

An Empirically-Derived Taxonomy of eGovernment Challenges

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ABSTRACT The progress of eGovernment(eGov) initiatives involves focused and contextual practices that address the requirements and concerns of multiple involved stakeholders. This article investigates the state of the practice in eGovernment challenges, assessing some eGovernment projects delivered by ten areas world over, and propose a taxonomy for eGovernment challenges. The taxonomy comprises of three (level-1) dimensions: economic, technological, and social challenges, and sixteen (level-2) dimensions: legal/regulatory, institutional/operational/environmental, political, financial, quality, process, structural, organizational, development, technical, managerial, contextual, policy & training, data & information, stakeholder, and other issues and challenges. The proposed taxonomy contributes to assistance in guiding the concerns by classifying a range of eGovernment challenges, providing how the challenges occur, to whom does it affect. Moreover, the study discusses the usage settings of the taxonomy by Government professionals, vendor organizations, researchers and IT staff. Furthermore, the researchers can also use this taxonomy for further development of the field. Such identification of a list of critical government challenges can also be beneficial to IT professionals in planning and executing the eGovernment projects.

INDEX TERMS Barrier(s), challenge(s), eGovernment (eGov), implementation, information and communication technology (ICT).

I. INTRODUCTION

It is expected that by 2030, 80% of the world will transform and shift to eGovernment [1]. Microsoft's Bill Gates stated that the most inspiring domain, in automated business will be eGovernment, in the future [2]. As the number of public users increases and the government initiatives and projects revolutionizes, there is a need that governments address implementation challenges in several fields, including eGovernment. eGovernment problems influence the users' satisfaction and the sustainability of eGovernment initiatives. It means that the service quality is directly and strongly related to customer satisfaction [3], [4]. "eGovernment has been conceptualized as the intensive or generalized use of information technologies in government for the provision of public services, the improvement of managerial effectiveness and the promotion of democratic values and mechanisms" [3], [5]. eGovernment is responsible for the country's progress [6]. Furthermore, being a part of the Sustainable Development

Goals (SDGs),¹ eGovernment intends to create inclusive, participatory and sustainable projects [5]. The governments' systems must be easily accessible, secure, affordable and viable for all [1], [7]. The eGovernment trend lies in the hope to attain the goals of improved service quality [8]–[10]. Democratic governments always aim to provide easy access to services [11]–[13]. The countries differ concerning ICT implementation and use [5], [14], [15]. Moreover, from the research perspective, most of the government targets in IT require effective government capacity to deliver a successful project [9], [16]–[18], it means that the automated public services focusing on particular strategies- such as in eGovernment, or on given related services. This declaration is associated with the state of practice results provided in this study, presenting the challenges faced by some indigenous governments developing eGovernment projects. Therefore, it is concluding the importance and necessity of indigenous governments to strategically use the technologies to attain sustainability, specifically into eGovernment initiatives.

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¹<http://www.un.org/sustainabledevelopment/>

Recently, multiple efforts have been made all over the world to develop various ICT applications through many ICT projects' dimensions [2], [19], eService, enterprise resource planning (ERP), and eGovernment systems, etc. Related to our research interest, eGovernment is the "use of Information and Communication Technology (ICT) and its application by the government for the provision of information and public services to the people" [20]. Some benefits of eGovernment services include efficiency, effectiveness, transparency, and accountability at a reduced cost. Together with the eGovernment's significance, the planning and development of eGovernment projects are quite challenging. A major challenge is that the professionals developing eGovernment projects have to consider the interests of several stakeholders, i.e. (public sector organizations, citizens, vendors, etc.) so that the most unlikely outcomes are reduced.

Existing practices, examples of hurdles in practices, are implemented in eGovernment, presenting a set of actions from which other public organizations can pick up and reflect according to their context. However, the available information about the eGovernment projects and initiatives is less, unstructured, and not well-kept. Additionally, due to the lack of experience-sharing and information, the local government faces issues based on its circumstances to develop eGovernment projects, overlooking the fact that several such eGovernment initiatives have some common functionalities in practice, and therefore, can face similar challenges in development, complicating eGovernment projects' development and increasing overheads.

To address the deficiency of structured evidence and to extend the information in eGovernment initiatives, the study explores the contemporary evidence of challenges in eGovernment initiatives analyzing 30 eGovernment projects delivered by ten areas worldwide. The research study is directed by two research questions: RQ1) What kind of challenges occur in the context of eGovernment projects? and RQ2) Who are affected by the challenges?

A. RESEARCH CONTRIBUTION

A thorough taxonomy of challenges and issues in eGovernment projects is proposed, based on the analysis and outcomes. The taxonomy comprises 3 (level-1) dimension: economic, technological, and social challenges, and 16 (level-2) dimensions: legal/regulatory, institutional/operational/environmental, political, financial, quality, process, structural, organizational, development, technical, managerial, contextual, policy & training, data & information, stakeholder, and other issues. The structured nature of taxonomy helps to find and define common ideas for the identified dimensions, giving the common terminology to discuss and communicate information about eGovernment challenges. Moreover, it serves as a special guide for eGovernment practitioners for the development of eGovernment projects. Particularly, the defined dimensions classify the range of challenges in eGovernment that affects the delivery, the ones who get affected by these, and the consequence.

To end with, the article provides the usage settings for this taxonomy by government representatives responsible for supervising and enhancing eGovernment systems, by vendor organizations in charge for developing and enhancing eGovernment projects, IT staff accountable for constructing and sustaining integrated eGovernment projects, and by researchers who are interested to develop the domain further.

Summarily, this study identifies the critical challenges to eGovernment projects which need to be addressed during development and presents the taxonomy of different eGovernment challenges and barriers. The usage scenarios have been developed and presented to illustrate the importance of this taxonomy. The main contributions of this study consist of (1) a thorough taxonomy for challenges in eGovernment projects, (2) definition of common notions for the mentioned dimensions, that might help to communicate regarding the eGovernment challenges, (3) identification of critical factors as crucial for eGovernment success, (4) usage settings for the taxonomy by the relevant stakeholders, and (5) the need to understand and tackle these issues not only by the government sector but also by other users.

B. RESEARCH SIGNIFICANCE

This study presents an extensive picture of the eGovernment services towards the sustainable government, the taxonomy of the resulting challenges to the project implementation, and the usage scenarios to improve the eGovernment implementation. The most evident part in eGovernment project is, of course, the handling of the critical challenges, their appropriate analysis and avoiding these challenges, by concerned parties, to achieve success in eGovernment project implementation. Encompassing all these, this effort forms the research implication and can serve as a basis to practitioners in industry and the future academic researchers.

The eGovernment projects studied include cities from major continents. However, the projects vary in scope and size, and simple replication would not be available, the initiatives produce various critical challenges which can increase the success rate if considered for any new eGovernment project context. The study proposes a taxonomy which structures various critical eGovernment challenges in a coherent and practical format. Each dimension of the taxonomy includes a set of critical challenges. This paper concludes by presenting the potential use of given taxonomy in eGovernment initiatives.

The remainder of the paper is organized as follows. Section 2 gives a background related to taxonomies. Section 3 describes the research methodology. Section 4 presents the state of the art on eGovernment projects, whereas Section 5 presents the taxonomy. Sections 6 discusses the lessons learned and the application of the taxonomy. Section 7 concludes the study.

II. BACKGROUND

Taxonomy is the discipline dealing with classification. It helps to structure the information within a particular field

into sets or groups and presents their associations, giving a theoretical framework to examine, analyze, and retrieve information [21]. The taxonomy is used as our concern is to only group the concepts. Additionally, it provides a comprehensive taxonomy of eGovernment challenges with richer associations and representation of the ideas. The major facets of taxonomy organizations and development are discussed below.

A. TAXONOMY ORGANIZATION

Hierarchies, faceted organization/structure, and trees are the most commonly used kinds of associations between concepts [22]. Our focus is on the faceted type organization because of its multiple advantages. The method reflects that there are various viewpoints or aspects to model the idea. The main benefits of this type are: 1) hospitability – it means that the form does not need to have comprehensive knowledge about the field. Such organization of taxonomy is quite attractive for changing and evolving fields, such as eGovernment field; a domain that is constantly evolving due to changing needs and the technology advancement; 2) flexible inquiries – it simplifies to recover information in various ways; 3) better clarity – the facets use the arrangement that represents the information in most suitable way, and; 4) flexibility – every idea(concept) can be put in various viewpoints. As a limitation, some applications were included only.

B. TAXONOMY DEVELOPMENT

We used the iterative procedure to construct the taxonomy's categories. At every iteration, an approach for development is selected and then analyze that the identified categories are appropriately defined, can be combined, or we need to identify some new [23]. Three known development approaches exist [24]: Operational, Empirical, and Conceptual. The first one is most commonly used and is a mixture of the other two. The operational technique can be empirical to conceptual in which one identifies some empirical cases. Then analyze and group the data based on the identified similarities and finally, the conceptual terms are defined, or the conceptual to empirical in which an analytical process is used to conceptualize the categories based on the concepts, experience and, the domain knowledge, and finally for every idea, the empirical cases are recognized. Additionally, there exist some practices and approaches to develop the taxonomy. We identify three general approaches which can be easily adapted to our area, i.e. focus is on information systems: 1) [NVM][23], 2) [CAL] [25], and 3) [BR] [21]. We consider that these three approaches complement one another, so we propose the method combining direction and stages from these all. Particularly, [NVM] approach identifies and follows an iterative process for development and gives direction to select the strategy for development, the taxonomy development criteria and the usage of that criteria for evaluating the taxonomy; [BR] distinguishes the necessity of the data collection process; and [CAL] and [BR] differentiate different structures for taxonomy and gives help to maintain the

taxonomy. Section 3 covers the description of the proposed methodology.

C. RELATED WORK

There exist a few taxonomies in the previous work currently, covering eGovernment challenges' concept, for example, a taxonomy of eGovernment ICT failure factors, categorizing the issues in project failure, system failure and user failure [26]; a taxonomy to classify eGovernment challenges comprising major categories: technical, social and economic [27]; a taxonomy of challenges classifying under few dimension [28], and a taxonomy of challenges encompassing institutional, managerial and policy issues in eGovernment [29]. Such taxonomies interconnect with our proposed one in organizational, managerial, and financial challenges' dimensions, and in few challenges found for some dimensions. We consider that the taxonomy proposed in this research article provides an extensive view of challenges in eGovernment projects. Further, foremost differences between our taxonomy and the others include: we recognize challenges and affectees for all dimensions of an eGovernment project, while other given taxonomies focus on very few challenges' dimensions; we focus in challenges at an extensive level and highly depending on ICT, whereas others reflect narrow range; and we develop the taxonomy based on the state of art determined from 30 eGovernment projects around the globe, whereas others do not consider practical information about barriers and challenges in eGovernment.

III. RESEARCH METHODOLOGY

The research methodology encompasses five stages: 1) Planning, 2) Data Collection, 3) Taxonomy Construction, 4) Validation, and 5) Maintenance. The methodology is shown in Figure.1 with the five major activities, tasks included and obtained results in each activity. The details of each stage are described in the succeeding sections.

A. PLANNING

This stage consists of the fundamentals for developing the taxonomy. It outlines the goals and scope of the taxonomy, meta-characteristics, ending conditions, and structure of the taxonomy.

1) GOALS, SCOPE, AND META-CHARACTERISTICS

To structure information related to challenges in eGovernment initiatives and projects is our goal. The scope of the taxonomy, in particular, is restricted to eGovernment projects. The meta characteristics of the taxonomy are research questions formed in Section 1, i.e., they specify the complete characteristics that can be helpful to identify the taxonomy features. The major dimensions in the taxonomy ought to be the logical value of the meta-characteristics.

2) TAXONOMY STRUCTURE

The taxonomy structure selected was the faceted one, due to its numerous advantages as described in Section 2. Also, due

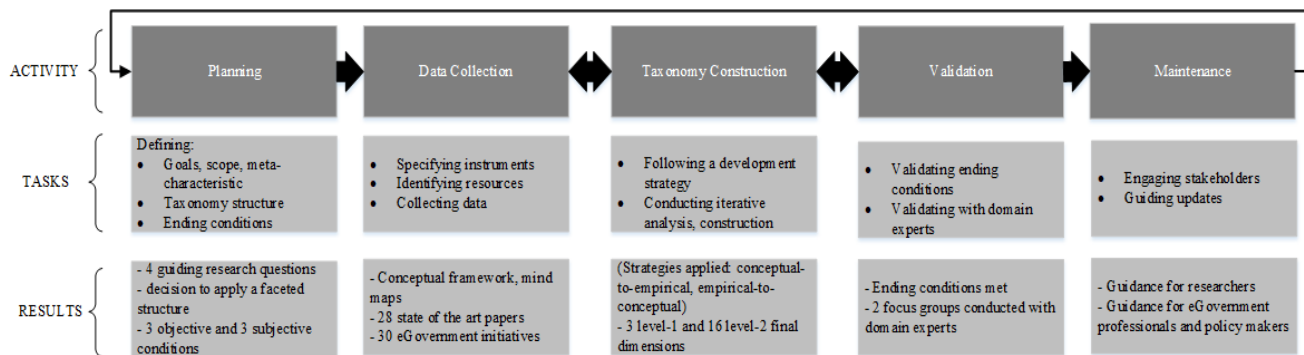


FIGURE 1. Method for developing taxonomy.

to the multiple features and facets, identified by the meta-characteristics.

3) ENDING CONDITIONS

We selected the subjective and objective ending conditions based on [NVM]. These are as follows: Objective conditions: 1) no dimensions or characteristics were merged or split in the last iteration; 2) no new dimensions or characteristics were added in the last iteration, and; 3) each dimension is unique and not repeated. Subjective conditions: 1) the dimension and characteristic explain about the object clearly; 2) dimensions and characteristics can be easily added, and; 3) the number of dimensions allows the taxonomy to be meaningful without being unwieldy or overwhelming.

B. DATA COLLECTION

The instruments and resources to collect data are identified in this step, and the data is collected as well from the state of practice regarding challenges faced in development in the context of eGovernment.

1) STATE OF PRACTICE

To identify eGovernment projects from the practical field, we conducted searches using Google search engine and the keywords ‘‘eGovernment’’ or ‘public service’, in conjunction with four continents names, Africa, Asia, Europe, and America, to include countries with different altitudes of eGovernment development. The selection criteria that were applied to all areas is: information is available for eGovernment projects in government websites, and range of the projects. In total 10 areas were selected as presented in Table 1.

All the ten areas and their projects have been recognized as eGovernment projects standing out with a high success rate. However, most of the selected projects were relatively challenging, i.e. not a straight success and faced various issues in development, then ended up with satisfactory delivery. Nairobi² is recognized by its ability to rationalize and streamline the management of Kenya’s ICT functions, as to

TABLE 1. Cities selected for eGov projects.

Continent	Country	Area	Reference
Africa	Kenya	Nairobi	http://icta.go.ke/
Asia	India	Karnataka	https://www.karnataka.gov.in/ceg/pages/home.aspx
		Andhra Pradesh	https://www.aponline.gov.in/aportal/index.asp
		Gujarat	http://gujaratindia.gov.in
		Maharashtra	https://www.maharashtra.gov.in/1125/Home
Pakistan	Pakistan	Islamabad	http://www.nitb.gov.pk/newnitb/
		Peshawar	http://kp.gov.pk/
		Daejeon	http://www.neargov.org/en/page.jsp?mnu_uid=3604
America	USA	Washington	https://www.gsa.gov/about-us
Europe	Austria	Vienna	https://www.vienna.gov/index.aspx?NID=9

deliver effective public service; Karnataka³ is a leading example in developing successful eGovernment projects; Andhra Pradesh⁴ is recognized as another major contributor to successful eGovernment projects; Gujarat⁵ and Maharashtra⁶ are also known as leading eGovernment project development area; Islamabad⁷ is recognized by its integrated citizen data management system; Peshawar⁸ is known as the leading area for successful eGovernment projects development in Asia; Daejeon⁹ is well known due to its best eGovernment practices because the country of this area was conceived as the highest-ranked eGovernment nation; Washington¹⁰ has also been recognized as top-ranked area in the UN surveys;

³<https://www.karnataka.gov.in/ceg/pages/home.aspx>

⁴<https://www.aponline.gov.in/aportal/index.asp>

⁵<http://gujaratindia.gov.in>

⁶<https://www.maharashtra.gov.in/1125/Home>

⁷<http://www.nitb.gov.pk/newnitb/>

⁸<http://kp.gov.pk/>

⁹http://www.neargov.org/en/page.jsp?mnu_uid=3604

¹⁰<https://www.gsa.gov/about-us>

²<http://icta.go.ke/>

Vienna¹¹ was recognized by its smart development world honor in 2016 for its integrated research.

The data were analyzed based on two constructs – What and Who. Each of the constructs addresses one of the formulated research questions, or meta-characteristics, specified as follows:

- 1) **WHAT – RQ1:** What are the eGovernment challenges? The construct explores the challenges of the eGovernment projects.
- 2) **WHY – RQ2:** Who is affected by these critical challenges? The construct assesses for whom the projects are developed and who are affected by these challenges.

C. TAXONOMY CONSTRUCTION

This stage works iteratively. The selection of a strategy is made to construct or improve the taxonomy in all iterations. Some steps are performed based on the strategy chosen and checked the ending conditions to decide if more iteration is required.

First, using the conceptual to the empirical approach, the taxonomy's major dimensions were identified, i.e., the ideas depicting the essence of questions were identified for both research questions (RQs). Two major level-1 dimensions and fourteen level-2 dimensions were identified at this stage. Secondly, we used the empirical to the conceptual method iteratively to meet the ending conditions. The challenges of projects in eGovernment domain were categorized in different dimensions in each iteration, based on common characteristics, giving such an extensive list of challenges of each dimension. We used conceptual maps to classify challenges. XMind mind-mapping tool was used for this classification. In this process, it became obvious that several challenges fall under more than one dimension, with slight variations, resulting in the classification of the challenge in both dimensions with their respective nature.

D. VALIDATION

In this step, validation of the taxonomy and the integration of the received feedback was done. Two focus group meetings were arranged with international government practitioners and academic experts with experience in the eGovernment initiatives. Both meetings conducted, one at IT government office and one at a local university, were arranged as one and a half-hour session, together with 20-minutes for presenting the taxonomy, following a discussion session between participants. The purpose of this activity was to discuss the appropriateness of the taxonomy, the completeness, weaknesses, effectiveness of notions, and improvements. 6 government professionals attended the meetings, from China (at work for government of Beijing), India (work for Ministry of ICT, India), Pakistan (work for DoIT), 2 from America (former government official), and Austria (working for Austrian government), and five academics from the local university. We got valuable feedback from both meetings to validate the

content of the taxonomy and to improve it. A new dimension at level-1 and level-2 each was incorporated, social challenges and other challenges, which was consistent with RQ1. It gave rise to a new step 3 iteration, in which we identified challenges for these dimensions using conceptual to empirical approach.

E. MAINTENANCE

We identified the stakeholders accountable to maintain and evolve the taxonomy continuously in this step. Besides, the guidelines for the stakeholders are provided in the study.

IV. STATE OF PRACTICE

Below we refer to the eGovernment projects identified from each area, in Table 1 and gives the code “S” to each project with the number in the order they are mentioned, such as the first project as S01 and so on. The eGovernment initiatives/projects are further categorized under the relevant dimension of the taxonomy in Section 5.

A. NAIROBI

S01) Business licensing e-registry, a Kenyan eGovernment project that facilitates to access thorough information on related business licenses and permits, as well as requirements, application forms, costs, and contact details for the governing agency. S02) Custom Regulations, an initiative for collecting and accounting for import duty and VAT on imports. S03) Kenya Corruption Reports, an eGovernment application to minimize the corruption and bribery levels.

B. KARNATAKA

S04) Bhoomi, an eGovernment system to digitize the paper land records, creating a mechanism to control changes to the land registries. S05) KAVERI—Karnataka Valuation and E-Registration, an application for document registration, facilitating to enter details and book appointment and to search for required index and registered copies. S06) Khajane, an eGovernment application of computerizing the entire array of treasury activities.

C. ANDHRA PRADESH

S07) CARD—Computer-Aided Administration of Registration Department, a project for computerization of the land registration process of Andhra Pradesh. S08) eProcurement, an eGovernment system for computerization of tenders and bids process. S09) eSeva, an eGovernment application intended to integrate and offer a wide range of government to citizen (G2C) services at a particular locality.

D. GUJARAT

S10) Ahmedabad Municipal Corporation (AMC) Civic Centers, an application for digitizing civic centers of Ahmedabad.

E. MAHARASHTRA

S11) Computerized Inter-State Check Posts, an eGovernment system for computerization of check posts. It uses electronic

¹¹<https://www.viennava.gov/index.aspx?NID=9>

TABLE 2. Major eGovernment challenges(Level-1 classification).

Challenges which are...	Encompassing:
Economic	Challenges concerned with return on asset w.r.t. Finance, inflation, rules & operations, and safeguard of the previous assets.
Technological	Challenges concerned with the technology, system design, IT background and knowledge, and disparity of quality, etc.
Social	Challenges concerned with the concerns of stakeholders

weighbridges to check for over-dimensioning and overload-ing, check vehicles for broken headlights, verify non-standard license plates, and check essential documents

F. ISLAMABAD

S12) Nadra, an eGovernment project for citizen-centric data management, providing multiple facilities: such as social grant programs, authentication of applications, financial inclusion programs, smart national identity cards, deceased identification, electoral roll, and disaster planning and disaster recovery program. S13) Online Recruitment System for Federal Public Service Commission Phase-II, a project by the federal government for recruitment purposes, a system for automating the examination system.

G. PESHAWAR

S14) KPK Assembly, an eGovernment application intended to automate the assembly of Khyber Pakhtunkhwa Peshawar. S15) Special Branch Information System (SBIS), an application for automating the entire business process of Special Branch. S16) Criminal Record Verification (CRV), a system for creating a centralized database of First Information Report (FIR) record of all the police stations in the province. S17) Prison Management Information System (PMIS), an eGovernment project for automating jail records and managing inmates' information.

H. DAEJEON

S18) Electronic Procurement Service, an eGovernment project to provide information related to all the public organizations' procurement: providing one-click online service for government procurement. S19) Electronic Customs Clearance Service, an eGovernment application for computerizing export/import logistics business and processes. S20) Comprehensive Tax Services, an application for computerizing tax affairs.

I. WASHINGTON

S21) E-Authentication, an eGovernment project for online identity validation service. S22) E-Travel, a collaborative, inter-agency system that deals with the integrated automated travel functions. S23) Federal Asset Sales, a system to find, recommend, and implement enhancements for asset recovery

and outlook. S24) Integrated Acquisition Environment (IAE), an application for automating IAE: provides functionality to better understand business choices in procurement, logistics, payment, and performance assessment. S25) USA Services, a project in eGovernment domain for computerizing system for providing information and services to citizens.

J. VIENNA

S26) Electronic Excise Tax Registration, a project for automating the excise tax registration, it allows the electronic submission of tax returns, to transfer data for the payment of all relevant taxes, and submission of rebate applications. S27) Electronic Customs (e-Zoll), a project for automating the process of customs clearance of goods and cargo. S28) Financial Police, an eGovernment project to computerize the anti-fraud unit. S29) Electronic Personnel Management, an application to computerize the personnel management records of the finance department. S30) Excise Movement Control System (EMCS), a system to automate the process of monitoring the movement of excisable goods within the country.

V. TAXONOMY OF E-GOVERNMENT CHALLENGES

The major dimensions defined for the taxonomy of challenges in eGovernment domain, level-1 (Table 2) and level-2 (Table 3), are represented in Figure 2. The identified challenges for these dimensions are described and illustrated in the following sections respectively.

A. LEGAL AND REGULATORY CHALLENGES

We define legal & regulatory barriers following the United Nations survey [1] to identify the related challenges and to classify those challenges in this dimension. Table 4 describes each challenge in this dimension and classifies each initiative described in Section 4.

B. INSTITUTIONAL/OPERATIONAL/ ENVIRONMENTAL CHALLENGES

We define this dimension as the issues that occur due to the problems at the executive level [3], [29]–[32]. Table 5 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

TABLE 3. A proposed taxonomy of eGovernment challenges/issues (Level-2 classification).

Economic	Technological	Social
Legal & Regulatory challenges	Quality challenges	Stakeholder challenges
Institutional/Operational/ Environmental challenges	Process challenges	Other challenges
Political challenges	Structural challenges	
Financial challenges	Organizational challenges	
	Development challenges	
	Technical challenges	
	Managerial challenges	
	Contextual challenges	
	Policy and Training challenges	
	Data and Information challenges	

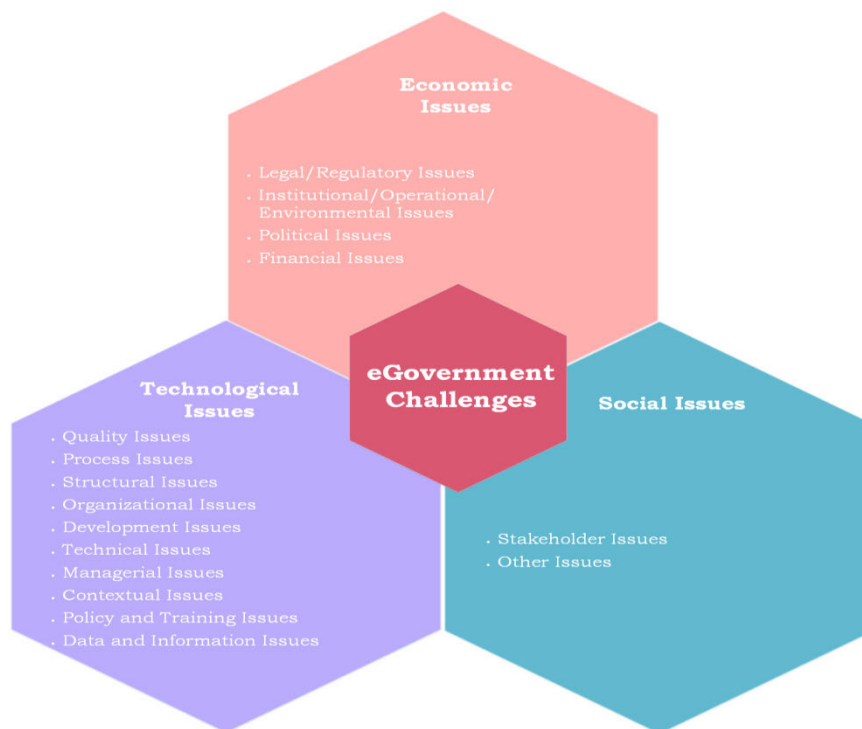


FIGURE 2. eGovernment challenges dimensions(level-1 & level-2).

C. POLITICAL CHALLENGES

In this dimension, the challenges that occur refer to the controversies within the administrative and governmental systems [33]. Table 6 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

D. FINANCIAL CHALLENGES

The challenges in this context refer to costs and funding. Table 7 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

E. QUALITY CHALLENGES

We refer to the quality challenges to the absence of a measure of excellence or a state of being free from defects

[3], [26], [34]. Table 8 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

F. PROCESS CHALLENGES

The challenges that arise in the software development process and its functionality are the process related challenges [35], [36]. Table 9 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

G. STRUCTURAL CHALLENGES

We define structural problems as the poor administrations and disarrangement for the project’s delivery [37], [38].

TABLE 4. Legal & regulatory challenges.

Challenge	Description	Example System/study
Improper Law Enforcement	It refers to the violation and non-compliance of the set laws and rules	S04, S16
Incompatible Law and Public Policy	It deals with inconsistent laws and principled guides/policies in the public sector	S02
Lack of proper Legal and Regulatory Framework	It refers to the absence of a necessary system of rules which supports the control direction or implementation of given actions, legal laws or principles	S06, S20
Poor E-literacy	It deals with the absence of required education and awareness regarding electronic services	S05
Less Accessibility	It refers to the less access to the eGovernment system; at customer or developer end	S14, S16, S23
Lack of Privacy Concern	It deals with the absence of the required privacy mechanism	S06, S20, S21
No Record Management	It states the inability to manage and update records or documents for the project	S09, S15, S17
Non-permanent availability	It states the issue that concerns are not being available at all time in project development and implementation	S13
Improper Preservation	The issue deals with the lack of a proper mechanism to maintain the system and archives to a specified degree	S05, S08, S09, S17
Lack of Benchmarking	It deals with the absence of proper standards and reference criterion for measurement purpose	S06-S09, S16

TABLE 5. Institutional/operational/environmental challenges.

Challenge	Description	Example System/study
Technology and Infrastructure costs and factors	It deals with the major elements and costs that come in way of identification of technology and its built set of concepts	S04,S07,S15, S27
Lack of Resources to support 24/7 Operations	The issue deals with the lack of proper 24/7 hour availability of employees	S03, S07, S09, S10, S11, S15, S17, S21
Lack of Innovative Incentives in the Public Sector	It deals with the issue of providing rewards to employees for better performance and their increased motivation	S08, S13,S10, S15,S17
Lack of Executive support	It refers to the absence of necessary support required at the supervisory and managerial level	S01, S04-S17
Organizational and Cultural Dichotomies	It deals with the irreconcilable differences present in the organization	S04-S17
Lack of Institutional support	The issue is concerned with the nonexistence of support to the employees at the organizational level	S08, S09, S15-S17
Information Mismanagement	It refers to the act of mishandling the important information of the eGovernment projects and related activities	S16
Reluctance to share among Departments	It deals with the act of being mean, hesitating to share information with other colleagues or concerns	S08-S11, S15-S17, S20-S22
Security and Privacy Concerns	It deals with the absence of confidentiality aspect	S02, S08-S10, S15, S21-S23, S26-S30
Digital Divide	It refers to the inequality of access to, use of, or impact of ICT	S08

Table 10 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

H. ORGANIZATIONAL CHALLENGES

The dimension refers to the absence of an alliance between the IT venture and organizational objectives, creating organizational issues in eGovernment projects [3]. Table 11 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

I. DEVELOPMENT CHALLENGES

We define the development problems like the ones that occur due to a deficiency of prerequisite tools and expertise, along with the compatibility issue. Table 12 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

J. TECHNICAL CHALLENGES

This notion focuses on the perspective of fewer ICT tools and computational methods useful to deliver eGovernment

TABLE 6. Political challenges.

Challenge	Description	Example System/study
Political Instability	The issue deals with the unstable democratic system and economic problems	S10, S14,
Bureaucracy	It refers to the scenario where all important decisions for eGovernment projects are taken by government officials instead of the elected development team; who knows the system better.	S15
Dominance of Politics and Self Interest	It states the presence of giving importance to personal benefits as compared to the organizational benefits	S06
Budgeting Barriers	It means the risks associated with the budget, such as less economic growth	S06-S10, S15-S17
Incomplete Scope	It refers to the definition of inadequate and poor constraints for projects	S16
Inappropriate Laws	It deals with the definition of wrong and unsuitable rules/set of actions	S09
Mismanagement of Laws	It deals with the mal-administration of the defined set of rules	S01, S10, S18

TABLE 7. Financial challenges.

Challenge	Description	Example System/study
Lack of Understanding of Direct financial, Indirect financial, Opportunity, Political, Beneficiary, and Future costs	It refers to the absence of properly comprehending the required financial terms and related characteristics	S03, S07, S09, S13-S16
Low Budget	It refers to the deficiency of the required budget	S08, S15-S17, S21, S23
Improper Use of Finance	It refers to use of the allocated budget unsystematically.	S16, S21, S23
Mismanagement of resources and costs	It means the inability to handle the assigned human, technical, and financial resources appropriately	S19
Management Shirks to Investment	It states the tendency of management to do less work when they see that the return will be small	S12-S16
costs and Risks of Contracting	It refers to the risks and issues related to contracts, such as breaching of contracts.	S16

TABLE 8. Quality challenges.

Challenge	Description	Example System/study
Design-actuality Gaps	It refers to the difference between the designed and the developed eGovernment system	S10, S12
Lack of Evaluation	It states the absence of the proper assessment mechanism in the development of the system	S25
Usage of Inappropriate Tools	It refers to the use of the tools that are either not updated (obsolete) or are not appropriate for the project	S09
Lack of Technology Expertise	It means to have the employees or managers who do not have sufficient experience regarding the use of technology	S08-S10
Lack of Understanding of Technology, Quality, User needs, Policy, Coordination, Stakeholders, etc	It states the absence of proper understanding regarding the used technology, about the quality aspects of the project, the needs of users and coordination mechanism, as well as the policies required to align the needs and technology	S03, S16
Donor Push	It refers to the account for pushing the teams harder, even towards constant overtime; from donor's side	S07
Less Effort and commitment	It means to put very little strength and obligation towards the project	S16
Lack of Involvement of Concerned Group & People	It states the less participation of concerns in the required development stages	S02-S13, S15-S17
Less People Orientation in Project Selection	It refers to the act of keeping some of the stakeholders away while selecting the software development process for the project	S24, S26
Low persistence	It means less determination and resolution to work	S22
Bad Leadership	It refers to the failure of leadership activities	S09

projects. Table 13 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

K. MANAGERIAL CHALLENGES

The concept refers to the managerial practices that affect the success and delivery of the eGovernment project.

TABLE 9. Process challenges.

Challenge	Description	Example System/study
Less Accurate Process/Selection of Improper Process	It states the selection of a software process that is not suitable for the project; i.e. not project-oriented, and any general software process is being selected	S16
Less Efficient Process	It refers to the characteristic of inefficiency in the software development process	S08, S09, S16
Low Productive Process	It refers to the selection of software development process that gives less productive results	S03
Inflexibility	It refers to the selection of software development process that does not provide the functionality of being flexible	S05-S08
Non-Robustness	It refers to the process inability of tolerating perturbations that might affect the system	S08, S09, S16
Less Scalability	It refers to the incapability of the software process to cope and perform well under an increased workload	S08, S09, S16
Low-Multi Modularity	It states the lack of the degree to which a process components can be separated and recombined	S09
Irregular Data Sparseness	It means to distribute the relevant and minor information in an inappropriate manner	S08, S09
Non-Multi Linguality	It refers to the absence of multi-lingual characteristic of the software process	S16
Lack of Business Process Re-engineering (BPR)	It refers to the absence of the process management strategy that focuses on the analysis and design of a project	S03-S07

TABLE 10. Structural challenges.

Challenge	Description	Example System/study
Lack of Infrastructure Definition	It states the deficiency of having a proper mechanism for defining the eGovernment project infrastructure	S16
Wrong Built Information and Communication Infrastructure	It refers to the development of ICT infrastructure in an inaccurate way, i.e. not according to the project and deliverables	S08, S09
Lack of Human Resources Development and Employment Creation	It refers to the lack of activity of providing better human resources growth and employment opportunities	S08-S11, S16
Lack of will to work or Monitor Change	It refers to the absence of determination to work and observe activities regarding any changes to the project	S04-S17
Strategic Issue	It refers to the critical challenge that affects the mission, values, stakeholders, resources, structure, processes, management, or services of any organization	S18
Content Deficiency	It states the absence of required and relevant information in the project and in the artifacts available	S01-S03
Unclear Responsibility Definition	It refers to the inability of assigning proper roles and responsibilities to the concerns in the eGovernment project	S04, S06, S08, S09, S10, S11, S13, S16

Table 14 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

L. CONTEXTUAL CHALLENGES

The dimension refers to the issues that occur due to misunderstanding of the context in which the eGovernment project is to be developed and implemented. Table 15 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

M. POLICY AND TRAINING CHALLENGES

We define policy and training issues as the less understanding and improper management of the policies, strategies and training concepts. Table 16 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

N. DATA AND INFORMATION CHALLENGES

The notion refers to the issues that occur due to less control over the data and information aspects. Table 17 describes

each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

O. STAKEHOLDER CHALLENGES

In this context, the stakeholder refers to the person who affects or gets affected by the success/failure of the eGovernment project. The problems related to stakeholders fall into this dimension. Table 18 describes each challenge in this dimension and classifies initiatives respectively, illustrated in Section 4.

P. OTHER CHALLENGES

We define this concept as the misinterpretation of some major and critical factors. Table 19 describes each challenge in this dimension and classifies each initiative described in Section 4.

The complete taxonomy with its respective level-1, level-2 dimensions, and the challenges are depicted in Figure 3. Associated with challenges, we can identify affectees or

TABLE 11. Organizational challenges.

Challenge	Description	Example System/study
Lack of Vision and Strategy	It deals with the deficiency of proper project idea and its appropriate approach for development	S08, S09
Management Unawareness on IT systems	It states the deficiency of having proper understanding regarding the IT systems at the managerial level	S21
Not Defined Principles	It deals with the inappropriate definition of the values and beliefs	S16
Misaligned perception of values	It states that the project values and its awareness is not aligned properly	S28
problem of Re-structuring Administrative Functions	It deals with the issue of defining and organizing the managerial level activities	S03, S07, S10
Requirement Barriers	It deals with the issues that come in requirement elicitation and specification	S15, S16
Coordination and Cooperation Barriers	It states the issue of less teamwork and poor confidence	S01-S30
Lack of monitoring mechanism	It refers to the absence of proper check and control procedure for the project	S05
No feasibility study conducted	It states the issue of not analyzing the viability of the project idea and the related factors properly	S08, S09, S16, S24-S26
Lack of Understanding of Key-components for eGovernment/Public Sector systems	It deals with the unfamiliarity of the major eGovernment and public sector elements	S10, S16
Irregular Adoption & Improper Use of Implemented System	It states the issue of using the developed system for an unintended purpose	S08
Ineffective Investment	It refers to the investment that is unplanned and accounts to be less effective	S16
Unsatisfactory User Acceptance of Technology	It deals with the problem of customer unsatisfaction, and the customer does not accept the developed system	S07

TABLE 12. Development challenges.

Challenge	Description	Example System/study
Poor or Unrealistic Design	It states the creation of an unintended and non-realistic project design	S11
Use of Improper Tools	It refers to the use of the tools that are not appropriate for the project	S10, S11, S16
Improper Environment for Working	It defines the issue of working environment which is not comfortable to work in	S09, S16
Poor Data systems & Lack of Compatibility	It refers to the development of systems that are not up to the standard and is not compatible with a new environment	S08, S22
Less Skilled Personnel	It refers to the issue of persons having less and poor working skillfulness	S03-S18, S27, S29
Poor Leadership Styles	It refers to the issue that the leaders for any project do not have required and effective way of carrying out the tasks	S08-S10, S16
Cultural & Bureaucracy Styles	It refers to the national and governmental approaches for eGovernment systems	S16
Lack of Local Adoption	It defines the state when the developed projects are not accepted and adopted at the local level.	S01, S05, S18
H/W, S/W Gaps	It relates to the issue when the already designed and manually implemented project is automated, but a huge difference occurs between the two systems; i.e. old hardware and new software system	S08, S09
Country-Context Gap & Private-Public Gaps	It refers to the gap that occurs when the eGovernment system developed for one country is adapted to be used in another country and does not fit appropriately. And, the gap that occurs when a public sector project is used for private sector creates huge differences	S08, S09

the stakeholders. A stakeholder is a person who has any stake in the project. An affectee is a stakeholder who gets affected by the success or failure of an eGovernment project. We identify government, executive committee/supervisory committee, vendor, and the client as affectees of any eGovernment project. We also identify the society, as one of the affectees, representing all social actors. Table 20 shows this relationship. Furthermore, the information on challenges in eGovernment can be related in several ways, due to

its faceted structure. Therefore, eGovernment challenges' dimensions can be related to the ITPOSMO model elements [39]; as Figure 4 shows the ITPOSMO model relevant element(s) against each dimension of eGovernment challenges.

The legal and regulatory challenges must be removed in order to ensure compliance and adherence to relevant guidelines, laws, specifications, and regulations. The violations of such challenges result in serious consequences.

TABLE 13. Technical challenges.

Challenge	Description	Example System/study
Lack of proper IT Planning	It refers to the shortage of required and proper planning activities	S08, S09, S10, S16
Selection of Improper IT systems	It states that the IT systems being selected are not accurate and do not provide the required functionality	S08
Injudicious use of computer	It refers to the practice of using computers unwisely	S16
Lack of Basic IT Knowledge	It defines the absence of primary knowledge regarding IT and its usage	S02-S16, S25-S30
Technological Incompatibility	It refers to the use of the obsolete technology, that does not provide compatibility feature	S08
H/W, S/W Gaps	It relates to the issue when the already designed and manually implemented project is automated, but a huge difference occurs between the two systems; i.e. old hardware and new software system	S08, S09
Shortage of IT skills and Knowledge	It refers to the deficiency of required skills and understanding regarding the latest IT	S03-S18, S27, S29
Lack of Standards of IT	It states the issue that the relevant IT values are missing	S06-S09, S16
costs of Internet Usage	It refers to the excessive overheads of using internet	S08, S09, S16
Technology Changes/Uncertainty of Technology	It refers to the fact of technology fluctuations and the ambiguity in using the technology	S16
Lack of ICT Policy	It states the absence of proper and quality ICT guidelines	S01-S30

TABLE 14. Managerial challenges.

Challenge	Description	Example System/study
Lack of Management skills	It refers to the fact that the managers do not possess the required skills for executing the project	S02, S08-S10, S15, S21-S23, S26-S30
Lack of Capacity to Manage Large Scale Projects	It defines the issue of managers that are unable to handle and carry out large projects effectively	S08, S09, S15
Lack of Conviction of Top & Middle Managers	It states that the top-level and middle-level managers lack the belief that they can lead and execute the project properly	S16
Doubts & Resistance by Leadership	It refers to the uncertainties & conflicts among the leaders	S16
Opposition by Professional & Union Interests	It refers to the conflicts by experts and groups	S08, S09, S29
Misuse of Sensitive Data	It relates to the issue that the important and delicate information is ill-used	S03,S07,S10
Lack of Strategic holdup	It refers to the weak and inactive command on the project	S09, S16
Lack of Internal Drivers	It refers to the absence of factors that motivate/drive to work in a better way within an organization	S16
Incompetency of Top Management	It states the inability and inexperience of higher-level managers	S01-S04, S08, S09, SS13, S16
Schedule Overrun	It relates to the schedule creep, i.e. exceeding the set schedule	S01, S07-S09, S15, S16
Poor Change Management	It refers to the incapability of managers to cope up with and manage the required changes effectively	S08

The operational, environmental and the institutional challenges have the potential. If not addressed properly, to cause shattering damage on the eGovernment projects and on the infrastructures on which the development depends at the local and international scale both. Therefore, efforts must be made to tackle such challenges for better progress.

Political challenges are the risks which significantly affect the involved stakeholders and the effectiveness and value of the project. These issues need to be understood and addressed effectively.

The financial issues are mainly due to the pressure of money stress. These can impact the mental health as well,

due to financial hardships. Therefore, the financial challenges must be overcome and the situation should be improved for development.

The quality challenges occur while implementing the quality initiatives. The actions, goals, and plans prepared, highly impacts the quality of the eGovernment projects. It is necessary to identify and address the quality aspects and the consequent challenges effectively.

The software development process challenges are among the most critical challenges in eGovernment, which needs to be addressed in time. The entire progress and success of the project is dependent on the development process. Hence,

TABLE 15. Contextual challenges.

Challenge	Description	Example System/study
Lack of Adequate Trained Employees	It relates to the issue of hiring the employees who lack the appropriate and sufficient training and experience	S01-S11, S16, S21-S30
Inadequate Infrastructure	It refers to the development of an inappropriate and poor foundation for project and plan	S04,S07,S15, S27
Lack of IT Plans	It refers to the shortage of relevant planning for carrying out IT systems	S01, S08, S09, S16, S24
Lack of Management Awareness	It refers to the lack of understanding and awareness about the project requisites by management personnel	S02, S08-S10, S15, S21-S23
Less Usefulness	It refers to the issue that the built system is not accurate and is of little practicality	S08, S09
Less Ease of Use	It refers to the issue of non-comfort of using the system	S11
Distrust	It refers to the fact of disbelief	S16
Incompatibility	It refers to the issue of not having the required feature of compatibility in the built system	S08, S09
Poor External Interface	It defines that the user interface is not friendly	S09
Poor Interpersonal Influence	It refers to the issue that there is the very less relational impact of any person on another	S09
Poor Self efficacy	It defines the problem that an individual does not have a strong belief in his or her inborn ability to achieve goals	S09

TABLE 16. Policy & training challenges.

Challenge	Description	Example System/study
Lack of Coordination or Strategic Planning	It refers to the absence of a process of aligned and strategic plans and clearly defined objectives	S01, S08, S09, S16, S24, S25
Lack of Comprehensive & Continuity of Policies & Programs	It defines the fact that the rules and regulations for the project are not complete & stable	S08, S09
Absence of Policy Guidelines	It refers to the shortage of guiding principles for making policies for the system	S08
Cultural dichotomy	It states the division into two contrasting groups w.r.t the cultural values	S16
Less Training sessions for Employees/Managers	It refers to the absence of workshops and meetings to train the concerns	S01-S11, S16
Improper Policies	It refers to define the policies that are not according to the project requirements and plan	S08, S09, S16

the challenges described under this category need to be given due importance to reduce the failure rate in the eGovernment domain.

The structural challenges for the eGovernment project are usually not considered properly, which increases the likelihood of various other issues and reduces progress significantly. So, these challenges also need much attention for better eGovernment development.

Organizational challenges are the issues that might create massive organizational destructions. These change the improved productivity and business goals into huge difficulties. Such challenges also need to be considered efficiently.

The constraints of the development are quite critical and hampers the Government progress significantly. Therefore, these issues and challenges must be dealt effectively. The better the development challenges handled, the better and smooth the progress becomes.

The technical challenges can be easily identified and solved using current resources. These challenges are

considered most critical by most of the eGovernment professionals. These reduce project efficiencies.

The managerial challenges are considered one of the most high impact challenges that drive a project towards straight success or failure. These issues must be identified and catered properly, as the success of the eGovernment project highly depends on the management aspects.

The contextual challenges are the ones which are overlooked in the eGovernment sector currently. However, these may cause problems in implementation. Therefore, the contextual challenges are also important to be identified and handled for eGovernment success.

Policy and training challenges are among the most important categories to be considered. It is because the human trainings and defined policies set the objectives and guides the execution of the eGovernment project. Hence, these issues and challenges need to be considered always in development.

The data and information challenges serve as the cutting-edge in the eGovernment project. These must be considered

TABLE 17. Data & information challenges.

Challenge	Description	Example System/study
Loss of control over Intellectual Assets	It relates to the problem of having limited access and commands over the knowledgeable resources	S16
Improper Strategy for Data Analysis	It refers to the inaccurate and poor plan to analyze the related information of the project	S08, S16
Misuse of Sensitive Data	It relates to the issue that the important and delicate information is ill-used	S16
Poor Data systems	It refers to the development of systems that are not up to the required standard	S08, S09, S16
Poor Infrastructure for Knowledge Management	It refers to the inappropriate scheme to manage the stated knowledge and information	S09
Insecure Data	It relates to the issue of data that is not secure	S08, S09, S16
Non-Transparent Data	It refers to the issue that the information is not available and clear to all concerns	S08, S09, S16
Poor Record Management of Data	It refers to the malpractice of recording and managing the project information	S07-S09
Poor Training for Knowledge management	It defines the issue when there is no proper mechanism to provide the training regarding managing the relevant information	S01, S08, S09, S16
Ambiguous Data	It refers to the unclear project information	S08, S09
Lack of Conciseness, Clarity, Accuracy, Compatibility, Trustful Data	It relates to the deficiency of some basic features of effectiveness	S04, S06, S08, S09, S10, S11, S16

and dealt effectively so that no information is lost and the project implementation is completed successfully.

The stakeholders are the core asset of the entire project and its implementation. The challenges related to stakeholders create obstacles in fine execution. Therefore, such issues need to be discussed and catered in an effective manner.

There are some additional challenges related to improper consideration and understanding of various elements, such as costs, time, and scope etc These challenges must be minimized and the terms should be communicated effectively for better understanding.

VI. DISCUSSION

This section consists of the challenges that we met in the taxonomy development process, the methods to overcome those challenges and the lessons learned. The usage settings of the taxonomy and recommendations for stakeholders of eGovernment projects are also provided.

A. CHALLENGES AND LESSONS LEARNT

A major challenge confronted was the difficulty to collect relevant information about eGovernment challenges because of the lack of standard and important data provided. Besides, complete lists of initiatives were missing in official portals. Several searches were conducted with different sources to ensure a rich representation of a particular project. Due to this, citizens, governments, and researchers find it difficult to acquire relevant information for such initiatives and practices implemented in the country. Moreover, the success of the implemented eGovernment projects could be affected, since some people might not know about their implementation and presence. Therefore, some mechanism to set standards and balance is needed. Stakeholders can get benefit from the available projects' information, how they can use these, and how the use of such projects can be beneficial to them. The

researchers, government professionals, and other stakeholders can be benefited from data about planning, development, technical particulars and lessons learned from eGovernment projects that are not executed successfully. Additionally, access to required information can serve related public sector requirements. In particular, the objectives of the public sector initiatives consist of to “discover and promote new and innovative eGovernment practices and techniques evolving worldwide; and create practical opportunities for other governments to learn from each other, share experiences, and build upon the public sector initiatives of their counterparts”.

In the process of data collection, we found it difficult to get proper information regarding the usage of eGovernment projects. Several complaints were also there in terms of project performance and interface.

We provide some recommendations to overcome this; have a devoted and effective approach to ensure the efficient implementation and practice of eGovernment projects. The approach must be participatory, i.e. it should include and engage all concerns in development, as a first step, conducting campaigns of communication to promote the projects, to inform residents about their benefits and availability. Additional steps would comprise projects to listen to the feedback from users, inform the user satisfaction level, modify projects based on the proper feedback, maintain users and inform them regarding the usage of their given feedback, ensure the system's maintenance, and collect information about the real use of the projects. Such exercise might increase the belief in the eGovernment initiatives and the development organization, and improve the acceptance level.

Finally, in some scenarios, the stakeholders' information was missing. Several projects were developed by the vendors, without much participation from the government. In such scenarios, we recommend that the roles must be revised by the government, to promote project development.

TABLE 18. Stakeholder challenges.

Challenge	Description	Example System/study
Lack of Trust	It refers to the fact of disbelief among the colleagues and concerns	S08, S09, S16
Lack of Political will	It refers to the fact that the collective amount of political benefits and costs are less	S01, S05, S08, S09
Lack of Social Influence	It denotes the case when a person's emotions, opinions or behaviors are not affected by any other person	S08-S10, S16
Lack of Stakeholder Involvement	It refers to the less participation of concerns in the project plans and milestones	S01-S17, S21-S26
Lack of Requisite Competencies	It denotes that there is less amount of required expertise and competency within an individual	S08, S09
Failure to perform	It denotes the scenario when any person, team, group, etc is unable to perform and deliver as desired	S09
Lack of Performance Expectancy	It refers to the disbelief that the use of a particular technology will be beneficial or will enhance the performance of any individual	S08, S09, S16
Lack of Effort Expectancy	It refers to the unease of an individual in using the system	S08, S09
Limited IT Knowledge	It refers to the presence of scarce understanding and knowledge regarding IT	S02-S16, S25-S30
Limited Budget	It relates to the deficiency of budget and finance	S06-S10, S15-S17
Unrealistic Expectations	It relates to the fact that hopes and beliefs associated with the project are unrealistic	S01, S06, S08, S09, S16 S03, S07, S09, S10, S11, S15, S17, S21
Staff Shortage	It means the scarcity of employees	
Cultural Difference(age, gender, cast),	It refers to the differences among the individuals and groups	S04-S17
Limited Career Growth	It defines the less likelihood of better opportunities for the progress of any individual	S08, S09
Ethical & Lingual Diversity	It refers to the variation and difference of language and values among individuals or groups	S16, S21, S23
Limited S/W Understandability	It denotes the fact of having scarce knowledge and awareness about the built system	S08, S09, S27
Fear of Change	It relates to the fact of reluctance and resistance about the changes that can occur while development and implementation	S04-S10, S15, S16
Lack of: Motivation, Awareness, Resources, Political desire, Cooperation, Communication, Collaboration, Training, Privacy, Security, Technical Skills, Staffing and Skills, Management Skills, Vision & Strategy, Willingness, Ability to Use, Qualified Staff, Education to Citizens, Public Sector Skills, Objectives, Values	It relates to the basic characteristics which an individual is deprived of	S01-S17, S21-S26
Resistance to Change	It refers to the reluctance to incorporate the changes(if any)	S04-S10, S15, S16
Social exclusion	It refers to the exclusion of an individual or group from the system and its rights and privileges, due to some social discrimination	S08, S09

TABLE 19. Other challenges.

Challenge	Description	Example System/study
Improper understanding of Cost, Complexity, Size, Time, Money, Accessibility, Accuracy, Flexibility, Compatibility, Strategic Planning, Leadership, Scope, User Needs, Maintainability, Reusability, Portability	It denotes the misinterpretation of some major and critical factors and features	S04, S07-S09, S16

B. APPLICATIONS OF THE TAXONOMY

There should be a conceptual framework for eGovernment and the eradication of challenges to support consistent information, and enable sharing of knowledge about eGovernment

initiatives. Our proposed taxonomy is an initial step to such a framework. It offers a common terminology for describing, discussing, and sharing of information about eGovernment projects' challenges. Moreover, different stakeholders

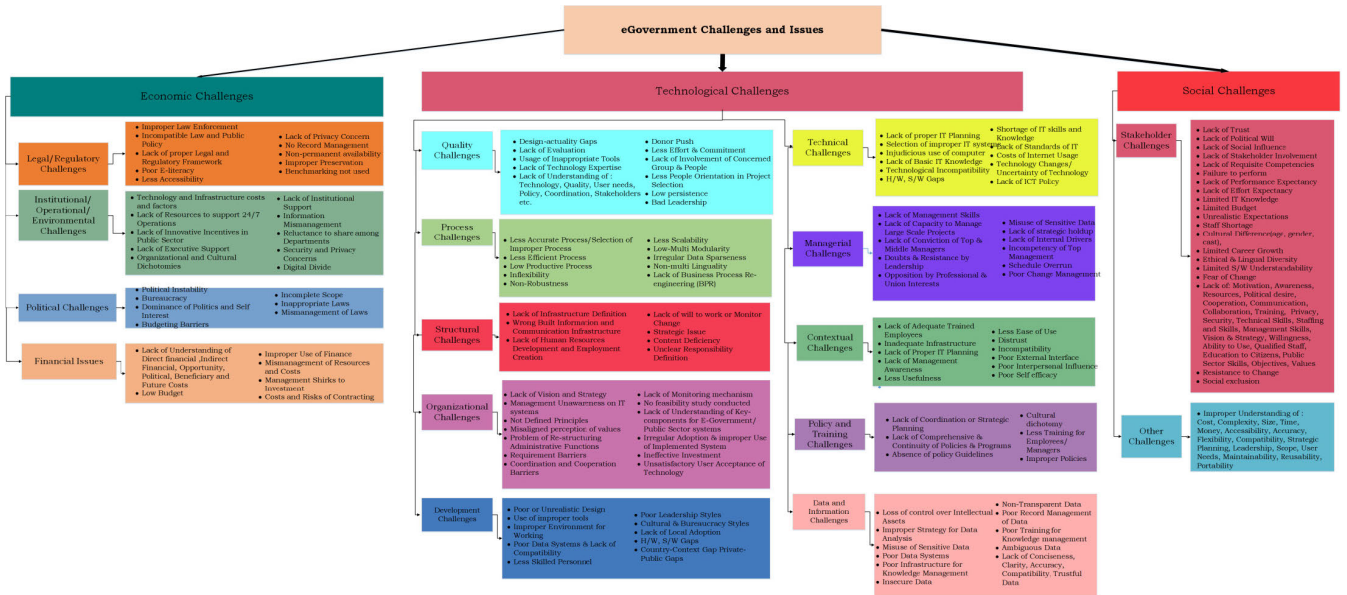


FIGURE 3. eGovernment critical challenges taxonomy.

TABLE 20. eGovernment challenges dimensions and affectees.

ID	Dimension	G	EC	V	C	S
D1	Legal & Regulatory challenges	X	X	X		
D2	Institutional/Operational/ Environmental challenges	X	X	X	X	
D3	Political challenges	X	X	X		
D4	Financial challenges		X	X	X	X
D5	Quality challenges			X	X	
D6	Process challenges			X		
D7	Structural challenges	X	X	X	X	X
D8	Organizational challenges		X	X		
D9	Development challenges			X	X	
D10	Technical challenges			X	X	
D11	Managerial challenges		X	X		
D12	Contextual challenges		X	X		X
D13	Policy and Training challenges			X	X	
D14	Data and Information challenges		X	X		
D15	Stakeholder challenges		X	X	X	X
D16	Other challenges	X	X	X	X	X

G=Government; EC=Executive Committee/supervisorycommittee; V=Vendor; C=Client; S=Society

are facilitated to identify information by means that better suit their interests due to the faceted structure, e.g., identify challenges and solutions associated with a particular eGovernment challenge dimension. Particularly, four key potential users of this taxonomy have been identified: government practitioners, vendor organizations, researchers, and IT staff. We have discussed the usage settings for every concern and depicted in Figure 5.

The uses of taxonomy by the government practitioners and officials of eGovernment projects consist of 1) planning strategically and effective policymaking – taxonomy supports in identifying major categories of challenges that come in way of eGovernment development and implementation and to identify and explain multiple problems that impede the progress. It also helps to identify relevant stakeholders who use the application and to identify corresponding challenges

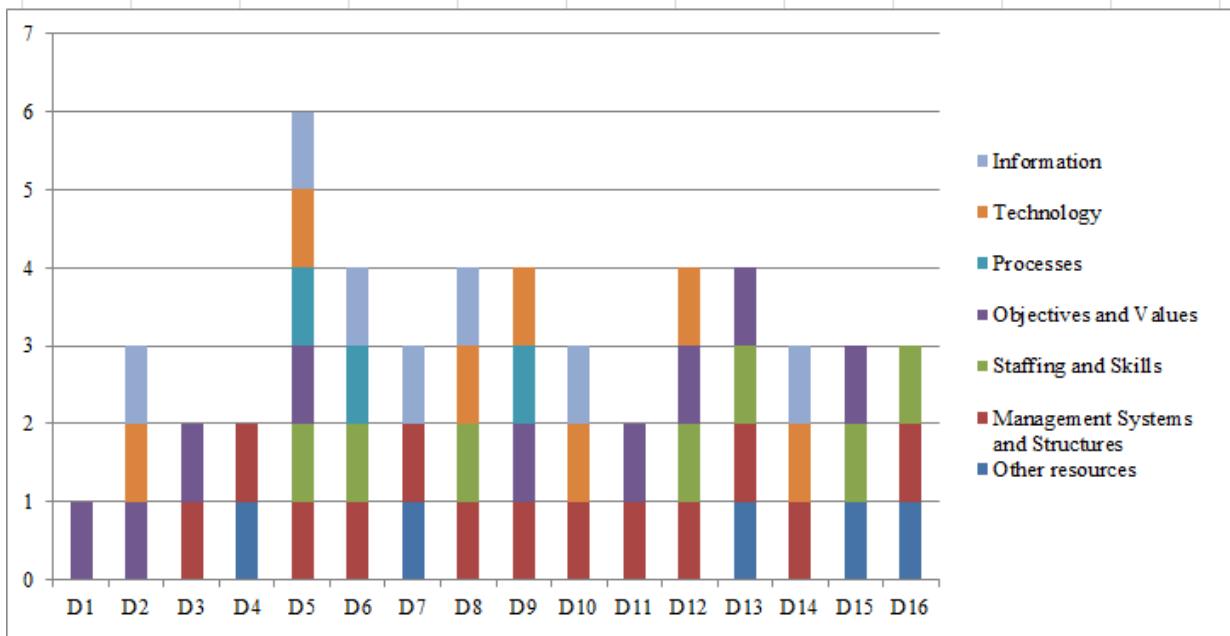


FIGURE 4. Type of challenge against ITPOSMO model elements.

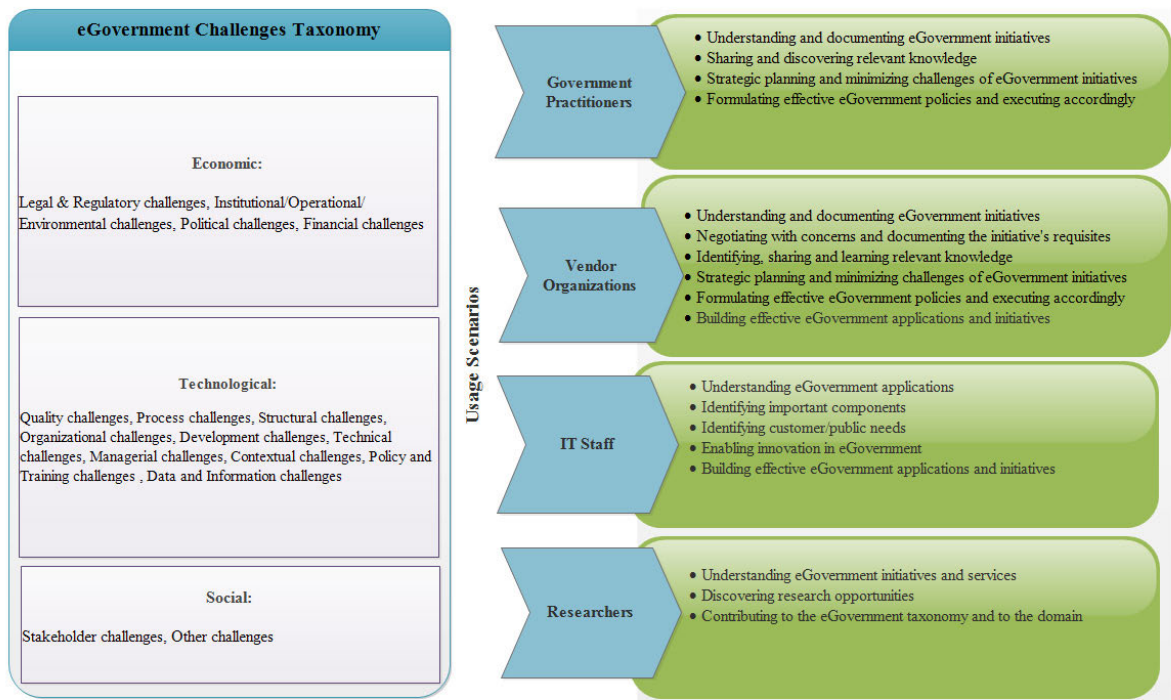


FIGURE 5. Usage settings of the taxonomy.

and effects. For instance, government practitioners can use the taxonomy to identify critical issues that affect their relevant needs, consequences they create, and application's functionality; and 2) to learn from others' practices – the taxonomy provides standard information about initiatives and the catalog creation of these projects.

The uses of taxonomy by the vendor organizations consist of 1) careful planning and effective policy creation – the taxonomy supports in identifying major categories of challenges and to identify and explain multiple problems that impede the progress.; and 2) to learn from others' practices – the taxonomy provides standard

information about initiatives and the catalog creation of these projects.

The uses of taxonomy by IT staff, consist of 1) to identify relevant public services and problems– taxonomy identifies major issues that hinder the performance of the eGovernment projects.

Additionally, the taxonomy is useful to learn and find a set of challenges, i.e., critical challenges and some with less criticality. A set of challenges can then be removed following some standard practices, simplify development practices, enhancing project interoperability, increasing efficiency and effectiveness, and minimizing costs; 2) finding novelty – the taxonomy can narrate best practices that can be used to minimize challenges. This is also useful to determine advanced usages of current technology, serving to reduce costs.

The uses of taxonomy by researchers consist of 1) understand the field – the taxonomy presents a comprehensive view of various features and challenges of eGovernment projects and initiatives, and; 2) develop new and innovative research ideas – researchers can discover novel opportunities for research using the taxonomy, e.g., identify new categories or evolve existing ones based on innovations.

Finally, to completely understand the challenges discussed above, a standard knowledge base of eGovernment projects is required, with customized practices, where projects are described with the proposed concepts and dimensions. It becomes quite challenging to get an exclusive universal repository for projects. However, the presence of a taxonomy that standardizes the particular field boosts several concerned stakeholders, especially governments, to form their specific sources.

As a result, the information is consistent, organized and simplifies information retrieval. Therefore, the governments are thought to be the stakeholders having greater interest and have a responsibility to provide such innovative projects.

VII. CONCLUSION

The taxonomy of challenges in eGovernment projects has been proposed, based on the contemporary analysis of challenges in eGovernment projects context. The taxonomy consists of three level-1 dimensions: economic, technological, and social challenges; and sixteen level-2 dimensions: legal & regulatory, environmental/operational/institutional, political, financial, quality, process, structural, organizational, development, technical, managerial, contextual, policy & training, data & information, stakeholder, and other challenges. The mutual concepts were synthesized in all dimensions respectively, providing descriptions and illustrating them under the identified dimension.

This effort is giving a twofold contribution. First, it provides a comprehensive mapping of critical challenges that can arise in eGovernment development and implementation context. Second, it presents a taxonomy outlining and categorizing important concepts in terms of challenges for eGovernment professionals and software engineers. Professionals can get assistance from the taxonomy when planning

and designing the eGovernment strategies, since it assists to identify relevant stakeholders who will use the application, identifies the different challenges that may occur, and the corresponding solutions to those problems, facilitating the smooth execution and success of the eGovernment project. Also, new entrants in the domain can get assistance from the taxonomy to learn about possible challenges and their solutions to avoid any failures and to deliver a successful project. Additionally, software engineers can also get assistance from this taxonomy to identify major challenges that can hamper the progress of eGovernment projects. The limitation is that our investigation was done using secondary data. The data was collected from documents reported, government websites, and from the research publications.

The future work intends to extend the taxonomy based on the domain experts' feedback, defining strategies to minimize challenges, to facilitate egovernment project planning practices based on the taxonomy dimensions. Also, to create a mechanism for the effective development and implementation of government projects.

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