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STUDY AND RECOMMENDATION ON THE ROLE OF INFORMATION TECHNOLOGY IN THE EFFECTIVE IMPLEMENTATION OF E-GOVERNANCE PROGRAMS

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ABSTRACT

Innovation and the growth of consumer-centric communication and digitized service delivery involve continued investment in the latest technology. And public sector agencies, like any other large enterprise, are expected to deliver programs with minimal human intervention to corporations, other partner public entities and to the citizens. And unlike an organized and tightly controlled private enterprise, due to many factors, government organizations frequently fail to deliver as expected. A detailed systematic review of existing research work has helped to identify key factors that define the role of IT in effectively implementing G2G, G2B and G2C services. This research illustrates the need and strategies for public sector standardization of the information technology environment. The main guidelines are presented based on the context of enterprise architecture and how standardization will gain control over the potential return on investment in technology. The study also opens the doors to further proposals for research and s tandardization in the Indian public sector, as the recent adoption of enterprise architecture framework for government initiatives matures further. ***General Terms:*** *Enterprise Architecture Implementation Capability, Standardization of the Use of Information Technology in Indian Public Sector*

KEYWORDS: *Enterprise Architecture, EA Implementation Capability, Connected Governments, e-Governance, Information Technology, Business Value, Digitalization, Innovation, Indian Public Sector, IndEA.*

1. Background

1.1 Digitalization & EA

Digitalization has played a vital role in business growth over the last three decades, enriching citizens' lives and characterizing India's overall development. While the private sector earned the greatest reward for digitization by improvising processes and running the technology-led systems, Indian public sector digitalization ingestion remained at a moderate pace and somewhat challenging. Among the major challenges faced by the public sectors were cooperation between different functions, process transformation, information sharing and organizational streamlining. [1] These problems can be easily addressed by implementing a set of standards and rules that can be personalized and allow the public sector to achieve, but in the least disruptive way, complete digitalization and other transformation projects. An architectural framework can tackle these challenges and pave a way for the transformational journey needed. [2]

An architecture framework is a foundational structure, or set of structures, which can be used for developing a broad range of different architectures. The purpose of enterprise architecture is to optimize across the enterprise the often-fragmented legacy of processes (both manual and automated) into an integrated environment that is responsive to change and supportive of the delivery of the business strategy. [3] This paper highlights the use of Enterprise Architecture (EA) to reap the maximum benefits of digitalization of Information Technology (IT) and to effectively deliver the services to the consumers. [4]

1.2 Evolution of IT in Indian Public Sector

Leveraging the established context, it is evident that for a successful delivery of services, IT has become an enabler as well as process and people together leverage it for better outcome. Digitalization of processes and infrastructure was needed for effective governance through electronic medium. [2] [5] [6] The digital delivery of services with neatly embedded process demands for the certain standards to be adhered to and if the delivery organization is as large and complex as a government, then setting up and maintaining the standards discretely, becomes a challenge. [7] [8]

Fig 1: Stages of Digitalization

To blame the absence of adequate processes and standards to manage and maintain the whole IT eco-system in public sector, it was the inorganic growth of the digital footprint. Following subsections highlight the different stages of technology evolution.

1.2.1 Compartmentalized

This was the era of the rise of computers within departments of the public sector and computers were introduced as stand-alone machines exclusively for data entry work. The increased adoption of computers, however, required the exchange of information within site / office, and thus required the mutual use of resources such as printers, files, etc., exploiting networking capacity.

While the citizens were not the clear beneficiary of the digital development at this stage, but inter-departmental need of running same set of technology framework became the immediate need to have effective process automation and information exchange. [7] [9] [1]

Fig 2: Challenges of Compartmentalized State of IT

1.2.2 Departmentalized

During this activity, there was invent of having citizen centric web applications to provide information, forms and email-based querying apart from providing some key statistics and news about the agency. Meanwhile, India's IT policy system was also being developed and established to provide simple set of standards on the availability, reliability, and privacy of information that was being distributed, shared, and interpreted across the various public departments. [10] [5]

The departmentalized state of digitalization was on the verge to have a major transformation by means of skills, processes and infrastructure underneath. The transformation also became a mandate, forcing government to decide on digital

programs budgets and creating overall strategy on a focused standard based approach, which will be followed by each associated department/function. The following challenges also acted as a catalyst to push different departments/functions towards having a standards-based model:

Fig 3: Challenges of Departmentalized State of IT

1.2.3 Standardized

With the rise of ICT in India, more and more discrete systems and technologies started dominating the operating environment and service delivery. The whole ICT world became the OEMs play with little space to define or amend the application structure. While private sector leveraged global consultants to lay down the scope and developed their own systems and architectures as per the defined set of rules, the public sector could not transform the underlying ICT systems due to several compelling reasons, which inhibited the required transformational movement.

GOI established Ministry of Information Technology in 2000 and the formal bodies were formed to conceive the different plans to boost the adequate use of ICT not only for provisioning the service through digital platforms but also to assess the citizen satisfaction and readiness for active participation in governance. Finally, in 2006 GOI released NeGP and under this plan several high priority projects were proposed, better known as Mission Mode Projects. However, the prime focus of these MMPs remained limited to the automation of the mundane tasks for different public service organizations. [1] [7] A research study stated that till 2006, out of all the eGov projects across the globe, 80% of them failed to achieve the desired outcome, resulting into a massive wastage of financial, human and political resources. [7]

Focusing on the ICT part of the failure, several research studies stated the need of a framework which could govern the overall transformation with seamless integration between the different phases i.e. from defining the strategy, mapping the skills and to the execution of the program. Enterprise Architecture was the framework, which provided the required help to reduce the complexity of overlapping systems and underlying discrete set of standards.

EA is characterized as the continuous procedure of building the capacity to handle unpredictability, with the critical objective of developing and supporting realistic service organizations. A logical EA design approach is used to plan and execute major transformational initiatives. However, for any government, the greatest need for EA is to improve service delivery to citizens and effective governance.

Generally, information on standards, skills, processes and technology across different functions of a multifaceted organization like any government, is available in a complex format and EA helps to manage it in a better, faster and cheaper way [9]. The motive of an enterprise is to give services to their consumers and its structural design is the EA. A logical structure for classifying and organizing complex information systems of an enterprise called its Enterprise Architecture Framework (EAF) [6]. EA comprises the enterprise components or business components with its properties and relationship. It mainly focuses on defining business components, addressing integration patterns, and deals with infrastructure including servers, databases etc., of an enterprise.

To summarize, the issues described here are not unknown to the Indian public sector, where government agencies have been troubled in the jungle of legacy systems, cost cuttings and the growing demands for efficiency, agility and better services. EA can help GOI to mitigate the issues and risks of running discrete systems across the functions and enable the Digital India approach in the more profound manner. [10] [11] [12] [13] [14] [15]

To summarize overall state of IT landscape and existing information systems are suffering with the following challenges:

TABLE 1. KEY CHALLENGES

Challenge	**Description**
Discrete Systems [8] [9]	Each local/regional office started their own procurement and hence ended up creating a farm of discrete systems
Information Sharing	Between the applications from different suppliers, there was no mean to share the data. Their interface didn't follow any standard protocols or formats to exchange information
Data Security [10] [8]	Data authenticity, integrity and security remained in question because local suppliers had the super admin privileges and none of the department user was well ready to transfer the knowledge or systems ownership
Inorganic Growth [11]	Generally local suppliers didn't plan for data/transaction growth and hence local bodies were forced to buy new application systems with new hardware. But again, due to the vendor lock-in issue, data from older systems could not be migrated to new systems and hence both instances of applications kept running
No Reporting [8]	Reporting from the discrete set of applications was another challenge and hence there were multiple

	reports available and each in different format, raising questions on overall efficiency of any given application or of overall information system landscape
Policy Compliance [12]	Overall technology landscape was disconnected and hence was not in compliance with major national and regional policies and guidelines
Skilled Personnel [12]	Technical trainers were not available and collaboration and learning sources were scarce. In addition to that there was a push-back from the public sector staff to learn technology
Process Compliance [10] [8]	The discreteness of systems resulted into another major challenge that almost no proposed system could completely adhere to the established departmental processes. Every system proposed the process re-definition and amendments and hence diluting the impact of overall service delivery
Cost Optimization [9]	With the growth of IT ecosystem there was a need to optimize the costs and deriving maximum value from the investment, but the overall un-organized local procurements resulted into shadow IT, multiple procurements for the same system and higher cost of systems support from suppliers

2. E-Governance & Digitalization

2.1 Literature Review

The idea of several nations was to use EA to remove the difficulties of managing fragmented processes, unstructured information and inefficient use of skills and resources, those who initiated the digitalization push to improve the citizen experience of the services being provided. Several scholars from across the globe has published several research papers highlighting the need of EA for better e-Governance. They also analyzed the output from different interviews with the different case organizations using empirical research techniques and highlighted the state of evolution of EA, the complexities of implementation and their benefits for governments.

In order to carry out the detailed analysis of multiple research papers and to put the information and analysis in Indian public context, Prisma flow diagram was adopted and following depicts the data with research papers/articles count and filtering.

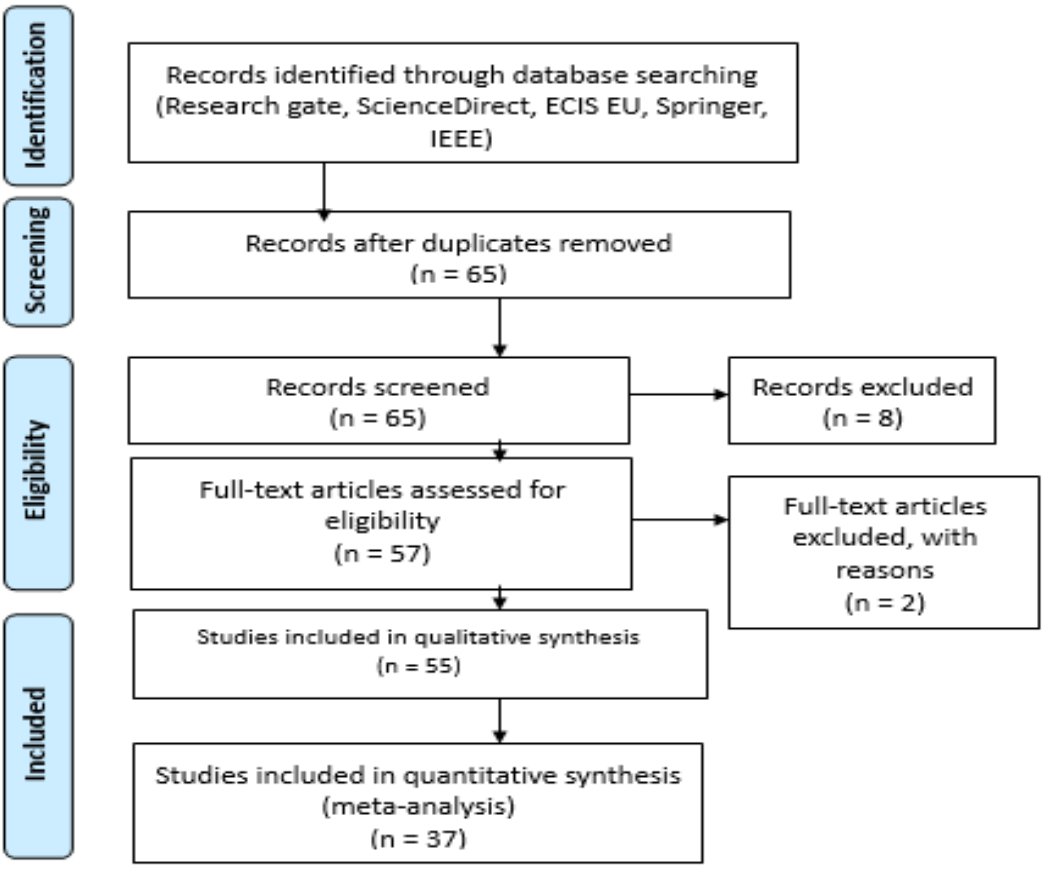

Fig 4: Prisma Flow Diagram

As the governments do not work like private sector [14], there are different factors which impact the EA development and most important ones are:

Fig 5: Key Factors for Effective e-Governance Initiatives

2.2 Key Findings

The following table illustrates the few of the countries where public sector has adopted and evolved EA for e-Governance programs and other initiatives:

TABLE 2. EA FRAMEWORKS STUDIED

Country	EA Framework	Literature Studied	Ref
USA	US FEAF	4	[15] [16]
Thailand	TIF	1	[15]
UK	xGEA	1	[16]

Germany	SAGA	1	[16]
UAE	Togaf	5	[16] [17] [18] [19] [20]
Korea	GEAF	1	[21]
China	National EA	1	[22]
Netherland	DYA	1	[23]
Sweden	BITA	2	[24] [19]
Malaysia	IGovEA	2	[18] [25]

A detailed systematic literature review highlighted that there were different objectives in mind when different EA frameworks were adopted by these public organizations (as mentioned in the Table 2. These objectives resulted into evolution of government enterprise architectures (GEA) which were specific to the country or department.

From the deep analysis of the studies of adoption of EA by different public sector institutions and governments across the globe, it is evident that IT plays a critical role in enabling the digital delivery of various government services to consumers. [10] [19] [18] It was also observed that EA framework adoption and evolution plays a vital role in standardization of IT landscape, associated processes and people. EA framework becomes a fabric to let people use the IT to deliver the services as per set standards and hence helps to achieves maximum consumer satisfaction. [11]

To make sure that IT investments are realized to the full potential, several initiatives are required to be considered to attack the IT landscape first so that EA framework could be leveraged to repair the revenue leakage and improving overall information flow across the existing systems. A service-oriented architecture design can help to design and deliver the required services using loosely coupled modules/components interfacing different systems or sub-systems. [4][33]

Globally, technology has been the biggest enabler to bring about significant change in both the private and public sectors. Given the complexity of the implementation of initial e-Governance initiatives on such a large scale and unparalleled scope, it is important to choose innovative and emerging technologies that can be customized, offer investment re-use, deliver value to service consumers, agility, better visibility on whole eco-system, effective management of resources and support process re-engineering. To support the initial initiative's vision and foundations, technologies such as cloud computing, automation, and analytics would be the most suitable. [12] [10] [17] Government of India (GOI) has been looking forward to improving the e-Governance and other mission mode programs to follow a common set of standards and policies and hence kept working with The Open Group to setup the initial draft of enterprise architecture of India (IndEA). Which further focuses on standardization of IT landscape, its

procurement, acquisition, customization and further progressive adoption to other initiatives. [33] [6] [4]

E-governance capabilities of a nation are measured the world over by the UN e-government survey rankings. The overall impact of few of the past initiatives was that GOI introduced similar projects at national level and the overall result was shown the Digital Evolution Index report (2017) by Digital Planet, which shows India as a steady mover towards digitalization. The international e-Government development index based on the survey of United Nations, India stands at 107th position as compared to 125th position in 2012. Similarly index report states the improvement in e-Participation with 27th position in 2016, as compared to 75th position in 2012.

Dr. P. Saha of The Open Group along with other researchers, Enterprise Architects and executives, has written several research papers, which were inducted as e-Governance program development guidelines by several governments across the globe. His contribution as a thought leader in drafting the first IndEA guidelines is commendable. He has repeatedly researched and released the articles that how the government's fragmented way of working could be transformed as a connect government using EA framework and position technology as a key enabler. [6] [18]

Similarly, other researchers have highlighted to focus on the improving and standardizing the IT landscape first so that a better EA framework implementation could happen.

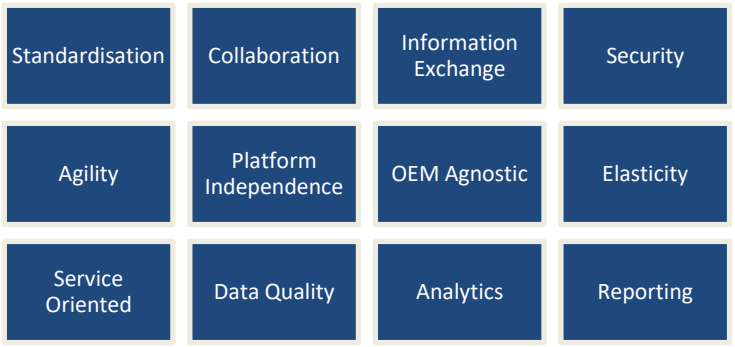

Fig 6: Key Factors foe Effective e-Governance Initiatives

There after next level of e-Governance programs could be initiated because IT becomes the foundation of such programs and will enable with above benefits. These factors are summarized in detail in consecutive section.

Fig 7: DIE Score Showing India in Steadily Advancing Countries

3. Recommendations

3.1 IT Standardization Benefits

To adopt the latest innovation in technology and to get maximum value from the investment in technology, it is required to have the set standards right from the procurement of IT. Several governments in different countries, while working on re-inventing and digitalizing the governance programs, paid much attention on standardization and kept it on top priority. And all e-Governance initiatives are prone to have a direct impact of political change, it was required that the core fabric of standards remain the same and unchanged and thus bringing the required rigidity and mandate to adopt the changes as per the set standards and policies as defined and governed by EA framework. [27] [24] [3] [5]

Digital evolution while provides power to consumers to receive and consume services with ease, it also becomes the single platform to deliver maximum number of required services. Additionally, consumer satisfaction index could be directly mapped with overall effectiveness of e-Governance program implementation, by capturing the feedback and providing required support on complaints and issues while using the same platform. [5] [34] [35] [13] Following are the key benefits, which could be achieved by standardizing the technology landscape, while keeping focus on other associated areas like trainings, budget approvals, identification of

EA framework and adoption, having right stakeholders on core team. [25] [10] [28] [36] [32] [5] [17] [29] [23] [7] [21] [37] [2]

3.1.1.1 Standardization

Establishment of national standards for procurement and acquisition of technology helps the overall effectiveness of existing systems and seamless transition towards target state of operations.

3.1.1.2 Collaboration

Having a common goal enabled by technology platform, where key resources could be assigned tasks and sub-tasks with adequate tracking mechanism, improves the overall collaboration within the team and removes ambiguity or doubts.

3.1.1.3 Information Exchange

Focusing on digital platforms which use open standards and protocols/formats for information exchange, provides the authenticity and integrity of data, which could be interpreted by other systems seamlessly.

3.1.1.4 Data Quality

The new system must adhere to the data quality standards so that overall effectiveness of e-Governance program and associated data could be measured by means of quality of information.

3.1.1.5 Security

While opting for new information systems platforms or modernization of existing systems, data security must be considered as key deciding factor. The platform must support a holistic approach to data security be it data at rest, in transit or under processing by application.

3.1.1.6 Agility

To be able to transform or adopt new industry information standards or protocols is another important factor while deciding on the target state of IT landscape. Agile systems help to adopt the change easily.

3.1.1.7 Platform Independence

The target state of IT must adhere to the guiding principle where information or data can be transported/migrated to new platforms easily and without any dependency on technology.

3.1.1.8 OEM Agnostic

The selection of systems/technologies must be such that it can work on different hardware with almost same capability. Selecting an OEM agnostic platform is a

very skillful decision and generally requires participation of industry experts to down select the best available system/technology.

3.1.1.9 Elasticity

The platform must support sudden ramp-up or ramp-down depending on the requirements. This feature will shorten the time to sell and enables no-interference provisioning/de-provisioning of access resources.

3.1.1.10 Service Oriented

The new digital platform must adhere to service-oriented architecture and hence makes the re-use of different software components in other systems as required.

3.1.1.11 Analytics

The new information system must have the inbuilt analytics capability so that it can churn the captured information and produce actionable intelligence to leadership and other stakeholders.

3.1.1.12 Reporting

The proposed system must have a separate reporting interface which could produce a governance dashboard, different alerts and customized reports in different formats, to support the effective decision making.

The first and foremost objective of EA implementation revolves around establishing standards for IT reuse, deriving value and increase digital footprint for the services being delivered via G2G, G2C and G2B channels. By setting up standards for IT procurement and inter-system data exchange formats and protocols, the overall e-governance is improving during past 3 years, which is pretty evident from the DIE score card for India.

Highcharts.com

EGDI Rank	2016	2014	2012	2010	2008	2005
India	107	118	125	119	113	87

Fig 8: E-Government Development Index

Highcharts.com

EPART Rank	2016	2014	2012	2010	2008	2005
India	27	40	75	58	49	57

Fig 9: E-Participation Index

4. Conclusion and Way Forward

4.1 Way Forward

The research acts as a foundation stone to further research on the subject and opens the channels of debates and development of direct co-relation between IT modernization and standardization, and implementation of EA-led e-Governance programs in India. Indian public sector, though is actively engaging citizens, businesses and peer government organizations to come to a single platform and start discussing about expectations and how the gaps could be covered by implementing the new digital technology initiatives which further promotes technology re-use, effective program governance and reporting, stakeholder sentiments feedback, analysis and intelligence on future resource requirements and setting up a standardized digital landscape across public sector, starting with mission mode programs.

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