

... for ONE Government



IndEA QSG

(India Enterprise Architecture Quick Start Guide)

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About the Document

Background

The Central Government constituted a Working Group that came up with a holistic framework named India Enterprise Architecture (IndEA) Framework for streamlining, standardizing, and optimizing the e-Governance efforts across the country. It serves as a common framework to address the much-needed interoperability and integration between government bodies at all levels. This document is a Quick Start Guide (QSG) that central ministries, state governments, departments and public sector agencies can refer to understand how Enterprise Architecture can help in a structured Digital transformation journey.

Scope & Purpose

This guide covers the following:

- Briefly explains the necessity for government-wide transformation;
- Briefly explains government enterprise architecture and its relevance to India's e-governance initiatives;
- Summarizes IndEA, elaborating on architecture models for executing EA initiative;
- Provides guidance on how to best plan and manage an EA initiative covering the key activities required across various phases of an EA journey;
- Summarizes pioneering enterprise architecture initiatives in the government and public sector, to help set the context and provide insights into some practical examples; and
- Provides further information about setting up an EA organization and strengthening the EA capability in government and public sector entities.

Related documents

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

- Part 1: India Enterprise Architecture Framework.
- Part 2: IndEA Adoption Guide – A Method Based Approach

Intended Audience

This guide is primarily intended for the following roles / groups:

- Government officers at the level of Secretaries, Additional Secretaries, and Joint Secretaries the Ministries and State Governments who intend to undertake enterprise architecture initiatives;
- Directors (eGovernance) and Heads (SeMT) who have been tasked to oversee and guide enterprise architecture initiatives to augment their understanding and promote active commitment;
- Other Government Leaders, Chief Architects, Analysts and Designers seeking faster initiation to IndEA, and sensitize themselves appropriately; and
- Electronic government professionals involved in organizational technology strategic planning, technology procurement, management of technology projects, consulting and advising on technology issues and management of total cost of ownership.

1. Why is Government (wide) Transformation Required?

Governance in India has unique challenges owing to its size and diversity. High population growth over the previous decade has left resources immensely pressurized, with every citizen aspiring for a better future and enhanced quality of life. To meet these aspirations today, India needs a “broad-based economic growth” and efficient public services delivery. Over the years, as the role of government has evolved from a ‘controller’ to a ‘coordinator’, it needs to deliver on its development agenda amidst incredibly complex challenges/ opportunities.

To meet these objectives, a number of lighthouse digital initiatives have been rolled out but many are yet to be initiated. For effective realization of long-term goals, these initiatives need to be aligned at the level of the underlying principles to ensure that the solutions are sustainable, scalable and replicable. The planning of all such initiatives need to consider three dimensions:

1. Demands of today’s citizen to meet self-expectations
2. Needs to the Government to enable effective eGovernance
3. Factors that influence the enablement and assessment of a successful initiative

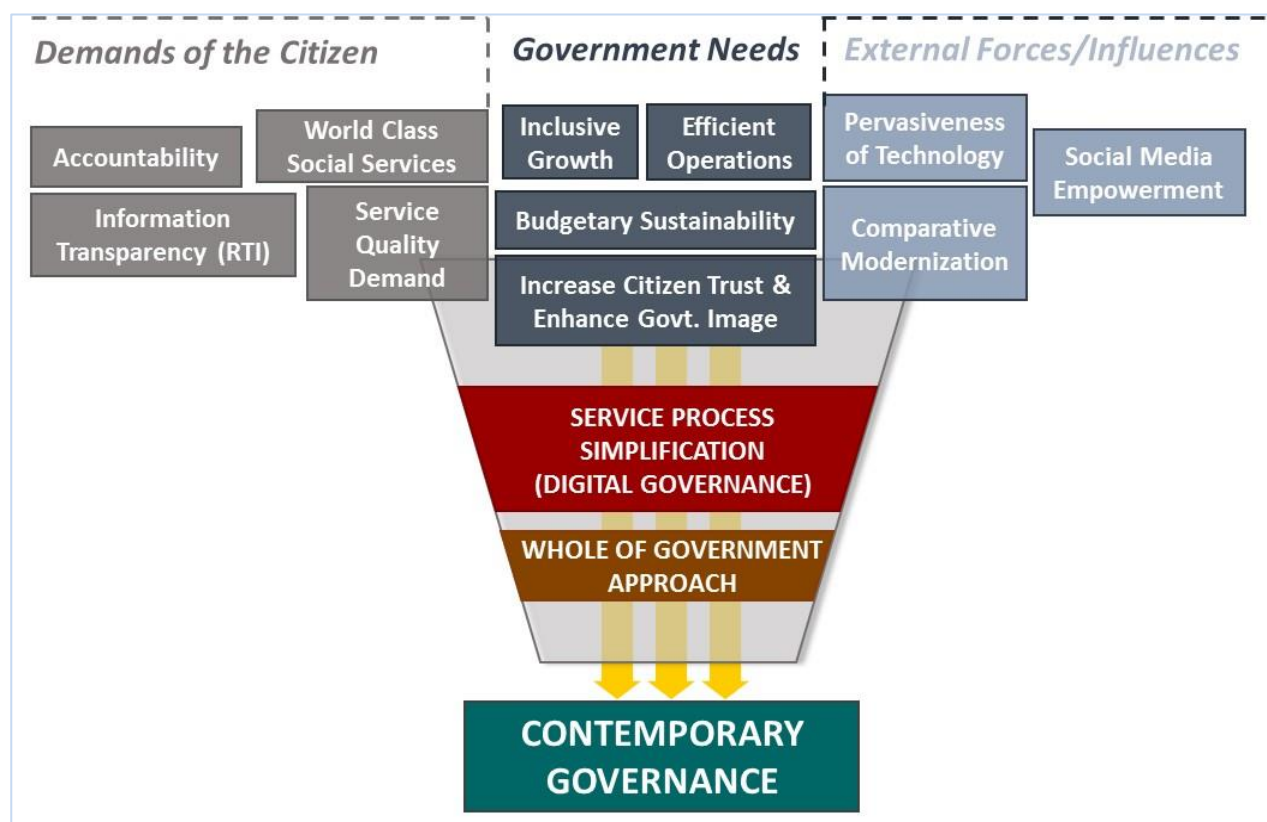


FIGURE 1: TRENDS SHAPING GOVERNANCE IN THE CURRENT TIMES

Figure 1 depicts the key points to be considered from the above mentioned three dimensions and the approach to deliver simplified and unified services to the citizens. The alignment of all citizen services delivered by Government bodies at any level will define the roadmap towards contemporary governance.

1.1. Digital Transformation Needs

In the years since Independence, even though India has steadily progressed in uplifting the lives of millions of people, a large population of the country still remains devoid of basic social welfare. Now, India needs a transformation to leapfrog in the way public services are delivered. Digital transformation gives India the opportunity to make a swift and substantial progress across all regions by raising productivity, efficiency, and innovation. The need for this transformation is driven primarily by three factors.

(i) Today's citizen has become a demanding Customer

Citizen Awareness has been a very potent force for change in governance. With more and more private sector organizations delivering parallel services, citizens now have higher expectations of service quality from public agencies. Travel across borders and access to information, has provided citizens the global lens to compare service delivery maturity across countries. Further, right to information has opened government activities to their scrutiny. The citizen today expects that taxpayer money is utilized prudently to deliver best quality public services.

Social media has empowered them with a platform for voicing their grievances and opinions. They have imbibed social interfaces as the user interface giving them the power somewhat similar to media. Mediums like Twitter and Facebook have become direct channel for opinions, inquiries and grievance statuses for public services along with the ability to connect directly to leaders at all levels.

(ii) Needs of the Government

The government handles enormous pressures of spurring growth, meeting citizen expectations while also sustaining citizen trust in it. To counter the popular criticism of public agencies being bureaucratic and slow in action, they are adopting social media to create a brand for their programs and embed citizen participation in their transformation journey.

Another enduring challenge for the government is to deliver the intended outcomes in minimal time and defined budget. It needs to ensure the accessibility, availability, quality, and affordability of services to all segments of the population because unless growth is not planned to be achieved inclusively, it will not be sustainable.

External Forces/Influences

Today, governments across the world are competing on various indices like Ease of Doing Business, ICT Development, Global competitiveness, Global innovation etc. There is intense competition for foreign investment making it imperative for government organizations to adopt a holistic approach in their service delivery processes for both, citizens and businesses.

Technology disruption in the recent years completely transformed the service delivery mechanisms across the globe. The Digital Revolution through convergence of SMAC (Social, Mobile, Analytics & Cloud), has taken service delivery to "Anytime-Anywhere" model. Social media has provided for self-expression and rapid formation of networks across regional boundaries and cultures. Emerging technologies are finding their best use cases to improve governance in the current times. Smart cities across the world are getting operationalized through IOT and many countries are actively exploring technologies like Blockchain to make service delivery accurate.

While all these forces of change seem like challenges, there is an opportunity in them to drive excellence in governance.

1.2. Planning the Digital Transformation Journey

One Citizen – One Government

The Indian Government structure is quasi-federal. The distribution of power is provided in the Constitution through the Union, State and the Concurrent list to allow state and regional governments to deliver locally preferred services more efficiently (Figure 2). While the idea was to increase efficiency, instead, it has led to the scenario of 'one citizen-multiple governments'. Digitization of services in local ecosystem of departments has led to creation of various siloed solutions accessible through independent channels. Even policy processes are fragmented over several administrative agencies. Departments are not able to interoperate, re-use investments and provide a seamless and unified experience to Citizen.

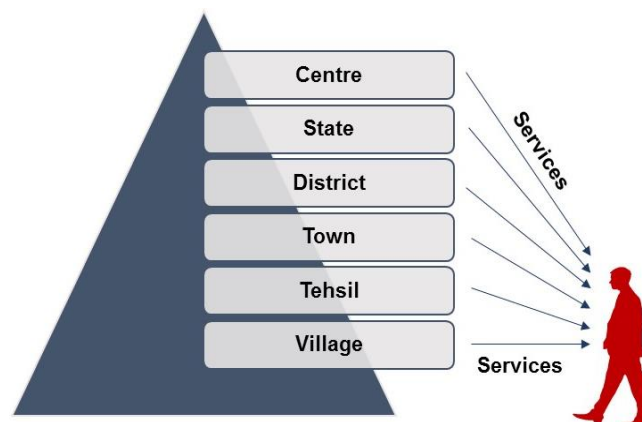


FIGURE 2: SERVICE DELIVERY TO CITIZENS FROM MULTIPLE SILO'ED CHANNELS OF GOVERNMENT AT DIFFERENT LEVELS

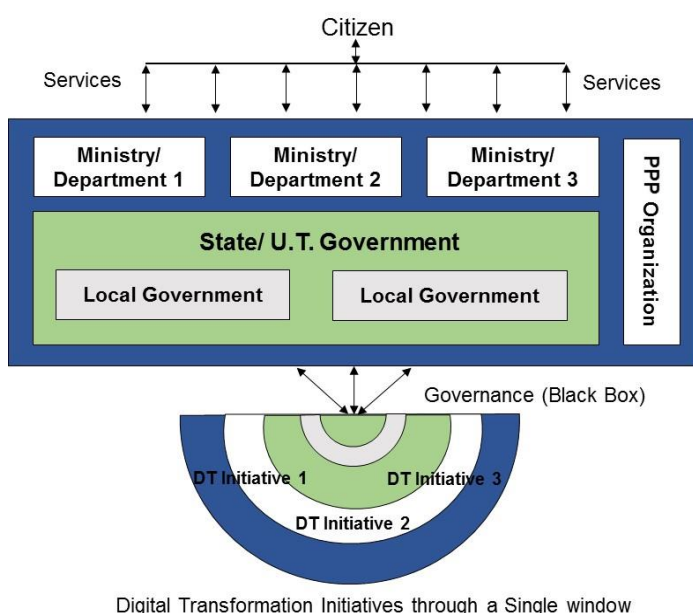


FIGURE 3: GOVERNANCE AS A BLACK BOX FOR THE CITIZEN

To deliver broad, complex services efficiently, effectively and equitably, it is imperative for the government to explore new sustainable models for service delivery – models that can significantly improve the beneficiary experience and intended outcomes through enhanced service levels at reduced cost.

In a digitally mature government, governance should be like a black box where in the citizen should state its expectations and receive services in return. The services could be delivered by a central ministry/department, a state government department, a local government agency a semi private organization fulfilling a governance initiative.

This can be achieved through single window driven digital transformation initiatives that operate across all levels of government, and are interoperable with each other (Figure 3). Interoperability and reusability can ensure effective coordination between

departments and allow government to offer new, integrated products and services, consolidate operations or properly measuring outcomes.

A strategy for this is the implementation of enterprise architecture program in government through whole-of-government approach. Enterprise Architecture ensures full articulation of all levels of an enterprise, integrating the strategic and business processes with the information (data) and technology that enables them.

Whole of Government Approach

The concept of 'whole of government' has been described as an overarching term for a group of responses to the problem of increased fragmentation of the public sector and public services and a wish to increase integration, coordination and capacity (Ling, 2002)¹.

The rationale for **whole of government (W-O-G) approach** is to eliminate 'silos', or departments working in isolation from one another, and achieve a seamless government. It optimizes the impact of government policies by using all the instruments at the disposal of the State in an integrated way.

A key benefit of a whole of government approach is the capacity to apply the combined resources for a national goal that requires acting preventatively and pro-emptively. It helps in dealing with problems proactively before they become too acute. Preventive initiatives like health promotion can benefit from the W-O-G approach involving multiple agencies and stakeholders.

Several countries have engaged successfully in whole of government work over many years. Countries like **Republic of Korea** and **Singapore** have emerged as top performers in the UN e-Government Survey of 2012.

(Annexure I). Figure 4 shows the key benefits of W-O-G approach.

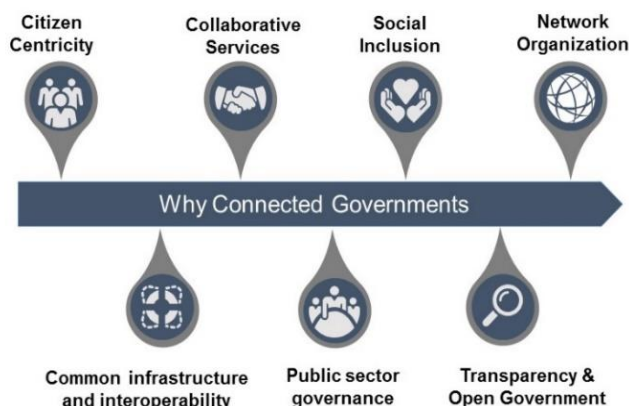


FIGURE 4: BENEFITS OF W-O-G APPROACH

The Vision for India – “Nation as a Digital Enterprise”

The W-O-G approach should be embedded in the various digital transformation initiatives to move towards one citizen - one government vision and build India as a Digital Enterprise. Enterprise Architecture led Digital Transformation can help realize this vision and deliver benefits to government as well as citizens.

A citizen accesses a Single Window delivery platform from multiple channels for anytime-anywhere access to all government information and services available 24x7 and grievance redressal which increases his trust in government (Figure 5). The Government provides a Single point access for all operational activities, Multi-departmental dashboards from all ministries and departments, fully governed futuristic multi system integrated platform driven by EA principles leading to enhanced Government Image. W-O-G led Enterprise Architecture has proven to be successful in achieving this vision across various governments and complex private institutions across the globe (Annexure I)



FIGURE 5: NATION AS A DIGITAL ENTERPRISE

¹ A Primer on Implementing Whole of Government Approaches, Anne Colgan, Lisa Ann Kennedy and Nuala Doherty, Centre for Effective Services

2. Government Enterprise Architecture

Enterprise Architecture is relevant to Government because Government is an ‘Enterprise of Enterprises’. EA enables a systematic and holistic development of a portfolio of e-Governance projects to provide integrated services to the stakeholders. To accomplish this objective, it is imperative to understand the significance of the term “Enterprise Architecture” and the benefits derived from it.

2.1. Enterprise Architecture

Enterprise Architecture is a combination of terms - Enterprise and Architecture (Figure 6), wherein:

- An **Enterprise** defines a collection of organizations (including partners, suppliers, and customers) that have common set of goals.
- **Architecture** lays down the fundamental organization of a system, embodied in its components, their relationships to each other and environment and principles governing its design and evolution.

Enterprise Architecture is 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.

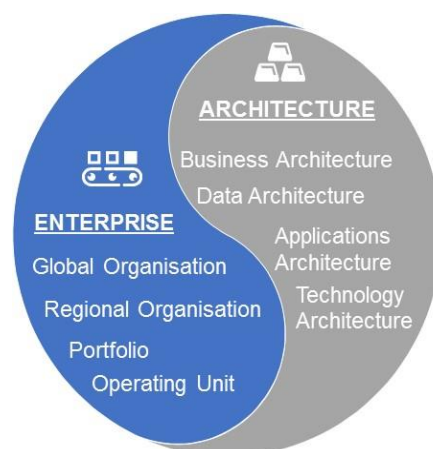
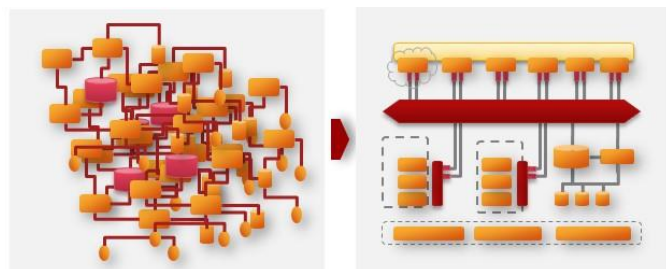


FIGURE 6: DEFINING ENTERPRISE ARCHITECTURE



Without EA: Fragmented, Point-Point, Inflexible, Fragile

With EA: Structured, Scalable, Flexible, Agile

It is the organizing logic for business processes and IT Infrastructure that reflects the integration and standardization requirements of the enterprise's operating model. The strongest driver for EA is to bring the ease in service delivery and enhance overall performance of the business segments. The real value of Enterprise Architecture is not in making better architecture, it is in making a better enterprise.

2.2. Enterprise Levels in Government

Institutions within and across various levels of government have singular agendas and because of which complex mixture of cooperation and conflict exists, with multifaceted goal structures. Therefore, in the context of government, “enterprise” can have many versions.

EA typically defines an enterprise as the planning and management of IT processes and services being conducted in a single organization- which can be small companies or large enterprises. The different EA levels- Strategic, Segment and Capability- can be organized in accordance with the National, State and Institutional level, wherein the three levels of EA could be defined. This operating model is depicted in Figure 7.



FIGURE 7: LEVELS OF ENTERPRISE IN THE GOVERNMENT

For such a case, management of technologies in public institution, such as Passport Seva Portal for the Consular and Visa Division of Ministry of External Affairs, at all levels constitutes “an enterprise” on their own. But the same institutions at the same time, can be a part of other enterprises at higher levels in government. Just as, all government enterprises (Ministry of External Affairs) are part of the overall national enterprise (Government of India).

EA can be induced from either a Top-down approach or Bottom-up approach to view the vision, operational priorities and future roadmap for an enterprise. In India as well, EA is happening at various government levels institutions. Some are following the principles of enterprise architecture for operationalizing the digital strategy (Figure 8) (Details in the Annexure II).

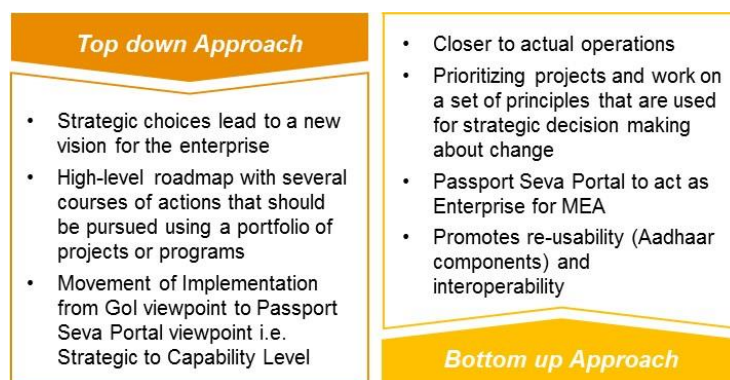
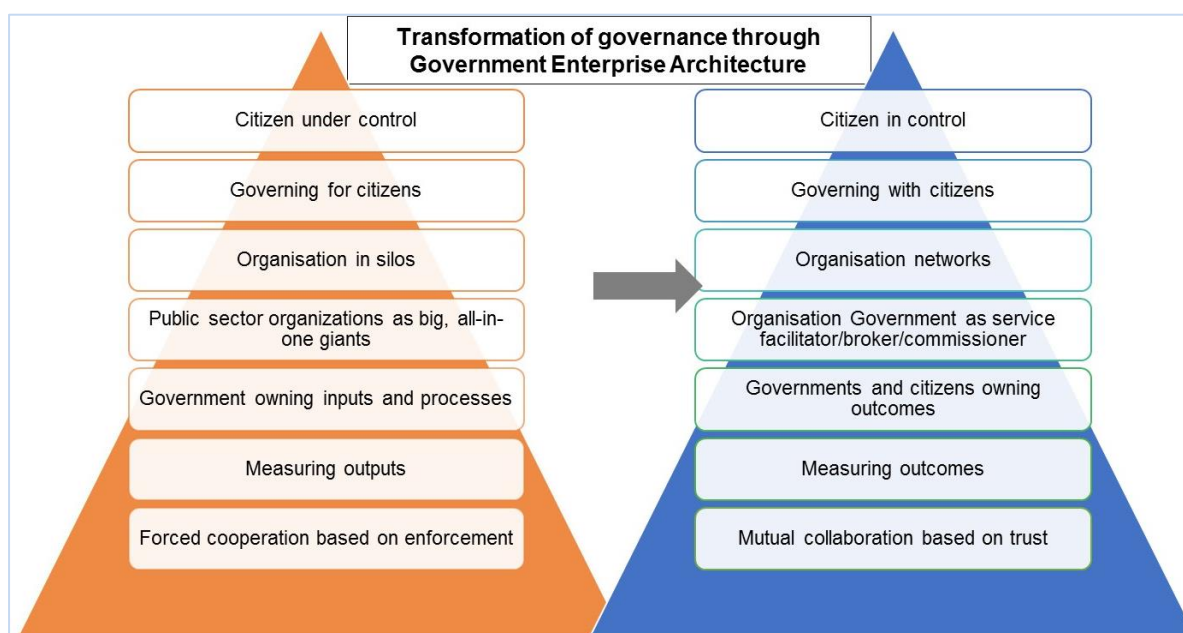


FIGURE 8: EA CAN BE DEDUCED AT TWO LEVELS WITHIN THE GOVERNMENT

2.3. Government EA Enables the Government Transformation Journey

EA for Governments is a Journey, not a project. It offers the leap from traditional to a modern approach where the citizen is central to all its efforts and creates a culture of citizen participation in governance. It breaks the silos to create a network of agencies where outcomes are measured instead of outputs.



GEA reforms the role of government from controlling public sector institutions to a service facilitator; and shifts the culture of governance from cooperation through enforcement laws to mutual collaboration. It sets out the case for a fundamental shift in public services to ‘minimum government, maximum governance’. Figure 9 lists the benefits of GEA, both to citizens and businesses (consumers) and governments (providers).

Benefits of GEA

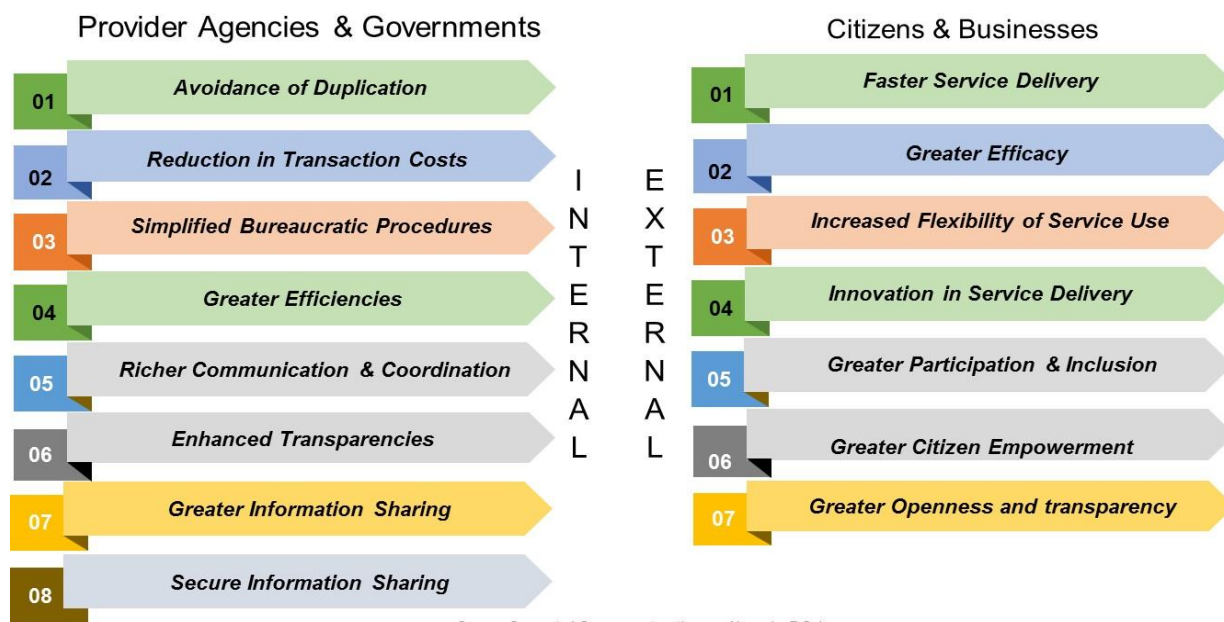


FIGURE 9: BENEFITS OF GEA FOR THE GOVERNMENT AND CITIZENS

GEA serves as an umbrella for explaining the relationships among the projects and managing change and can increase the potential for cross-public sector reuse, reduce duplication and hence reduce costs. It creates an ecosystem of richer communication and coordination between agencies, empowers citizens with greater awareness of public sector functioning and thus greater participation in governance. A number of countries in the Asian subcontinent like Bangladesh, Bhutan and Malaysia have formally adopted the GEA methodology to reform the nature of their governance (Annexure I).

Why GEA now in India?

E-Governance has acquired a new momentum in India. The progress of Digital India program and emphasis on adoption of Aadhaar in the various welfare schemes has created the expediency for painting the big picture of e-Governance and deriving the maximum out of this soft infrastructure. The need for adopting a holistic approach in the domain of e-Governance has become evident to deal with the interoperability issues within and across multiple clusters of stand-alone applications developed by the States and Central Ministries over the last decade. A brief of the e-Governance initiatives in India are available in the Annexure III.

IndEA to accelerate the EA journey

The above factors present an opportune time for the Indian Governance ecosystem to identify the enterprise and initiate the EA journey. To augment the same, the Central Government has published a holistic framework, named IndEA, for streamlining, standardizing, and optimizing the e-Governance efforts, to speed up the EA transformation journey of an enterprise. It has been leveraged from established international frameworks and customized by the IndEA Working Group for India. It treats the Government as a single enterprise or more realistically, its services as an Enterprise of Enterprises, which are functionally inter-related.

3. Brief Introduction to IndEA

Digital India (DI), the flagship programme envisioned under Government of India for the transformation of the country to a digitally empowered society and knowledge economy, has mandated ICT to be the core element for the expansion of Indian landscape from economic, political and social point of view. Some of the marquee initiatives are the foundational India Stack, GSTN to usher uniform tax policy, service aggregator app UMANG and multiple sectoral initiatives (Annexure III). Open Standards and Digital Service Standards have streamlined the ICT infrastructure and also brought in a complete reformation process for the government sector, with Enterprise Architecture as the driving force.

Goods & Service Tax (GST), established on the concept of single Tax policy by abolishing central and state taxes, is a pertinent representation of leveraging EA to introduce a singular, unified and integrated approach in governance. Such initiatives and ever-changing demands of citizens/beneficiaries have led to the development of IndEA, based on TOGAF, that promises *“to establish best-in-class architectural governance, processes and practices with optimal utilization of ICT infrastructure and applications to offer ONE Government experience to the citizens and business”*. The envisaged benefits of IndEA are shown in Figure 10.

IndEA framework is a structured combination of eight 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, through ICT enabled infrastructure. An advantage of IndEA is that it has a Performance Architecture to help find the return on investment on a transformation initiative by elaborating a set of KPIs designed rationally to measure the outputs and outcomes of the various programs, schemes, projects and activities. 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. The target is to provide citizens an ecosystem of Connected Government that works for inclusive development and brings cost effectiveness through use of shared infrastructure and services.



FIGURE 10: BENEFITS OF INDEA FRAMEWORK

3.1. Vision of IndEA

The inconsistency in maturity levels with respect to architecture driven approach for digital governance stimulated the need for IndEA. The primary requirement was to assist various government organizations such as ministries, state governments and departments to adopt a structured and formalized approach in developing their Enterprise Architecture. IndEA bridges this need by providing with a long-term vision for ONE Government Experience. In the short and medium-term, however, it seeks to enable the Central Ministries, States / Union Territories, State Departments, Zilla/District/Gram Panchayats, and large PSUs to establish a better governance through a concerted approach for implementing the Enterprise Architecture. Figure 11 highlights the major benefits sought to be given to the stakeholders and the methods required to be adopted in the areas of People, Process and Technology, to achieve the end goals.

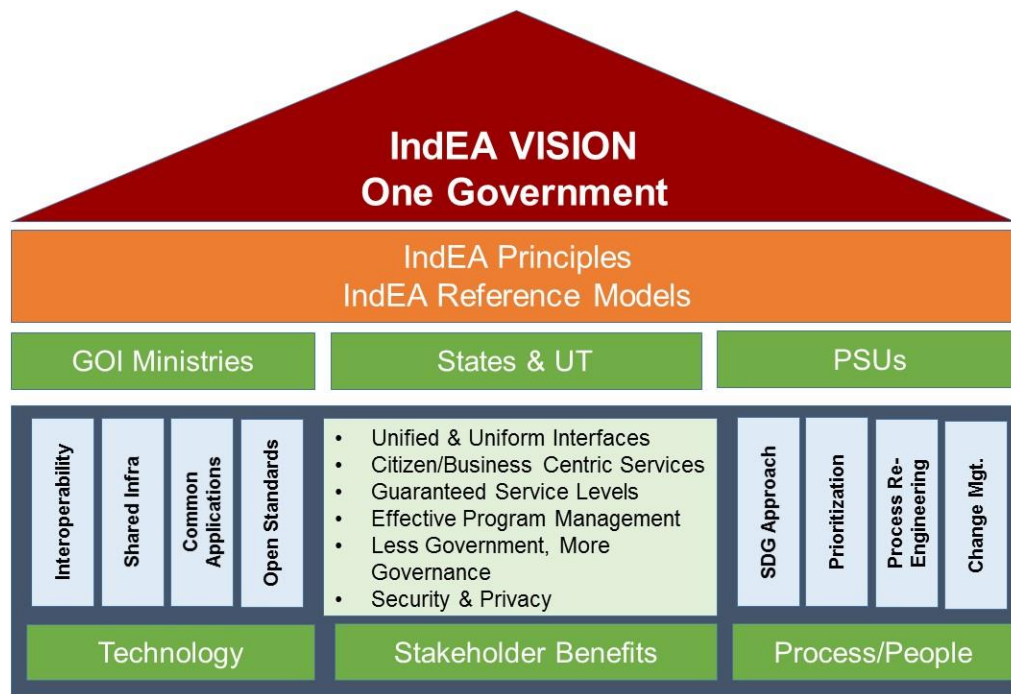


FIGURE 11: VISION OF INDEA

Objectives of IndEA framework

IndEA Reference models document the best practices for solutions delivery teams to make effective design and technology choices. The purpose of the reference models is to increase adoption of standards, speed up service design and delivery, and advance towards the target state architecture. They aim at:

- Documenting and sharing explicit and implicit architecture best practices;
- Providing guidance in the development of enterprise architectures;
- Capturing key elements of architecture and inter-relationships between them;
- Providing the means for architecture governance by enabling an audit process; and
- Enabling adoption of standards based on common understanding.

3.2. IndEA Structure

IndEA is a stepping stone for Government organizations to design and develop Enterprise Architecture. It is a framework, wherein it retains itself at the level of Reference Models and does not deep dive into domain specific architectural and implementation details.

Description on Reference Models

A Reference Model is an **abstract representation of the entities relevant to a domain of the Enterprise Architecture, the inter-relationships among those and the standards to be followed**. The representation for the Reference Model can be both **graphical (Archimate notation)** and **descriptive (defining capabilities for each of the components)**. Each reference model consists of list of standards that govern the entities, their relationships and the manner in which communications happen among the entities. All the Reference Models comprising IndEA are

technology-agnostic and desist of details specific to their implementation. They are driven by **three key features** that has allowed for wide adoption (Figure 12).

- a. **Abstraction**, signifies a high-level summarization or generalization of complex or detailed content;
- b. **Standards Base**, describes the database of set industry standards these reference models follow; and
- c. **Technology neutrality**, elucidates independence from specific technology and implementation across varied technologies

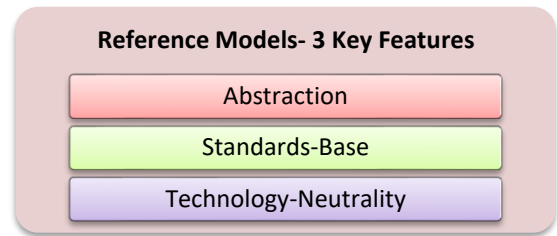


FIGURE 12: THREE KEY FEATURES OF REFERENCE MODELS

3.3. Principles of IndEA

IndEA is based on two set of Principles that inform and guide the Architecture Development process:

- **Enterprise Principles** provide the basis for high-level decision-making for fulfilling the organizational goals and mission. Enterprise Principles relate to the functions in the domains of Performance, Business and Architecture Governance.
- **Architecture Principles** derived from the Enterprise Principles, govern the process of development, maintenance and use of the Enterprise Architecture. Architecture Principles relate to the domains of Application, Data, Technology, Security and Integration.

These principles satisfy the five criterions of design - **Understandable, Robust, Complete, Consistent and Stable**.

IndEA framework, was designed on the following key mantras that would constitute the core theme of the framework (Figure 13):

1. **Citizen Centricity**, which insists that neither the product nor its technology, but the citizens have to be the core of the design strategy;
2. **Outcome Focus**, outcome oriented based on clear and measurable agreements;
3. **Standardization**, bringing in consensus of multiple parties involved in implementation and development;
4. **Reusability**, promoting maximum usage of existing assets within the organization; and
5. **Integration**, endorsing IndEA ability to be vendor neutral and easy assimilation across different environments.

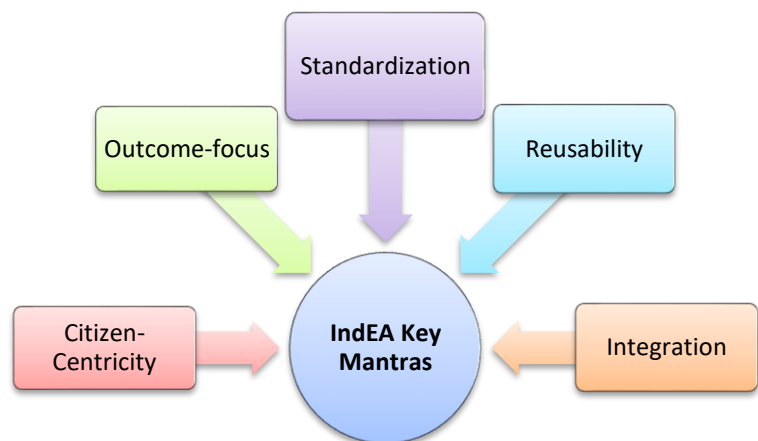


FIGURE 13: INDEA KEY THRUST AREAS

The above core themes laid the principles for each Reference Model under IndEA. All the Reference Models must conform to the standards laid down by the Enterprise Architecture, keeping the enterprise requirements above the domain compulsions (Figure 14).

IndEA Quick Start Guide

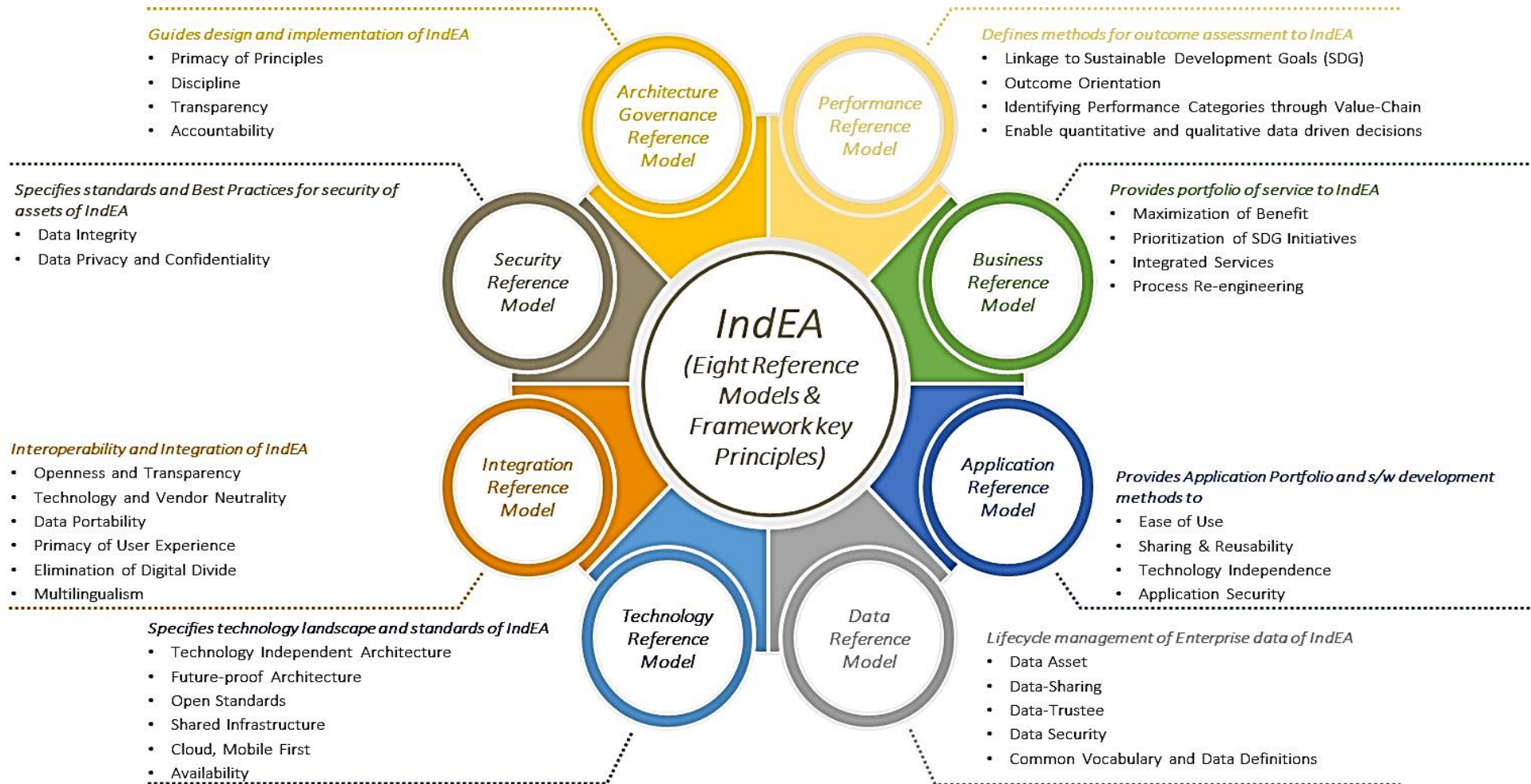


FIGURE 14: INDEA EIGHT REFERENCE MODELS AND FRAMEWORK PRINCIPLES

3.4. IndEA Reference Models – Executive Brief

TABLE 1: EIGHT REFERENCE MODELS OF INDEA

Reference Model	Description	Key Objectives	Features	Expected Benefits
Performance Reference Model (PRM)	Delivers a consistent mechanism for measuring the efficiency and effectiveness of various sectors for achieving the overall goals of the Government	<ul style="list-style-type: none"> Creating a framework for defining a set of consistent, sustainable, integrated and self-policing KPIs Developing an outcome-oriented Performance Management system along multiple dimensions such as Business, Citizens, Process and Technology 	<p>Three stages have been defined</p> <ul style="list-style-type: none"> Define (Identification of Goals & Definition of KPIs) Measure (Assigning Targets against each KPI & Progress Measurement) Analyze (Variations between actual & target outputs and providing feedback) 	<ul style="list-style-type: none"> Cost Savings Standardization & Reuse Effectiveness in Planning & Coordination
Business Reference Model (BRM)	Focuses on the business vision and on the requisite services/functions for fulfilling this vision and not on the technologies required to be used.	<ul style="list-style-type: none"> Delineate Scope of EA Identify broad parameters requiring process-re-engineering Identify broad parameters for performance assessment Redesign organization structure Role-Responsibility Matrix 	<p>Three major parts</p> <ul style="list-style-type: none"> Framework for Goal Setting Framework for organization restructure Service Framework for defining, transforming, delivering & measuring services <p>Service Portfolio, Citizen/Business-centricity, Service Prioritization and Integration – Essential Components. Sixteen vertical domains and Twelve horizontal functions were identified for representing of the Government</p>	<ul style="list-style-type: none"> Defining Business Landscape of EA, useful for scope definition of EA initiative Business Process Re-engineering, useful in service transformation for creating a better Government Realization of ONE GOVERNMENT

Reference Model	Description	Key Objectives	Features	Expected Benefits
Data Reference Model (DRM)	Delivers a model to consistently define the data in data architecture. Using this reference model, the data architects can arrive at a comprehensive Data Architecture	<ul style="list-style-type: none"> • Discovery, Access and Sharing of data among internal and external stakeholders • Nomination of data stewards • Identification of Security and Technical requirements for data assets • Development of shared vocabularies and adoption of notified standards 	<p>Key Focus areas for DRM are:</p> <ul style="list-style-type: none"> • Data Description (Semantics and Syntactic structure of the data assets) • Data Context (Information on data assets, data steward, relation to business architecture) • Data Sharing (How data can be accessed and exchanged) • Data Security • Data Governance 	<ul style="list-style-type: none"> • Increased Inter-operability • Reduction in incompatible systems • Focus on security and technical aspects of data elements • Increased Data Discovery
Application Reference Model (ARM)	Provides the framework for grouping similar applications, leading to maximum reuse. The inner-most layer of the 4 layers of ARM is the IndEA Core Platform (domain-agnostic, application-agnostic and technology-agnostic).	<ul style="list-style-type: none"> • Bridge between BRM and TRM • Identification of re-use applications & components • Provision of effective and integrated services • Defining building blocks for high level Application Architecture 	<p>Key Components of ARM</p> <ul style="list-style-type: none"> • Application • Application Type (Core, Common, Group, Department) • Application Function • Application Service • Interoperability layer • Application Portfolio 	<ul style="list-style-type: none"> • Effective software development • Enhances re-usability and sharing of application components by mapping commonality of functions • Technology Independence because of promotion of usage of open standards
Technology Reference Model (TRM)	Depicts the layout of technology foundation of ICT based systems. TRM defines the currently applicable open standards for all the solution building blocks and components and identifies the Open	<ul style="list-style-type: none"> • Promoting Open Source Products • Open API Gateway • Virtualization of Services on Cloud • A hybrid orchestration model for Microservices based on ROA and Integrated Services based on SOA 	<p>TRM components</p> <ul style="list-style-type: none"> • IT Infrastructure • Applications • Access Devices • Communication Systems • Service Delivery modes 	<ul style="list-style-type: none"> • Technology Neutrality • Shared Infrastructure • Cloud and Mobile First Approach • 24x7 availability of applications • Homogeneity of platforms and technologies

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Reference Model	Description	Key Objectives	Features	Expected Benefits
	Source Products for each technology component.	<ul style="list-style-type: none"> Highly Interoperable & Scalable Services 		<ul style="list-style-type: none"> Continuous evaluation of technologies & standards
Integration Reference Model (IRM)	While other reference models cover aspects important to building blocks, integration reference model puts the perspective that keeps them together and relevant	<ul style="list-style-type: none"> All technology options for integration Cashless, Paperless and Faceless public services Fostering cross-organizational and cross-sectoral interoperability 	IRM Consists of six layers <ul style="list-style-type: none"> Performance Process Service Application Data Infrastructure 	<ul style="list-style-type: none"> Seamless service experience Availability of multiple delivery channels Re-use of business, data, technology services Boundary-less information flow
Security Reference Model (SRM)	Framework for developing comprehensive method of describing current and future information security systems to align with business strategies	<ul style="list-style-type: none"> Provide structure to the design of security policies & considerations Assessment of security risks & threats to information assets Identify security requirements and approach to address them 	SRM has namely six layers <ul style="list-style-type: none"> Business, Data, Application, Perimeter, Network, End Point Other important aspects designing Security Policies & Operating Procedures Framework for selection of Security Controls 	<ul style="list-style-type: none"> Integrity Privacy Confidentiality
Governance Reference Model (GRM)	Guides in establishing institutional structure for the development, management and maintenance of EA and its artifacts	<ul style="list-style-type: none"> Manage and Maintain architecture requirements & artifacts Architecture consistency with Business vision & objectives 	Three tier governance structure <ul style="list-style-type: none"> Political, Executive, Technology Establishing 2 entities Architecture Governance Board IT Governance Board 	<ul style="list-style-type: none"> Quick decision making Clarity in roles responsibilities Promotes architecture thinking in Government Compliance culture

3.5. IndEA Implementation Approach

To achieve the vision of ONE Government, meticulous planning and risk mitigation is required to reap maximum benefits from IndEA (Figure 15). Government EA follows a multi-level approach to account for different layers of government bodies. Business services should be analyzed for inter-departmental linkages, and automation/digitization and infrastructure requirements. Different viewpoints should be linked to ensure a 360-degree view of the citizens and businesses. Service design must be citizen centered (i.e. services are anchored on key stakeholders – citizen, farmer, student, land owner, senior citizen, beneficiary). Service delivery is to be supported by deep collaboration between departments in terms of information flow, application interaction and common infrastructures. State governments and other government entities are advised to traverse the phases of the ADM in a structured manner.

FIGURE 15: STEPS TO ADOPTING INDIA BY GOVERNMENT ENTITIES

1. Capability Assessment

- **People Dimension-** Existence of an overarching political desire and an executive capacity to undertake EA journey
- **Process Dimension-** Readiness of the organization in the overall interests of the EA program
- **Technology Dimension-** involves gauging the technological maturity of the enterprise
- **Resource Dimension-** looks at the existing budgetary resources, the recent trends of IT spend and the political commitment

2. Customizing IndEA framework for the enterprise

- Fit the broad requirements of the business vision & objectives of the enterprise

3. Converting reference models into set of Architectures

- Each Reference Model leads to a set of Artefacts that form the basis for the next phases of procurement and application development
- Effort especially in compiling information and data specific to the enterprise

4. Implementing EA

- Plan Big, Start Small, Scale Fast
- Establish an EA organization for continuity in Architecture Governance, agility in procurement, program management and risk management

4. Managing the EA Journey Using IndEA Framework²

Architectural Development Method (ADM) Cycle

The development method for Enterprise Architecture (Figure 16) is a step-by-step approach and an iterative method between and within phases. Throughout the cycle, a set of architecture views are developed to ensure that complex requirements are adequately addressed.

Each phase should consider assets produced from previous iterations of the process and external assets, such as other frameworks or models. Requirements Management Phase is at the center of the ADM and other phases are validated against current requirements of the business. Also, each phase is validated by current requirements of the business

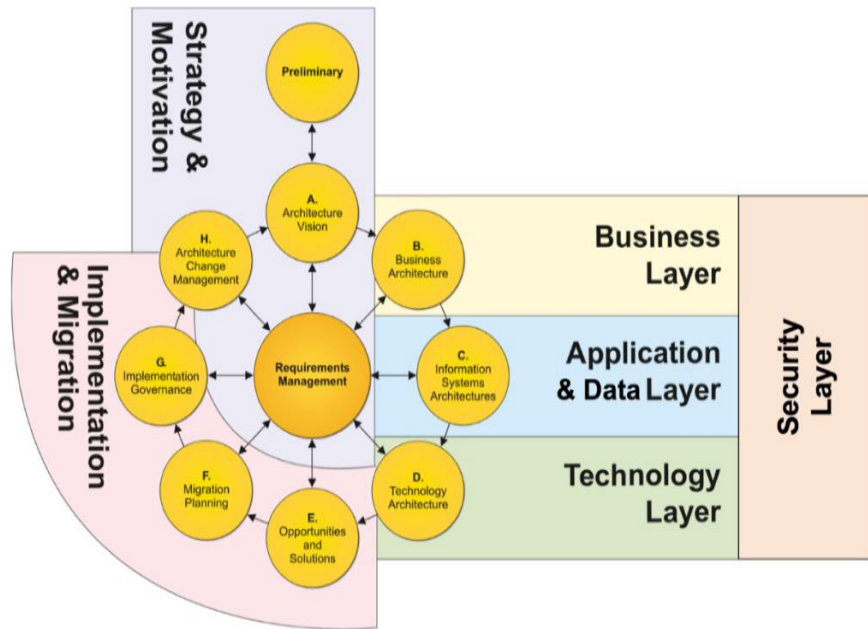


FIGURE 16: ARCHITECTURE DEVELOPMENT METHOD ITERATIONS

For every ADM iteration, decisions need to be taken for following context:

- **Enterprise Coverage:** Coverage of entire enterprise or one or more line of business in an iteration
- **Level of Detail:** Coverage of level of depth. For instance, while covering the entire width, it will not be practical to cover entire depth owing to time, budget and resource constraints
- **Time Horizon:** Time of completion of each iteration
- **Asset Re-use:** Deciding on the assets that can be reused from previous ADM iterations, other frameworks, industry model etc.

The phases defined are further decomposed into steps, which are similar for Business, Data, Application and Technology Architecture Phases.

Figure 17 elucidates the steps required for different phases of Architecture Development Method and also details out each sub-step within broadly identified steps.

² TOGAF Architecture Development Method.



FIGURE 17: STEPS FOR PHASES OF ARCHITECTURE DEVELOPMENT METHOD

4.1. Institutionalizing Enterprise Architecture³

The Institutionalization process of EA for any organization entails answers to Five W's and How - "**What**"- Describes the structure (things), "**Where**"- Defines the spatial description (locations), "**Who**"- Defines the operational description (people), "**When**"- Defines the timing description (events), "**Why**"- Defined the motivation description (strategies) and "**How**"- Defines the functional description (processes).

To simplify the development and management of Enterprise Architecture (EA), Architecture partitioning aids in the cost management and reduces the complexity by dividing an enterprise into partitions. On doing so, appropriate roles and responsibilities are assigned to each partition.

Architecture Partitioning:

- **Manages complexity:** Enterprises are complex, and partitioning the enterprise into a set of architectures manages the complexity.
- **Manages conflict:** Partitions help to manage the conflicts of organizational unit architectures with one another.
- **Manages parallel developments:** In an enterprise, different teams work on various elements of an architecture simultaneously. Partitions allow specific groups of architects to own and develop specific elements of the architecture.
- **Manages reuse:** Effective architecture reuse requires modular architecture segments that can be taken and incorporated into broader architectures and solutions.

Architectures are grouped into partitions using the below criteria-

- **Subject Matter or Breadth of the enterprise:** Solutions are organized into groups to support operational management and control.
- **Time:** The solution lifecycles are organized around a timeline, which allows the impact of solution development, introduction, operation, and retirement to be managed against other business activities occurring in similar time periods.
- **Maturity and Volatility:** The maturity and volatility of a solution impact the speed of execution required for the solution lifecycle. Additionally, volatility and maturity shape investment priorities. Solutions existing in highly volatile environments may be better suited to rapid, agile development techniques.

Steps for institutionalization are as follows:

1. Initiating the Process

As the first step, enterprise should scope the overall project - what to include, who to involve and how to do. The next step comprises of building the team and establishing a formal target vision. During the process of building the team, stakeholders such as - users, system architects, developers, support team, business and IT managers need to be included as each stakeholder views the architecture differently. EA is subsequently categorized into- **Performance, Business, Data, Integration, Security, Application and Technology Architectures.**

For adopting the enterprise architecture for an organization, it is essential to document and publish standards.

³ <https://pdfs.semanticscholar.org/7586/03353479ad069b2f5e287662349b5f3cc9d4.pdf>

The core artifacts can be categorized as:

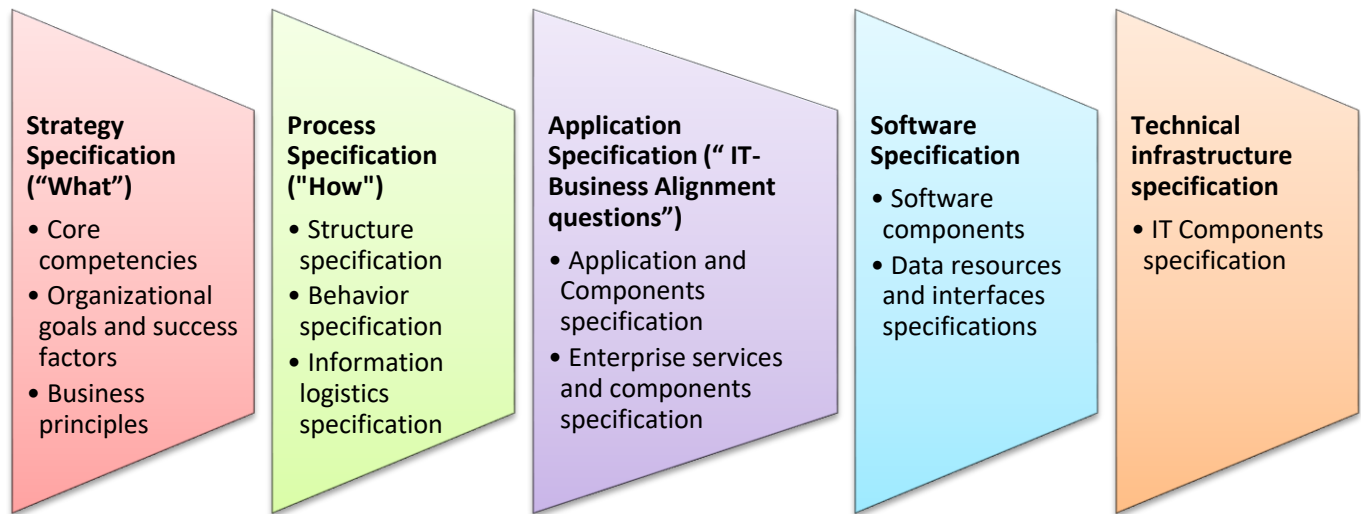


FIGURE 18: CORE ARTIFACTS FOR ADOPTION OF EA

2. Baseline Architecture Characterization (where is the organization now)

An effective implementation of new architecture design requires thorough understanding of the present state of information system. The organization needs to identify gaps and redundancies for describing the baseline architecture. Figure 19 depicts the information from architecture point of view.

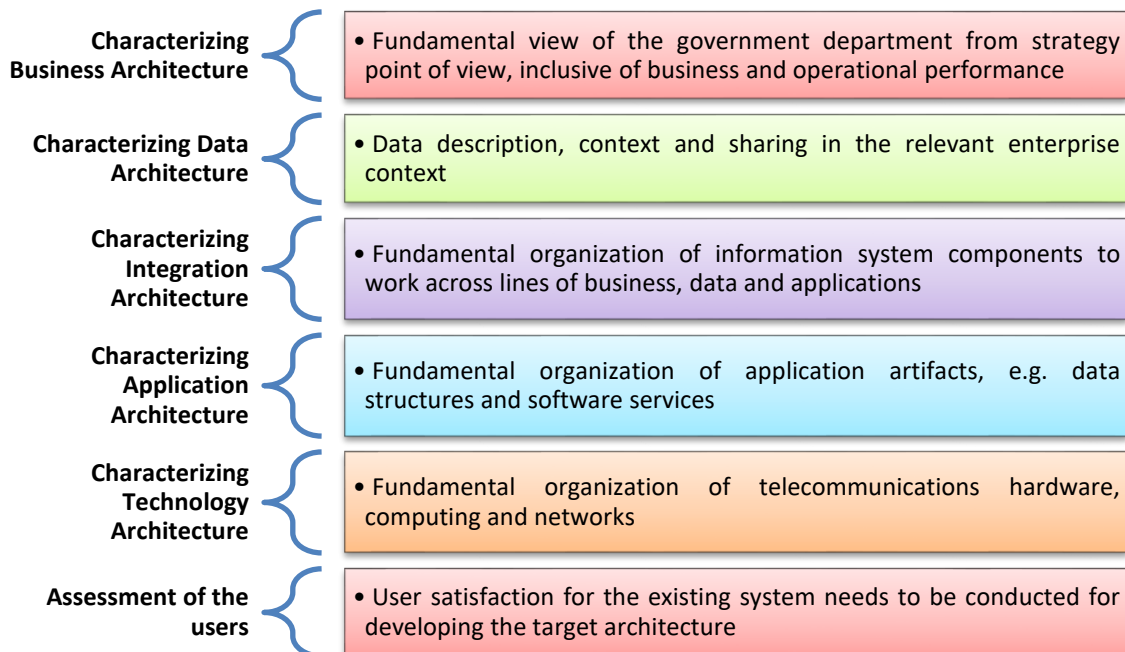


FIGURE 19: CHARACTERIZATION OF DIFFERENT ARCHITECTURES

3. Target Architecture Design

Architectural differences between baseline and target business architecture, related to business strategy, are to be analyzed. Gap analysis results, assist in the design of Process, Integration, and Software and Technology architectures. Strategy and goals should intrinsically be a part of target business architecture.

Representative characteristics for a target architecture are:

- **Conformity:** to the principles and standards
- **Traceability:** for the relationships among components
- **Modifiability:** evolution of infrastructure components

4. Planning for Architecture Transition

Following points need to be duly considered while planning the architecture transition for an enterprise.

- Assessment of the organizational technology maturity
- Identification and analysis of design constraints to ensure the quality of the implementation
- Performance: How often/fast system needs to run?
- Interoperability: Conditions under which system needs to perform?
- Reliability: System ability to perform requisite functions under defined conditions and time period

5. Assessment of the Enterprise Architecture

Institutionalization of Enterprise Architecture is an incremental and continuous process and following analyses can be conducted within an organization to measure the quality of the EA

- **Dependency analysis** exploits the associations between the various EA artifacts to derive direct and indirect dependencies of these artifacts. For e.g. - Which business processes are affected if we switch-off a certain server? Which applications are required to facilitate the value chain of a product offered at the marketplace?
- **Coverage analysis** represented as matrices relating the two dimensions of interest. Redundancies and gaps can be identified.
- **Interface analysis** focuses on the interfaces within a class of EA artifacts. Minimizing the coupling, maximizing the cohesion.
- **Complexity analysis** calculates a complexity measure based on the number of architectural components and the dependencies between those components. The design goal is to reduce the overall EA complexity.
- **Cost analysis** is the calculation of IT-related costs, the cost for the allocation of products/process/organizational units.

IndEA encapsulates the entire value proposition of adopting Enterprise Architecture plus more. It derives its approach from the globally known architectural frameworks like TOGAF, Zachman and Federal Enterprise Architecture. The models and concepts contained in these global frameworks have been substantially simplified and suitably contextualized to the Indian conditions. The principles of 'Just-in-Time' and 'Just Enough' have been advocated in the design and implementation of Enterprise Architecture.

Simply stated, IndEA is a way to establish Unity in Diversity in the domain of e-Governance. 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.

4.2. Planning the Enterprise Architecture

The phase kick starts the Enterprise Architecture journey, and begins with the preparation and initiation activities to create an Architecture Capability. The purpose of the phase is for the entities desirous of embarking on enterprise architecture to prepare and get the entire ecosystem ready. As part of this phase, organizations should study and understand the Reference Models, their purpose, and implications.

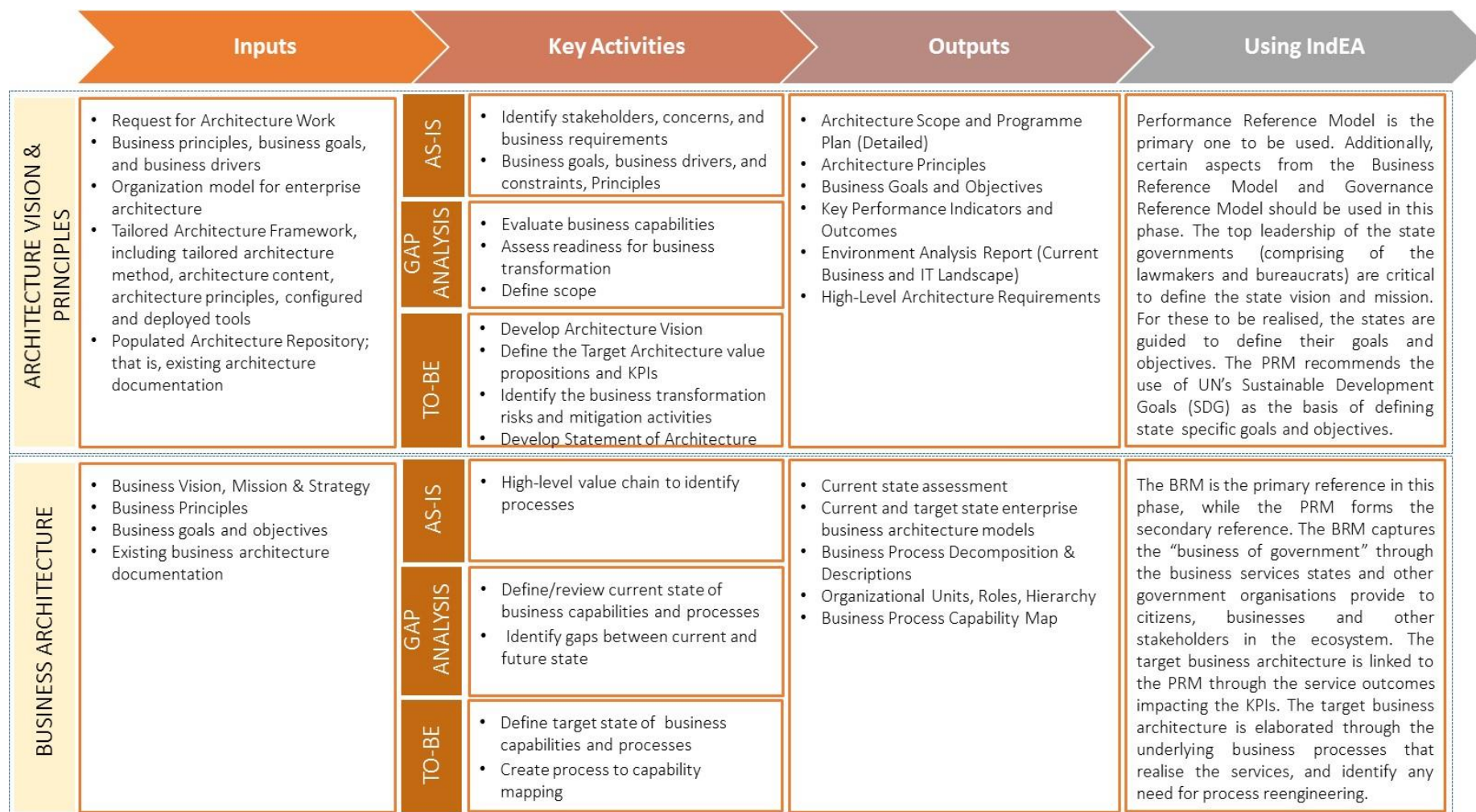


The primary aim is to be able to explain organization's strategic situation and detail out on the requirements such as resources, tools, governance & legal frameworks needed to embark on EA journey. The scope of Enterprise Architecture is also defined in this phase along with the acceptance criteria and authorized personnel for this journey.

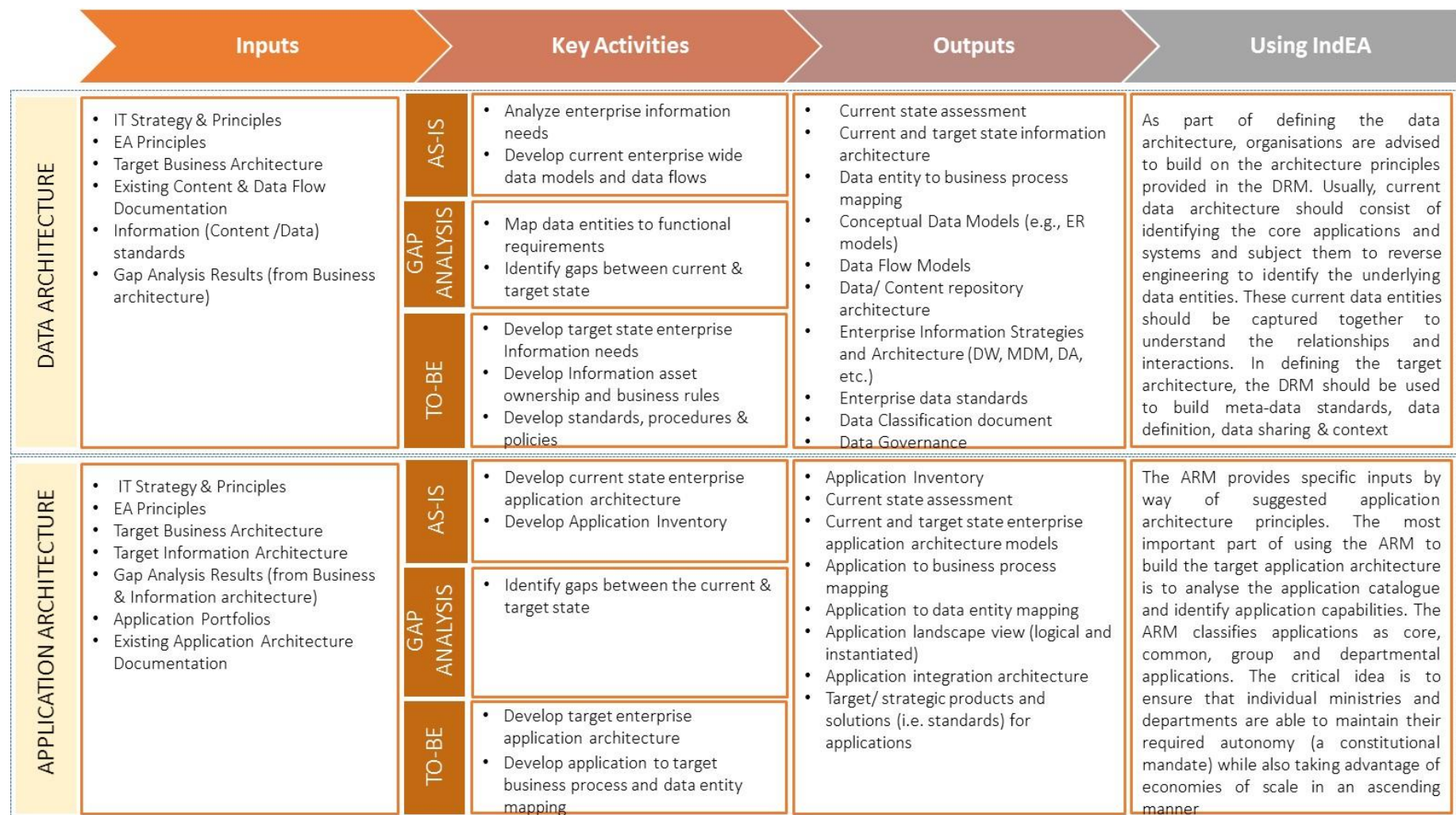
Capacity Building for EA (Architecture Skills Framework)

The successful implementation of Enterprise Architecture mandates the availability of requisite skills in an organization. For the same to happen, it is essential for the organization to encourage capacity building initiatives internally as well as by involving external experts from private industry. The training methodologies can be focused on the Architecture Skills Framework defined by TOGAF. A detailed capacity building plan is available in Annexure VI. The Skills framework provides a view of the competency levels required for the specific roles of the architecture. It defines the roles within a work area, skills needed by each role and knowledge required to fulfil the role requirements. Main categories of skills need to be included are Generic skills such as leadership, teamwork and inter-personal skills, Business skills such as business process, strategic planning, EA skills such as modelling, building block design, applications and role design, system integration, Program/Project Management, IT general skills such as asset management, migration planning, SLAs, Technical IT skills such as security, data, interchange etc. and Legal environment knowledge such as data protection laws, contract law etc.

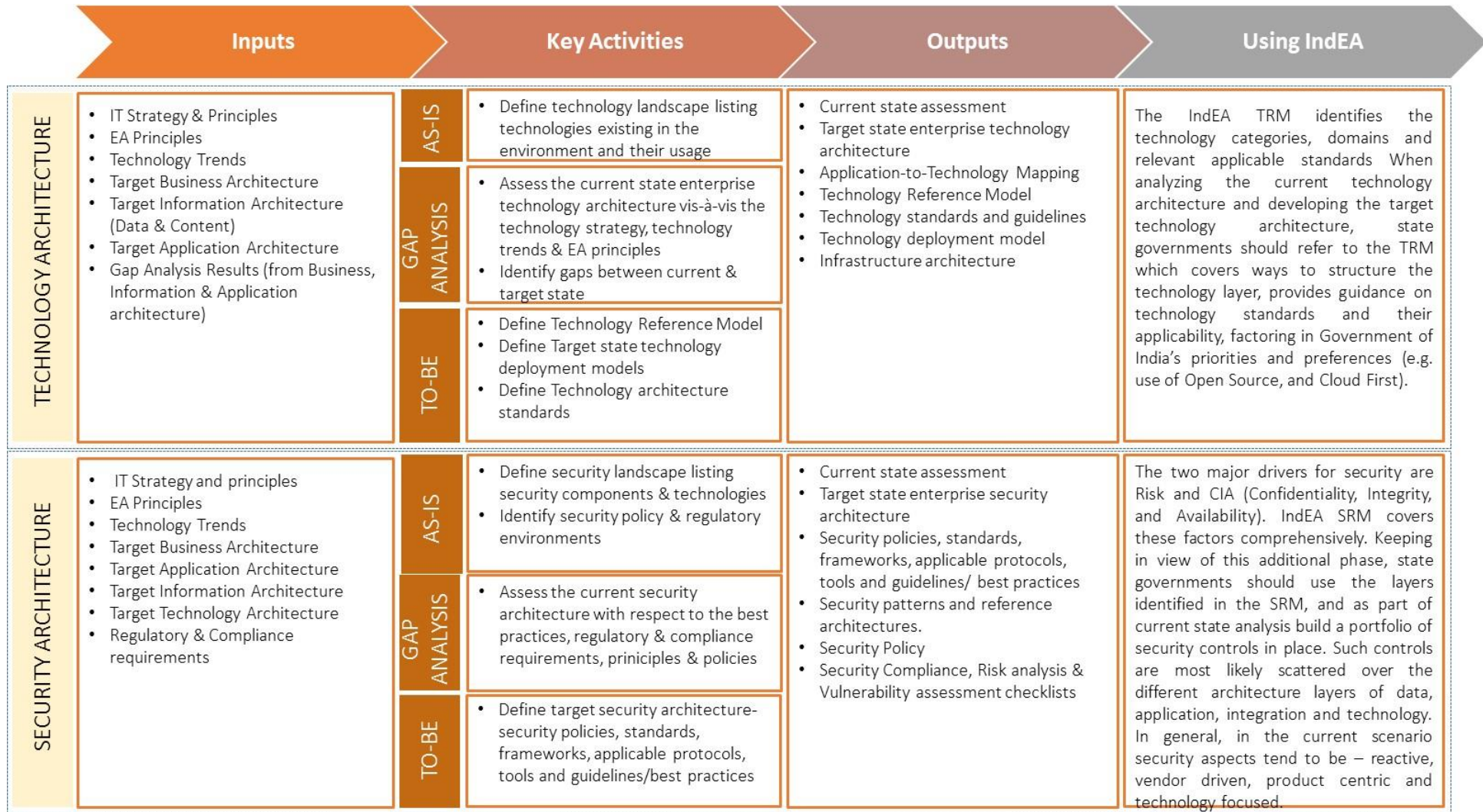
4.3. Developing the Enterprise Architecture



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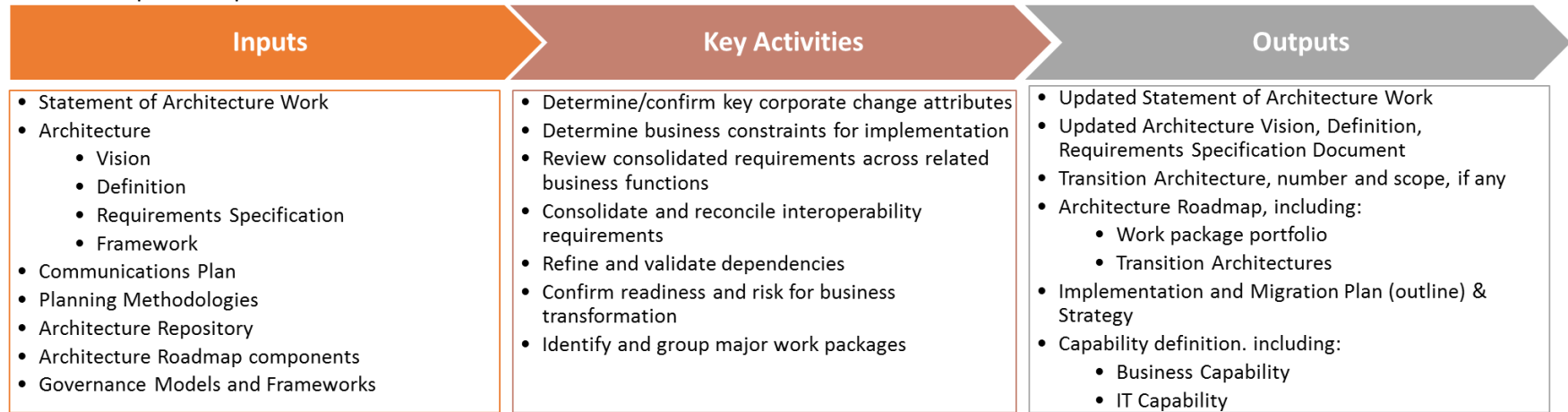
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Executing Enterprise Architecture

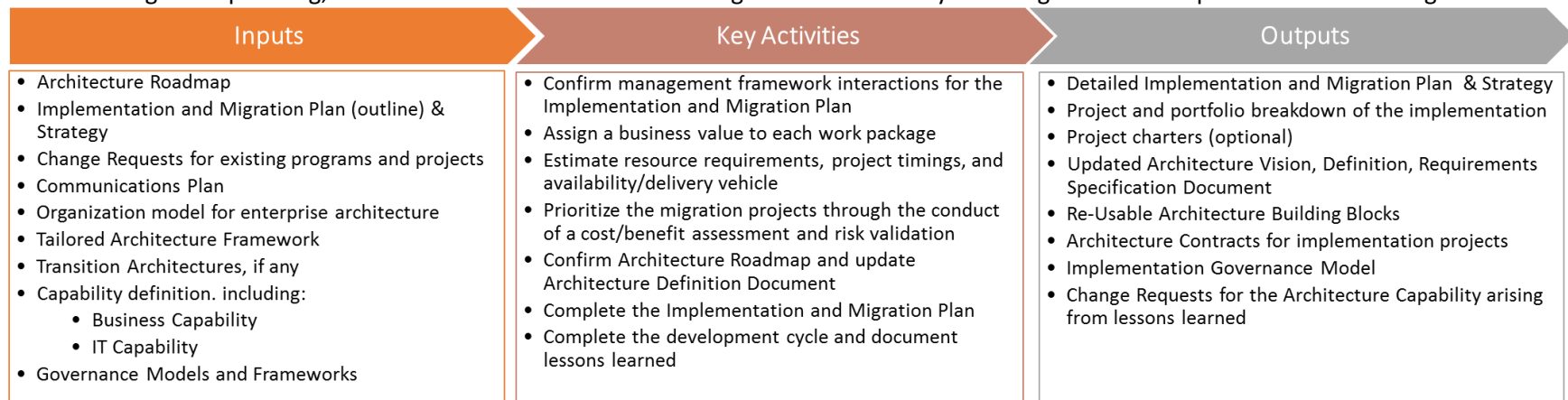
Opportunities and Solutions

The first phase describes the process of identifying delivery vehicles (projects, programs, or portfolios) that deliver the Target Architecture identified in previous phases.



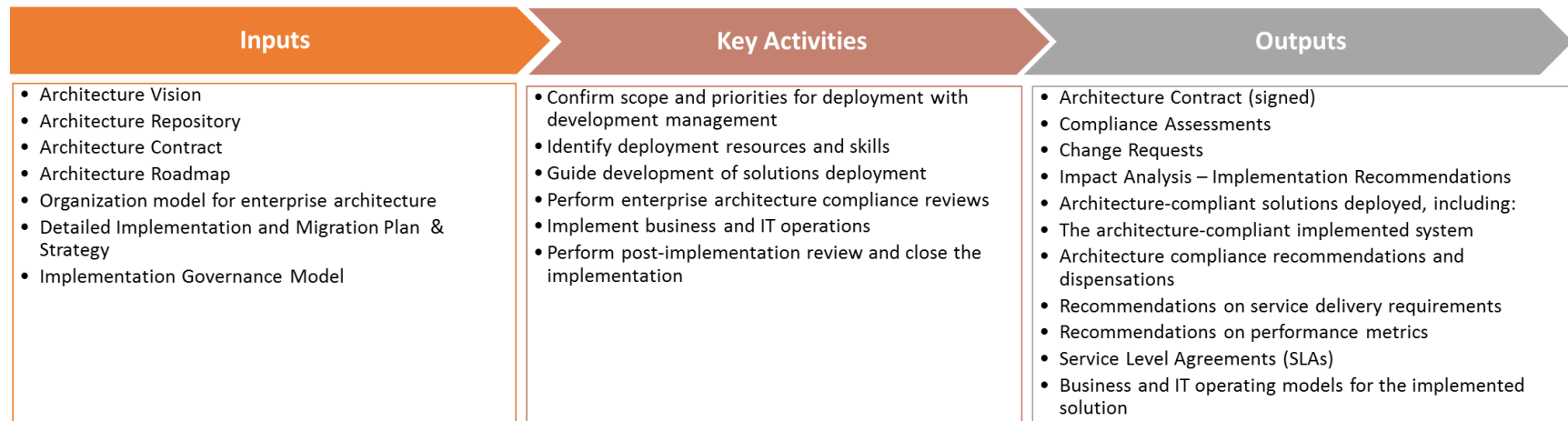
Migration Planning

Addresses migration planning; to move from the Baseline to the Target Architectures by finalizing a detailed Implementation and Migration Plan.



Implementation Governance

Define the architecture constraints the implementation projects, monitors it while building it, and produces a signed Architecture Contract.



The GRM is the primary reference to be used in this phase. The GRM provides guidance on the mode of governance, and mechanisms to ensure that the decision rights and accountabilities are clear and assigned to the right stakeholders. These should be part of the architecture governance strategy.

Conceptual Solution Architecture

This is an additional phase which extends the standard ADM. From a government organization perspective, the need for this is driven by four factors:

- Depicting the link from enterprise architecture to the downstream activity of solution architecture;
- Building the capability to realize the target architecture;
- Providing an integrated view of the services, systems and technology architectures in a visible way; and
- Enabling and enriching the procurement process by getting a better understanding of constraints, risks, possibilities and users.

Guided by the priorities elaborated in the target enterprise architecture and the overall business vision and mission, the development of the conceptual solution architecture initiates with the assessment of current systems and services to determine the business value and overall alignment to business goals and objectives. Based on the analysis of the current systems and services, the requirements for the target systems and services are derived in a way that conforms to the target enterprise architecture. In developing target solution architecture, the reusable components (from the various reference models) should be used. This should also include understanding the dependencies, constraints, risks and issues in getting the architecture components to work together coherently. To the extent possible, the outputs from this phase should be vendor and technology agnostic.

Critical factors that need to be addressed in this phase and few outputs are

1. How are systems and services in the selected area / domain / unit / function performing to deliver business value for costs associated in operating and maintaining them?
2. How are the current systems and services linked? What data sources do they use?
3. What risks are associated with existing systems and services? Do these risks affect business continuity?
4. What systems and services should be retired / decommissioned? What should be retained for the target state? Are the reasons retention clear and understood?
5. What security and privacy monitoring activities should be considered for the target state?
6. What is the preferred solution development model? Is the implementation in-sourced or outsourced?
7. Have the target systems and services been consolidated, rationalized and combined as a portfolio (representing a group of similar or highly dependent systems and services)?
8. Is the portfolio reflected in the transition roadmap?
9. Are there reusable components identified that can potentially be included in the next cycle of the IndEA reference models?

Key outputs of this phase are (Figure 20):

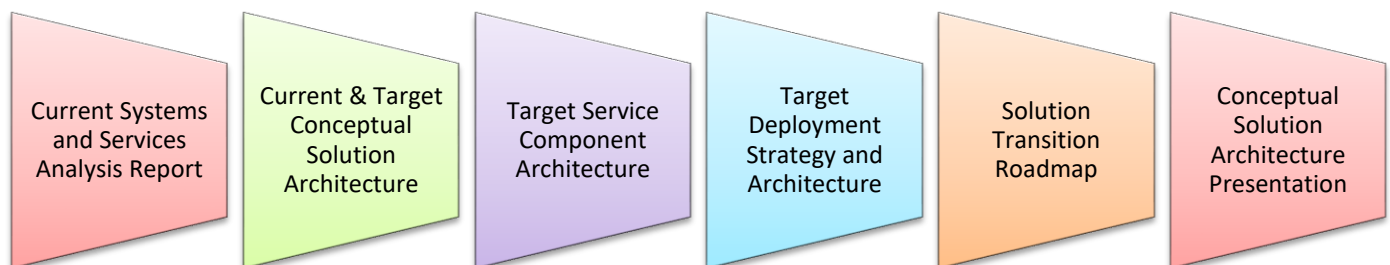


FIGURE 20: OUTPUTS OF SOLUTION ARCHITECTURE PHASE

4.4. Governing the Enterprise Architecture

The architecture governance is the practice and orientation by which the architectures at an enterprise-wide level are managed and controlled (Figure 21). It is concerned with design governance to control change processes and operational governance to control the operation of product systems

Architecture Governance characteristics:



FIGURE 21: ACTIVITIES FOR ARCHITECTURE GOVERNANCE

Organizations Structure to implement Enterprise Architecture

To ensure effective control for architectural governance within the organization and to ensure that all governance activities are supported, the appropriate organizational structures must be established. The organizational structure illustrated by the image highlights the major structural elements required for an architecture governance initiative (Figure 22).

Although each enterprise has differing requirements, the basics of organizational design shown here are applicable and implementable in a wide variety of organizations. The figure identifies three key areas of architecture management: Develop, Implement, and Deploy.

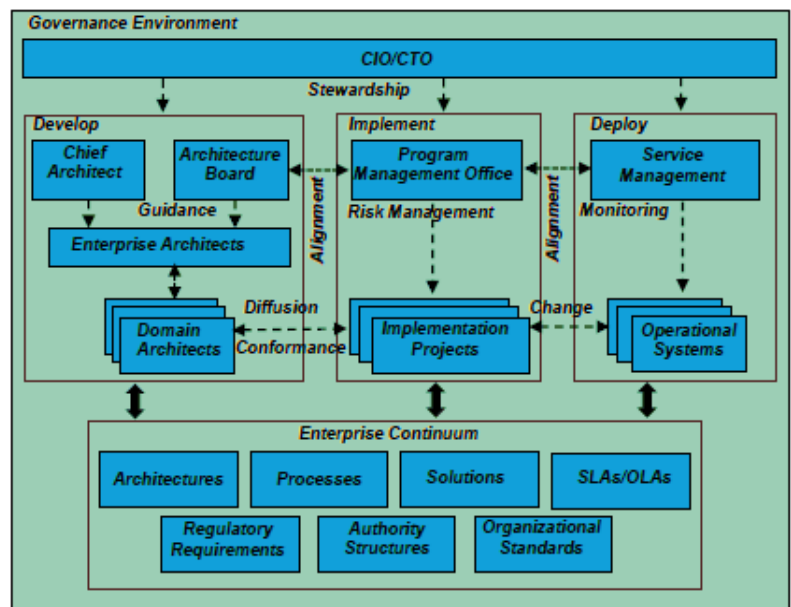


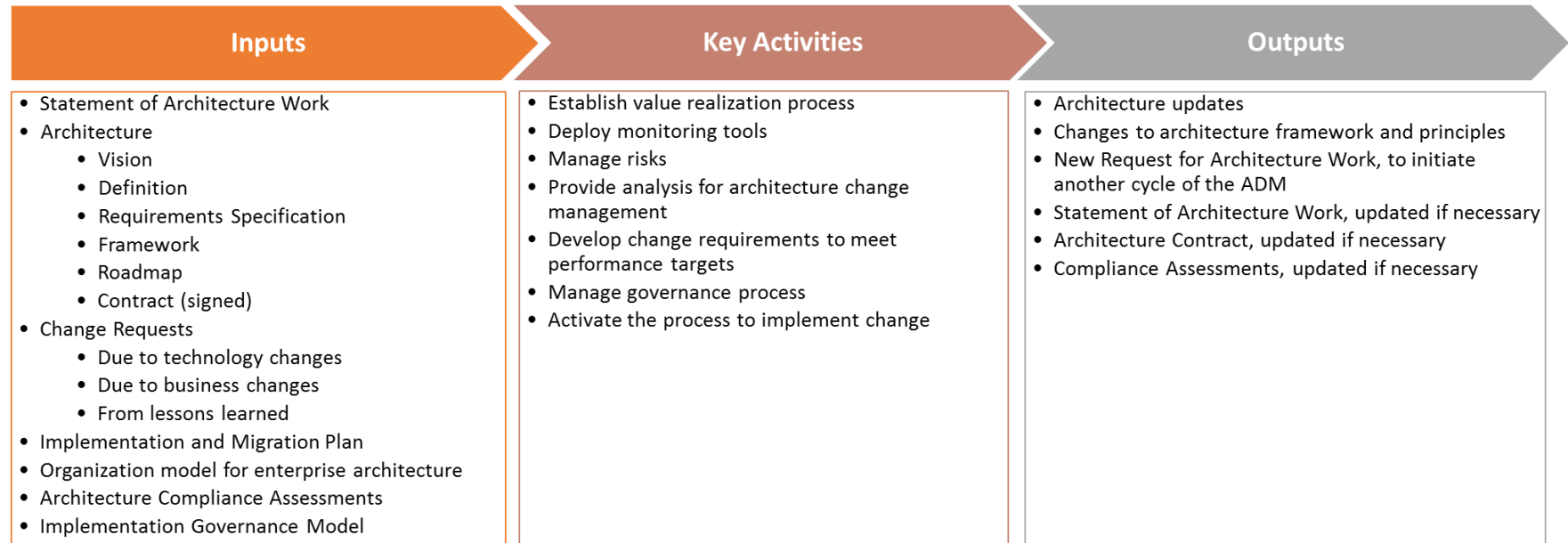
FIGURE 22: TYPICAL EA ORGANIZATION AND INTERACTIONS

Each of these is the responsibility of one or more groups or teams within the organization.

- The responsibilities, processes, and structures of the develop area are primarily managed by the EA team.
- The responsibilities, processes, and structures of the Implement area are primarily managed by the implementation project teams. They are typically linked to Implementation Governance.
- The responsibilities, processes, and structures of the Deploy area are primarily managed by the operation, infrastructure, or environment teams; they are typically linked to Implementation Governance.

Architecture Change Management

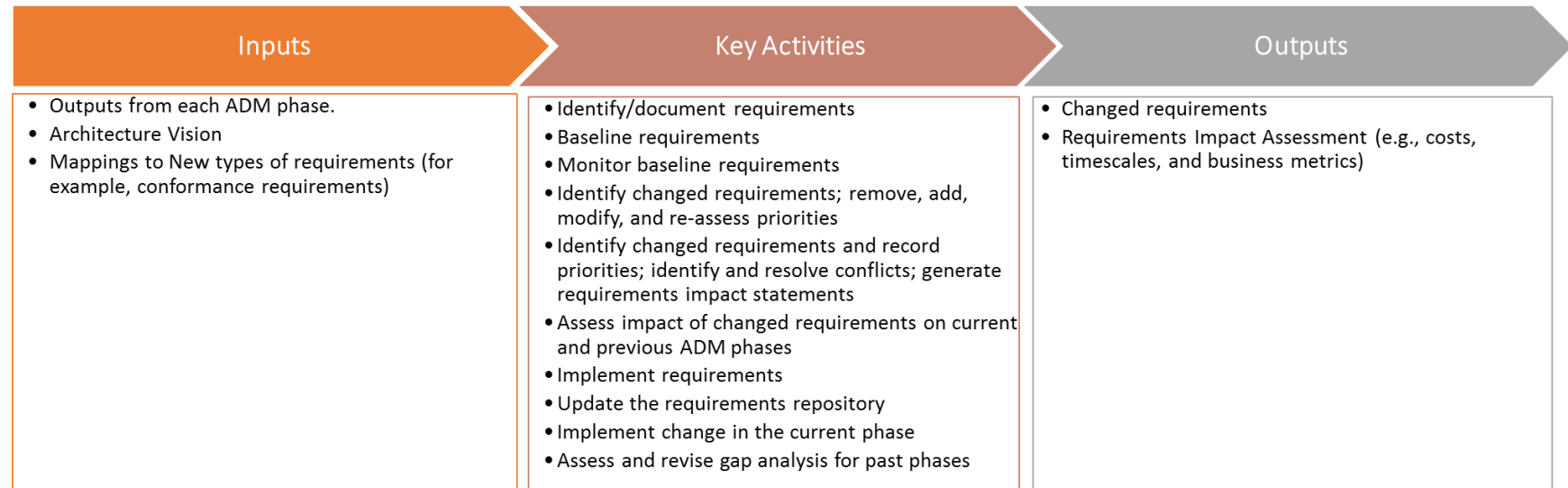
This phase ensures that changes to the architecture are managed in a controlled manner.



Architecture Change Management establishes procedures for managing change to the new architecture. This process will typically provide for the continual monitoring of governance requests, new developments in technology, and changes in the business environment. The Change Management approach is based on classifying architectural changes either of the 3 categories- Simplification Change, Incremental Change and Re-Architecting change.

Requirements Management Phase

The Requirements Management phase focusses on the management of architecture requirements throughout the ADM. This phase, being central to ADM, applies to all the phases of the ADM cycle and addresses the identification of requirements, their storage, and delivery to the phases



The ability to deal with changes in the requirements is crucial. The architecture activity by nature deals with uncertainty and change—the "gray area" between stakeholder aspirations and what can be specified and engineered as a solution. Therefore, Architecture requirements are invariably subject to change in practice. Furthermore, architecture often deals with drivers and constraints such as, changing market conditions or new legislation that are beyond the control of the enterprise and produce unforeseen changes in requirements. The Requirements Management process itself does not dispose of, address, or prioritize requirements. It is merely a process for managing requirements throughout the Architecture Development Cycle.

Measurement of Impact of EA and Compliance⁴

Some Common Approaches for calculating EA value (Figure 23)

- **Return on Investment:** EA investment efficiency
- **Benefits-to-cost Ratio:** EA benefits / EA costs
- **Direct User Value:** Benefits directly realized by users such as government employees, government organizations and citizens
- **Non-Direct User Value:** Benefits for society as a whole. It is typically qualitative in nature such as well-functioning court system
- **Government foundational value:** Improvements for current government processes and operations for laying the groundwork for future initiatives
- **Government financial value:** Cost savings, cost avoidance realized by the government

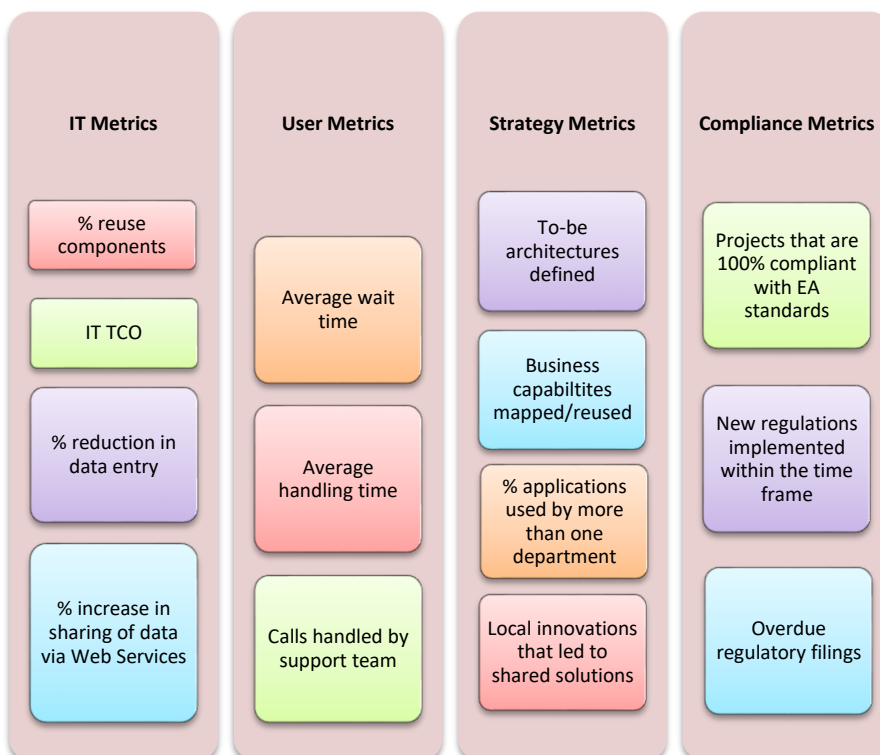


FIGURE 23: COMMON EA METRICS

Architectural Maturity Assessment - An Example

Score	Element Level	Architecture Process
0	No EA	Not established or does not exist
1	Initial	The architecture exists in ad-hoc or localized form or early draft form. Some Enterprise Architecture processes are defined. There is no unified architecture process across technologies or business processes.
2	Developing	The architecture is being actively developed. Basic EA Process program is documented. The architecture process has clear roles and responsibilities developed.
3	Defined	The architecture is well defined and communicated to IT staff and business management with Operating Unit IT responsibilities. The process is largely followed
4	Managed	Enterprise Architecture process is part of the culture, with strong linkages to other core IT and business processes.
5	Optimizing	Concerted efforts to optimize and continuously improve architecture process.

⁴ <https://www.cutter.com/sites/default/files/architecture/fulltext/reports/2015/02/index/ear1502.pdf>

Architecture Compliance Review- Reporting Results

The steps in the Architecture Compliance Review process (Figure 24) are:

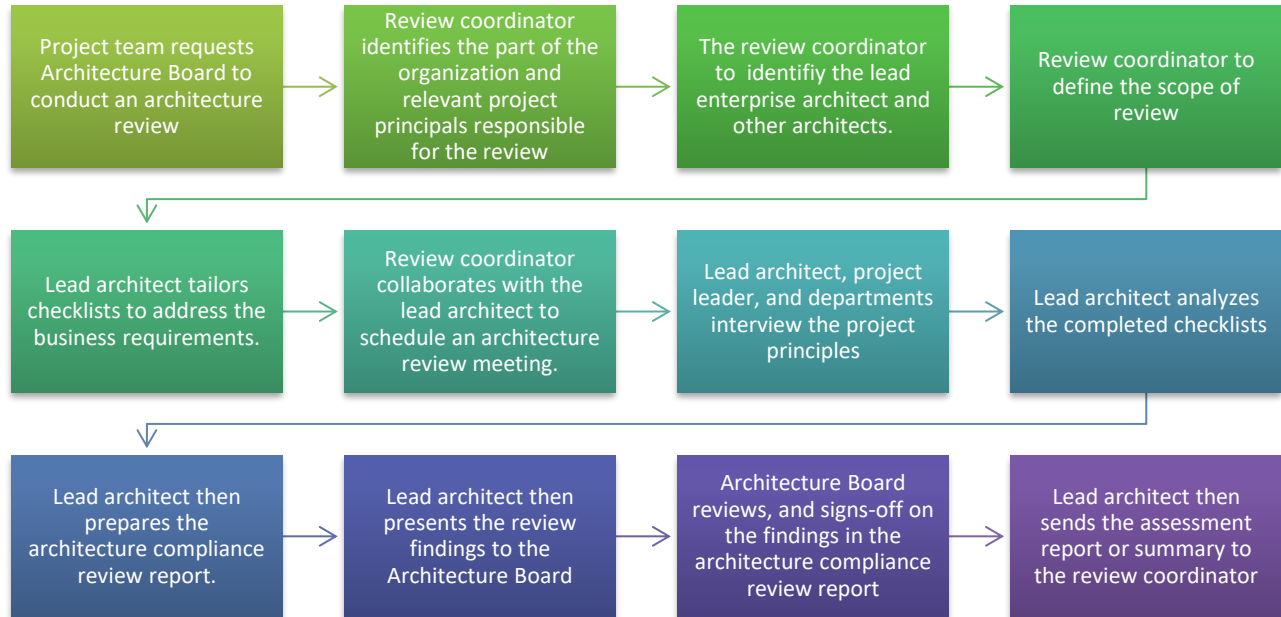






FIGURE 24: ARCHITECTURE COMPLIANCE REVIEW PROCESS









Annexure

I. Government EA Programs in Selected Countries





TABLE 2: GEA PROGRAMS IN COUNTRIES AROUND THE WORLD

Country	Government EA Program	Key Features/ Benefits Realized
	Bangladesh National Enterprise Architecture	<ul style="list-style-type: none"> • W-O-G EA framework, interoperability framework and broad guidelines for establishing smart e-governance • Foundation for the successful ICT adoption for realization of the vision of 'Digital Bangladesh'
	Architecture-Driven e-Government Development, Royal Government of Bhutan	<ul style="list-style-type: none"> • Whole of Government Plan (11th Five Year Plan Document) with National Key Result Areas (NKRAs) – 16 and Sector Key Result Areas (SKRAs) – 250 and prepared the Whole of Government Agency Service Catalog along with SDS, SOP, and SLA and e-GIF Portal (EA Repository System) • Ensured clear articulation of the vision statement, desired outcomes and goals of Bhutan's ICT development
	GovEA Framework, Malaysian Administrative Modernization and Management Planning Unit (MAMPU)	<ul style="list-style-type: none"> • Six key components: 1GovEA Vision, Principles, Architecture Domains, Governance, Methodology and Tools & Repository • Community of Practice for Enterprise Architecture which comprises members from the government, industry and academia to spearhead the development of NEA. • In line with "one service, one delivery, no wrong door" policy
	Government Enterprise Architecture for New Brunswick, Canada	<ul style="list-style-type: none"> • Unique because it identifies service vehicles to enable the rest of business capabilities (EA Roadmap, EA Manual followed by Business Capabilities Modeling was done to form clearer view of each individual capability (people, process, and technology) that allows better execution of strategy). • Objective was to lead, enable and assure the efficient use of Information management & Information and Communications Technology (IM&ICT) investments across all four parts (Part I- Core Government; Part II – Education; Part III – Health; and Part IV – Crown Corporation and others)

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Country	Government EA Program	Key Features/ Benefits Realized
		<ul style="list-style-type: none"> • Led to improved management and quality of information, more efficient business technology operations, better return on existing investments, reduced risk for future investments, faster, simpler and cheaper procurement process.
	Government Enterprise Architecture for New Zealand (GEA-NZ) Framework	<ul style="list-style-type: none"> • Provides a consistent view and accurate information within and across agencies to support planning and decision making • Provides a harmonized and consistent view of all types of resources in each functional area • Provides an integrated, consistent view of strategic goals, business services and enabling technologies • Facilitates and encourage interoperability within and across agencies and between programs
	WOG Approach in eGovernance - 4 National Portals and about 400 Agency websites.	'E-CITIZEN' Portal - One-stop portal for government information and e-Services and OLBS (Online Business Licensing System) - Single integrated form for 77 licenses from 18 public agencies.
	<i>Modernizing Government</i> program works across organizational boundaries	Integrated and seamless service delivery through portals such as gov.uk .
	<i>Public Value Management</i> for seamless and citizen-led services through partnership	Redesigned public services around the needs of service users, driving up quality, standards, innovation, creativity and continuous improvement
	<i>Government On-Line Initiative</i> , aimed to bring together 170 different Government websites	Service Canada , provides a one-stop point of access for citizens to all federal services
	'One-Stop Shop' for service delivery program	Centrelink - integrated delivery mechanism for employment and income support across all levels of government
	W-O-G Approach concentrates on horizontal activity in 4 priority areas: employment, entrepreneurship, information society and civil participation.	Each area has its own programme, outlined in the Government Strategic Document , which focuses on horizontal policies and identifies the targets, measures and concrete acts required for success
	<i>Delivering Better Government</i> programme joined-up government	Integrated, person-centered services across the lifespan of citizens

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Country	Government EA Program	Key Features/ Benefits Realized
	EA Law formally merged into the <i>e-Government act</i>	Inter-Department and Inter-Ministry integration in the e-government efforts. Emergence as top performer in UN e-Government Survey, 2012
	Integrates the collaborative efforts of the departments and agencies of a government to achieve unity of effort toward a shared goal	USA.gov - best example of a highly-integrated portal. Carefully organized, starting from a sufficient level of abstraction for the citizen.
	Developed and continually refined its own whole of government approach	One portal, Die Bundesregierung , focuses primarily on information. A second portal, Bund De, focuses primarily on services.
	<i>Whole of Government Strategy Map</i> (WOG) enables government agencies to “think across organizational boundaries” and work in a collaborative mode across portfolio boundaries	The “ Citizen ” portion of Mauritius’ integrated portal is organized primarily around key services, but also groups information by audience and includes an A – Z thematic index.



II. Government EA in India

TABLE 3: GEA IN INDIA THAT SUBSTANTIATE THE EXISTENCE OF EA AT ALL LEVELS







GEA Level	Example	Brief Description
National	State Bank of India (SBI)	SBI is re-architecting its enterprise architecture for digital strategy to include cutting edge technologies in innovative new banking models. Enterprise & Technology Architecture department oversees implementation (EA) and manages the complex distributed technology systems.
State	ePragati, Andhra Pradesh	The first state in India to develop a state-wide enterprise architecture derived from TOGAF and consensus of different political parties operating at local government levels.
Panchayat	Panchayat Enterprise Architecture Framework (PEAF)	Developed for Panchayat as an Enterprise using the TOGAF approach followed by clustering of about 240,000 Panchayats in 30 clusters based on their business architecture
Organizational	Goods and Services Tax Network (GSTN)	Green field Business and IT Strategy, Operating Model, Business Capabilities and processes, information and integration architectures, application and technology architecture were done for the new organization.
	Government e-Marketplace (GeM)	Leveraged TOGAF to define the Business Strategy of GeM. Business Capability Architecture Model, Enterprise Data Management Strategy, Service Oriented Enterprise Strategy, Integration with Multiple Integration partners and Implementation Roadmap.
	Unique Identity Authority of India (UIDAI)	National identity platform supporting interoperability, reusability and scalability
	Passport Seva Portal	Passport Seva Portal System has built-in interoperability to exchange information with other government departments to qualify as an enterprise
	National Informatics Centre (NIC)	The Digital NIC Enterprise Architecture is underway at NIC which is a Blueprint for Information systems and IT Management tools in NIC.
Domain (Replicable/ Re-usable)	University Enterprise Architecture Framework at NIC	Work reference for development of Enterprise Architecture for Universities and other higher education institutes in India
	State Public Service Commission Architecture Framework at NIC	Reference for development of Enterprise Architecture for State Public Service Commission of India
	Land Hub Enterprise Architecture at NIC	Blueprint for Land Hub in Andhra Pradesh

III. Overview of Digital India Initiatives

TABLE 4: KEY DIGITAL INITIATIVES IN INDIA

Key Area	Initiative	Description	Impact (All nos. till Nov 2017 unless specified)
Foundational Digital Platforms 	Aadhaar UID	12-digit unique identification number based on biometric and demographic data	<ul style="list-style-type: none"> • 13.4 billion Aadhaar based authentications done • 558.4 million bridge accounts linked
	e-KYC	Paperless identity and address verification of the subscriber electronically through Aadhaar	3.8 billion eKYCs done in 3 years
	e-Sign	Aadhaar holders can electronically sign documents	442 million eSigns done
	Digilocker	Platform for issuing and verifying documents digitally using cloud storage linked to Aadhaar	<ul style="list-style-type: none"> • 8.9 million users • 12.2 million documents uploaded
	UPI	Enables all bank account holders to send and receive money instantly using smartphones, without bank account information	<ul style="list-style-type: none"> • 77 million monthly UPI transactions • INR 71 billion monthly value
e-Governance 	UMANG	Service Aggregator Mobile app for availing various government services	<ul style="list-style-type: none"> • 162 government services from 33 departments • Multi-lingual support
	GSTN	Unified indirect tax administration platform to handle invoices, returns, registrations and payments	<ul style="list-style-type: none"> • 8.7 million businesses registered • 39.7 million returns filed in July'17
	Direct Benefit Transfer	Subsidy and benefits disbursements directly to bank accounts	<ul style="list-style-type: none"> • ₹2.45 trillion disbursed through DBT • 395 schemes from 56 ministries covered
	Government e-marketplace	Online marketplace for procurement of goods and services by various government departments	<ul style="list-style-type: none"> • 17,275 buyer organizations and 44,787 sellers • ₹25 billion order value booked
	Common Service Center	Access points for delivery of various electronic services to villages	<ul style="list-style-type: none"> • 0.27 million functional CSCs with 65% gram panchayats covered • 34,000 women entrepreneurs
	Digital land	Development of a modern, comprehensive and transparent land records management system	<ul style="list-style-type: none"> • 31 states and UTs with digitization of land records • 30 states and UTs with digitization of property registration

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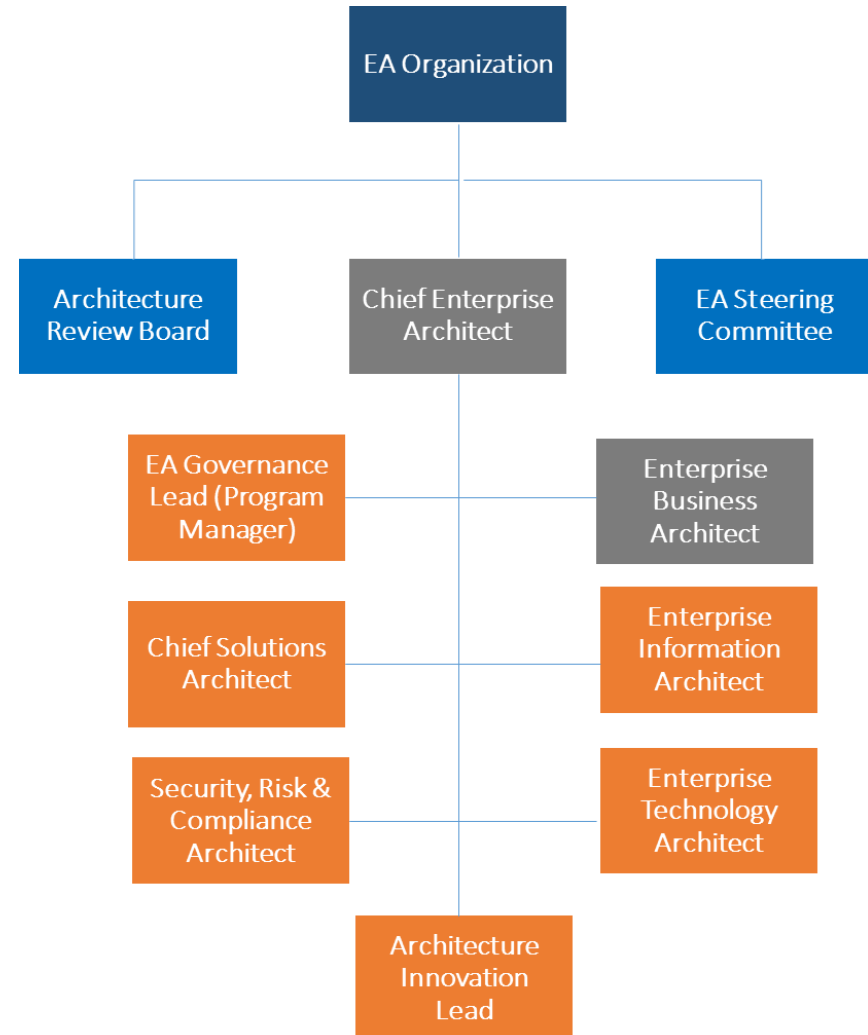
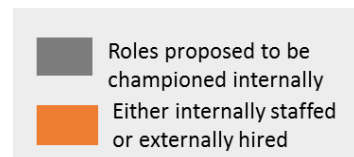
Key Area	Initiative	Description	Impact (All nos. till Nov 2017 unless specified)
Agriculture 	eNAM	Pan India electronic trading portal for agricultural commodities	<ul style="list-style-type: none"> • ₹314 billion value traded on eNam • 96,000 buyers and 5 million sellers
Health 	eHospitals	Workflow based Hospital Management ICT system	<ul style="list-style-type: none"> • 17 million transactions made at IPD, labs, or during registrations • Transactions implemented at 158 hospitals
Education 	Swayam	Web portal for accessing open online courses	<ul style="list-style-type: none"> • 778 MOOCs (Massive Open Online Courses) • Courses prepared by over 1,000 faculty and teachers
Finance 	Jan-Dhan Yojana	National Mission for financial Inclusion to ensure access to financial services	<ul style="list-style-type: none"> • Total of 307 million beneficiaries • 60% of beneficiaries at rural/semi-urban center bank branches • ₹690 billion deposited in banks
Skills 	PMG Disha	Digital literacy program for rural citizens	8.5 million candidates trained in basic digital skills through partnering with 602 training agencies
Digital Infrastructure 	BharatNet	High-speed broadband services in over 2.5 lakh villages	<ul style="list-style-type: none"> • 0.25 million km OFC has been laid covering 0.11 million GPs out of which • 0.10 million GPs have been made Service Ready till Dec, 2017
	MeghRaj	NIC cloud offering services like platform, infrastructure, software as a service	<ul style="list-style-type: none"> • 680 NIC applications hosted on MeghRaj till Jan 2017 • 12,740 virtual servers operational till Jan 2017
	Sectoral CERT	Computer Emergency response teams for every sector	<ul style="list-style-type: none"> • 4 CERTS setup for power Transmission, Thermal, Hydro and Distribution • Dedicated CERTs for Finance sector under way

IV. Typical EA Organization Structure

Establishing the right organizational structure is the foundation for all large-scale government enterprise architecture. An inadequate organization structure will not perform well. Thus, it is important to assess the needs and accordingly do staffing. Certain roles like the Chief Enterprise Architect and the Enterprise Business Architect are proposed to be championed internally while the others can either be internally staffed depending on the expertise available or hired externally. The size of the delivery team will depend on the scale of the EA. A basic structure is available in the figure on the side.

In case the roles are taken up government officials in either a Ministry, State, Department or Agency, the Chief Enterprise Architect would be ideally championed by the Secretary of Ministry, Chief Secretary of the State or their equivalent in a department or agency. The Enterprise Business Architect should also be championed by a senior official like the Additional Secretary of the Ministry of its equivalent in department or state. The EA governance lead could be championed by the Secretary, MeitY or Secretary IT for a State or the Chief Information Officer of a department or agency and so on.

The figure represents some the lead roles of the EA organization, which are further supported by junior architects and EA analysts depending on the scope of the enterprise architecture.



V. Summary of Role Descriptions

TABLE 5: SUMMARY OF ROLE DESCRIPTIONS IN AN EA ORGANIZATION

Role	Qualities/ Skills	Responsibilities
Chief Enterprise Architect (Manager of Architecture)	<ul style="list-style-type: none"> • Sound understanding of entire governance landscape • Has a strategic, enterprise focus, is future-oriented • Displays leadership, management and influencing qualities and skills. 	<ul style="list-style-type: none"> • Define the Mission, Vision and thought leadership for the Architecture practice for the Ministry/ department/ State • Reviews the priorities and initiatives for the program • Evangelize Enterprise Architecture throughout organization • Managing the overall capacity building program for EA
EA Governance Lead (Owner of the Architecture governance process)	<ul style="list-style-type: none"> • Balances strategic thinking with tactical needs, driving appropriate tradeoffs between architectural purity and business value 	<ul style="list-style-type: none"> • Drive EA Implementation Governance • EA communication (including EA publication, education) • Measure and report on the value delivered by the EA practice and approve deviations from / exceptions to EA standards • Endorse the assets created by EAs across architectural domains and drive a forum to share architectural best practices across domains
Chief Solutions Architect (Owner of Application portfolio strategy)	<ul style="list-style-type: none"> • Deep understanding of enterprise applications, best practices, and available off-the-shelf components for applications. • Ability to optimize reuse, simplify application landscape and increase service-orientation. . 	<ul style="list-style-type: none"> • Define Application Portfolio Strategy and Roadmap (Strategic Context, Business Architecture, Current State Assessment, Application Architecture, Technology Deployment, Roadmap) • Define the Solution Architecture framework and guide Solution Architecture and Solution development • Drive the rationalization of the application/technology portfolio across the enterprise by identifying opportunities for reuse and drive the reuse of technology components • Drive exchange of best practices across domains/portfolios
Enterprise Information Architect (Owner of data requirements of business processes / applications)	<ul style="list-style-type: none"> • Deep knowledge of the content and data domain, including Information Modeling, Content Rendering, Data Warehousing, Information Quality, Master Data Management, Metadata, etc. 	<ul style="list-style-type: none"> • Analyze enterprise information requirements • Define & Review conceptual enterprise wide information models and Information Flow / Movement architecture • Define & Review enterprise content strategy and information architecture for Metadata, Data warehousing, MDM, Data quality, Canonical Data Model, etc. • Approve new technology selection in information domain and drive adoption

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Role	Qualities/ Skills	Responsibilities
Enterprise Business Architect (Owner of the understanding of business and target business operating model)	<ul style="list-style-type: none"> Understands the business organization, functions and processes within the business. Ability to articulate target business operating model and business processes 	<ul style="list-style-type: none"> Analyze business strategy and change drivers and their impact on business processes and define capabilities needed to address the change Drive the Business process and capability modeling / definition Facilitate Business-IT Alignment
Enterprise Technology Architect (Owner of technology domain strategies)	<ul style="list-style-type: none"> Specialist in one or more technology domains (e.g., Server, Networking, Storage, Data Management Technology, Middleware and Integration, Application Platforms, Enterprise Systems Management, etc.). 	<ul style="list-style-type: none"> Define and maintain the enterprise Technology Stack and Technology Reference Models and the roadmap. Review and approve the technical architecture standards framework, reference technical architectures and the Technology Lifecycle Management process. Guide, review and approve overall integration architecture for application portfolio. Perform industry due diligence to drive rationalization of technology landscape, including decisions to invest in, stabilize or retire technologies
Enterprise Security Architect (Owner of the security architecture)	<ul style="list-style-type: none"> Specialist in the field of data, infrastructure, intellectual and business security risk evaluation, compliance to standards and best practices in the security domain. 	<ul style="list-style-type: none"> Define the security architecture standards including frameworks, product suites, applicable protocols, tools and other components. Create target state enterprise security strategy and architecture Identify the key risk areas and define mitigation plan against each one of them. Develop security awareness model to communicate security architecture
Architecture Innovation lead (Owner of Architectural Change with changes in ecosystem)	<ul style="list-style-type: none"> Broad knowledge of IT and IT Architecture covering all the architecture domains and has a sound understanding of business. Deep knowledge and experience in architecture innovation 	<ul style="list-style-type: none"> Ensure that baseline architectures continue to be fit-for-purpose. Review and improve architecture maturity of the enterprise. Make recommendations for architectural change based on current state architecture assessment and research on new technology/ architecture trends and best practices. Establish an architecture change management process for the new enterprise architecture baseline.

VI. Capacity Building for an EA Organization

The Architecture Skills Framework serves as the basis of an internal architecture practice. Despite the lack of a uniform terminology, architecture skills are in increasing demand, as this discipline gains prominence within the industry. An enterprise architecture practice is a program of development and certification by which an enterprise formally recognizes the skills of its practicing architects, demonstrated by their work. Such a program is essential to ensure the alignment of staff skills and experience with the architecture tasks the enterprise wants performed.

An enterprise architecture practice is both difficult and costly to set up. It is normally built around a process of peer review, involving the time and talent of the enterprise's strategic technical leadership. Typically, this process requires the establishment of a peer review board, and documentation—both for the process itself and the internal certification requirements.

Identification of Candidate Architects

In order to ensure that right amount of investment is done for capacity building initiatives, it is imperative to perform an initial prescreening process to understand the training needs of the candidates. The screening will assist in understanding the candidate's inclination towards the EA program. The objective is to gauge the current skill-set of the organization with regards to Enterprise Architecture and decide on the level of training to be imparted.

Depending on the current capacity within the organization, the training can be categorized into two levels:

1. **Elementary Training**- Awareness Sessions by Core EA Team, Workshops/Webinars, Mentorship Programmes
2. **Advanced Training**- Classroom Training, Online Courses

The mentioned trainings can be built around following families (Figure 26):

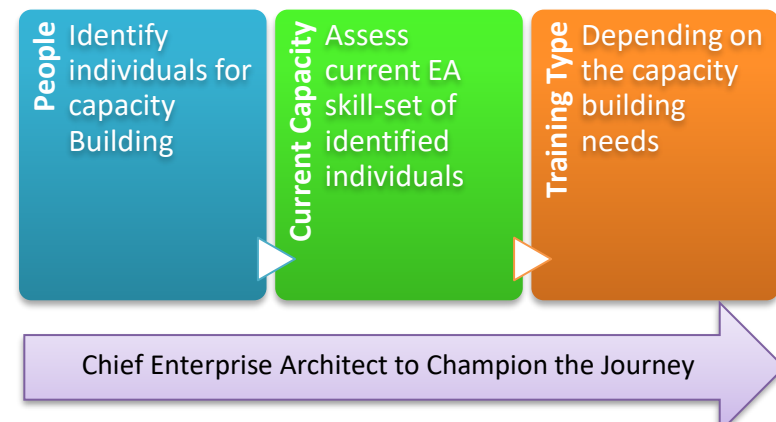


FIGURE 25: CAPACITY BUILDING NEEDS ASSESSMENT

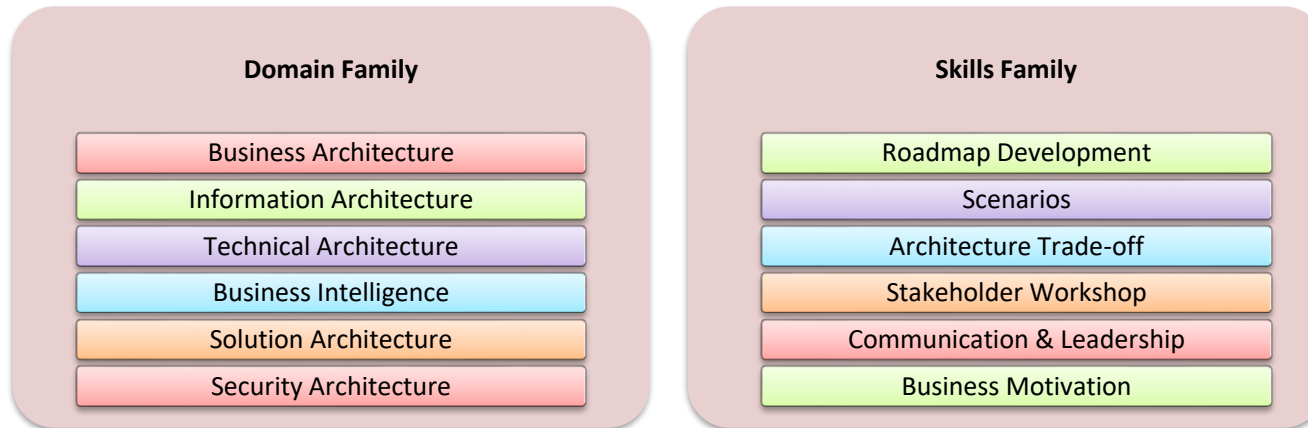


FIGURE 26: TRAINING NEEDS FOR VARIOUS ARCHITECTURE DOMAINS

In addition to the aforementioned training programmes, an individual can enhance the EA skills by undergoing **TOGAF 9.0 Certification Training**.

There are two levels to TOGAF 9.0 certification. These are Level 1, known as TOGAF 9 Foundation, and Level 2, known as TOGAF 9 Certified.

Level	Tag	Purpose
1	TOGAF 9 Foundation	To provide validation that the candidate has gained knowledge of the terminology and basic concepts of TOGAF 9 and understands the core principles of Enterprise Architecture and TOGAF
2	TOGAF 9 Certified	To provide validation that in addition to the knowledge and comprehension, the candidate is able to analyze and apply the knowledge of TOGAF

Using TOGAF results in enterprise architecture that is consistent, reflects need of stakeholders, employs best practice, and gives due consideration to both current and future requirements of the business.

The lessons of TOGAF training course is divided into the following five parts (Figure 27).

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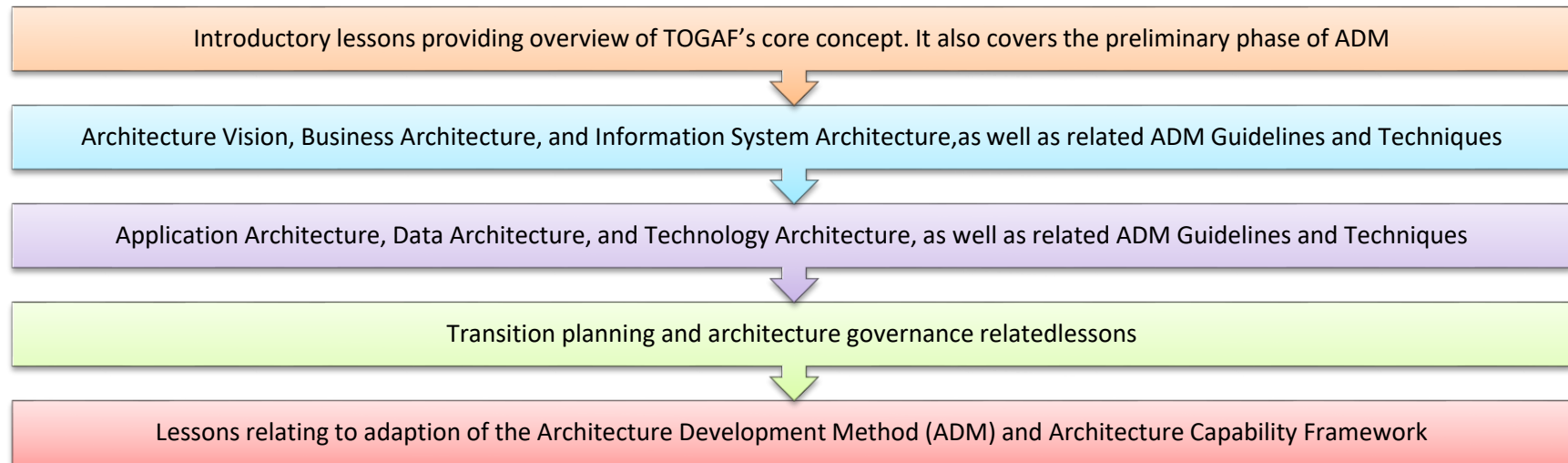


FIGURE 27: TOGAF LEARNING PHASES

For any EA program, Communication, Training and Education are important elements. The purpose of the EA team is to facilitate communication and learning within the Office of CIO, Public Bodies and External Stakeholders. Following broad activities need to be undertaken within a Capacity Building Initiative

1. Providing strategic communication and learning advice
2. Developing and maintaining communication and learning plans
3. Designing and Delivering Education, Training and Awareness materials such as presentations and learning modules
4. Ensuring Stakeholder Engagement
5. Ensuring Continuous improvement of communication processes and practices

Summarizing, it can be concluded that for a successful EA program different skills are required at different hierarchy levels and each skill need not be of same proficiency level. The TOGAF Architecture Skills Framework identifies four levels of knowledge or proficiency for a given role.

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Level	Proficiency	Description
1	Background	Not a required skill, though should be able to define and manage skill if required
2	Awareness	Understands the background, issues, and implications sufficiently to be able to understand how to proceed further and advise client accordingly
3	Knowledge	Detailed knowledge of subject area and capable of providing professional advice and guidance. Ability to integrate capability into architecture design
4	Expert	Extensive and substantial practical experience and applied knowledge on the subject

Sample Skill Matrix

Roles	Architecture Board Member	Architecture Sponsor	Enterprise Architecture Manager	Enterprise Architecture Technology	Enterprise Architecture Data	Enterprise Architecture Applications	Enterprise Architecture Business	Program/Project Manager	IT Designer
Generic Skills									
Leadership	4	4	4	3	3	3	3	4	1
Teamwork	3	3	4	4	4	4	4	4	2
Inter-personal	4	4	4	4	4	4	4	4	2
Oral Communications	3	3	4	4	4	4	4	4	2
Written Communications	3	3	4	4	4	4	4	3	3
Logical Analysis	2	2	4	4	4	4	4	3	3
Stakeholder Management	4	3	4	3	3	3	3	4	2
Risk Management	3	3	4	3	3	3	3	4	1

TABLE 6: SAMPLE SKILL MATRIX

VII. Procurement Needs Assessment

The success of an EA program hinges on its right implementation. The key to a proper implementation is assessing whether the capability for it lies in-house or it has to be done with the support of an external consultant partner. Once the intent has been established, the first step to this initiative is to assess the in-house capability to implement which starts with capability organizational Budget assessment. It sets the tone for effort estimation in an EA office (Figure 28).

The scope of work as defined in **Section 4** of the guide follows the assessment of budget for the initiative. Suggestions can be taken from IndEA working group. The definition of enterprise cannot be outsourced. It is a strategic decision that has to be taken by the organization to define the depth and breadth of EA. It is important to realistically define implementation timelines in accordance with breadth and depth of EA. Not all digital initiatives identified can be implemented on the first day. Final step is to follow the MeitY guidelines.

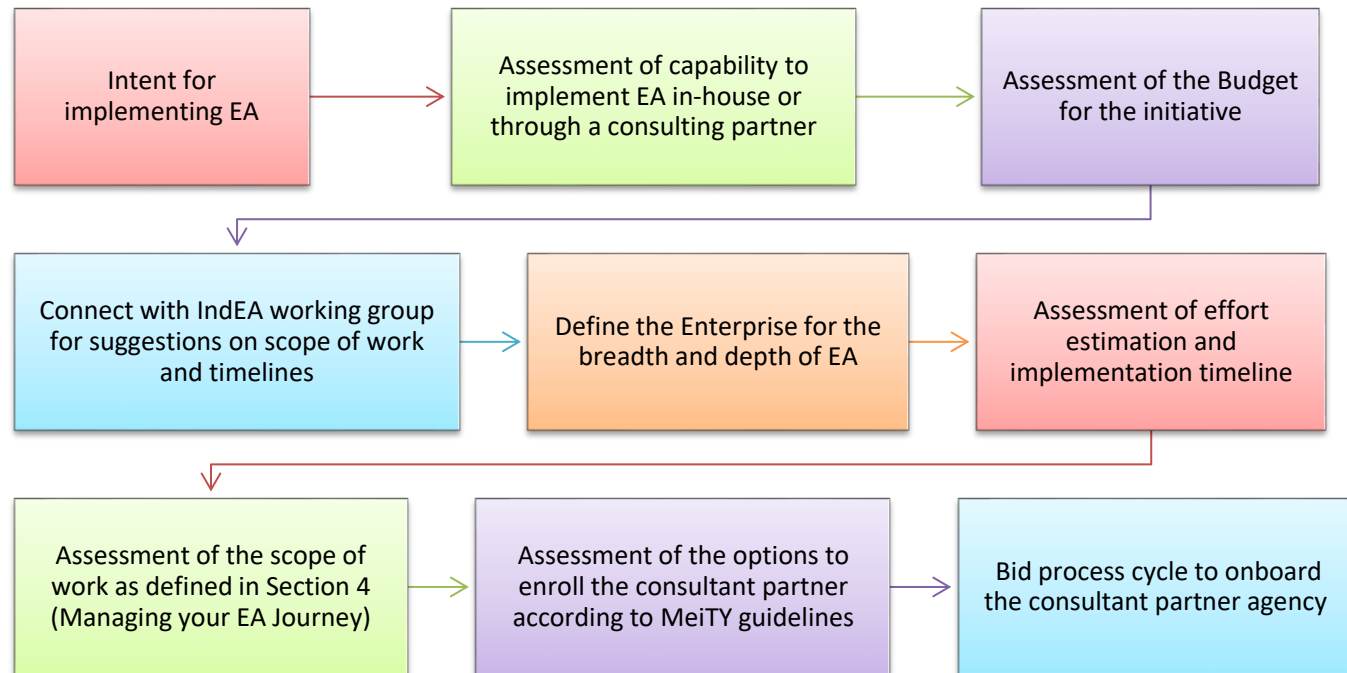


FIGURE 28: PROCUREMENT NEEDS ASSESSMENT FOR ENTERPRISE ARCHITECTURE

VIII. Summary of EA Tools and their Capabilities

EA tools store description of architectural domains as separate independent models, auto generate visualizations, increase consistency of the architecture and have a database of the architecture principles. A good EA tool should minimally have, a repository, a metamodel that supports business, information and technology viewpoints along with solution architectures, ability to create or import models and artifacts and the ability to present repository information to support stakeholder needs, including graphical text and executable forms. Some of the best tools available in the market are:

Vendor	Tool	Evaluation criteria					
		Governance, Risk, Compliance	Program Management	Enterprise/ IT Portfolio Management	Business/ IT Strategy	Enterprise Architecture	Solution Architecture
Mega	HOPEX	*		*	*	*	*
Software AG	Alfabet, ARIS	*	*	*	*	*	*
BiZZdesign	Enterprise Studio	*			*	*	*
QualiWare	QualiWare EA	*	*	*	*	*	*
Avolution	Abacus			*	*	*	*
Planview	Troux, Planview Enterprise, Projectplace	*	*	*	*	*	*
Orbus Software	iServer					*	*
Sparx Systems	Enterprise Architect					*	*
BOC Group	ADOIT					*	*
Unicorn Systems	System Architect, Focal Point	*	*	*	*	*	*

Legend: “*” depicts the specific capability fulfilled by the tool.