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-RESEARCH ARTICLE-

E-GOVERNMENT ARCHITECTURE IN DEVELOPING COUNTRIES: A CASE OF PUBLIC ENTITIES IN VIETNAM

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─Abstract─

The application of information technology in the actions of state agencies toward the creation of e-government is an inevitable trend and a popular model in many nations; constructing e-government has become a crucial undertaking, particularly during the Covid-19 pandemic. As the top objective of any government, e-government enables individuals to engage, obtain government services, boost transparency, decrease expenses, and enhance operational efficiency. This article suggests an e-Government Architecture Framework produced by Vietnam's National Foundation for Science and Technology Development, a government agency. This framework was developed as a research framework to expand in developing countries to improve their capacity to connect, integrate, share, and reuse information deployed at these agencies and the National Systems (National Document Unified Axis System and National Government Service Platform) and national data databases (National Database on Business Registration; National Land Database and National Database on Population). The proposed framework will increase the adaptability of the procedure for building and deploying information systems and components under local requirements.

Key terms*:* E-services, E-government, Architecture Framework, Vietnam

1. INTRODUCTION

The Covid-19 pandemic has presented significant socioeconomic concerns in 2020-2021. However, it has also become the driving force that makes the digital transformation process more important than ever, particularly the digital transformation process in government activities to establish e-government. There are now numerous

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definitions of e-Government. Nonetheless, the primary text is as follows: ICT can be utilized to improve the government's efficiency, effectiveness, transparency, and accountability (Hofmann, Madsen, & Distel, 2020). Similarly, an E-Government is a government that uses information technology (IT) to enhance the efficacy and efficiency of the operations of public institutions. Local governments provide improved public services due to increased publicity and information transparency (Lee, 2022). As shown in Fig. 1, Standard e-Government services consist of the following service categories: G2E - Government delivers information and services to cadres, civil servants, and public employees (Pourkhani, Abdipour, Baher, & Moslehpour, 2019)

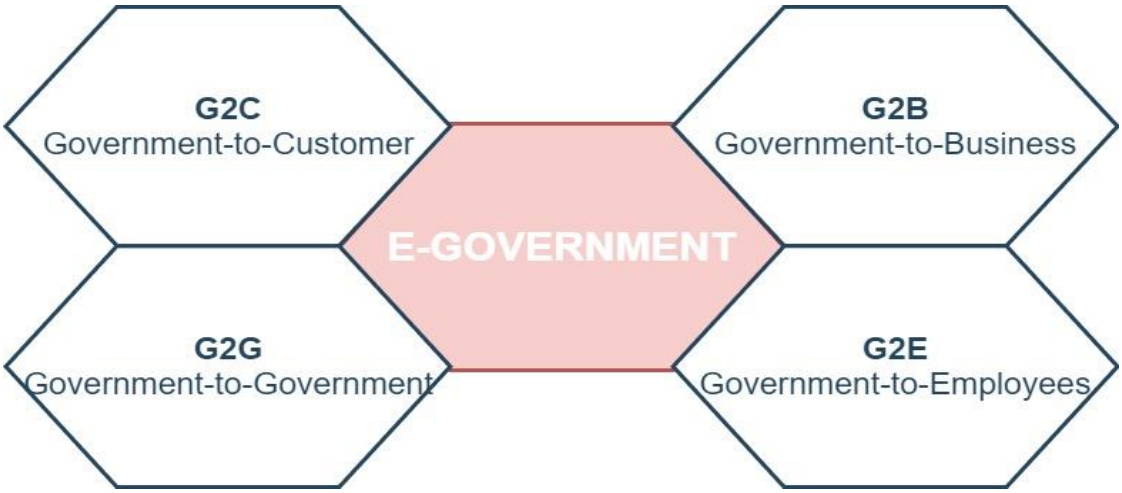

Figure 1. Types of e-Government Transactions

In establishing e-Government, particularly in industrialized nations, the benefits of e-Government are demonstrated and quantified. E-government, for instance, facilitates the improved and expedited delivery of administrative services to citizens and enterprises (Sá, Rocha, & Cota, 2016).

The work of implementing information technology and establishing e-Government in Vietnam is currently stimulating and supported by government agencies, provinces, and municipalities. This is shown in the desire to create strategies and procedures for the implementation, inspection and evaluation, recruitment, and support of information technology specialists. The implementation results have contributed to administrative reform, boosting state institutions' management and administration efficiency. In addition, they are providing information and online public services to serve individuals and businesses better. Compared to 2010-2015, the Ministry of Science and Technology (Science and Technology) of the Vietnamese government has significantly improved. The initiatives of this ministry's divisions, particularly at the National Foundation for Science and Technology Development, have yielded tangible e-government development outcomes (Guijarro, 2007). The Ministry of Science and Technology had

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risen from the bottom of the rankings for Ministries and Sectors to the top group, especially in 2018, when it was rated 2/19. (Government, 2021).

E-government will become a premium channel for achieving these goals based on these criteria (Layne & Lee, 2001). This study focuses on the experience of investigating the scientific foundation and creating e-government at Vietnam's NAFOSTED. The foundation, headquartered in Hanoi (Vietnam), is a public organization at the forefront of implementing information technology applications and establishing an e-Government in Vietnam. This article presents an e-Government Architecture for scientifically managed funds that will assist in the achievement of the following specific objectives:

- The architecture provides a comprehensive view of the Foundation's IT under the specified time; Establish strategic goals and programs that the agency must adapt to suit user needs.
- The architecture strengthens the link between improving technology and operations when deploying IT applications to solve the agency's business; provides information to support the selection of solutions; and reduces the foundation's infrastructure, hardware, and software investment costs for IT projects.
- The architecture plays a significant role in identifying possibilities to interchange and share information/data inside and between agencies. Hence it enhances agency adaptability (deploy IT service applications more quickly; increase IT infrastructure efficiency and performance, deploy new business quickly; improving decision making).
- The architecture helps decrease risks associated with the Foundation's IT deployment by facilitating accurate project cost estimation, complying with government and agency rules, and preserving IT design intellectual property rights.

2. BACKGROUND

Implementing electronic governance aims to improve the information and services supplied by public sector organizations. E-governance is using information and communications technologies, mostly the internet, to improve government (Burlacu, Patarlageanu, Diaconu, & Ciobanu, 2021). Utilizing the internet or several digital channels is all that is required to provide public services and communicate information with residents, corporations, and government agencies. Palvia and Sharma (2007) defines e-governance as the continual optimization of service delivery, constituent engagement, and governance through transforming internal and external interactions via technology, the internet, and new media. This definition offers a more comprehensive understanding of e-governance (Adjei-Bamfo, Maloreh-Nyamekye, & Ahenkan, 2019). According to Adu, Patrick, Park, and Adjei (2018), e-governance ushers in a new era of modernism, innovation, and adaptability that aspires to enhance the efficiency and

quality of the delivery of public services. According to the research of academics in both developed and developing countries Adu et al. (2018), e-governance increases citizen participation in the decision-making process, makes governments more transparent, responsible, and effective, and enhances the quality of service delivery. These claims are made in two separate studies. In a similar spirit, Meiyanti, Utomo, Sensuse, and Wahyuni (2018) assert that e-government offers substantial opportunities for public sector reforms in developing economies. Specifically, according to Adjei-Bamfo et al. (2019), e-government can aid in the control of risks and irregularities connected with public procurement, as well as the promotion of positive environmental and social outcomes, also known as sustainable public procurement.

In the past two decades, many countries have swiftly adopted electronic governance due to the numerous benefits it provides to residents and governments. It can manage data, enhance the delivery of public services, and expand communication channels for the public's benefit. As a result, governments will reap the benefits of greater productivity, a flourishing commercial sector, increased global information exchange, and automated corporate operations and communications. Although the electronic government has many benefits, it also has several drawbacks (Lõhmus, Nyman-Metcalf, Ahmed, Pappel, & Draheim, 2020).

Over the past two decades, substantial progress has been made in e-government research within the canon of information systems literature Adjei-Bamfo et al. (2019). Multiple authors, like Denbu and Kim (2019) and Zeebaree and Aqel (2021), have investigated the potential effects of ICT on managerial issues. Others have focused on the transfer of information and communications technologies (ICT), culture and country-specific factors in constructing electronic governments, and diffusion among developing nation stakeholders (Olugbara & Joseph, 2018). There is a need for greater research on the organizational elements that affect e-government efficiency. Most study on this topic has focused on technological factors, including ICT architecture and infrastructure; interoperability; metadata, open-source software, domain policy, connectivity; procurement practices and project design; and implementation challenges (Homburg, 2018). Other subjects have Existing research has primarily focused on issues related to the functioning and technical aspects of ICT in the context of e-service delivery (Denbu & Kim, 2019; Olugbara & Joseph, 2018).

On the other hand, there is a substantial gap between what can be accomplished with the aid of ICTs and what has been achieved in practice (Alzahrani, Al-Karaghouli, & Weerakkody, 2017). In many cases, the failure of an e-government initiative can be attributed to one of the following: the technological system is either not implemented at all, the technology is abandoned after it has been implemented, or major goals are not met (relative to cost, implementation timelines, and capabilities), and they produce a substantial number of unanticipated outcomes (Hofmann et al., 2020). Approximately one-seventh of e-government initiatives are effective. Although certain studies focus on

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the success and failure rates of e-government, these numbers indicate that: more than one-third of e-government projects are failures generally (for instance, the failure of the e-government initiative for the city of Chicago); (Homburg, 2018). The currently existing methods for e-readiness do not adequately address organizational concerns. Access to information within organizations is an example of something that is commonly disregarded (Morrison, 2002). In numerous e-readiness evaluation approaches, education and measurements of the physical information and communication technology (ICT) infrastructure are common components. Existing techniques provided criteria and characteristics unsuitable for evaluating organizations' overall e-readiness and incompatible with the legislative and economic context (Fröhlich, Nieminen, & Pinomaa, 2020). According to Kagoya and Gilbert (2020), there is a need for a new integrated instrument for e-readiness that prioritizes information access and co-locates the various organizational, information and communications technology (ICT), human resources, and external readiness components. In addition to ignoring organizational challenges, existing technologies place insufficient attention on e-government considerations.

According to research undertaken on e-government framework assessment, many e-readiness instruments do not evaluate e-government (Arrosagaray, González-Peiteado, Pino-Juste, & Rodríguez-López, 2019). These techniques evaluate e-services in addition to the accessibility, support, and use of information and communications technology (Bindu, Sankar, & Kumar, 2019). E-readiness evaluation techniques are weak in their examination of e-government-relevant elements. Among these aspects include the culture and embrace of technology by public officials (Olugbara & Joseph, 2018), the excellence of ICT infrastructure in government organizations, policies, and the architecture of the national e-government plan. Insufficient study has been conducted to establish a correlation between a nation's e-readiness and its implementation of e-government (Burlacu et al., 2021). When attempting to measure e-government, it is strongly encouraged to focus primarily on challenges unique to e-government Denbu and Kim (2019). The research on the readiness of information and communication technologies within organizations for e-government is in its infancy.

The academic literature recognizes the importance of information and communications technology (ICT) preparedness in enterprises Hofmann et al. (2020), but empirical research is still in its infancy. The e-government literature focuses mostly on technical skills and relationships and their implications on e-services Lõhmus et al. (2020); Olugbara and Joseph (2018). Despite this, the literature on e-government often disregards both the organizational approach to e-government and the idea of a national e-government strategy dependent on contextual factors. Because e-government research is still in its infancy, organizational ICT architecture and adoption strategy have not gotten much attention in the existing body of literature. Numerous researchers, such as Denbu and Kim (2019) and Zeebaree and Aqel (2021), have analyzed and discussed the numerous dimensions of e-government. On the other hand, these studies did not examine the component of e-government organizational strategy and the national e-government

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programme model, as well as their relationship to ICT readiness, organizational architecture, business process and information systems, ICT infrastructure, and human resource dimensions. It is necessary to do research that will provide a framework for an integrated architecture for adopting e-government.

The primary objective of e-Government development is to increase the efficacy and openness of government processes, provide better services to citizens and businesses, and create sustainable and resilient societies Hasan et al. (2019). The United Nations introduces and employs the Global E-government Development (EDGI) benchmarking to evaluate e-Government support for sustainable and resilient communities.

Country	**2014**	**2016**	**2018**	**2020**
South Korea	1	3	3	2
Singapore	3	4	7	11
Malaysia	52	60	48	47
Vietnam	99	89	88	86

Table 1. E-Government Development in Selected Asian Countries (Government, 2021)

As shown in Table 1, the development trend of e-Government towards digital government and the direction of technology development, such as IoT Bansal, Sirpal, and Choudhary (2022) and Gao et al. (2021), pose new requirements for the development of e-Government in developing nations like Vietnam.

Vietnam is a Southeast Asian country bordered by China to the north, Laos to the west, and Cambodia to the southwest. With a population of 92,701,100 and a land area of 330,967 km2, the country is composed of 5 cities and 58 provinces. Over the past two decades, the nation's economy has grown at an average rate of 7 to 8 % per year. With the initiation of the "Doi Moi" reform in 1986, which shifted the economic structure away from agriculture to manufacturing and services, reducing agriculture's contribution to GDP to below 20 %, the growth has been primarily driven by a transition from a centrally planned economy to a market-driven one (T. P. Nguyen, 2018). Vietnam initiated a program to promote e-Government and administrative procedure reform at the beginning of the 21st century to accomplish particular goals. However, the implementation process is lengthy and has minimal effects on the country's socioeconomic development. Since the beginning of the process, the government has paid close attention to and thoroughly understood the possible opportunities and challenges posed by the Fourth Industrial Revolution to the country. Vietnam has demonstrated a commitment to implementing reforms to become more proactive and innovative in reforming the economy and renewing the growth model to capitalize on opportunities that accelerate the country's growth Breul and Pruß (2022); B. T. Nguyen and Pham (2019).

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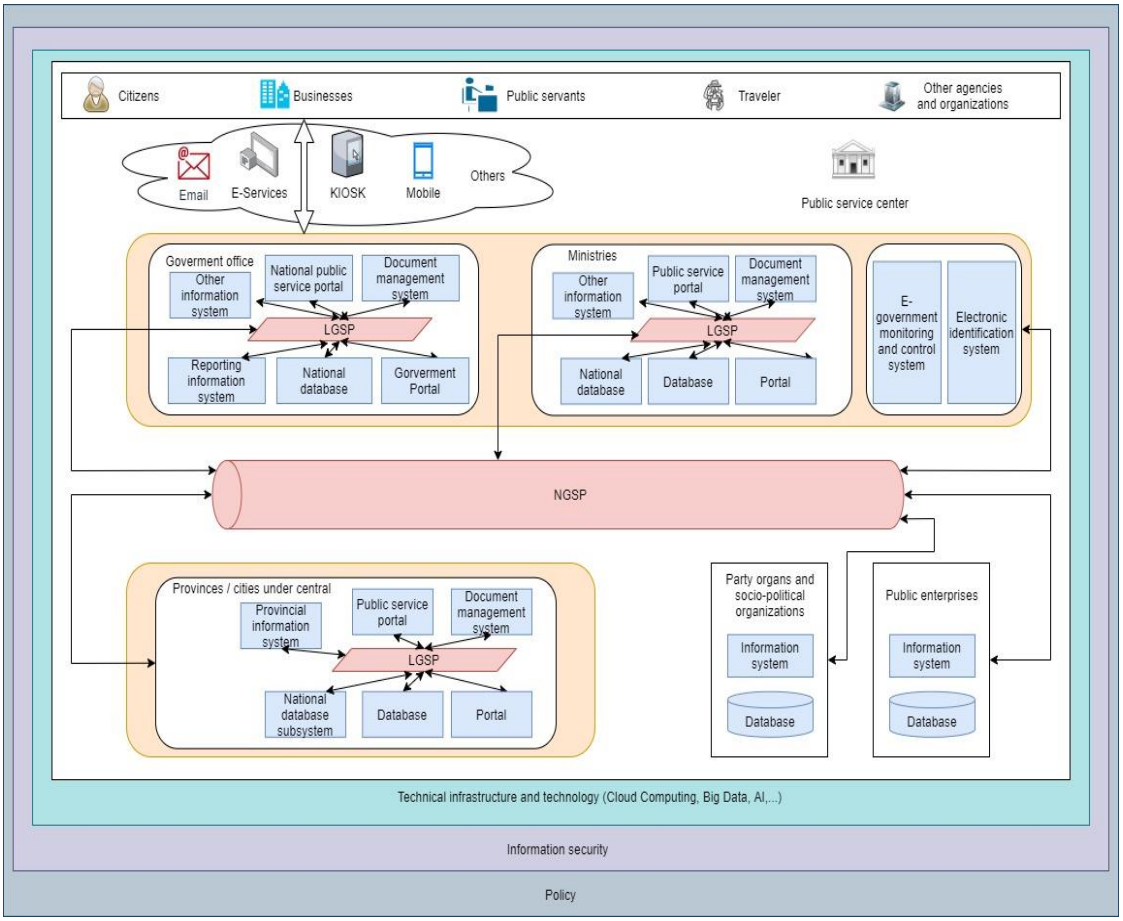

Figure 1. Vietnam e-Government Architecture Framework 2.0

The development of an e-Government Architecture Framework for the country and public entities must be implemented to meet the requirements of e-Government development trends. It is towards the digital government shortly and to bring the public's new technology in line with the development practices of e-Government in developing nations. Common aspects that affect the effectiveness of e-government programs include governance capacity, ICT infrastructure, human resources, and socioeconomic characteristics (Alzahrani et al., 2017; Bakunzibake, Klein, & Islam, 2019). Numerous studies on e-government and the transition to the digital economy have been conducted in Vietnam, with version 1.0 of the national e-government architecture framework (see Figure 2) being published in 2017 and version 2.0 in 2020. (B. T. Nguyen & Pham, 2019).

Beginning in 2019, Vietnam has established the following e-Government development priorities: First, create a national portal; second, build six major national databases; and third, link and share data and information among agencies. Vietnam is well-positioned for this development because all federal and local government bodies have an online

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presence. Additionally, certain cities and provinces offer sophisticated services. Ho Chi Minh City, for instance, provides 300 online public services at level 3 to advance to level 4. Beyond 2018, a basic strategy exists until 2020: First, to provide a comprehensive range of online services; second, to apply information technology to the operation of state agencies; third, to develop technical infrastructure, information systems, and national databases; and fourth, to conduct smart city pilot projects. However, most cities still offer online public services at levels 3 and 4 that are ineffective, lack online records, or have a low number of online applications. Numerous services are deployed independently and are not synced, causing duplication and making it difficult to connect, share, and reuse information. This makes the usage of online public services inconvenient for individuals and is one of the factors that reduces the service's effectiveness (Breul & Pruß, 2022; T. P. Nguyen, 2018).

2.1 The Open Group Architecture Framework (TOGAF)

The Open Group Architecture Framework is the architecture we used for this research. TOGAF describes the systematic technological transformation from ideas and strategic requirements into workable and documented products, systems, or solutions (Gao et al., 2021; Tambo, Bargholz, & Yde, 2016). The TOGAF reference model shows a 5-step sequence approach: BRM - Define business architecture; DRM - Define information/data architecture; ARM - Defines the application architecture; TRM - Define technology architecture; SRM/IRM - Interoperable Architecture/ Information Security Architecture.

2.2 Government Service Platform

Technology compatibility of systems has also proven to be an important factor as they influence the information sharing and connectivity of systems throughout the government (Charalabidis, Loukis, Alexopoulos, & Lachana, 2019). The Government Service Platform (GSP) aims to put all government agencies and government employees online, place government application services online, link all government agencies through networking, and provide a versatile Internet-based services system.

National Government Service Platform (NGSP): is a system of connecting and connecting information systems at a national scale, acting as an intermediary serving the connection between effective information systems (national information system, national database, etc.), an information system with a scale and scope from central to local). This system includes services and applications that can be shared and shared at the national level. Investing is not only to duplicate and save but also to facilitate interconnection and system integration.

Local Government Service Platform (LGSP): This component integrates and shares information systems and databases within ministries, branches, localities, and between churches, departments, and localities through NGSP. LGSPs include the same essential

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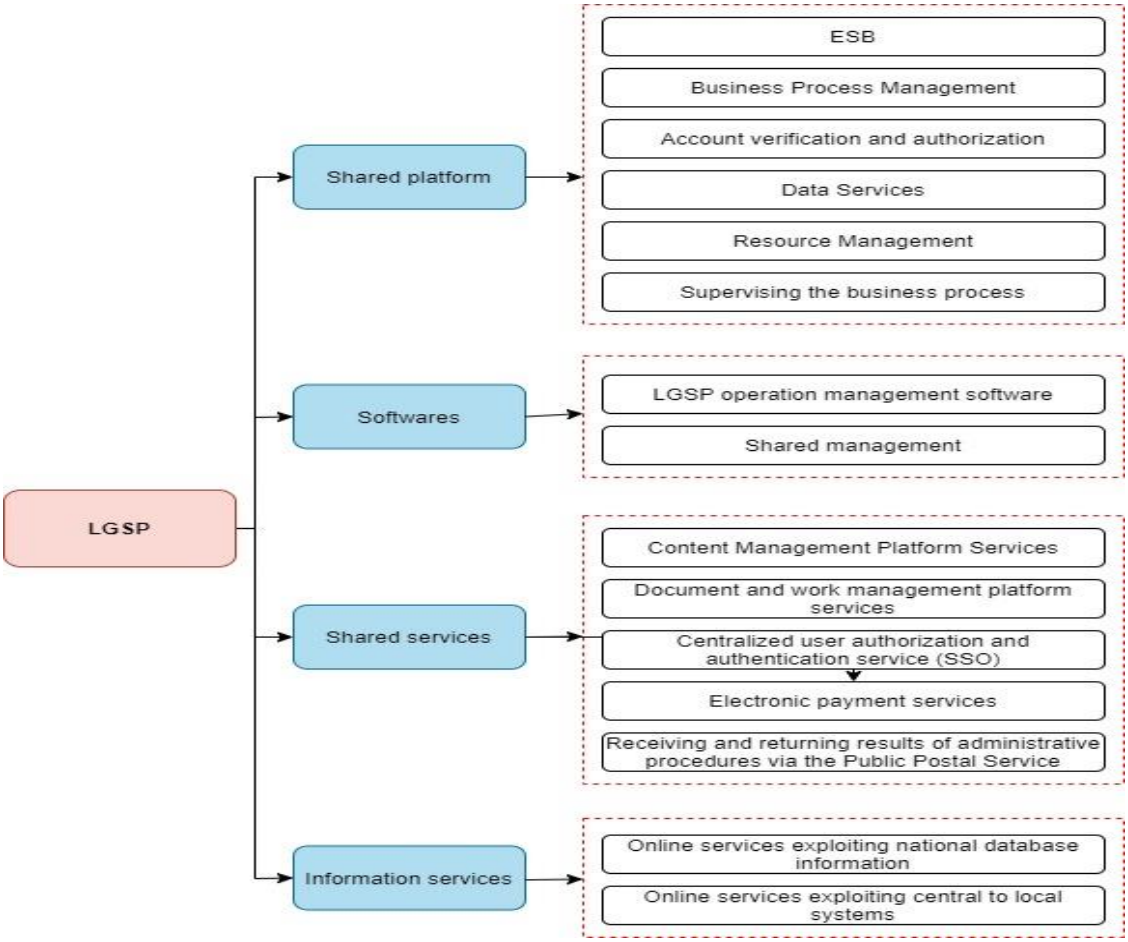
services as Platform Services, Operations Services, Integration Services, and Information Services.



The ministry- and provincial-level integration and division platforms connect and share information for the ministry's departments, agencies, institutes, state agencies, and other departments, branches, districts, and provinces. Provinces and urban areas. Both horizontal and vertical business information exchanges are possible between state agencies within the ministry. Together with ministerial-level services, this component also serves as a professional portal for exchanging information with other ministries, provinces, Party agencies, enterprise information systems, or other entities as needed.

3. RESEARCH METHODOLOGY

3.1 Overview of E-Government Architecture of NAFOSTED

Based on the guidelines of the e-Government Architecture Framework version 2.0, the overall e-Government diagram for NAFOSTED is described as follows (Figure 2).

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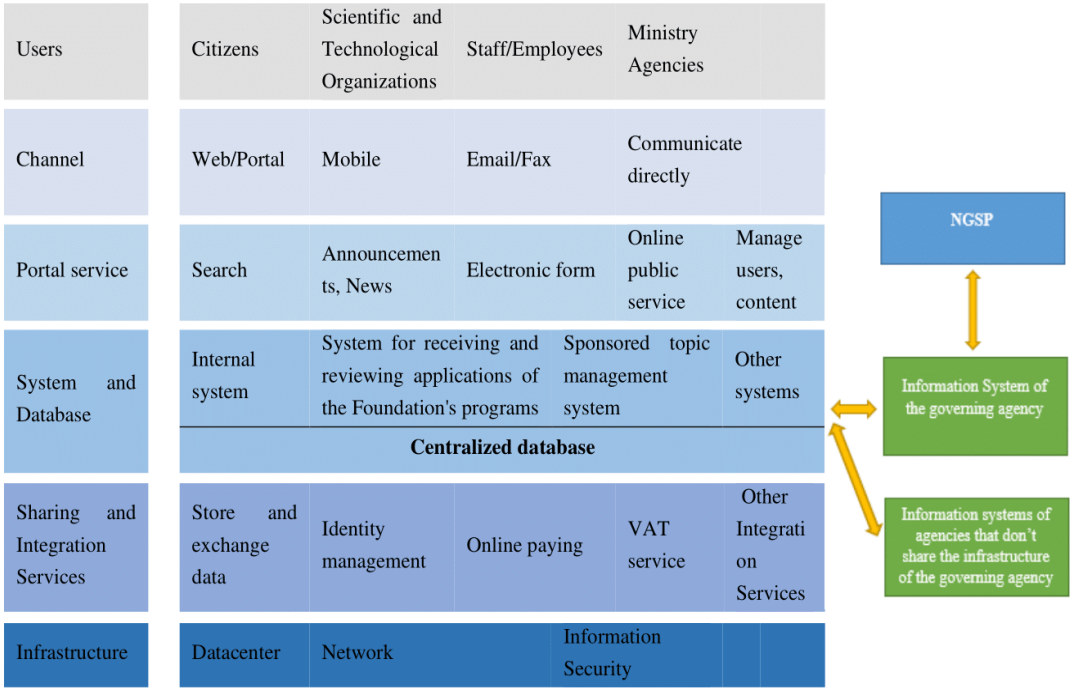

Figure 2. NAFOSTED's e-Government Architecture

The e-Government architecture includes the following essential elements: Users (organizations, people), Communication channels (computers, cellphones, portals, etc.) Class of databases; Application integration and data sharing Technical infrastructure layer; administration and management class.

3.2 Description of Components

3.2.1 Application Integration, Data Sharing

These services are used to support upper-layer applications and databases. These services can be shared between applications in the Foundation's Information System. On the other hand, one of the essential functions of these grouping services is to connect, communicate, and integrate applications.

3.2.2 Users

Users of services include agencies, organizations, individuals, officials, and employees.

- State agencies (G2G): State agencies use services from other state agencies to perform work or provide services to other state agencies;
- Enterprise (G2B): Enterprise using services provided by different state agencies;

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- Citizens (G2C): Citizens use services provided by different state agencies;
- Government officials, civil servants, and public employees (G2E): Public servants have access to the internal services of the agency to perform their jobs.

3.3 Access channel/Communication Channel

Access channels are forms and mean users access the foundation's information and services. The main access channels include: electronic information pages/portals (website/portal), electronic mail (email), telephone (landline or mobile), fax machine, or can come directly to the Foundation's One-Stop Department. In the first stage, the main access channels were electronic information pages and mail, then expanded to other forms such as public postage (submission of documents via postal service) or other forms of public service.

3.4 Professional and Administrative Procedures

Including business processes, the foundation's managerial procedures have been standardized.

3.5 Electronic Portal

Electronic portal: offers agencies, organizations, and individuals information about the foundation. The portal of the foundation incorporates the public service portal. The public service portal facilitates communication with NAFOSTED's level 3 and level 4 public services (T. P. Nguyen, 2018; Pourkhani et al., 2019). At a minimum, the gateway will comprise the following components:

• Content management component allows storing, administering, and delivering material for the portal's information channels.

• Search and querying features: Provide keyword search capabilities for a search engine.

• Electronic form management component.

3.6 Service & Application Layer

Table 2 below presents the details of the service & application layer. These layers have been divided into two main categories, i.e., business application and general engineering application.

3.7 Database

The database collects data arranged and organized to access, exploit, manage, and update information electronically. Table 3 below presents the details of the database and its description.

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Table 2: Service & Application Layer

I	**Business application**
	Foundation's web portal
	Online Public Service Portal
	Document management and administration
	Online Public Service System
	Asset Management
	Management of cadres, civil servants, and public employees
II	**General engineering application**
	Authenticate, grant user rights
	Digital Signature, Encryption, and Decryption, Copyright Management
	Data management (Data backup and recovery, data warehouse tools/solutions)
	Manage shared folders
	Manage statistics, reports
	Online meeting conferencing
	Email
	System operation (System monitoring, Configuration management, Remote access management, Connection health management, Synchronization)

Table 3. Database Categories

	Database	**Description**
1	Scientist and expert reviewer	Scientist Information Information about expert assessment
2	Scientific and technological tasks and activities are sponsored and supported by the foundation.	Topic information Progress Information on assessment and acceptance Economic information Synthesis report
3	Internal Database	Document management and administration Financial data

3.8 Infrastructure

As shown in Fig. 4, the infrastructure provides the following infrastructure, facilities, and platforms to support users and applications:

• Data and server systems are centrally controlled in the physical server room and virtualized infrastructure (outsourced), facilitating information safety and security assurance under applicable legislation.

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A computer network system comprises an intranet, a virtual private network (VPN), and the internet. In addition, it safeguards end-user computer equipment such as personal computers, laptops, and personal support devices.

• Security and confidentiality system: designed and maintained to protect an information system against assaults and intrusions that could result in data corruption or loss.

• Infrastructure services: encompass the information system's operating systems, servers, and various physical components.

• Management of infrastructure services must match the requirements and definitions outlined in the Vietnam e-Government Architecture Framework.

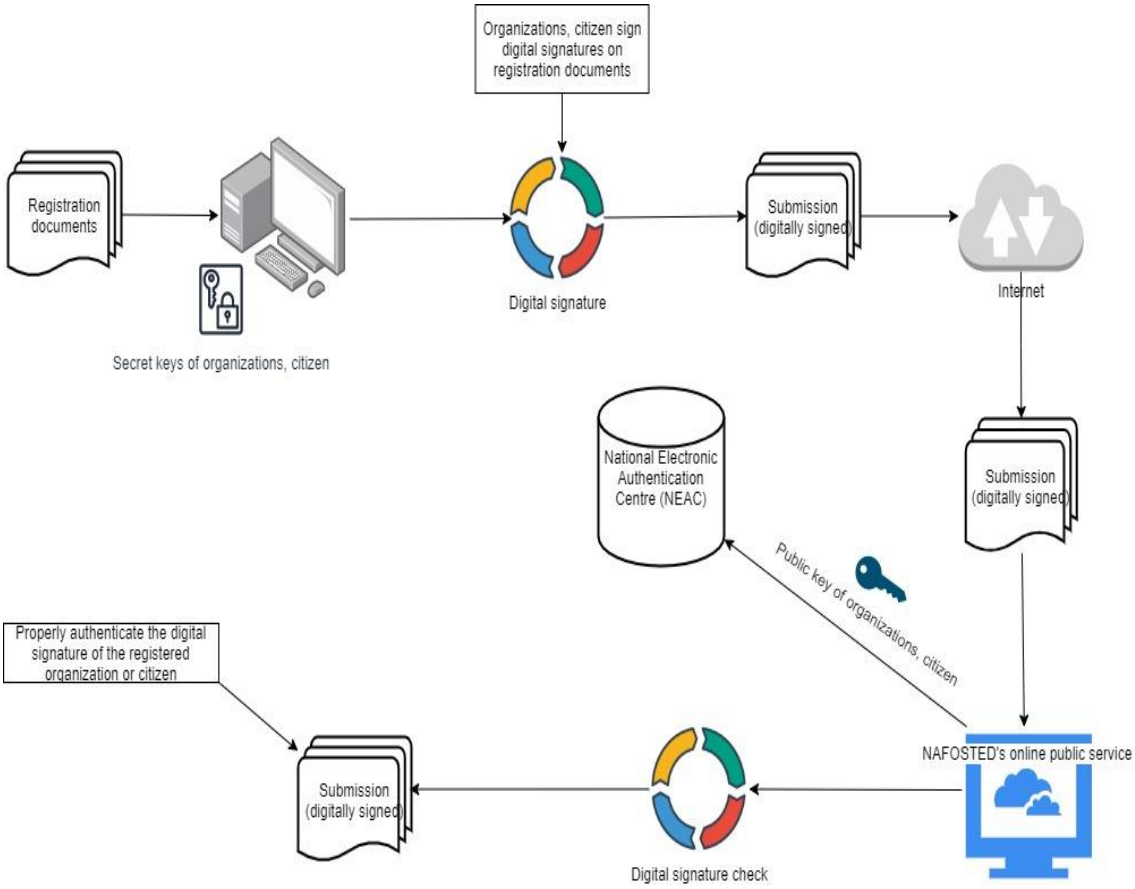

Figure 3. Method of Digital Signature Authentication on NAFOSTED's Online Public Service

3.9 Directing Management

It includes guiding, organizing, and developing e-Government Architecture policies, standards, guidelines, training, and communication.

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- Directing: Participation of the Leadership in directing, coordinating coordination, resolving disagreements, and addressing developing difficulties; • Organization: Organizational structure, rights and responsibilities of stakeholders, and the procedure for organizing the implementation of the architecture;
- Policies: Specific Foundation policies, laws, and standards that support the application of the design;
- Implement instructions, training, and communication to raise knowledge regarding implementing the NAFOSTED's e-Government Architecture.

3.10 Reference Model

The reference model (Ostašius & Laukaitis, 2015) is the content ministries, branches, and localities refer to in building their e-Government Architecture. The reference model includes a standardized list of essential components that will help the e-Government Architecture content development of ministries, branches, and localities are synchronized and unified, increasing the ability to connect, share, and reuse the infrastructure platform previously deployed applications.

3.11 Business Reference Model (BRM)

The business Reference Model Baars and Kemper (2008) is a framework for approaching business functions by target group (people, businesses, and other organizations. The foundation's business reference model is described based on the Science and Technology business group (BRM004.002) of the Vietnam e-Government Architecture Framework:

BRM004: Professional domain supporting government activities

BRM004.002: Science and technology task force

BRM004.002.002: Scientific research, technological development, and innovation activities

3.12 Data Reference Model (DRM)

The foundation's data reference model is described based on the Science and technology data group (DRM004.002) of the Vietnam e-Government Architecture Framework:

DRM004: Professional domain supporting government activities

DRM004.002: Science and technology task group

DRM004.002.002: Scientific research, technological development, and innovation activities

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3.13 Application Reference Model (ARM)

Provide a common framework describing and classifying essential application components serving business goals; this description defines the capabilities of application consolidation and integration when providing services together for the profession. The Application Reference Model is the basis for building the Application Architecture (See Table 4). The detailed application reference model is described, including the following main content:

Table 4: Service & Application Layer

Function Group Citizen Communication (ARM001)	Services necessary to perform the services provided by the foundation directly to individuals or organizations
Process automation function group (ARM002)	Application to automate the functions and business processes in the foundation
Functional Group Business Management (ARM003)	The application is used to maintain business continuity in the foundation.
Functional group of digital asset management (ARM004)	Applications used to support the creation, management, and distribution of assets and electronic media across businesses
Functional group Business Analysis Management (ARM005)	The application assists in extracting, synthesizing, and presenting information to facilitate decision-making analysis and business evaluation.
The internal functional group (ARM006)	General classification of applications used to support management and operations
Collaboration and Support function group (ARM007)	The application's general classification supports business functionality and service performance within the foundation.

3.14 Technical and Technological Infrastructure Reference Model

The Technology Infrastructure Reference Model (TRM) (Kokar & Daly, 1999) is a component-based technical framework for categorizing standards and enabling the development of application components and Application Services capabilities. Moreover, it unites any current agency-specific TRMs into a common standard by offering a platform to promote the reuse and standardization of service components and technologies from a single perspective.

This reference model provides a Technical Framework that classifies standards and technologies to support and enable the deployment of application components, as shown in Table 5. The Technology Reference Model is the foundation upon which the Technology Architecture is constructed. The following key characteristics characterize the detailed technological reference model:

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Table 5: Technical and Technological Infrastructure Reference Model

Service Access and Delivery (TRM001)	Defines the Access and Distribution Channels to be used by the application & service component and the legal requirements governing channel usage and interactions through the channel.
Service Infrastructure and Platforms (TRM002)	Defines a set of technical infrastructure platforms, hardware, and standards that enable the forum and service infrastructure to scale, share, and reuse.
Application and service development framework (TRM003)	Define the underlying foundation and technical elements upon which applications are built, integrated, and deployed on distributed and component-based architectures.
Interface and Service Integration (TRM004)	Identify mining, interaction, and communication technologies to enable the interconnection of different systems and service providers to ensure interoperability and scalability.

3.15 Network Information Security Reference Model (SRM)

The issue of network information security is significant, crucial, and cross-cutting across all architectural domains and organizational levels. Consequently, the network information security reference model (SRM) (The World Bank, 2016) must be incorporated into every architectural component of the e-Government Architecture. Cyber information security must be considered at various agency and organization levels. Governance of the whole architecture is a comprehensive way of developing network information security policies, standards, and technical restrictions.

The Information Security Reference Model is a framework that describes the components of information security that must be implemented while establishing e-Government. The model serves as the foundation for the Information Security Architecture. The detailed SRM is specified with the following exact levels and features:

• Objective (SRM001): The implementation of security policies must strike a balance between risk mitigation and regulatory compliance. To pick the appropriate security mechanism, SRMs combine regulatory compliance at the organization level with risk issues at the system and application levels.

• Risk (SRM002): The ultimate goal of installing security controls is to minimize risk.

• Controls (SRM003): SRMs classify monitoring based on organizational policies. Maintaining level monitoring at the system or application-level improves the design and determination of the needs for specific techniques.

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4. RESULTS

The online public service portal system is selected in this study because it is the closest component to the user and directly interacts with the user, focusing on the user's needs in access to information and services (Yigitcanlar et al., 2021). In addition, it can show the impact of e-government on users (Pérez-Morote, Pontones-Rosa, & Núñez-Chicharro, 2020).

4.1 Online Submission Rate

This exploratory study sought information from government employees involved in e-government project implementation. The data was validated. Specifically, we created statistics to assure the dependability of the outcomes. We made the results available to the participants through reports and feedback requests (Eriksson, 2022). In general, the participants strongly agreed with the study's findings. Mishra, Alowaidi, and Sharma (2021) state that inductive analytic methods involve organizing data by coding, classifying data into themes, and determining links between subjects.

Statistics indicate that the rate of submissions through NAFOSTED's public service portal has increased dramatically over time. Specifically, the quantity of digitally signed papers has increased over time, illustrating the digital revolution in response to the needs of individuals and enterprises. In 2020, more than 80 % of applications will be submitted online, as depicted in Fig. 5. The rising-rate has been exponential over the years, as shown in Fig. In 2020, the average rate of submissions for e-services in Vietnam will be 22.98 %. Therefore, the rate at NAFOSTED is three-and-a-half times the national average. In addition, the number of digitally signed documents has gradually expanded and will reach approximately 200 records by 2020.

4.2 Satisfaction Index of Public Administration Services (SIPAS)

The Satisfaction Index of Public Administration Services (SIPAS) measures the satisfaction of individuals and organizations with the service provided by state administrative agencies. The SIPAS index is an objective metric that accurately reflects the evaluation results of individuals and organizations on the service provided by state administrative agencies through the delivery of particular public administrative services. The SIPAS assessment method is primarily based on sociological questionnaires; the subjects of the investigation and survey are individuals and representatives of organizations who have directly transacted and received the results of public administrative service provision during the sociological investigation period. We determine the SIPAS index by surveying 5,700 people who utilized the foundation's public services in 2018-2020. (Fig. 6, Fig. 7). In contrast to the national average of 85.17

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% in 2020, the results indicate that the level of satisfaction among the population is above 90 % 2021.

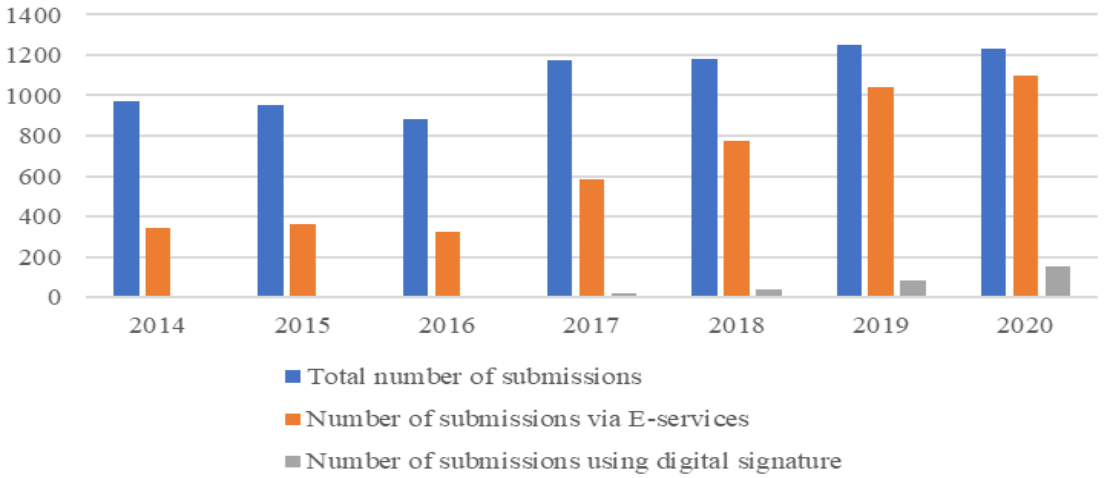

Figure 4. Statistics of registration records of people and businesses

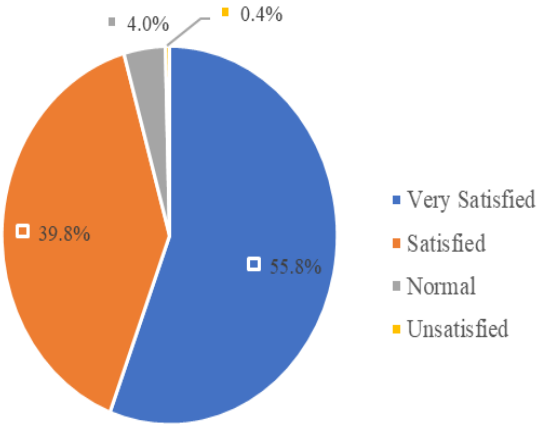

Figure 5. Evaluation of the process of interacting with online public services

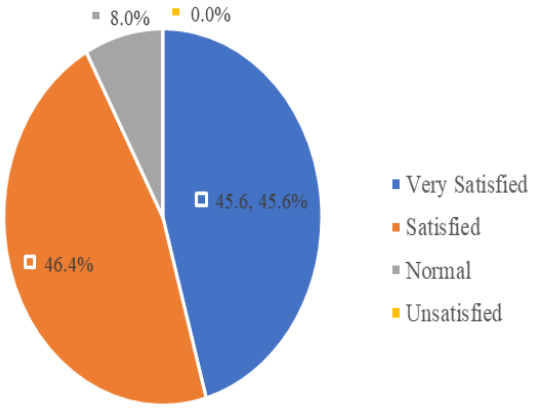

Figure 6. Assessment of the satisfaction with requests for information technology support

4.3 Enhance International Integration Connection Capacity

With the development of e-Government at the Foundation, many bilateral grant programs are easily implemented through online public service systems (FWO - Belgium, DFG - German Research Foundation, The National Health and Medical Research Council (NHMRC) - Australia) (T. T. H. Nguyen et al., 2021). The NAFOSTED's e-Government Architecture fully meets The EU-Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the

protection of natural persons about the processing of personal the free movement of such data.

5. CONCLUSION

This study contributed to developing the National Foundation for Science and Technology Development's e-Government Architecture. Since then, it has helped increase The National Foundation for Science and Technology Development's ability to link, integrate, share, and reuse information and the information infrastructure of deployed information systems. National Systems (National Documentary Axis System, National NGSP System) and national data databases (National Business Registration Database, National Land Database, National Database on Population) ensure synchronous implementation of information technology applications, limiting duplication, reducing costs, and accelerating deployment at the foundation. Enhance the foundation's adaptability while developing and deploying information systems and components based on conditions. In addition, with this model, state agencies and organizations can conduct research and use it as a foundation for the growth of e-Government, particularly in developing nations.

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