The Interoperability Framework for Integration of E-Governance Services Based on Semantics an Indian Perspective

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1. Introduction

The topic of E-Government (EG) has been of significant interest to researchers, professionals, politicians, and decision-makers for several years, since its emergence in the 1990s. The subject matter under consideration is a field of study that encompasses multiple disciplines and serves as a nexus for other related research domains. This trend is characterised by a comprehensive, integrated, and interdisciplinary approach, as evidenced by sources [1] and [2]. The dynamic nature of citizens' demands in the realm of information and communication technology (ICT) has necessitated the acquisition of new proficiencies, aptitudes, capacities, and erudition by researchers and practitioners. This is in order to effectively adapt to the evolving service delivery environment of ICT.

The objective of the EG is to enhance the quality, speed, convenience, affordability, efficacy, and efficiency of public services offered to its stakeholders, including citizens, businesses, employees, and other governmental bodies, through a unified platform. The Evolutionary Growth (EG) model progresses through four distinct stages of maturity, namely Information, Interaction, Transaction, and Transformation. The field of EG Development (EGD) exhibits similarities across different countries, albeit with greater complexity in India owing to a multitude of factors. On a global scale, the EG system (EGS) represents a concerted effort to eliminate redundant data and minimise unnecessary effort through a comprehensive approach. The requirement for interoperation between governmental departments across the country is perceived as a crucial element in a developed EGS. The primary obstacle in EGS appears to be the EG Interoperability (EGIOP) [3].

The utilisation of Service-Orientation (SO) within Enterprise Systems (ES) offers a comprehensive structure for facilitating interoperability. This facilitates the exchange of data among diverse participant systems, enables their participation in Business Processes (BP), and fosters collaboration towards achieving the common objective of the enterprise. Current research has identified a strong correlation between the public service concept and the more technologically-oriented service concept utilised in Service Oriented Enterprise (SOE), particularly in light of EG's classification as an ES. The responsibility is directed towards attaining an Agile Enterprise Governance Structure. The adoption of a Service-Oriented System (SOS) is a contemporary approach that can enhance an organization's agility by transforming its conventional enterprise. This study presents a proposal for

a Service-Oriented e-Government Enterprise (SOeGE) system that aims to implement Agile EGS as a viable solution for EGIOP. The objective is to facilitate the provision of integrated public services in the Indian context.

2. Literature Review

The concept of e-Government Interoperability (e-GI) pertains to the capacity and consensus among the disparate administrative reforms of the e-Government system to effectively exchange information with one another [4]. According to reference [5], the term interoperability refers to the capacity of multiple e-Government systems or components with different characteristics to effectively and smoothly exchange information and utilise the exchanged information. This results in the interoperability among e-Government systems, as referenced in sources [6] and [7]. The attainment of electronic government infrastructure (e-GI) is a gradual and iterative process that necessitates the establishment of a robust framework comprising personnel, procedures, technology, and expertise, as indicated by sources [8] and [9]. The employment of methodological tools such as e-GIF and NEA [10], [47] can facilitate the achievement of the task at hand. The Electronic Government Interoperability Framework (e-GIF) comprises a compendium of standards and guidelines that are recommended for implementation by diverse electronic government entities to facilitate interoperation [11]. The NEA is a nationwide architectural framework that encompasses a detailed depiction of fundamental components and their interconnections within government enterprises [12].

During the 1970s, India began utilising information and communication technology (ICT) for internal government applications aimed at managing data-intensive functions such as elections, census-taking, and tax administration. The development advanced in the direction of the technological framework utilised for the provision of services and the processing of information [13]. The Government of India (GOI) continued its electronic governance journey by implementing significant policy initiatives in 1999, which served as a crucial milestone. Subsequently, in 2006, the GOI proceeded with the launch of the National e-Governance Plan (NeGP)[14], which was a national strategy aimed at promoting electronic governance. The National e-Governance Plan (NeGP) established a framework for electronic governance initiatives that progressed through various stages of development, including Information, Communication, Transaction, and Transformation. This model was documented in reference [15]. India has successfully completed the initial two stages, wherein nearly all government departments and ministries have established their own websites. The stakeholders have the ability to gather data, establish communication with government officials, and convey their messages through designated channels, identified as windows [16] and [17]. India is currently approaching the third stage and strategizing for the ultimate stage. During the third stage, it is necessary to integrate the scattered systems that exist at various levels of government in order to facilitate inter- and intra-departmental transactions. During the transformation phase, the integration of various functions and services (horizontal) from separate e-Government systems is

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necessary [18]. The final phases necessitate a smooth and uninterrupted transmission of data among various e-Government entities, as evidenced by the e-GI.

Particularly on computerization, but efforts were also made to set up the agendas for information and service delivery. After that, numerous steps were taken to assist the government and people's instantaneous participation with the help of e-governance [5]. In the last decades, e-governance contributed much, and many projects were started in different nations around the globe [10].

The Indian government has created a division, known as the Ministry of Information Technology, which works with the Department of Electronics to accomplish various e-governance objectives. One of these was to electronically distribute a minimum of 25 percent of government services by the end of 2005. [16] mentioned that the earliest e-governance project that started in Kerala was AKSHAYA. It involved around 5,000 multipurpose organizational centers in Kerala called Akshaya e-Kendra. To consider the needs of about 1000-3000 families, each e-Kendra was located within 2-3 kilometers of every household. It was a social and economic facilitator focused on e-learning, e-transaction, e-governance, databases, e-transaction. With the success of this project, the participation of the nation towards e-governance was commenced.

Various e-Government agencies at the central, state, and grassroots levels have implemented multiple initiatives that offer exceptional services to their stakeholders. However, a few of these agencies continue to rely on outdated legacy systems and manual processes [19]. In order to disseminate these exceptional islands of proficiency throughout the nation, there is a need for a nationwide electronic governance infrastructure (e-GI) in India. E-government agencies are independently creating systems to enhance service delivery to their clientele, without prior knowledge of other departmental systems and without due consideration of integration. The duplication of data and efforts has led to the generation of multiple applications, as evidenced by sources [20]. The implementation of this action results in an escalation of expenses and intricacy. The reusability of software components in e-Government applications throughout the nation constitutes a viable solution. The feasibility of accomplishing this task is contingent solely upon the utilisation of electronic government infrastructure within the confines of the nation.

India has implemented several initiatives in the field of electronic government information (e-GI). The proposed concept involves a comprehensive framework of fundamental policies and infrastructure amenities aimed at facilitating a cohesive provision of services. India has established a national web portal known as the e-India Portal, in addition to state portals [21]. The Government of India has created a national e-GIF, known as the Interoperability Framework for e-Governance (IFEG), which establishes policies and standards for multiple domains. The text describes the presence of a national policy pertaining to open standards [22], as well as the existence of standards for both technical and non-technical domains.

The process of standardisation is considered a viable initial step towards embarking on the

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enterprise architecture journey for numerous nations, as per reference. The Government of India envisions the National e-Governance Architecture (NEA) as a means to facilitate electronic governance infrastructure, as stated in sources [24] and [25]. India has initiated several measures as discussed above to embark on its journey towards Environmental Accounting (EA). Therefore, based on the aforementioned amenities, it is feasible to initiate EA in India.

In recent years, there have been numerous global endeavours to assess the feasibility of employing Enterprise Architecture (EA) and Service-Oriented Architecture (SOA) in the context of electronic government (e-Govt) systems. A framework for e-Government in India was proposed by some researchers who analysed the existing concepts and methodologies of Enterprise Architecture (EA), as documented in sources [11] and [14]. Certain scholarly works suggest the adoption of Service-Oriented Architecture (SOA) as an alternative to Enterprise Architecture (EA) in the context of electronic government, as referenced in sources [23] and [16]. IBM suggests the simultaneous utilisation of analogous technologies, namely EA and SOA, within an administrative system. Based on their empirical observations, the authors arrived at the conclusion that while there may be some overlap between architecture domains, the strategic utilisation of these domains within an IT-centric enterprise can yield significant benefits [11].

The focus of EA is primarily on enterprise components and their interrelationships, with relatively less emphasis on business services. Therefore, Electronic Administration (EA) in isolation is insufficient for the effective management of electronic government systems. According to IBM, the incorporation of Service-Oriented Architecture (SOA) principles within an Enterprise Architecture (EA) framework has the potential to address interoperability challenges, thereby enabling the integration of business services across an organisation. The present study expounds on our suggested conceptual framework [2], incorporating a Service-Oriented Government Enterprise Architecture (SOGEA) within the context of India.

3. Findings

The administrative framework of India exhibits notable distinctions from that of other nations. The matter becomes more intricate due to the multi-tiered structure of departments or governmental agencies at the central, state, and local levels [26]. Various e-Government agencies have implemented multiple e-Government initiatives, some of which offer exceptional services to their stakeholders via their respective websites [40]. However, the existence of various administrative levels has led to the creation of multiple systems and duplication of data and efforts, as evidenced by sources [27] and [12]. The sole resolution to this predicament is the integration of application silos through the reuse of software components, resulting in a one-stop service delivery. The integration can only be achieved through the utilisation of e-GI at all levels throughout the nation [6]. The Government of India made a sincere effort to implement a high-tech system in a gradual manner. This system facilitates the proximity between the government and its citizens by providing access to government services.

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The Government of India (GOI) perceives the Enterprise Architecture (EA) paradigm as a mechanism for the electronic Government Infrastructure (e-GI) to provide cohesive electronic government services via a unified interface, as referenced in sources [16] and [25]. The primary focus of EA is centred on the delineation of business components, the resolution of integration patterns, and the management of infrastructure. The business services exhibits limited functionality. Therefore, it can be argued that Enterprise Architecture (EA) in isolation may not suffice for a complex service-oriented system that involves multiple levels of government agencies with separate ownership structures, such as e-Government. The focus of Service-Oriented Architecture (SOA) does not encompass the creation of business architecture within an organisation. The approach employed does not rely on conventional methods, but rather utilises the results of business processes and other artefacts of business architecture to serve as input for the purpose of identifying business services. Service-Oriented Architecture (SOA) possesses the capability to arrange and employ dispersed business functionality that could be managed by distinct ownership domains.

The Government of India has developed the e-India portal, which aims to provide a unified platform for accessing government information and services in multiple languages. The establishment of a national electronic Government Interoperability Framework (IFEG) has been proposed. This framework would consist of a comprehensive collection of standards, policies, specifications, and guidelines that would govern the flow of information across various government sector agencies. The e-Governance Service Delivery Gateways were implemented in India to establish a standardised interface for the exchange of services between consumers and providers within the e-Government system. Within the present context, it is deemed sufficient to employ a comprehensive conceptual framework in the Indian context. In our prior research [29], we presented a conceptual model for electronic governance infrastructure (e-GI) utilising enterprise architecture (EA) and service-oriented architecture (SOA) frameworks, leveraging the pre-existing resources in India.

The primary components of the framework under consideration are as follows:

1) The stakeholders: The primary stakeholders of the electronic government system in India comprise of citizens, businesses, employees, and governmental entities. The internet serves as the communication channel through which individuals can submit requests for government services via a national portal that offers web-based services. The individuals or groups who utilise the services are considered the stakeholders.

2) National Portal: According to sources [5] and [12], a national portal based on Service-Oriented Architecture (SOA) provides a convenient method for accessing government services. The national portal possesses the capability to function as the primary interface of the entire Government Emergency Assistance and Facilitation (GEAF) system. According to reference [6], it functions as an intermediary between the stakeholders and the electronic government agencies or departments. This facilitates the provision of integrated government services through the rapid integration, construction, and deployment of new services across various departments.

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At present, the e-India portal functions as a routing mechanism to various other websites. The feature is characterised by its static nature, which precludes the possibility of conducting online transactions. The proposed portal offers a centralised online platform for accessing information and services from various e-Government agencies, catering to diverse linguistic needs. The platform is anticipated to serve as a centralised repository for over 6500 government websites, encompassing diverse categories of content such as forms, acts, rules, services, schemes, and documents. At present, the appointment of National Portal Coordinators is carried out on a state-by-state basis, with the aim of facilitating content creation [20]. The e-India portal has the potential to be transformed into an online portal within a well-established e-Government system.

3) Service providers: The Government agencies at the central, state, and local levels are the service providers within the framework of the Government Enterprise Architecture Framework. Government agencies offer public services in response to stakeholder requests via the national portal.

4) Architectural Domains: The GEAF framework typically comprises discrete architectural domains. The concerns regarding BPA pertain to the delineation of operational procedures for services, the definition of cross-agency services, the facilitation of departmental communication, and the establishment of standardised processes to promote interoperability and reuse. The issue at hand pertains to the challenges associated with establishing a clear and comprehensive delineation of services, their interrelationships and dependencies, as well as the requisite procedures to be adhered to for each service provided by various governmental entities. The text delineates the application architecture of individual services across various tiers in the form of modules. The DIA is focused on compiling a comprehensive list of all data elements related to services, as well as the associated data and metadata. Additionally, the implementation of open data systems based on established standards is intended to promote seamless integration and interoperability. The technology platforms for software and hardware are defined by the TA according to established standards that prioritise flexibility, interoperability, security, and modularity. Additionally, the TA outlines how technology is utilised to facilitate the delivery of service components, and specifies the relevant standards for implementing said technology, as referenced in sources [30] and [31]. Architectural domains have the potential to serve as reference models across various time periods.

5) Service Delivery Gateway: At the core of the proposed framework lies a Government Service Bus platform, designed to facilitate standardised information exchange among various governmental departments within the nation. This platform has been extensively discussed in prior literature sources. The system ought to possess an atmosphere that supports a multi-platform infrastructure for the government portal's backbone, while also enabling a user-friendly interface. According to reference [32], a services gateway serves as the basis for a GSB and functions as an intermediary between service providers and consumers. The national portal facilitates access to diverse administrative department services. A gateway facilitates the provision of unified access for consumers seeking public services from any government department.

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The proposed electronic government system facilitates stakeholder communication by allowing them to articulate their requirements in a natural language format via a centralised portal. Subsequently, the software agent, with consideration to the system designer or analyst, formalises the aforementioned need into a set of requirements. The Business Analyst has transformed these stipulations into operational features for the enterprise. The participation of both the system analyst and business analyst in the service design procedure for a centralised electronic government system results in the potential for reusing service components, which can lead to cost optimisation and timely completion of electronic government projects, as cited in reference [33].

The proposed framework serves as a platform for facilitating connectivity between the government and its citizens, thereby promoting a focus on citizen-centric and service-centric approaches. Through the implementation of this Government of India (GOI) initiative, the organisation can effectively coordinate its information technology (IT) assets with its overarching strategic objectives, particularly in facilitating public services for citizens. The outcome of this is a decrease in expenses and intricacy, while simultaneously facilitating adaptability in business operations and streamlining processes The recurrence of procedures within electronic government applications results in the replication of data and exertions. The implementation of a centralised repository for reusable service components within an e-Government system based on Service-Oriented Architecture (SOA) has the potential to prevent this issue. The utilisation of portal-based service delivery results in a reduction of service life cycle delivery time. This means that stakeholders are able to conveniently access services from their respective residences or workplaces at any given time. This results in the avoidance of the discomfort of waiting in a lengthy queue outside government offices.

Several developing nations have effectively incorporated the Enterprise Architecture (EA) paradigm into their electronic government (e-Govt) systems. In India, accomplishing the task is a challenging endeavour due to various factors, such as inadequate documentation within the current system and the division of responsibility among distinct tiers of the federal government. The utilisation of Service-Oriented Architecture (SOA) in the Indian context presents numerous challenges. According to reference [34], the initial expenses associated with the implementation of Service-Oriented Architecture (SOA) on a large scale are substantial, and the management of metadata can be quite intricate. The implementation of a new paradigm is often met with resistance from departments who have established successful applications and are hesitant to cede decision-making power to a central authority. India is currently making diligent efforts towards achieving a connected e-Government system through the implementation of an Enterprise Architecture paradigm, which is being facilitated by a strong vision and policy changes within the country.

4. Conclusion

India, as a developing nation, possesses a multifaceted administrative framework that encompasses a wide range of individuals, demographics, cultural backgrounds, and income levels, which are managed through various governmental departments and agencies at the central, state, and local

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levels. India has numerous e-Governance initiatives; however, they appear to be disparate efforts at various administrative tiers. The integration of information silos is necessary for the establishment of a unified access point for e-Government services, which can be facilitated through the implementation of an e-Government Interoperability Framework (e-GI). The National Education Association (NEA) is a methodological tool utilised to achieve interoperability within the nation. Enterprise Architecture (EA) plays a crucial role in the effective implementation of e-government applications by ensuring adherence to established standards, promoting interoperability, and upholding principles of security and transparency. India has made noteworthy advancements in the implementation of diverse e-Government initiatives and endeavours to attain integrated service delivery by means of a fundamental policy framework and infrastructure facilities.

This paper discusses the proposed framework and its implications for a Service Only Gateway Ethernet Access (SOGEA). The attainment of e-Governance maturity is a gradual process that necessitates persistent and sustained efforts over an extended period of time. India had set an expectation to achieve this by the year 2020 and is currently contemplating a granular level expansion within its borders. There is a widespread adoption of a service-oriented culture in organisations worldwide, which operates within the framework of an enterprise paradigm to ensure the provision of high-quality services. The aforementioned principle is also implemented by various governmental agencies globally in the context of their electronic government systems. The forthcoming research will focus on the integration of e-Government services within the e-Government system.

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References

[1] Shah, M., 2007. E-governance in India: Dream or reality. International Journal of Education and Development using ICT, 3(2).

[2] Paul, S., 2007. A case study of E-governance initiatives in India. The International Information & Library Review, 39(3-4), pp.176-184.

[3] Yadav, N. and Singh, V.B., 2013. E-governance: past, present and future in India. arXiv preprint arXiv:1308.3323.

[4] Anand, D. and Khemchandani, V., 2019. Study of e-governance in India: a survey. International Journal of Electronic Security and Digital Forensics, 11(2), pp.119-144.

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[5]   Paul, A. and Paul, V., 2011, February. The Implementation issues of e-Governance in India. In the Proceedings of the National Seminar on Modern Trends in Electronic Communication & Signal Processing, Kerala, India, 2011a, Excel India Publishers (pp. 43-48).

[6]   Yadav, K. and Tiwari, S., 2014. e-Governance in India: Opportunities and challenges. Advance in Electronic and Electric Engineering, 4(6), pp.675-680.

[7]   Prabhu, C.S.R., 2013. E-governance: concepts and case studies. PHI Learning Pvt. Ltd..

[8]   Sachdeva, S., 2002. e-Governance strategy in India. White Paper on e-Governance strategy in India.

[9]   Das, S.R. and Chandrashekhar, R., 2007. Capacity-Building for e-Governance in India. Regional Development Dialogue, 27(2), p.75.

[10] Singh, H., Kar, A.K. and Ilavarasan, P.V., 2017. Assessment of e-governance projects: an integrated framework and its validation. In Proceedings of the special collection on eGovernment innovations in India (pp. 124-133).

[11] Mathur, D., Gupta, P. and Sridevi, A., 2009. e-governance approach in India the national e-governance plan (negp). Transforming Government, 3.

[12] Banday, M.T. and Mattoo, M.M., 2013. Social media in E-governance: A study with special reference to India.

[13] Bhanti, P, Lehri, S. and Kumar, N., 2012. E-Governance: an approach towards the integration of higher education system in India. International Journal of Emerging Technology and Advanced Engineering Website: www. ijetae. com (ISSN 2250-2459, Volume 2, Issue 8.

[14] Marawar, T.R., Kale, S.P. and Araspure, K.I., 2010, February. E governance. In 2010 International Conference on Data Storage and Data Engineering (pp. 183-186). IEEE.

[15] Mittal, P. and Kaur, A., 2013. E-governance: A challenge for India. International journal of advanced research in computer engineering & technology, 2(3).

[16] Muttoo, S.K., Gupta, R., Pal, S.K. and Muttoo, S.K., 2019. E-Governance in India (pp. 13-25). Springer Singapore.

[17] Sivathanu, B., 2018. An empirical study of cloud-based e-governance services adoption in India. International Journal of Electronic Government Research (IJEGR), 14(1), pp.86-107.

[18] Sapru, R.K. and Sapru, Y., 2014. Good governance through e-governance with special reference to India. Indian Journal of Public Administration, 60(2), pp.313-331.

[19] Sinha, R.P., 2006. E-Governance in India: Initiatives & Issues. Concept Publishing Company.

[20] Shrivastava, R.K., Raizada, A.K. and Saxena, N., 2014. Role of e-Governance to strengthen higher education system in India. IOSR Journal of Research & Method in education, 4(2), pp.57-62.

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[21] Chauhan, R., 2009. National e-governance Plan in India. United Nations University–International Institute for Software Technology.

[22] Sharma, A., 2013. Rural E-governance in India. Yojana, p.29.

[23] Kalsi, N.S., Kiran, R. and Vaidya, S.C., 2009. Effective e-governance for good governance in India. International Review of Business Research Papers, 5(1), pp.212-229.

[24] Muttoo, S.K., Gupta, R., Pal, S.K. and Pal, S.K., 2019. Changing technological trends for E-governance. E-Governance in India: The Progress Status, pp.79-105.

[25] Kumarwad, L.L. and Kumbhar, R.D., 2016. E-Governance Initiatives in Maharashtra (India): Problems and Challenges. International Journal of Information Engineering & Electronic Business, 8(5).

[26] Das, R.K. and Patra, M.R., 2009, November. SOA for e-Governance in India: Potentials and Pitfalls. In Proceedings of the 3rd international conference on Theory and practice of electronic governance (pp. 36-41).

[27] Misra, H., 2009, November. Managing rural citizen interfaces in e-governance systems: a study in Indian context. In Proceedings of the 3rd international conference on Theory and practice of electronic governance (pp. 155-162).

[28] Singh Kalsi, N. and Kiran, R., 2013. E-governance success factors: An analysis of e-governance initiatives of ten major states of India. International Journal of Public Sector Management, 26(4), pp.320-336.

[29] Tripathi, A. and Parihar, B., 2011, June. E-governance challenges and cloud benefits. In 2011 IEEE International Conference on Computer Science and Automation Engineering (Vol. 1, pp. 351-354). IEEE.

[30] Singh, A.K. and Sahu, R., 2008. Integrating Internet, telephones, and call centers for delivering better quality e-governance to all citizens. Government Information Quarterly, 25(3), pp.477-490.

[31] Chandra, D.G. and Malaya, D.B., 2011, December. Problems & prospects of e-Governance in India. In 2011 World Congress on Information and Communication Technologies (pp. 42-47). IEEE.

[32] Sharma, M.K. and Thapliyal, M., 2011. G-cloud (e-Governance in cloud). International Journal Engg. TechSci, 2(2), pp.134-137.

[33] Heeks, R., 2001. Understanding e-governance for development.

[34] Vinod Kumar, T.M., 2015. E-governance for smart cities (pp. 1-43). Springer Singapore.

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