E-Government Service Management System (E-GovService) to Improve Local e-Government Using DevOps Approach

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***Abstract*— The Electronic-Based Government System is an Indonesian government framework utilizing technology to improve governance, public services, and community participation, aiming for transparency and accountability. However, the Indonesian e-government faces complex challenges like balancing service provision, information security, integration, e-readiness, unemployment, data interchange regulation, and plastic waste management. Previous studies struggled to overcome the e-government problem, evaluating maturity, capabilities, implementation gap, and developing strategies for ICT HR competencies, but still no satisfactory result. This study aims at two things: (1) to develop an e-Government Service Management System (e-GovService) using DevOps, (2) to identify challenges and critical factors for the development of e-Government Service Management with a Multi-Criteria Decision Making (MCDM) approach. Limited research has been explored on the e-Government Service Management System in Indonesia and the benefits of DevOps in the e-Government development process, which combines traditional software engineering roles and improves communication, automation, continuous feedback, and collaboration. The results of this research are e-government challenges and critical factors that influence the e-government's successful implementation. This research contributes significantly to identifying e-Government challenges with MCDM.**

Keywords—e-Government, Service Management System, DevOps, Multi-Criteria Decision Making

I. INTRODUCTION

The Electronic-Based Government System is a framework that employs information and communication technology to support government systems and enhance the efficacy and efficiency of government institutions' performance. This is legal protection and a new administrative reform breakthrough for the Indonesian government[1]. E-Government aims to achieve clean, effective, transparent, accountable governance, quality, and dependable public services, necessitating an electronic government system[2]. By Indonesian law no. 95 of 2018, every government agency must deploy its services and periodically evaluate its implementation[3]. E-Government implementation is anticipated to increase community participation in development implementation and enhance government performance. E-Government Governance is a framework that ensures the implementation of e-Government-related arrangements, direction, and control in an integrated manner[4].

However, the Indonesian e-Government has complex problems and challenges, including balancing expedited service provision and information security[5], integrating government service information systems[6], e-readiness and behavior change[7], unemployment and economic disruptions[8], lack of data interchange regulation and standardization[9], and plastic waste management[10]. Balancing these challenges requires effective leadership, coordination, competence, and performance of human resources within government institutions[5]. Moreover, achieving a higher level of integration is crucial for enhancing the efficiency and effectiveness of government services. Addressing these challenges is essential for the successful implementation and sustainability of e-government in Indonesia.

Various studies have been carried out previously to overcome this e-Government problem but have not found satisfactory results. Various researchers have evaluated the service maturity level of e-Government [3], analyzed capabilities in the e-Government[11], management domain, evaluated the e-Government[12], service domain, evaluated e-Government[2], service management, analyzed the e-Government [13], implementation gap, and designed an e-Government [14], System Audits. Some researchers have also created a Digital Enterprise Architecture for Green e-government [1], an e-government Master Plan Initiative[6], and an e-government Service Enterprise Architecture for Local Government[15] and developed a strategy for strengthening ICT HR competencies for e-government [16]. However, there is still limited research about Indonesia's E-Government service management system. It is crucial to capture the challenges and critical factors for developing and implementing e-government service management in Indonesia.

This study aims to identify challenges and critical factors for developing e-government Service Management. Based on the author's current best knowledge by tracing databases of international and national journals, this is the first time a researcher has done this. DevOps has many benefits, including combining traditional software engineering roles and

improving communication to increase deployment frequency and software quality[17], automation to reduce manual effort and increase stability, continuous feedback using metrics to improve the software development process, and a culture of collaboration and information sharing between teams[18]. DevOps in information system development speeds up customer feature delivery, defect identification, and project lead times[19], [20]. DevOps can align the incentives of crucial software delivery workers by integrating development and operations processes, techniques, responsibilities, and skill sets[21].

This research contributes significantly to identifying Indonesian e-Government challenges with MCDM.

II. Literature Review

A. The Indonesian e-Government and its Implementations

The electronic Government System is a legal protection and an innovation in reforming the Indonesian government bureaucracy. Presidential Regulation (Perpres) 95/2018 guides the implementation of e-Government in Indonesia[1]. In Indonesia, the state-of-the-art performance of e-government incorporates real fundamentals of a Digital Enterprise Architecture (DEA) [1]. The Drug Enforcement Administration uses digital repositories to generate documents that can be readily accessed, modified, and managed by the government's evolution[1]. Indonesia's modern e-government implementation prioritizes sustainable practices, focusing on environmental impact, plastic debris management, and government digital operations for eco-friendly practices. The Indonesian government's e-government implementation prioritizes governance, strategic planning, and evaluations at city and maturity levels. Technological advancements like artificial intelligence and data analytics improve citizen engagement and streamline government processes, transforming the government into a digitally-driven organization providing efficient, citizen-centric services[1].

Several previous works on Indonesian e-Government There is research by La Adu et al. (2023) on e-Government Service Evaluation Central Maluku District Government Age Level Using The e-Government 2020 Framework[3]. The paper assesses the maturity level of e-Government services in the Central Maluku Regency Government using the e-Government 2020 framework. The study finds an average maturity level of 2.36 in the e-Government Service Domain index. Improvement recommendations are provided for low-value e-Government service indicators. Work from Anjani et al. (2023)[11] on Process Capability Analysis in e-government Management at Diskominfo Tasikmalaya City Based on PERMENPAN-RB No. 59 of 2020. The City of Tasikmalaya government needs to improve its e-government Management domain, with a low index value of 2.28 in 2022. Focusing on collaboration, literacy, and budget planning is essential. Research by Rozas et al. (2022)[1] on Indonesian Digital Enterprise Architecture for Green e-Government. The paper proposes a Digital Enterprise Architecture model for Green e-government in Indonesia, utilizing digital repositories for efficient document creation and change management. Research by Payong et al. (2022) on Evaluating Electronic-Based Government System Domain Government Services in Kupang City[12]. The paper assesses the maturity level of the w-Government service domain in Kupang City's sub-district government environment, revealing a value of 0.132, below the one maturity level. The maturity level in government administration and public services also falls below 1, suggesting improvement in implementation. Nafi'ah et al. (2022)[22] on Implementing an Electronic Government System: Obstacles Facing Local Governments. The paper analyzes local governments' challenges in implementing the Electronic-Based Government System in four dimensions: environmental, structural, infrastructure, and superstructure. Challenges include regional topography, facilities, infrastructure, human resources, digitization, and policies. The 2020 e-Government index for Wonogiri Regency is 2.79, indicating the potential for improvement with the right strategy.

Research by Kuncoro et al. (2022)[2] on SPSS Evaluation of E-Government System. The paper assesses the trust quality of the Electronic Based Government System using SPSS, revealing an average of 88.33 with a standard deviation of 12.25, indicating good classification in the Magetan Regency Government. Erizal et al. (2022)[6] on Metro City, Indonesia's e-Government Master Plan Initiative for an E-Government. The paper presents the Master Plan Initiative for the Electronic-Based Government System in Metro City, Indonesia, aiming to develop a 2022-2026 master plan document. The research uses qualitative and quantitative methods, collecting primary data through questionnaires, interviews, and Focus Group Discussions. The analysis includes a SWOT analysis to identify weaknesses, opportunities, and threats in the implementation of e-government, guiding the development of strategies in the e-government domain. Dwitawati et al(2022)[13] on Gap Analysis of e-Government in Bener Meriah District. The paper analyzes the implementation of the Electronic-Based Government System in Bener Meriah Regency in 2021, focusing on policy, governance, management, and services. It provides a gap analysis, identifying areas for improvement, target achievement, current state, and an action plan for the e-Government Master Plan from 2022 to 2026.

Research by Wulandari et al. (2021)[15] on e-Government Enterprise Architecture Design in Sukabumi Regency Government. The paper designs an Enterprise Architecture for the Electronic-Based Government System in the Sukabumi Regency Government, utilizing references TOGAF ADM framework, and aims to improve maturity and compliance with Presidential Regulation 95 of 2018. Hidayat et al. (2021)[14] on the Design And Analysis of the E-Government Integrated E-Audit System at the Internal Audit Unit of the Indonesian Government (APIP). The study analyzes an integrated e-audit system model in the Government's Internal Supervisory Unit (APIP) environment using a qualitative case study approach. The model is described using the System Context Diagram, Data Flow Diagram, and Entity Relationship Diagram. Arief et al. (2021)[23] on Literature Review: e-Government Implementation Constraints. A literature review identifies obstacles to e-government implementation in developing and developed countries, focusing on IT infrastructure, human resources, policy, politics, economy, geography, and culture. Awaludin et al. (2019)[16] on ICT—Information Technology and Communication HR Competency Strategy For e-government Implementation. The paper discusses the Electronic-Based Government System implementation in Kabupaten Bandung Barat and the challenges in managing human resources with technical competencies in technology and communication. It proposes a strategy to strengthen competence through e-

learning methods, resulting in an average 9.09 score, indicating successful implementation.

B. Service Management Information System(SMIS) Model for e-Government

The Service Management Information System (SMIS) model for e-government is a framework that focuses on the effective management of services provided by the government to its citizens through the use of information systems[24]. The SMIS model for e-government in Indonesia focuses on the effective management of government services through information systems. The model involves various stages of implementation, including infrastructure development, e-readiness assessment, service design, system integration, and continuous improvement[24]. Challenges include a lack of ICT skills among government personnel, incomplete infrastructure, a digital divide, data privacy and security concerns, and a lack of comprehensive ICT policies and legislation[25]. Benefits include improved service delivery, enhanced transparency, increased efficiency, cost savings, and citizen empowerment[24]. Best practices in e-government portals are adopted, eliminating physical paperwork and reducing the time and effort required for service delivery[26]. Procurement challenges include system integration, standardization, immaturity of the e-procurement market, process improvement, change management, and IT infrastructure and skills development[27]. By effectively implementing the SMIS model, the government can enhance service delivery, transparency, and efficiency, leading to the overall development and modernization of the public sector.

C. The DevOps Automation Frameworks

DevOps Automation Frameworks are crucial tools and practices used to automate and streamline software development, deployment, and operations processes. The DevOps Handbook by Ali Ali (2023)[28] provides a comprehensive guide to creating world-class agility, reliability, and security in technology organizations. Leite et al. (2019)[29] conducted a survey on DevOps concepts and challenges, developing a DevOps conceptual map that correlates automation tools with DevOps concepts. Senapathi et al. (2018)[21] conducted an in-depth exploratory case study on DevOps implementation in a New Zealand product development organization, finding that DevOps practices led to increased deployment frequency and improved communication and collaboration between development and operations personnel. Technological enablers, such as automation pipelines and cross-functional organizational structures, were critical to achieving the expected benefits of DevOps. The study also addressed different views on DevOps, considering it a specific job description or addressing emerging needs in contemporary software development. Overall, the state-of-the-art research on DevOps Automation Frameworks emphasizes the importance of automation, continuous delivery, and collaboration in achieving agility, reliability, and security in technology organizations.

III. METHODOLOGY

The steps of research on the e-GovService Model to Improve Local e-Government with DevOps Automation were described as shown in the flow chart and Fig. 1 below. The first stage is to analyze the needs and context. Then, we studied and implemented the DevOps approach in this research. Furthermore, we conducted a gap analysis, built an implementation plan, and assembled the team and resources. After that, we implemented, evaluated, improved, created documentation, and dissemination of the results. Then, we identified the challenges and critical factors of the e-government Service Management system.

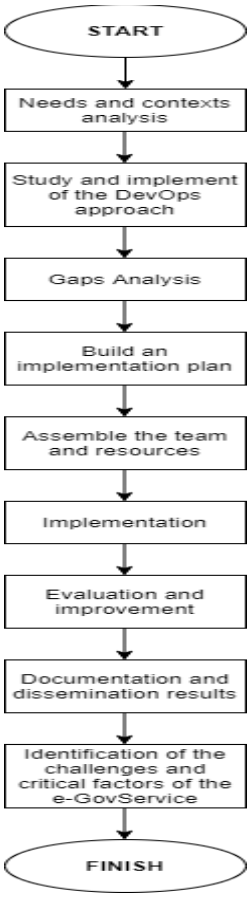

Fig. 1. Research Steps

IV. RESULT AND DISCUSSION

Following are the outcomes of the analysis obtained after completing the steps outlined in the previous section on research methodology:

A. Proposed Problems and Challenges for Indonesian e-Government Implementation

The problems and challenges for e-government implementation were divided into three categories: Structural, Infrastructure, and Superstructure Dimensions. The dimension for Indonesian e-Government challenges is shown in Table I, II, and III below:

TABLE I. STRUCTURAL DIMENSION CHALLENGES FOR E-GOVERNMENT IMPLEMENTATION

No	Problems	Description	Proposing Solution
1	Lack of Cross-Department Coordination	Fragmented services due to poor government department communication.	Interdepartmental working groups and meetings promote teamwork and information sharing.
2	Bureaucracy and Red Tape	Service delivery is slowed by bureaucracy and lengthy approval processes.	Digitize approval workflows, streamline administrative processes, and minimize paperwork.

3	Inflexible Organizational Structure	Organizational structures and walled departments hinder service adaptability.	Agile organizational models enable cross-functional teams and faster decision-making.
4	Limited Stakeholder Engagement	Insufficient stakeholder engagement (citizens, businesses, employees) in service design and improvement.	Focus groups, polls, and public consultations can involve stakeholders.
5	Insufficient Skills Alignment	Staff needs digital service delivery and modernization skills.	Create online classes, upskill staff, and foster a learning culture.
6	Governance and Accountability Gaps	Unclear roles and duties cause accountability gaps in government service delivery.	Define clear governance structures, assign ownership, and establish performance metrics for each service area.

Furthermore, Table I explained the structural challenges, Table II presented the infrastructure challenges, and Table III captured the superstructure challenges for the E-Government implementation.

TABLE II. INFRASTRUCTURE DIMENSION CHALLENGES FOR E-GOVERNMENT IMPLEMENTATION

No	Problems	Description	Proposing Solution
1	Outdated IT Infrastructure	Legacy systems and antiquated technologies make government data integration difficult.	Modernize IT infrastructure with cloud, data integration, and API frameworks.
2	Limited Digital Access for Citizens	Citizens who need online government services need more digital inclusion.	Launch digital literacy programs, increase public Wi-Fi, and make all gadgets user-friendly.
3	Inadequate Data Security Measures	Weak cybersecurity puts citizen data at risk, undermining online government service security.	Encrypt data using multi-factor authentication, audit security, and train employees.
4	Data Silos and Incompatibility	Separated structures hinder interdepartmental data sharing and the need for compatibility.	Integrate data, standardize data formats, and share data.
5	Digital Divide	Technology and digital services access disparities.	Provide technology to underserved communities through focused digital divide programs.
6	Scalability and Performance Issues	IT infrastructure cannot handle rising workloads and service needs.	Invest in scalable hardware, optimize software architecture, and utilize cloud-based resources for elasticity.

TABLE III. SUPERSTRUCTURE DIMENSION CHALLENGES FOR E-GOVERNMENT IMPLEMENTATION

No	Problems	Description	Proposing Solution
1	Complex Regulatory Environment	Services are complicated by overlapping legislation and compliance requirements.	Create a centralized regulatory agency to harmonize, simplify, and promote digital standards.
2	Resistance to Change	Stakeholder resistance to new technologies and processes slows modern solution deployment.	Change management, training, and benefits communication are key.
3	Limited Citizen Engagement	Poor citizen feedback and government service design platforms.	Launch user-friendly digital portals for citizen feedback, conduct regular town hall meetings, and engage in social media outreach.
4	Lack of Clear Service Ownership	Confusing service accountability slows citizen needs.	Each offering should have a service owner, clear accountability lines, and updated service ownership documentation.
5	Inadequate Performance Metrics	Poor service metrics.	Develop and implement key performance indicators (KPIs) that align with government service objectives and citizen satisfaction.
6	Legacy Mindset and Culture	Traditional mindsets and resistance to innovation hinder the adoption of modern service delivery approaches.	Encourage innovation through training, leadership support, and recognition.

This proposed problem and solutions should be adapted to your specific research context and the challenges you've identified within each dimension of the e-government system in different local governments.

B. The Critical Success Factor(CSF) for e-Government

The proposed critical success factor (CSF) for e-Government implementation is described in Table IV below:

TABLE IV. CRITICAL SUCCESS FACTOR FOR E-GOVERNMENT IMPLEMENTATION

No	Critical Success Factor	Indicator	Description
1	Stakeholder Engagement	Stakeholder Involvement	Participation of citizens, enterprises, and employees in the design and enhancement of services.
2	Digital Inclusion	Accessible Digital Services	Equal access to digital government services for all population segments.
3	Seamless Service Integration	Interconnected Government Systems	Integration of the systems of multiple departments to provide seamless and unified services.
4	Data Security and Privacy	Robust Data Protection Measures	Implementation of reliable cybersecurity procedures and compliance with data privacy regulations.
5	User-Centric Design	Citizen-Centric Interfaces	It is creating user-friendly interfaces that adapt to the requirements and preferences of citizens.

6	Agile and Adaptive Governance	Flexible Policy Framework	Policies and regulations that accommodate transforming technological landscapes and increasing service demands.
7	Effective Change Management	Smooth Transition to New Technologies	Practical strategies for managing the adaptation of stakeholders to new digital processes and instruments.
8	Performance Measurement	Well-Defined KPIs	Clear metrics for assessing service quality, citizen satisfaction, and process effectiveness.
9	Continuous Innovation	Culture of Experimentation	Encouragement of innovation via the evaluation of new approaches and technologies.
10	Clear Accountability	Service Ownership and Responsibility	Defined responsibility for each service area to ensure prompt and effective problem resolution.

These proposed CSFs are essential for e-Government system development and operation. Each element provides metrics to measure CSF progress and efficacy. Moreover, the descriptions explain the importance of each CSF. Moreover, these CSFs are still based on desk research. It needs more empirical research to obtain more valid and contextual results. Furthermore, Artificial Intelligence (AI) is one of the most trending technology in the world. Therefore, it seems interesting if the eGovService implementation combines with Artificial Intelligence (AI) technology.

V. Conclusion

This study aims to identify challenges and critical factors for the development of eGovService with a Multi-Criteria Decision Making-Government (MCDM) approach. This study resulted from the e-GovService design and proposed e-government problems, challenges, and critical factors that influence e-government's successful implementation. Future research will develop and deploy eGovService in the Communication and Informatics Department in Pamekasan, Madura, Indonesia.

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