security Architecture
3	EA Training	Training on Enterprise Architecture
4	EA Printed Documents	EA Printed documents communicate following: • EA framework overview and its benefits

[26] Source: IndEA Governance Reference Model

		• EA Dashboard with key EA Metrics • Roles and Responsibilities
5	Email	Communication over email about Enterprise Architecture
6	EA Workshop/Seminars	EA Workshop/Seminars communicate following: • EA Overview and Benefits • Case Studies and success stories on Enterprise Architecture

7 Adoption Guidelines

This section describes the key processes involved in an architecture lifecycle, methods and stages of adopting DRS EAF and developing state / union territory specific enterprise architecture.

The key processes in a typical architecture lifecycle [27]comprise of:

1) **Architecture governance**: Establishment and maintenance of architectural coherence and alignment with objectives and constraints with respect to the current and future needs of the enterprise and its ecosystem.
2) **Architecture management**: Implementation of governance directives and the timely and efficient achievement of architecture objectives.
3) **Architecture conceptualisation**: Identification of architectural initiatives that address stakeholder concerns, achieve architecture objectives, and meet relevant requirements.
4) **Architecture evaluation**: Determination of the extent to which one or more initiatives meet architecture objectives and address stakeholder concerns, or to determine the quality or completeness of architecture.
5) **Architecture elaboration**: Description or documentation of architecture in sufficiently complete and correct manner for the intended uses of the architecture.
6) **Architecture enablement**: Development, maintenance and improvement of the enabling capabilities and resources needed in performing the other architecture processes.

[27] IndEA Part II [Adoption Guide]

The following diagram describes the overall approach proposed for document registration for states and union territories along with the tools which are available or being developed to support the document registration enterprise architecture development phase.

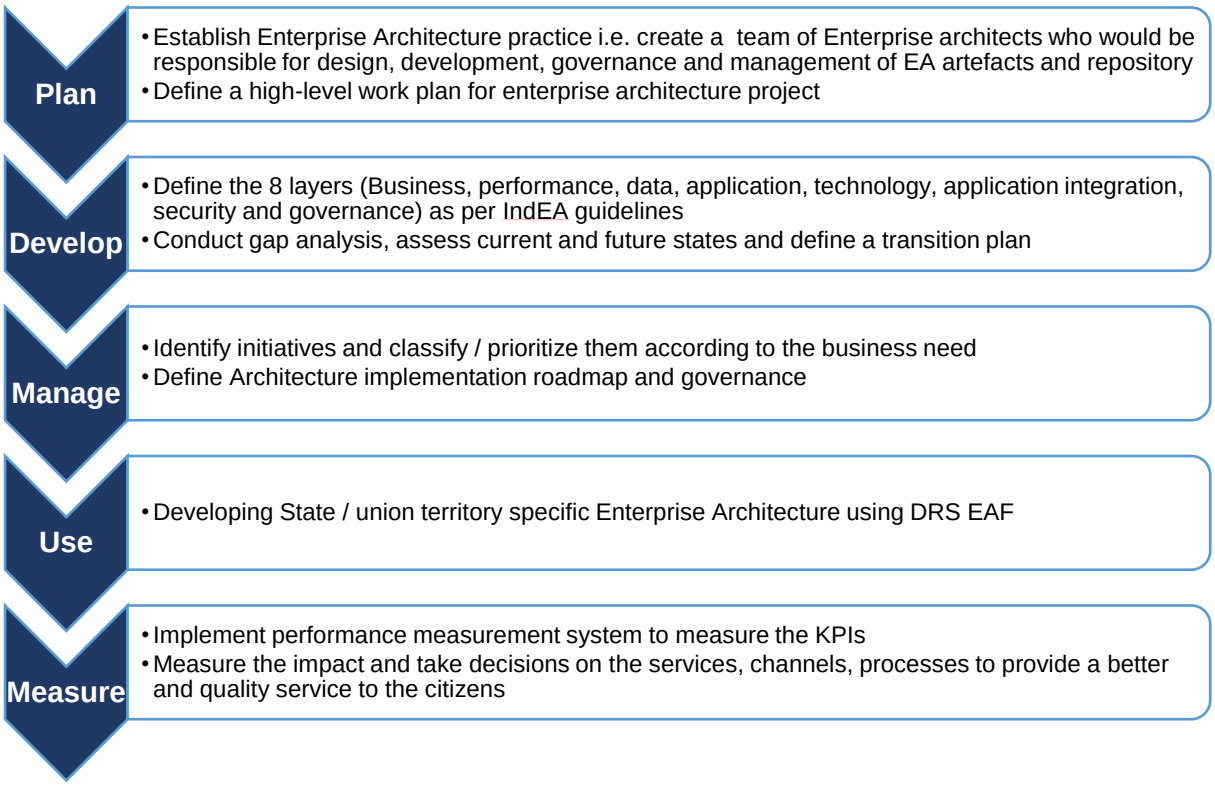


Figure 41: Stages to adopt DRS EAF

The table below mentions what different tools can be used for each stage and what should be the indicative outputs from each of the stages:

Table 57: Stages, Tools and Outputs

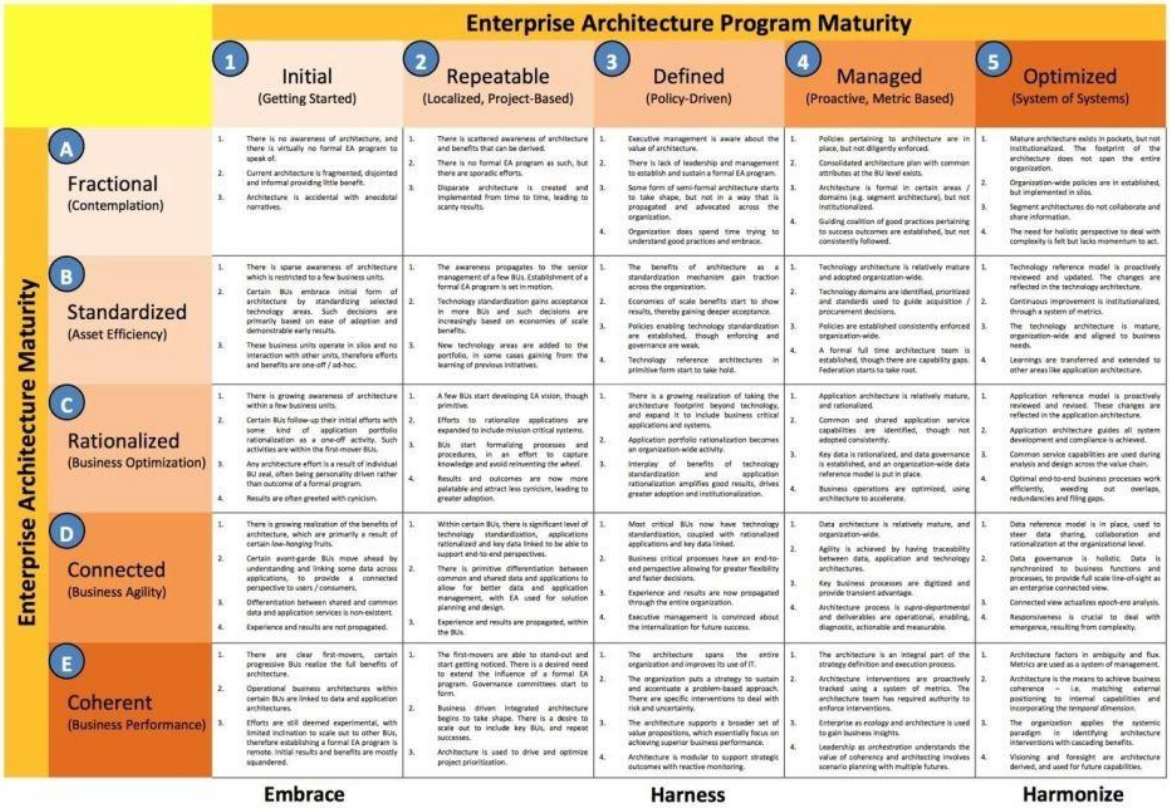
Stage	Tools	Indicative Outputs
Plan	DRA EAF framework overview will support the state/union territory to identify the quantum of work required to tailor / adopt the framework	Organization vision, mission, goals, Organization challenges, concerns, wish lists, Architecture scope including applicable frameworks, team and timelines
Develop	Architecture Reference models (Business, performance, data, application, technology, application integration, security and governance) IndEA Part 1	Architecture definition report covering business, data, application, technology, application integration, security, governance and performance
Manage	Initiatives classification tool, Initiatives prioritization tool	Architecture implementation plan (draft)
Use	DRS EAF Framework	State Specific DRS Enterprise Architecture
Measure	KPI, Performance Measurement tool	Performance Measurement Report

Enterprise Architecture Maturity Model

The maturity model would help the State IGR to create a roadmap to implementation of Enterprise Architecture and assess its As Is Landscape in detail. The enterprise maturity model would describe the As-Is Landscape of States' document registration system's maturity on two parameters:

1) Enterprise Architecture Maturity:

   The enterprise architecture maturity identifies the maturity of EA practice at State IGR and helps create a roadmap for achieving a Target State.



2) Maturity of Services Delivered:

   The maturity of services define the maturity of the current business processes. Each services delivered by the document registration system is given a rating. This model would help the IGR to focus on the services which are not matured.

   The ratings and their description are as follows:

Rating	Description
Ad hoc	There is evidence that the enterprise has recognized that the issues exist and need to be addressed. There are, however, no standardized service or processes; instead, there are ad hoc approaches that tend to be applied on an individual or case-by-case basis. The overall approach to management is disorganized (score - 1)
Repeatable	Processes have developed to the stage where similar procedures are followed by different people undertaking the same task. There is no formal training or communication of standard

	procedures, and responsibility is left to the individual. There is a high degree of reliance on the knowledge of individuals and, therefore, errors are likely. (score - 2)
Defined	Procedures have been standardized and documented, and communicated through training. It is mandated that these processes should be followed; however, it is unlikely that deviations will be detected. The procedures themselves are not sophisticated but are the formalization of existing practices (score - 3)
Managed	Management monitors and measures compliance with procedures and takes action where processes appear not to be working effectively. Processes are under constant improvement and provide good practice. Automation and tools are used in a limited or fragmented way. (score - 4)
Optimized	Processes have been refined to a level of good practice, based on the results of continuous improvement and maturity modelling with other enterprises. IT is used in an integrated way to automate the workflow, providing tools to improve quality and effectiveness, making the enterprise quick to adapt. ((score - 5)

8 Annexure

8.1 Supporting Information, Templates and Tools

8.1.1 Application Capability and Usage by States (As-Is)

#	Application Capability	Usage by States
1	Stakeholder Information Management	Partial Automated
2	Registration Management	Manual
3	Registered Document Management	Partial Automated
4	Encumbrance Certificate Management	Manual
5	Grievance Redressal	Not Available
6	Property Valuation	Partial Automated
7	Appointment Management	Not Available in most states (eStep-in in Maharashtra)
8	Case Management	Not available (Manually done in few states like Rajasthan)
9	Rule Management	Manual
10	Stamp Duty & Fees	Partial Automated
11	Payment	Partial Automated (Some states use applications for receipt generation)
12	Registry Office Management	Manual
13	Reporting and Analytics	Manual
14	Refund	Not Available

8.1.2 Application Integration Reference Model's interaction with other Reference Models

Integration Layer is one of important component of the Application Layer which ensures the information sharing between the disparate applications. At the same time, it gets input from other reference models. The interaction between AIRM and other reference models is depicted below:

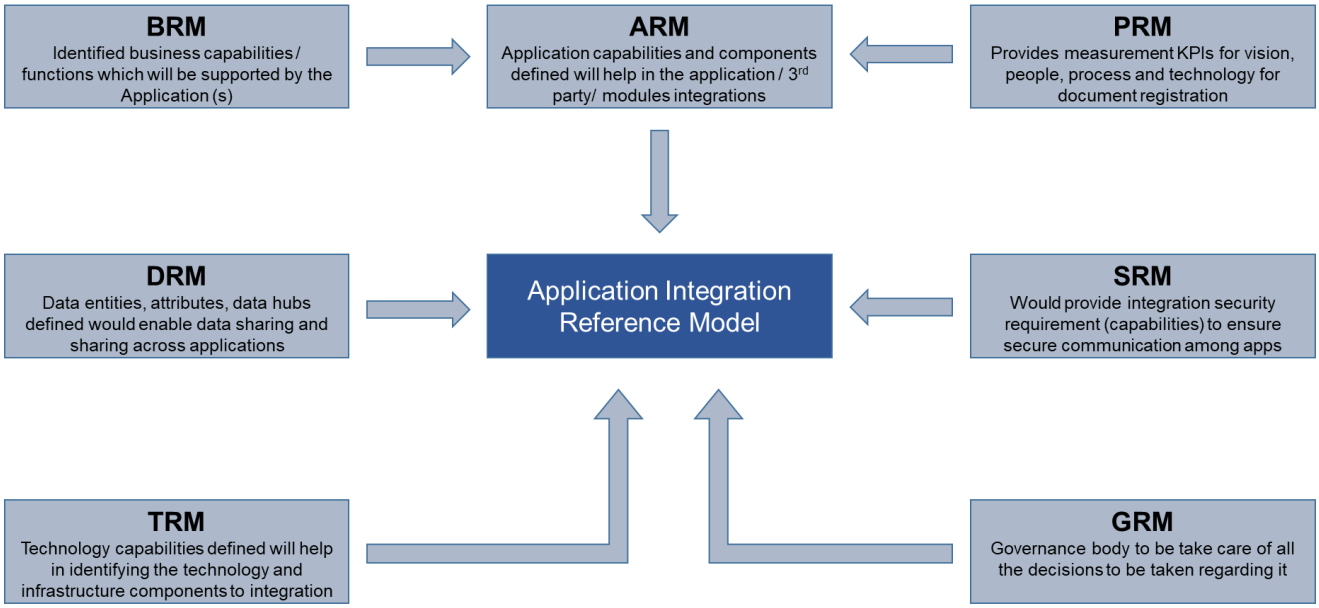


Figure 42: Interaction between AIRM and other Reference Model

8.1.3 Organisation Chart Analysis[28]

Sr. No.	Name of the State/UT	Maximum Office Levels	Maximum Office Categories in single level	Number of SR Offices
1.	Andaman & Nicobar	3	5	5
2.	Arunachal Pradesh	9	4	45
3.	Assam	6	1	----
4.	Bihar	7	5	84
5.	Chandigarh	3	2	1
6.	Chhattisgarh	5	13	92
7.	Dadra & Nagar Haveli	NA		
8.	Daman & Diu	2	1	2
9.	Delhi	NA		
10.	Gujarat	6	2	331
11.	Haryana	4	3	130
12.	Himachal Pradesh	3	1	143
13.	Jharkhand	6	2	42
14.	Karnataka	10	4	169
15.	Kerala	5	7	314
16.	Lakshadweep	5	1	10
17.	Madhya Pradesh	3	4	299
18.	Maharashtra	5	9	504
19.	Manipur	4	2	4
20.	Meghalaya	6	6	11
21.	Mizoram	7	2	3
22.	Nagaland	3	1	11
23.	Odisha	NA		
24.	Puducherry(UT)	4	1	10
25.	Punjab	4	1	82
26.	Rajasthan	7	15	409
27.	Sikkim	4	1	16
28.	Tripura	3	1	17
29.	Uttar Pradesh	5	3	354
30.	Uttarakhand	5	1	50
31.	West Bengal	7	7	223

[28] Source: DRS – Gap Analysis Document

8.1.4 DRS – As-Is System Actors and Goals[29]

Sr. No.	Stake holders / Actor	Goal
1	Citizen	Registration, OTP enabled login credentials, entry of property and party details, valuation & online stamp duty payment (if compulsory) as a pre-registration process for own document.
2	Document writer	Entry of property and party details & online stamp duty payment (if compulsory) as a pre-registration process for documents of other individual citizens.
3	User manager	To create user, Assign role & access permissions to user. Deactivate user.
4	Configuration Manager	Configuration Manager can create custom workflow and assign them to user. Location levels, usage types can be configured. Valuation rules, stamp duty calculation rules, counter payment calculation rules, fee exemption rules
5	Administrator	Initialize/Update counters & master codes. Use activation period, delayed document acceptance period, financial year , bank details,
6	Information officer	Data entry of property and party details, stamp duty payment received details at SRO level
7	Sub Registrar	Scrutiny of the documents generated by citizen & , presentation, fee collection, admission, identification and final registration, document handover, certified copy generation
8	Cash Counter Officer	Counter fee collection
9	Document scanner operator	Scanning of registered documents and upload to storage area
10	Inspector General of Registrar (Higher authority as per hierarchy : JDR, DIG, IGR)	Verification and monitoring of hierarchy wise registered/ pending documents, revenue received etc.
11	Property Inspector	Inspection of property with details & uploading of inspection report.
12	External Department	To fetch the data from NGDRS.

[29] Source: DRS – Gap Analysis Document

8.1.5 List of Articles

Sr. #	Article Name
1	Acknowledgement/Possession Receipt
2	Administration Bond
3	Adoption Deed
4	Affidavit
5	Agreement or its records or Memorandum Of Agree men
6	Agreement Relating to Deposit of Title Deeds, Pawn,
7	Execution of Power
8	Valuation
9	Apprenticeship Deed
10	Articles of Association of a company
11	Articles of Clerkship
12	Award
13	Bond
14	Bottomry Bond
15	Cancellation
16	Certificate of Sale
17	Certificate or Other Document
18	Charter Party
19	Clearance List(Purchase or sale of government security)
20	Clearance List(Purchase or sale of cotton)
21	Clearance List(Purchase or sale of Boolean or spic
22	Clearance List(Purchase or sale of oil seeds)
23	Clearance List(Purchase or sale of yarn)
24	Composition Deed
25	Conveyance
26	Copy or Extract
27	Counterpart or Duplicate
28	Customs or Excise Bond
29	Delivery Order
30	Exchange of Property
31	Further Charge
32	Gift
33	Inspectorships Bond
34	Lease
35	Letter of Allotment of Shares
36	Letter of License
37	Memorandum of association of a company
38	Mortgage Deed
39	Mortgage of a crop
40	Notarial Act
41	Note of Memorandum
42	Note of Protest by Master of a Ship
43	Order for the Payment of Money

44	Partition
45	Partnership
46	Power of Attorney
47	Protest of Bill or Note
48	Protest of a Master of a Ship
49	Reconveyance of Mortgaged Property
50	Release
51	Respodentia Bond
52	Security Bond or Mortgage Deed
53	Settlement
54	Share Warrants
55	Shipping Order
56	Surrender of Lease
57	Transfer
58	Transfer of Lease
59	Trust
60	Warrant for Goods
61	Will
62	Declaration
63	Correction Deed
64	Notice of Lease Pendancy
65	Apartment Deed
66	Agreement
67	Apartment Deed
68	Confirmation Deed
69	Leave and Licenses
70	(51-A)Record Of Transaction(Electronic or Otherwise)
71	Work Contract

8.1.6 Party Types

Sr. #	Party Name
1	Seller/Executor1
2	Purchaser/Buyer/Executor2
3	Confirming Party/Granter
4	Presenter
5	Power of Attorney Holder
6	Borrower/Guarantor
7	Donor

8.1.7 BPR Template

Department	Sub Department/ Process	Area of improvement	Basis for the recommendation (Gap in the current process	BPR Recommendations			Importance	Priority	Decision maker/Authority designation	Can be implemented	Cannot be implemented	Reason	Timeline to bring into implementation
				Process	People	Technology							
							High/Med/Low	High/Med/Low					

8.1.8 KPI & Measurement Template

Area (Function / Capability)	KPI	Dimension	Actual	Target	Result (Cumulative %)	Inference

8.1.9 Gap Analysis conducted by NIC

NGDRS-GapAnalysisReport.pdf

8.1.10 Generic Security Policy Document[30]

TABLE OF CONTENTS

1. INTRODUCTION

This section provides the information about what the security policy document covers and why is it required. It also mentions about various levels at which the security needs to be address. It provides information about the stake holders, various roles and responsibilities that are addressed in the security policy.

1.1 Purpose

It specifies the intension of the security policy document.

1.2 Scope

Specify the scope of the document in this section. Whom does which part of the policy apply?

1.3 History

The history of the document revision and the reason behind the change is specified here. A template table for the same is shown below

Table 1: Revision History Table template

Version	Description	From	To	Author	Reviewer	Reason for modification
1.0	Initial version	8/1/2017	7/1/2018	ABC	PQR	--

From – To date: The validity of the document is mentioned in from and to dates. Usually To date gives the date at a regular interval
when it should be revised or at least audited to check if any changes are required in the policy.

[30] Source: IndEA Framework Security Policy

Author: Name of the author of the document.

Reviewer: Name of the policy reviewer.

Reason for modification: If any revision is made in the policy the reason for the policy should be mentioned here.

1.4 Responsibilities

Identify the roles and their responsibilities in order to enforce the policy. Below table gives the template for the same.

Table 2: Roles and Responsibilities Template

Roles	Responsibilities
Chief Information Officer	• Accountable for all aspects of the Organization's information security.
Information Security Officer	• Responsible for the security of the IT infrastructure. • Plan against security threats, vulnerabilities, and risks. • Implement and maintain Security Policy documents. • Ensure security training programs. • Ensure IT infrastructure supports Security Policies. • Respond to information security incidents. • Help in disaster recovery plans.
Information Owners	• Help with the security requirements for their specific area. • Determine the privileges and access rights to the resources within their areas.
IT Security Team	• Implements and operates IT security. • Implements the privileges and access rights to the resources. • Supports Security Policies.
Users	• Meet Security Policies. • Report any attempted security breaches.

1.5 General policy Definitions

List of all the policies that are related to this document should be listed here for reference.

2. IT Asset Policy

This section covers security policy regarding secured handling of IT assets.

Under IT asset policy there can be policy definitions such as-

- Every user is responsible for the preservation and correct use of the IT assets they have been assigned.
- Active desktop and laptops must be secured if left unattended
- All desktops and laptops must have appropriate anti-virus installed and should be accessible only as the access control policy.
- Every desktop and laptop must have password protection as a minimum access control mechanism.
- Access to assets in the Organization location must be restricted and properly authorized, including those accessing remotely.
- Company's laptops, PDAs and other equipment used at external location must be periodically checked and maintained.
- The IT Technical Teams are the sole responsible for maintaining and upgrading configurations. None other users are authorized to change or upgrade the configuration of the IT assets. That includes modifying hardware or installing software.
- Disposal of the assets must be done according to the specific procedures for the protection of the information. Assets storing confidential information must be physically destroyed in the presence of an Information Security Team member. Assets storing sensitive information must be completely erased in the presence of an Information Security Team member before disposing.

3. Access Control Policy

This section lists the policy related to access control of various kinds such as network access control, guest access control, remote access control etc. Under Access Control policy there can be policy definitions such as-

- Any system that handles valuable information must be protected with a password-based access control system.
- Any system that handles confidential information must be protected by a two factor -based access control system.
- Discretionary access control list must be in place to control the access to resources for different groups of users.
- Whenever possible, access should be granted to centrally defined and centrally managed identities.
- Access shall be granted under the principle of "less privilege", i.e., each identity should receive the minimum rights and access to resources needed for them to be able to perform successfully their business functions
- Users should refrain from trying to tamper or evade the access control in order to gain greater access than they are assigned.
- Automatic controls, scan technologies and periodic revision procedures must be in place to detect any attempt made to circumvent controls.

4. Password Control Policy

This section lists the policies regarding securing password control. Under Password Control policy there can be policy definitions such as-

- Every user must have a separate, private identity for accessing IT network services.
- Identities should be centrally created and managed. Single sign-on for accessing multiple services is encouraged.
- Each identity must have a strong, private, alphanumeric password to be able to access any service. They should be as least 8

characters long.
- Each regular user may use the same password for no more than 90 days and no less than 3 days. The same password may not be used again for at least one year.
- Whenever a password is deemed compromised, it must be changed immediately.
- For critical applications, digital certificates and multiple factor authentication using smart cards should be used whenever possible.
- Identities must be locked if password guessing is suspected on the account

5. Email Policy

This section covers the lists of policies for securing electronic mail. Under Email policy there can be policy definitions such as-

- Use of official email address should be mandated for official work.
- Use of the Organization resources for non-authorized advertising, external business, spam, political campaigns, and other uses unrelated to the Organization business is strictly forbidden.
- Use of the Organization email resources is maintained only to the extent and for the time is needed for performing the duties. When a user ceases his/her relationship with the company, the associated account must be deactivated according to established procedures for the lifecycle of the accounts.
- Privacy is not guaranteed. When strongest requirements for confidentiality, authenticity and integrity appear, the use of electronically signed messages is encouraged. However, only the Information Security Officer may approve the interception and disclosure of messages.
- Scanning technologies for virus and malware must be in place in client PCs and servers to ensure the maximum protection in the ingoing and outgoing email.
- Security incidents must be reported and handled as soon as possible according to the Incident Management and Information Security processes. Users should not try to respond by themselves to security attacks.
- Corporate mailboxes content should be centrally stored in locations where the information can be backed up and managed according to company procedures. Purge, backup and restore must be managed according to the procedures set for the IT Continuity Management.

6. Internet Policy

This section covers the lists of policies for securing Internet Access. Under Internet policy there can be policy definitions such as-

- Limited access to Internet is permitted for all users.
- The use of Messenger service is permitted for business purposes.
- Access to pornographic sites, hacking sites, and other risky sites is strongly discouraged.
- Internet access is mainly for business purpose. –some limited personal navigation is permitted if in doing so there is no perceptible consumption of the Organization system resources and the productivity of the work is not affected. Personal navigation is discouraged

during working hours.
- Inbound and outbound traffic must be regulated using firewalls in the perimeter. Back to back configuration is strongly recommended for firewalls.
- In accessing Internet, users must behave in a way compatible with the prestige of the Organization. Attacks like denial of service, spam, fishing, fraud, hacking, distribution of questionable material, infraction of copyrights and others are strictly forbidden.
- Internet traffic should be monitored at firewalls. Any attack or abuse should be promptly reported to the Information Security Officer. Reasonable measures must be in place at servers, workstations and equipment for detection and prevention of attacks and abuse. They include firewalls, intrusion detection and others.

7. Antivirus Policy

This section covers the lists of policies for securing using anti-virus and other forms of protection mechanisms. Under Anti-virus policy there can be policy definitions such as-

- All computers and devices with access to the Organization network must have an antivirus client installed, with real-time protection.
- All servers and workstations owned by the Organization or permanently in use in the Organization facilities must have an approved, centrally managed antivirus. That also includes travelling devices that regularly connects to the Organization network or that can be managed via secure channels through Internet.
- Traveling computers from the Organization that seldom connect to the Organization network may have installed an approved antivirus independently managed.
- All the installed antivirus must automatically update their virus definition. They must be monitored to ensure successful updating is taken place.
- Visitors computers and all computers that connect to the Organization’s network are required to stay “healthy”, i.e. with a valid, updated antivirus installed

8. Information Classification Policy

This section covers a framework for classification and the use of information according to importance and task. Under Information classification policy there can be policy definitions such as-

- Information in the Organization is classified according to its security impact. The current categories are: confidential, sensitive, shareable, public and private.
- Information defined as confidential has the highest level of security. Only a limited number of persons must have access to it. Management, access and responsibilities for confidential information must be handled with special procedures defined by Information Security Management.
- Information defined as sensitive must be handled by a greater number of persons. It is needed for the daily performing of jobs duties, but should not be shared outside of the scope needed for the performing of the related function.

- Information defined as shareable can be shared outside of the limits of the Organization, for those clients, organizations, regulators, etc. who acquire or should get access to it.
- Information defined as public can be shared as public records, e.g. content published in the company's public Web Site.
- Information deemed as private belongs to individuals who are responsible for the maintenance and backup.
- Information is classified jointly by the Information Security Officer and the Information Owner.

9. Remote Access Policy

This section covers a security policy for remote access to the organization's resources. Under Remote Access policy there can be policy definitions such as-

- To gaining access to the internal resources from remote locations, users must have the required authorization. Remote access for an employee, external user or partner can be requested only by the Manager responsible for the information and granted by Access Management.
- Only secure channels with mutual authentication between server and clients must be available for remote access. Both server and clients must receive mutually trusted certificates.
- Remote access to confidential information should not be allowed. Exception to this rule may only be authorized in cases where is strictly needed.
- Users must not connect from public computers unless the access is for viewing public content.

10. Outsourcing Policy

This section covers a security policy for outsourcing IT services, functions and processes. Under outsourcing policy there can be policy definitions such as-

- Before outsourcing any service, function or process, a careful strategy must be followed to evaluate the risk and financial implications.
- Whenever possible, a bidding process should be followed to select between several service providers.
- In any case, the service provider should be selected after evaluating their reputation, experience in the type of service to be provided, offers and warranties.
- Audits should be planned in advance to evaluate the performance of the service provider before and during the provision of the outsourced service, function or process. If the Organization has not enough knowledge and resources, a specialized company should be hired to do the auditing.
- A service contract and defined service levels must be agreed between the Organization and the service provider.
- The service provider must get authorization from the Organization if it intends to hire a third party to support the outsourced service, function or process.

11. Network Policy

This section covers a security policy for network. The policy will contain other policy documents related to the network such as-

- Router and switch security policy
- Wireless communication policy
- Wireless communication standard

12. Server Security Policy

This section covers a security policy for servers. The policy will contain other policy documents related to the network such as-

- Database credential policy
- Information logging standard
- Server Security policy
- Workstation policy
- Lab security policy
- Technology equipment disposal policy

13. Application security Policy

<This section covers a security policy related to the application>. Under application security policy there can be policy definitions such as-

- Web applications are subject to security assessments based on the following criteria:
  a) New or Major Application Release – will be subject to a full assessment prior to approval of the change control documentation and/or release into the live environment.
  b) Third Party or Acquired Web Application – will be subject to full assessment after which it will be bound to policy requirements.
  c) Point Releases – will be subject to an appropriate assessment level based on the risk of the changes in the application functionality and/or architecture.
  d) Patch Releases – will be subject to an appropriate assessment level based on the risk of the changes to the application functionality and/or architecture.
  e) Emergency Releases – An emergency release will be allowed to forgo security assessments and carry the assumed risk until such time that a proper assessment can be carried out. Emergency releases will be designated as such by the Chief Information Officer or an appropriate manager who has been delegated this authority.

- All security issues that are discovered during assessments must be mitigated based upon the following risk levels. The Risk Levels are based on the OWASP Risk Rating Methodology. Remediation validation testing will be required to validate fix and/or mitigation strategies for any discovered issues of Medium risk level or greater.
  a) High – Any high risk issue must be fixed immediately or other mitigation strategies must be put in place to limit exposure before deployment. Applications with high risk issues are subject to being taken off-line or denied release into the live environment.
  b) Medium – Medium risk issues should be reviewed to determine what is required to mitigate and scheduled accordingly. Applications

with medium risk issues may be taken off-line or denied release into the live environment based on the number of issues and if multiple issues increase the risk to an unacceptable level. Issues should be fixed in a patch/point release unless other mitigation strategies will limit exposure.

c) Low – Issue should be reviewed to determine what is required to correct the issue and scheduled accordingly.

- The approved web application tools for development are-
  <Tool 1>

  <Tool 2>

  14. Annexures –

  Note that each of the policy chapters or sections should have below subsections.

  • Purpose

  • Scope

  • Policy Definitions

  The template given here is the bare minimum fields. Each of the sections on policies covered in this template may have a detailed policy document.

8.1.11 Heat Map Template

Service	Citizen Friendliness	SLA definition	Inter-departmental interaction	Notifications	Security	KPIs	Automated / Partially Automated / Manual
Property Valuation							
Stamp Duty & Fee Calculation							
Stamp Duty & Fee Payment							
Registry Office Appointment Scheduling							
Document Registration							
Encumbrance Certificate							

Legend	Description
	Low Gap
	Medium Gap
	High Gap

8.1.12 Departmental Stakeholders and their responsibilities

Departmental Roles / Stakeholders	Responsibilities
Inspector General of Registration	• Superintendence and control over the department. • Appellate authority under section 47A(5) and 56(1) of the Stamp Act. • Chairman of the Central Guideline Value Fixation Committee
Additional Inspector General of Registration (Stamps & Registration)	• Assists the IGR to take decisions in the matters regarding the Registration Act, Stamp Act, and CCRA cases under section 56(1) of the Stamp Act.
Deputy Inspector General of Registration	• In charge of achieving the revenue target within the zone. • Superintendence and control over the zone. • Conduct annual inspections in Sub Registrar Offices and District Registrar Offices. • Acting as a chairman in Departmental Audit Committee. • In charge of preparing the basic Guideline Registers and submit it to approval of District Guideline Valuation Committee.
Sub Registrar	• Register the documents relating to movable and immovable properties within the limits of his jurisdiction. • Issues the certified copies and encumbrance certificates to the registering public.

8.1.13 DRS Maturity Tool

MaturityTool.xlsx

8.1.14 Endnotes

[i] Department of Land Resources, Website: http://dolr.gov.in/

[ii] Digital India Land Records Modernization Programme, Website: http://dilrmp.nic.in/

[iii] The Open Group Architecture Framework (TOGAF) Management Overview, Website: http://pubs.opengroup.org/architecture/togaf9-doc/arch/

[iv] [Part I] IndEA Framework, Website: http://egovstandards.gov.in/sites/default/files/India%20Enterprise%20Architecture%20Framework%20Ver.%201.1.pdf

[Part II] IndEA Adoption Guide, Website: http://egovstandards.gov.in/sites/default/files/IndEA%20Adoption%20Guide%20A%20Method%20Based%20Approach%20Ver.1.1.pdf

[v] Registration Act 1908, Website: https://indiacode.nic.in/acts/7.%20Registration%20Act,%201908.pdf