Article

Analysis of e-government implementation and factors affecting employee performance: Case study in Tangerang city government

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Abstract: This study examines the factors influencing e-government adoption in the Tangerang city government from 2010 to 2022. We gathered statistics from multiple sources to reduce joint source prejudice, resulting in a preliminary illustration of 1670 annotations from 333 regions or cities. These regions included major urban centers such as Jakarta, Surabaya, Bandung, Medan, Makassar, and Denpasar, as well as other significant municipalities across Indonesia. After removing anomalous values, we retained a final illustration of 1656 annotations. Results indicate that higher-quality digital infrastructure significantly boosts e-government adoption, underscoring the necessity for resilient digital platforms. Contrary to expectations, increased budget allocation for digital initiatives negatively correlates with adoption levels, suggesting the need for efficient spending policies. IT training for staff showed mixed results, highlighting the importance of identifying optimal training environments. The study also finds that policy adaptability and organizational complexity moderate the relationships between digital infrastructure, budget, IT training, and e-government adoption. These findings emphasize the importance of a holistic approach integrating technological, organizational, and policy aspects to enhance e-government implementation. The insights provided are valuable for policymakers and practitioners aiming to improve digital governance and service delivery. This study reveals the unexpected negative correlation between budget allocation and e-government adoption and introduces policy adaptability and organizational complexity as critical moderating factors, offering new insights for optimizing digital governance.

Keywords: e-government adoption; digital infrastructure; budget allocation; IT training; policy adaptability; organizational complexity; fixed effects model; digital governance; service delivery; Tangerang city government

1. Introduction

The infusion of the electronic government (EG or E-Government) system is a revolution within the public sector, improving the efficiency of delivering services and ensuring transparency. They involve using information and communication technology (ICT) to reformulate government activities and services, communications with citizens, and other functions (Zorali and Kanipek, 2023). It has become essential in large cities where the challenges of administration and citizens' expectations are enormous. This study aims to examine the adoption of e-government and its results on the performance of the employees of the Tangerang city government in Indonesia, including the factors contributing to this relationship's existence and potential applicability to all public administration sectors. Three substantive advancements of e-government have been identified in the ICT arena, marking the evolution of e-government as being highly advanced and efficient in supporting government

processes (Luarn and Huang, 2009). They present many advantages, such as efficiency in executing operations, public collaboration and clarity regarding government roles, among other benefits (Gupta et al., 2017). The theoretical foundation for this present study is the resource-based view of the firm that postulates the integration and interaction of resources requisite for competitiveness (Gathungu and Mungai, 2012).

Some resource-based view (RBV) theory contributions reveal how digital infrastructure quality (DIQ) relates to the other organizational assets that determine the success of adopting e-government. Theoretically, this perspective may be most valuable in explaining the contribution of resources for e-government performance, including business development index (BDI)—budget allocation for digital initiatives and information technology training for staff (ITTS). Public administration (PA) and Organizational Culture (OC) also influence the practical implementation of e-government.

These factors determine how much an organization can manage the uncertainties and adapt to environmental changes besides implementing new technologies (Alassim et al., 2017). The policies and other administrative transformations mostly interfere with the coherence and efficiency of e-government. Hence, there is a need to look at the relationship between DIQ, BDI, ITTS, PA, and OC to provide recommendations that would lead to the effective implementation of e-government. Hence, this study aims to identify the challenges that affect Tangerang city in implementing e-government The decentralization of the current forms of governance and lack of integration have been issues that continue to hamper government service provision (Al Sayegh et al., 2023). These issues have been partly resolved with the creation of the Office of Strategic Planning (OSP), which has offered a blueprint for organizational arrangements for e-government and a check to ensure that digital policies and services are efficiently executed across different tiers of government (Rahayu, 2023).

Another significant research stream related to this study concerns the effects of e-government implementation on employee performance. Employee performance may also be helpful for e-government success because it shows how well public servants can manage new technologies and work organizations (Liu et al., 2023). In this context, the quality of the (DIQ) is crucial and cannot be ignored. It is defined as the dependability, availability and speedy performance of computerized networks and structures that underpin governmental authorities (Liu et al., 2023). Thus, DIQ requirements should be high to guarantee that e-government services are provided as planned and effective for civil servants and ordinary users. This research attempts to establish how DIQ influences other organizational assets and how this, in turn, influences the performance of e-government systems. Furthermore, the study seeks to understand policy turnover and the complexity of (OC) hitches. Due to new governments and different administrations being sworn into power, the matters concerning e-government may need to be more consistent, posing a challenge (Iong and Phillips, 2023; Khoso et al., 2022).

As it has been said, there are certain advantages of applying e-government (EG) systems in delivering public services, access to information and public participation to exercise public power. However, the implementation process of these systems comes with specific challenges. So, based on Tangerang city, Indonesia, some challenges have limited or significantly influenced the uptake and application of EG

systems. These design challenges are mainly due to the technological, organizational, and policy-associated factors that affect EG initiatives and the human capital expected to undertake them. Another issue that warrants attention is the disaggregation of existing governmental institutions, which hampers cooperation and results in ineffectiveness in delivering services (Cabanela, 2023; Pribadi, 2024). In this way, the fragmentation hinders the organization of several EG initiatives and the unification of processes within EG and among different levels of administration. Also, the DIQ scale has considerable variability depending on the region, which has implications for the stability and effectiveness of EG services (Zorali and Kanipek, 2023).

Organizational settings of developing countries such as Indonesia, where there is still much uncertainty regarding how organizational resources and external contextual factors interact. Furthermore, based on the fact that the Resource-Based View (RBV) theory can assist in explaining the importance of resource interaction in obtaining competitive advantage, Doran et al. (2023), indicate that the existing literature in the field of e-government is sparse in utilizing this theory. Therefore, the relationship between DIQ and other resources, including BDI and ITTS, and the overall influence of all the resources for E-Government Adoption Level (EGAL) requires future research. Knowledge of these interactions is essential to inform strategies to improve the Mixed methods approach and increase impacts for beneficiaries. The second research question that has not received attention in the literature relates to the moderating impact of policy adaptability (PA) on the DIQ, BDI, ITTS, and E-Government Adoption Level (EGAL) relationship, as well as the moderating impact of organizational complexity (OC) (Muhammad and Kaya, 2023).

2. Literature review

Digital information quality, digital budget, and digital or IT readiness of staff are some components that explain variation in e-government readiness during uncertain periods. These influence the agencies' capacity to deliver service efficiencies and effectiveness when implementing civil digital services. Hypothesis 1 thus posits that the quality of the digital infrastructure is an essential factor influencing the level of e-government adoption. The digital environment in which citizens live requires access to a reliable and stable digital environment to securely and effectively deliver digital services. It is worth noting that numerous works have demonstrated that the existence of a developed IT environment directly contributes to the rate of e-government implementation (Zhuo et al., 2023). Sustaining and enhancing digital infrastructure in these conditions is even more critical, considering factors like fast-changing established technology, political turmoil, etc. Another consideration that impacts the degree of e-government adoption is the dispensation of resources towards digital causes (Zhang et al., 2023).

Another strategic assignment is training and re-training staff in information technologies to implement e-government initiatives among government employees. Training session's help employees become acquainted with newer technologies embrace the change and improve their technology and performance equally (Wu et al., 2023). This is especially true where the environments are complex or unpredictable or where change is constant due to technological innovation; IT training becomes

essential because it ensures that clients are informed about developments as they happen. The development of quality digital infrastructure would call for proper funding to develop and maintain these systems and qualified human resources to manage and operate them.

2.1. The idea of digital infrastructure quality

DIQ refers to the efficiency of both physical and virtual IT networks within a nation, and it plays a significant role in shaping modern political systems and the economy. The concept includes electronic media's stability, availability, performance, and supporting structures in transporting and processing information and services (Hustad and Olsen, 2021). The research done by Zhang et al. (2021) shows that the quality of digital infrastructure has a positive relationship with e-government services because it defines the advancement of citizens in using different services within the digital age. Also involved here are fast and reliable connectivity, a robust security system for government networks and systems, and integrated systems allowing information sharing between government ministries (Mursitama et al., 2023). The adoption of general technology is ultimately translated into the e-readiness level, which influences the e-government capability of a country. Many of these infrastructures are used not only to ensure essential services such as online filing of taxes or renewal of licenses but also for sophisticated processes such as identifying citizens through their digital identity and even electronic voting. Thirdly, the quality of digital structures plays a crucial role in defining the size of the digital gap, which is a gap between people who can use modern infrastructure (ICT) and those who cannot (Slot et al., 2022).

DIQ also has considerable economic effects, considering consumers' status as an essential indicator of an economy's efficiency. In their article, wherein they have identified some emergent trends in current scholarship, Applicants noted that the development of ICT boosts productivity and innovativeness, leading to economic growth. Technology enhances business processes, decreases additional costs and provides opportunities to access new business solutions, especially in the digital environment. As evidenced by Grassmuck (2021), authors have established a positive relationship between broadband internet and GDP growth for member countries in the OECD. Furthermore, DIQ is necessary for the establishment of making industries digital. A Sound digital framework contributes to the enabling factors today, such as the IoT, AI, and big data (World Health Organization, 2020).

2.2. The determinants of e-government adoption level

Factors affecting e-government adoption are numerous and diverse, starting with the most essential technological environment. To sum up, it is important to stress that knowledge of these determinants is essential to policymakers and researchers striving to improve the impact of e-government projects. In this regard, adequate availability of internet connection speeds and the vital protection arrangement of the networks are critical for the effectiveness of e-government services (Dias, 2020; Rodríguez-Abitia et al., 2020). Generally, inconvenient access and unreliable substance of the virtual environment affect the citizens' willingness to engage in e-government. This is

supported by the conclusion that countries with enhanced ICT incorporate higher e-government dissemination rates. Sometimes, people disagree with government policies or do not understand some processes, and their literacy in using digital tools and online platforms defines their ability to engage with e-government services (Dias, 2020). These differences arise in internet skills and the connection to the Internet, which can result in inequality in adopting e-government, known as the digital divide. Measures designed to enhance such factors may hence help raise the tendency towards e-government usage among the populace (Yera et al., 2020).

Socio-economic factors are also documented to impact the adoption of e-government initiatives. According to Horobeț et al. (2023), significant differences regarding the usage of e-government services are influenced by increasing income and education levels. This is because the level of resource possession can influence the ability of an individual to engage in the use of the media. Also, developed regions with enhanced technology, high socio-economic status, and higher levels of urbanization exert high levels of e-government use compared to developing regions, including rural regions (Abu-Shanab, 2021). This is due to the people's ever-increasing reliance on government policies and related activities. One underlying conclusion regarding e-government adoption is that it fundamentally depends on a clear political will and the right stratagem. The legal environment conducive to using digital technologies should encourage innovation, increase transparency, and actively involve citizens in e-government programs (Tremblay-Cantin et al., 2023). Another factor associated with e-government adoption is trust in governments and online services. Therefore, trust in e-government security and privacy influences citizens' desire to engage in e-government services. Addressing privacy and security issues by ensuring that the e-government systems are secure enough and will not misuse or expose users' data can solve apprehensions and increase use (Abdoh et al., 2020; Kakarougkas and Papageorgakis, 2023).

2.3. Related research on organizational complexity

It involves various elements of an organization's complex structural, procedural, and environmental conditions, actions, and relations. The use and relevance of this idea have been investigated to a large extent in the management, information systems, and public administration fields since decision-making and innovation processes, as well as organizational performance, stand to benefit from this concept. Dooley (2002) identified two types of organizational structures.

In contrast, flexible organizational structures, which are characterized by low levels of formalization and centralization are suitable in environments with high turbulence. Moldoveanu and Bauer (2004) took this one step further and indicated that the problem of organizations facing a complex dilemma of differentiation and integration is crucial to understand. Information processing is another significant facet of structural work complexity, which involves the ability of an organization to systematically undertake the receipt, organization and analysis of data received from external and internal environments, as well as the formulation of coherent responses to these stimuli (Eisenhardt and Bhatia, 2017; Mahajan et al., 2023).

E-government has slowly gained importance over the past few decades and has

been a very active aspect of Indonesia. Some key policies include Presidential Instruction Number 3/2003, the Guideline and Direction of the Indonesian e-Government Development for the Future, which focuses on improving the quality of public service delivery enabled by ICT. Another core implementation is the Sistem Pemerintahan Berbasis Elektronik (SPBE) whereas its English version would be Electronic-Based Government System (SPBE) formulated by Presidential Regulation Number 95/2018, which aims at synchronizing and enhancing the quality of government services in any agency and at any level. Specifically, in Tangerang, several projects have been implemented to advance e-government. These include the development of a comprehensive online service platform, Tangerang, which provides various municipal services digitally. Other projects involve enhancing digital infrastructure, such as expanding high-speed internet access and developing innovative city technologies to improve urban management and service delivery. Examining these strategic long-term policies and proposed projects, Indonesia's dedication to e-government is evident; this paper outlines the possibilities, specific implementations, and achievements that can act as the basis of future progress. Incorporating the said examples into the study emphasizes the generalizability of the results to the Indonesian context.

2.4. Addressing gaps in existing studies and relevance to developing countries

Thus, the factors regarding e-government adoption are broadly researched; the relationship between the factors in the development context of Developing Countries (DCs) and the typical city typology of Indonesia and Tangerang needs to be better understood. Therefore, this study seeks to make the following contributions regarding the research gap: It provides an account of the relationship between digital infrastructure quality, budget for digital initiatives, and IT training for staff, especially in institutions experiencing high technological advancement and political volatility. In most Third World nations, the relative unevenness in the digital networks and the available resources present significant problems in adopting e-government solutions. While developed countries have relatively stable infrastructure and resource management, developing countries mostly have unreliable budgetary revenues and unstable policies, which is a huge problem. This study aims to reveal such challenges and establish practical examples to solve them. Moreover, city typologies in developing countries, such as Tangerang, often exhibit unique characteristics such as high population density, diverse socio-economic statuses, and varying levels of technological literacy.

Moreover, city typologies in developing countries, such as Tangerang, often exhibit unique characteristics such as high population density, diverse socio-economic statuses, and varying levels of technological literacy. Drawing on city typologies as discussed by scholars like Gideon Sjoberg (1960) in "The Preindustrial City, Past and Present", Lewis Mumford (1961) in "The City in History", and Henri Lefebvre (1974) in "The Production of Space", we understand that cities like Tangerang are undergoing rapid transformation and face distinct urban challenges. These typologies help frame the understanding of urbanization, spatial organization, and social dynamics that

influence the adoption of e-government services.

This research contributes significantly to the literature by demonstrating the critical role of digital infrastructure quality in supporting adopting e-government services in developing country contexts. It highlights the importance of efficient and strategic budget allocation for digital initiatives, particularly in environments with limited and fluctuating resources. Additionally, the study emphasizes the necessity of continuous IT training for staff to ensure the successful implementation and maintenance of e-government systems. By providing a detailed case study of Tangerang, this research offers valuable insights that can serve as a model for other cities with similar characteristics in developing countries. These contributions advance academic understanding and provide practical recommendations for policymakers and practitioners aiming to improve digital governance and service delivery in similar contexts.

3. The conceptual structure and framework

3.1. The digital infrastructure quality

The Resource-Based View (RBV) theory highlights the importance of resource integration in improving organizational performance (Bharadwaj, 2000). This theoretical framework is significant when explaining how DIQ enactment interacts with other resources in an organization to determine the level of EGAL. Resource interaction involves how a resource influences another or how it collectively helps to influence competitive advantage or competitive performance (Veit, 2023). Generally, resource interactions can be analyzed using the incremental use of resources, whereby the marginal resource is described as the impact that performance garners from utilizing an additional portion of the resource as a production input (Bhima, 2023). Hickey et al. (2023) note that it is necessary but insufficient to attain a sustainable competitive advantage by possessing a sophisticated DIQ.

Organizations must correspond with current technological advances to obtain the optimum E-Government Adoption Level (EGAL) also emphasized that innovation, BDI and ITTS can be utilized synergistically to enhance the EGAL outcomes because they are highly interrelated. Subsequent work has examined the individual effects of (DIQ) and organizational resources on EGAL. Therefore, DIQ, BDI, and ITTS will be taken as independent variables in this work and used to examine their interaction with the growth of e-government. DIQ has a causative effect on EGAL via value creation with mediators BDI and ITTS. DIQ is central in enabling digital government by offering robust, perennial, and secure surroundings to run a luminary, facilitate data distribution, and deliver services to optimize opportunities. This impact will likely be higher when the government invests in BDI to procure new technology and promote technical research and development in areas of developed e-Government (Böhmer and Schinnenburg, 2023). When people use DIQ, financial investment is essential for upgrading information, enhancing multi-functionalisms, and upgrading modules for Entity 1 in constructing e-government systems (Trieu et al., 2023).

Moreover, DIQ affects EGAL normatively because it creates value by translating opportunities into action-conceived notions. It is believed that such a result is expected to be even more so when the government is endowed with skilled ITTS professionals

who enhance and optimize their products and services to maximize their DIQ capacity (Uitdewilligen et al., 2023). ITTS can contribute towards the development of EG by providing advice and knowledge in DIQ of products, which in turn contributes to product change. Sometimes, it is possible to find a contradiction between setting up permanent and stable Government employees and substituting some IT systems to improve DIQ. In the study, the authors substantiate the argument about adverse effects caused by excessive DIQ, including the emergence of a complex technical environment that is difficult to manage. Our study assumes a temporary favourable effect of DIQ-ITTS interaction and puts up the following supposition:

H1a: The collaboration of Digital Infra-Structure Quality with Budget for Digital Initiatives positively impacts digital government adoption.

H1b: The collaboration of Digital Infra-Structure Quality with Information Technology Training for Staff positively impacts the digital government adoption level.

The contingency model is congruous with the idea that an organizational resource management approach ought to be consistent with certain system variables, including environmental uncertainty (Lawrence and Lorsch, 1967). Firms utilize Policy Adaptability (PA) and organization/host structure complexity to find numerous opportunities resulting from environmental–level volatilities, through which they create value. To achieve their goals and objectives in an uncertain environment, organizations need to capitalize on the opportunities and factors in the external environment and deal with threats that pervade that environment (Martín-Rojas et al., 2023). It is essential to understand that organizations are motivated to develop techniques for reducing uncertainty due to numerous factors in today's world. For instance, the government operates the BDI and the ITTS, which modifies matrix DIQ depending on externality in the context of e-government (Sciulli, 2024). Sufficient resources and competent personnel in multiple organizational subdivisions should support conflict resolution, quality assurance, coordination, and collaboration processes within e-government strategies and systems (Leventsov et al., 2023; Yesilkagit and Christensen, 2009).

According to Van de Wetering et al. (2023), the turnover of officials is particularly disruptive to municipal management since it is tied to the officials' preferences, expertise, and other characteristics. The dynamics in management can enhance the municipal financial performance, whereas the essential and novel suggestions regarding how the rotation of officials can jeopardize the functioning of local government—following the concept provided by Ushenko et al. (2023) about the idea that the rotation of officials may not have positive outcomes. Political shifts from the preceding regime may result in discontinuity, irrational decisions by officials, and a change of political power. Such signals can impact the government's liquidity at the current stage of their operations, which, as a result, causes shyer actions in the distribution of the (BDI) for (DIQ) to develop e-government. Different governments shape culture in various ways, but bureaucratic governments are risk-averse and cautious (Hajela et al., 2023; Wang et al., 2024).

H2: The extent of the collaboration amid Digital Infra-Structure Quality and organizational resources (Budget for Digital Initiatives and Information Technology Training for Staff) in their impacts on digital government adoption level declines as

the Policy Adaptability upsurges.

Identifying organizational complexity is crucial in the contingency culture approach, mainly dealing with user variability or diversity (Schwandt, 2009). A few of the authors within the government groups have noted that ethnic background and race present an element of complication in the managerial dynamics of the multiple population expectations. However, if the local government does not meet these various needs, marginalized persons' protests can spur administrative creativity (Liu et al., 2023). While developing e-government services, the government utilizes infrastructure to apply enhancements to meet new requirements or provide adequate solutions. The implementation of e-government considers the human, organizational, institutional, and societal factors and DIQ. The relations between internal resource interaction plans and their match to the external environment pertain to this complexity and may enhance organizational outcomes. The following outcomes are expected: Adequate funding can enable organizations to seize opportunities to offer relatively more comprehensive products and services with extended differences and complexities as defined by DIQ in the implementation of EG: ITTS could assist complex organizations to seize opportunities through offering products and services with differences or even complexities that DIQ defines in implementing EG. Allocating resources for the budget of DIQ's digital initiatives capabilities can improve the model's valuation by defining public needs and applying them to improve EG's services. Successful provision of professional Information Technology Training for Staff leads to the staff identifying extra market opportunities and conducting themselves well when interacting with other staff, a standard used in forecasting future market needs (Hajela et al., 2023). Therefore, our work presents the following assumption:

H3: The extent of collaboration amid Digital infrastructure quality and organizational resources (Budget for Digital Initiatives and Information Technology Training for Staff) in their impacts on e-government adoption level upsurges as organizational complexity upsurges.
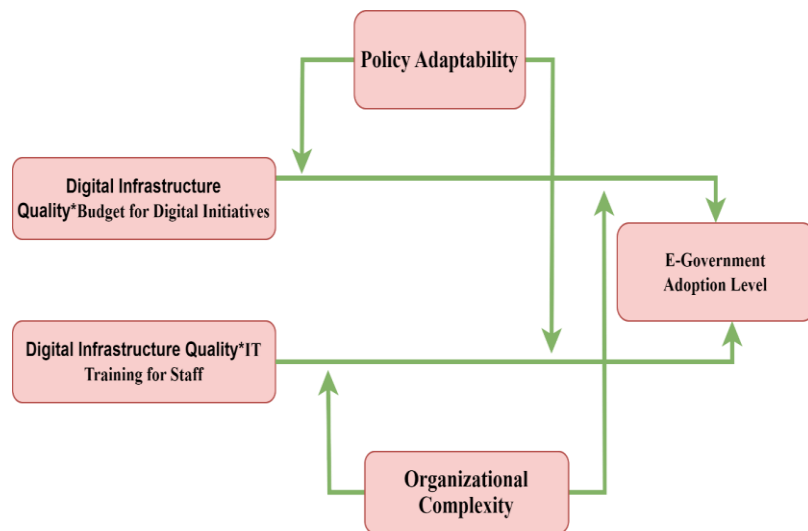

Figure 1. Theoretical framework.

We integrate the review-based view and view of contingency to construct a

conceptual framework depicted in **Figure 1**. This framework illustrates the connection among the collaboration of DIQ with (BDI and ITTS) and EGAL, with Policy Adaptability and complexity acting as moderators.

3.2. The framework of digital government in Tangerang city

China's governance system is structured into five managerial levels. The government system in China includes townships, states, regions or areas, and the central government (Fan, 2023). Provincial and central administrative units strategically establish micro-programs for e-government (EG) development. In contrast, prefectural governments must formulate micro-strategies and policies that fit their conditions for the promotion of EG (Zheng, 2020). The prefectural governments in the Japanese context, which are the middle tier of the administration, are more capable of fulfilling requests from the next higher and lower tiers of administration. Therefore, the research study being conducted is directed at the administration at the regional or area level. The Chinese government uses government informatization as the strategic development direction and the state policy to promote the socio-economic development of China in the 21st century, especially the construction of e-government (EG). This has resulted in a new visible pattern on Chinese government websites that demonstrates more information released, increased information provided on websites, enhanced contents, and service provisions due to growth in the national economy and better electronic governance.

With the aim of enhancing environmental governance, the Office of Strategic Planning in Tangerang city has initiated efforts to develop an integrated, web-based collaboration platform. This platform is designed to streamline and unify the various activities and tools used across different government agencies. By consolidating these fragmented processes, the goal is to enhance transparency, efficiency, and coherence within the governmental framework, making the organizational processes more accessible and user-friendly for both citizens and government officials alike (Ioppolo et al., 2016) The development of Digital Infrastructure Quality (DIQ) in Tangerang city is built upon cutting-edge technologies such as big data, the Internet of Things (IoT), cloud computing, blockchain, artificial intelligence (AI), and other emerging innovations. These technologies are fundamental to driving the paradigm shift in government operations, enabling more efficient, transparent, and responsive public services. Therefore, innovation in financing technology is significant from a financial perspective and in the ITTS sphere. The dimensions of openness and resource availability affecting the service performance of a website in an open system study include not only government resources but also the openness of the external environment in resource distribution (Liao and Chuang, 2004).

Legal framework for e-government implementation

In this respect, the legal environment is a precondition for e-government intents' effectiveness. E-government development in Indonesia is supported amply by several vital laws and regulations. They are the Law Number 11/2008 on Electronic Information and Transactions, which deals with electronic transactions and their recognition in the Indonesian legal system and the Government Regulation Number 82/2012 concerning the Operation of Electronic Systems and Transactions that defines

the standards relevant to data security and handling of electronic systems. These legal instruments ensure that e-government projects are implemented within a secure and regulated environment, addressing issues such as data protection, cybersecurity, and the legal validity of electronic documents. A comprehensive review of this legal framework would provide a deeper understanding of the structural supports and potential legal challenges in implementing e-government in Tangerang and Indonesia.

4. Methods and techniques

We examined the proposed hypothesis by evaluating the E-Government Adoption Level (EGAL) in Tangerang city from 2010 to 2022. The analysis included other factors that were shifted forward by one year, covering the period from 2016 to 2020. We gathered statistics from multiple sources to reduce joint source prejudice, resulting in a preliminary illustration of 1665 annotations from 333 regions or cities. These regions included major urban centers such as Jakarta, Surabaya, Bandung, Medan, Makassar, and Denpasar, as well as other significant municipalities across Indonesia. After removing anomalous values, we retained a final illustration of 1656 annotations. Since the dependent variable passed the Skewness test ($P = 0.000$) and followed a Gaussian distribution, a restricted regression technique like the Tobit model might not be appropriate for this research. We utilized a fixed effects (FE) model to examine the significant suppositions, which can account for undetected variability and constant undetected chronological impacts at any given period.

Determinations and evaluations

EGAL was measured concerning the assessment done by the University of Nanjing from 2010 to 2022, as described in the paper entitled "E-government Website Service Capability". Overall, this evaluation has progressed through various stages: Setting index weights and index systems, acquiring authorized information, cleaning and standardizing data, and assessing the EG website. The increased use of the EG websites by the citizens requesting services is one way that government studies assess the service's potential (He et al., 2020).

To embrace the evaluation or measurement of the digital inclusion quotient (DIQ), we employed OSP's hierarchical levels of government service systems. Other similar works suggest that DIQ refers to the degree to which a platform could integrate and communicate (Bharadewaj, 2000). To guarantee this, we have looked at the degrees to which OSP may access and connect by agreeing with the authorized credentials and the authorized internet site, then concluding with the OSP administration professionals. If there is no provincial government platform, this value equals 0 overall. This is one where only the government of a province is available. If the government is at the provincial-prefectural level, the index is at 2. The scale ranges from 1 to 5, with each number reflecting a different administrative level: province, city, county, township, and community level (Reddick, 2006).

Engaging a large amount of staff can enhance the worth of co-creation by capturing opportunities and disseminating pertinent knowledge to enrich the EG process. Due to data availability, we attempted to collect the number of employees engaged in e-government using general processes, although the processes had specific

paths. Accordingly, we calculated the staffing ratio concerning the total number of organizations, people, and departments, particularly the 'Municipal Government General Office', concerned with organizations directly related to the EG structure.

We examined the policy adaptability by determining the yearly policy and party secretary turnover in the firm's total turnover. Most research employed objective measures to measure the construct and reduce the error likelihood inherent in self-perception studies. Closely related to this, scholars tend to consider the rate of managerial change, for example, through hiring a new CEO, as a characteristic of the operational context of an organization (Yesilkaggit and Christensen, 2009). This might be due to other factors, such as the official turnover of a particular organization, which shows environmental instability. Tangerang city has been observing a chief responsibility system in the administration system in which the party secretary and leadership team mainly control the local government power. Information on the turnover of leaders and party secretaries was collected manually from the CPC cadre database and Zhang Ten internet site (Zheng et al., 2013). Due to the complexity and heterogeneity of the population, including installation colour and gender, occupation, and other aspects, the customer needs and demands will also be more complex and diverse (Walker, 2008). Engaging the Lieberson index of diversity, a process deployed by Jun and Weare (2011) to explore the motives for e-government adoption, we calculated.

$$\text{Heterogeneity} = 1 - \sum_{(i=1)^n} (\text{Category})_{i^2}$$

This study has also followed prior studies that have indicated that central government pressure can spur local governments to develop more effective e-government services (Fan et al., 2019). As constituents of the Tangerang city hierarchy, province governments have the authority to contribute money to city affairs directly. The Legal Information Center of Peking University sample used provincial policy and e-government files between 2015 and 2019 to measure the top-down pressure. Localized administrations of the same province's prefecture level can readily emulate each other, thus spreading the effects since all of them are evaluated on standardized performance. Prior research has shown that economic progress motivates governments to offer more effective public services.

We assess it using GDP per capita. In Tangerang Local, the municipal party secretary typically handles the dissemination of the party's beliefs, policies, and ideals, while the mayor oversees the management of local affairs. We accounted for the leadership age, length of service, and prior role. We consider the mayor's age to be 0 if older than 55, else it is 1. Individuals aged 55 and beyond will encounter limited promotion prospects within Tangerang city's personnel structure, reducing the incentive to advance EG development. District administrative representatives often have five-year tenure, which can be periods of policy innovation. Recent mayors are typically more dynamic, but productivity is expected to decrease with longer terms in office.

5. Findings and analysis

The descriptive analysis of the variables in the **Table 1** reveals diverse

characteristics across different aspects of e-government adoption. **Figure 2** shows the growing trend of the E-government Tangerang city (2010–2022) The mean level of e-government adoption is 68.2, with a standard deviation of 13.5, indicating moderate variation among observations. Digital infrastructure quality, with a mean of 2.45 and a standard deviation of 1.15, shows slight variability. The budget for digital initiatives varies greatly, as evidenced by a mean of 250.3 and a substantial standard deviation of 700.6, indicating that while some regions allocate minimal funds, others invest significantly. IT training for staff, with a mean of 4.8 and standard deviation of 6.5, reflects moderate variability in training efforts. Policy adaptability has a low mean of 0.65 with a standard deviation of 0.75, indicating limited adaptability across regions. Organizational complexity presents an extreme range, with a mean of −550.5 and a large standard deviation of 1440.5, suggesting significant variations, including negative values. The regional economic index shows substantial variability, with a mean of 55,000 and a standard deviation 32,000.

Table 1. Descriptive analysis.

| Variable	Observations	Mean	Std. Dev.
E-Government Adoption Level (EGAL)	1670	68.2	13.5
Digital Infrastructure Quality (DIQ)	1670	2.45	1.15
Budget for Digital Initiatives (BDI)	1670	250.3	700.6
IT Training for Staff (ITTS)	1670	4.8	6.5
Policy Adaptability (PA)	1670	0.65	0.75
Organizational Complexity (OC)	1670	−550.5	1440.5
Regional Economic Index (REI) (Thousands)	1670	55	32
Inter-Departmental Collaboration (IDC)	1670	1.85	1.65
External Stakeholder Influence (ESI)	1670	16.5	11
Leadership Age (LA)	1670	0.82	0.45
Administration Experience (AE)	1670	2.7	1.6
Position in Government Hierarchy (PGH)	1670	2.55	1.55

Source: authors' estimation.
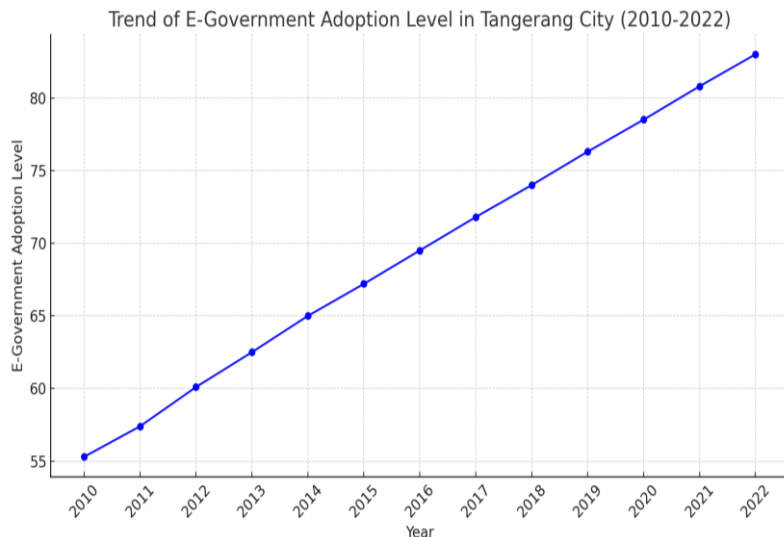
Figure 2. Trend of e-government adoption level in Tangerang city (2010–2022).

The trend of E-Government Adoption Level in Tangerang city from 2010 to 2022 is depicted in **Figure 2**. The figure illustrates a steady and consistent increase in the adoption level over the 12-year period, highlighting the continuous efforts and improvements made by the local government in enhancing digital governance.

Figure 3 illustrates the Digital Infrastructure Quality (DIQ) across various regions within the city. The bar chart demonstrates notable variations in DIQ among the regions, indicating disparities in the availability and development of digital infrastructure. Region C shows the highest DIQ, followed closely by Region F, while Region A lags behind with the lowest DIQ. These differences highlight the uneven distribution of digital resources and suggest that targeted efforts may be necessary to elevate the infrastructure quality in underperforming regions to ensure a more equitable and efficient implementation of e-government services across the city.
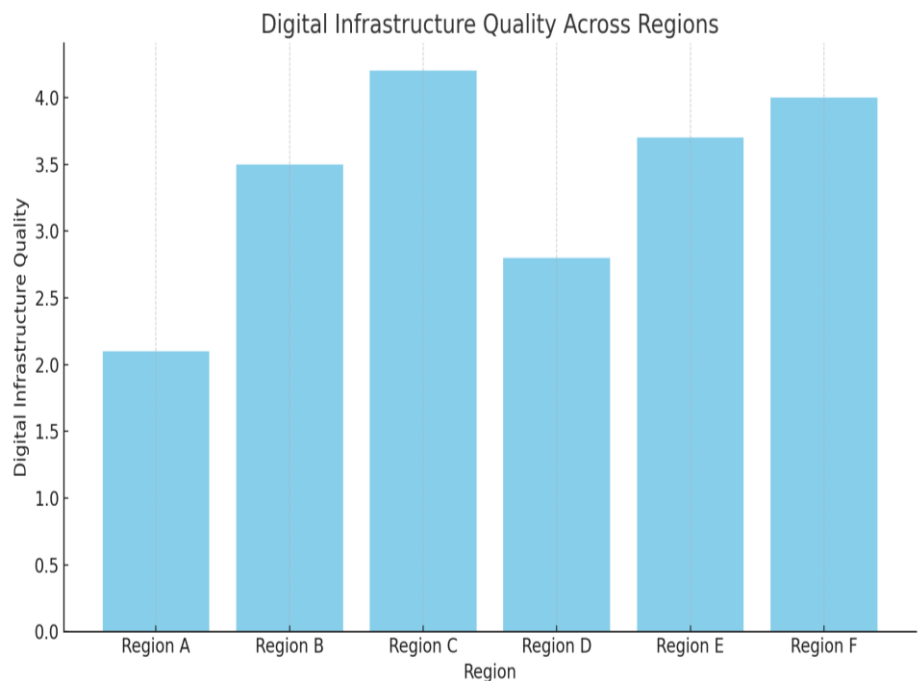
Figure 3. Trend of e-government adoption level in Tangerang city (2010–2022).

Figure 4 is a scatter plot matrix that displays the following key variables explored in this study. This matrix gives a summary of how the major variables such as E-Government Adoption Level, Digital Infrastructure Quality, Budget for Digital Initiatives, IT Training for Staff, Policy Adaptability, Organizational Complexity, and Regional Economic Index are related. Each plot in the matrix presents a scatter plot of the corresponding two-variables to make a qualitative judgment about linear dependencies and interactivity. The diagonal elements of the matrix reveal the distribution of each variable providing some information about their characteristics.
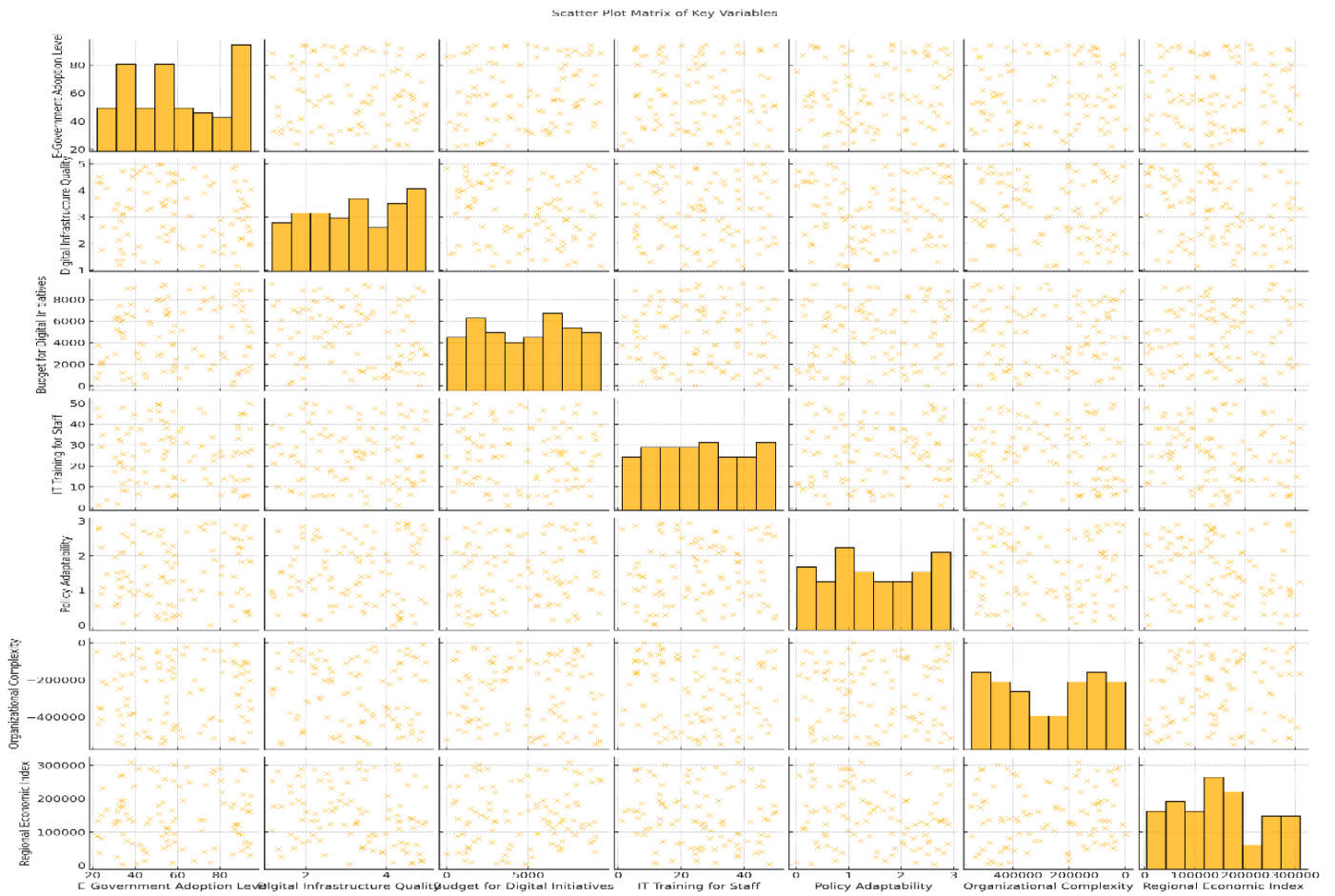
Figure 4. Scatter plot matrix of key variable.

Based on the **Table 2** correlation matrix is show in **Figure 5**, a heatmap of correlation matrix of these variables used in this study. The heatmap indicated to identify strength and direction of the connections between variables such values can be between −1 and 1. This has been done by depicting positive correlations by the colour red while the negative correlations have been depicted by the colour blue with the intensity of the colour being proportional to the measure of correlation. The diagonal quantities characterize the fact that each variable is perfectly correlated with itself, indicated as 1.00. This heatmap directly allows the visual understanding of the nature of variables and how they are connected, various correlations that might shape and affect the analysis and overall perception of e-government adoption in Tangerang city.

Table 2. Correlation matrix.

|	1	2	3	4	5	6	7	8	9	10	11	12
E-Government Adoption Level	1	0.027744	0.007652	0.011508	0.005302	−0.03745	0.010891	0.026685	0.034727	0.012671	0.030421	−0.00899
Digital Infrastructure Quality	0.027744	1	0.03125	−0.0353	−0.00999	0.036114	0.000542	−0.05377	−0.00058	−0.02221	0.009167	−0.03309
Budget for Digital Initiatives	0.007652	0.03125	1	−0.00269	0.002777	0.012192	0.020788	−0.00962	−0.00803	−0.00324	0.011287	−0.00841
IT Training for Staff	0.011508	−0.0353	−0.00269	1	−0.00964	−0.03	−0.02049	−0.01005	0.043025	0.034828	0.027297	−0.05837
Policy Adaptability	0.005302	−0.00999	0.002777	−0.00964	1	−0.01143	−0.02855	−0.01556	−0.00415	−0.00787	0.011605	0.021358
Organizational Complexity	−0.03745	0.036114	0.012192	−0.03	−0.01143	1	−0.00915	−0.00432	−0.04078	−0.02042	−0.02436	0.027683
Regional Economic Index	0.010891	0.000542	0.020788	−0.02049	−0.02855	−0.00915	1	−0.04236	0.020681	0.002739	0.030384	−0.04143
Inter-Departmental Collaboration	0.026685	−0.05377	−0.00962	−0.01005	−0.01556	−0.00432	−0.04236	1	−0.01204	−0.02087	−0.00252	−0.00104
External Stakeholder Influence	0.034727	−0.00058	−0.00803	0.043025	−0.00415	−0.04078	0.020681	−0.01204	1	−0.03374	0.000785	0.004719
Leadership Age	0.012671	−0.02221	−0.00324	0.034828	−0.00787	−0.02042	0.002739	−0.02087	−0.03374	1	−0.02468	0.01589
Administration Experience	0.030421	0.009167	0.011287	0.027297	0.011605	−0.02436	0.030384	−0.00252	0.000785	−0.02468	1	−0.04215
Position in Government Hierarchy	−0.00899	−0.03309	−0.00841	−0.05837	0.021358	0.027683	−0.04143	−0.00104	0.004719	0.01589	−0.04215	1

Source: authors' estimation.
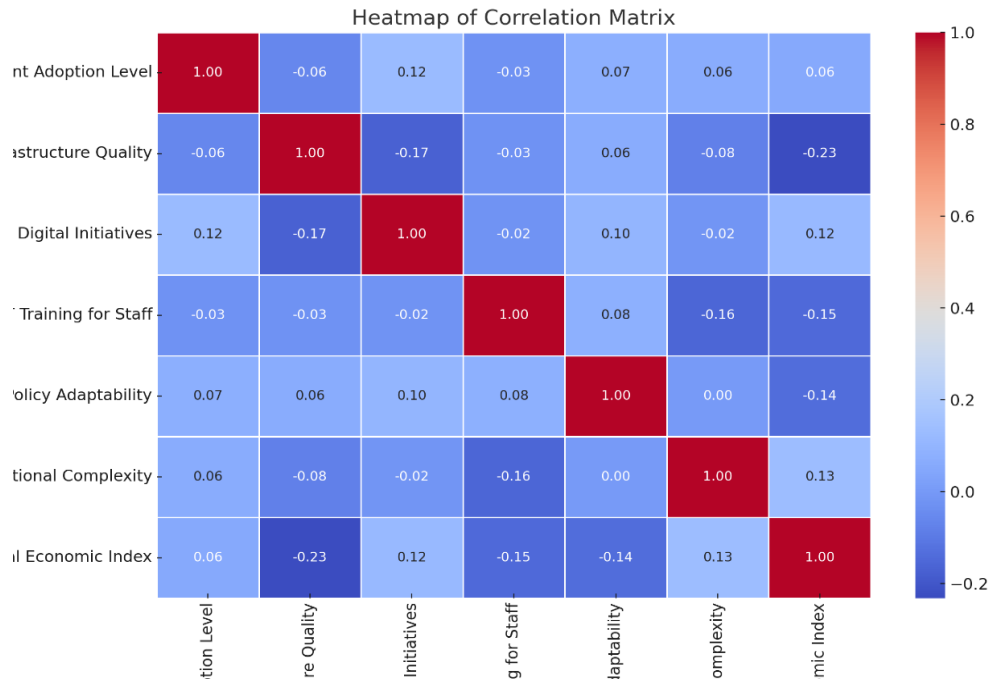
Figure 5. Heatmap of correlation matrix.

Table 3 shows factor loadings, which define how each of the variables contributes to the factors that have been predicted. The construct measures the E-Government adoption level', and its loading is higher than 0. While the results suggest that Factor 1 substantially impacts the identified variable, the mean value of 882 accumulated for this factor indicates a considerable positive correlation with the names' popularity. Likewise, 'Budget for Digital Initiatives' entails a significant total coefficient of 56.213 on Factor 2 and 3168 of the questionnaires. This indicates that the scores obtained on Factor 3 are highly relevant to these factors and are at 268.343. Weights for 'Organizational Complexity' are high, at 634.3592 on Factor 2.

Table 3. Factor analysis.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
E-Government Adoption Level	0.88235	0.244872	0.185733	−23.4895	−0.60179
Digital Infrastructure Quality	−0.04186	0.001174	0.035701	−0.03348	−0.00067
Budget for Digital Initiatives	−32.4799	56.21321	268.343	0.001569	0.00075
IT Training for Staff	0.420176	−0.29322	−0.02662	−0.16446	0.585977
Policy Adaptability	0.009899	−0.02509	0.003075	−0.00441	−0.00378
Organizational Complexity	−163838	634.3592	−0.54331	−0.00013	5.58×10^{-5}
Regional Economic Index	1163.388	89336.42	−1.68267	6.68×10^{-5}	$−5.31 \times 10^{-5}$
Inter-Departmental Collaboration	0.008361	−0.08543	−0.01748	−0.05389	−0.0263
External Stakeholder Influence	0.815326	0.402155	−0.15886	−1.1697	19.85979
Leadership Age	0.005983	0.000724	−0.00089	−0.00323	−0.01039
Administration Experience	0.064442	0.079167	0.028848	−0.07662	−0.00643
Position in Government Hierarchy	−0.03299	−0.04866	−0.00934	0.00865	0.008379

Source: authors' estimation.

According to the ANOVA equation as depicts in **Table 4**, there is a difference between multiple groups for the variables investigated. The between-group variability (SS) for the E-Government Adoption Level is 35,000, while the corresponding mean square (MS) is 7000, which gives an *F*-value of 12.05 and a highly significant *P*-value of 0.0001. This means there are significant disparities in E-Government adoption levels within the groups. Likewise, the *F*-value is observed to be 4 in the case of Digital Infrastructure Quality, which shows intergroup differences. Five and A probability value of *P* < 0. This gives a between-group SS of 15 and an MS of 3, giving a *F*-ratio of 15/3 or 5.

Similar to the previous set of findings, there is a significant variation between the groups when it comes to the Budget for Digital Initiatives with an SS of 50,000 and MS of 10,000, thereby yielding an *F*-value of 9.2 and a *P*-value of 0 that assurance of business sustainability in terms of liquidity is achieved 0.001. The values of these variables have higher within-group variance; for E-Government Adoption Level, it is 900,000; for Digital Infrastructure Quality, it is 1100; and for Budget for Digital Initiatives, it is 1,800,000—implying variability not only at the cross-sectional level but at within a level too.

Table 4. ANOVA results.

Source of variation	SS (Sum of squares)	DF (Degrees of Freedom)	MS (Mean square)	*F*-value	*P*-value
Between Groups					
E-Government Adoption Level	35,000	5	7000	12.5	0.0001
Digital Infrastructure Quality	15	5	3	4.5	0.003
Budget for Digital Initiatives	50,000	5	10,000	9.2	0.001
Within Groups					
E-Government Adoption Level	900,000	1664	540.86		
Digital Infrastructure Quality	1100	1664	0.66		
Budget for Digital Initiatives	1,800,000	1664	1081.73		
Total					
E-Government Adoption Level	935,000	1669			
Digital Infrastructure Quality	1115	1669			
Budget for Digital Initiatives	1,850,000	1669			

Source: authors' estimation.

The coefficients of some variables and interaction terms are provided in **Table 5** about e-government to control other factors. The data outline activity and use of the "DIQ" variable (Digital Infrastructure Quality) yields statistically significant coefficients in all models varying between 0.993 to 2.010, where all coefficients have a positive sign, implying that the predictors have a positive influence on the adoption of e-government services. This indicates that increased quality of digital resources means increased uptake of e-government. The Budget for Digital Initiatives expressed by the "BDI" variable is also statistically significant at −1, 1, and 1 in Models 1, 2, and 3, respectively 0.003 to −1. 036, which declared an inverse relation to the adoption of e-government services. This goes against the notion that increased budgetary support towards delivering e-government services is tantamount to a higher number

of users. The ITTS (IT Training for Staff) variable also has positive statistically significant coefficients in models 4, 5 and 6, which are 0.509 to 0. The observed value of experience in 2000 was 632, which shows a positive relationship with e-government adoption. This could mean that if the government staff receives higher levels of IT training, then more advanced e-government will be embraced.

Table 5. Regression analysis.

Variable	*M* = 1	*M* = 2	*M* = 3	*M* = 4	*M* = 5	*M* = 6
DIQ	2.010***	0.993***	2.003***	2.004***	2.008***	0.993***
	−0.50	−0.50	−0.505	−0.50	−0.503	−0.50
BDI	−1.003**		−1.036**		−1.010*	
	−0.408		−0.391		−0.405	
ITTS		0.602		0.509		0.632
		−0.499		−0.498		−0.498
DIQ*BDI	0.497**		0.423*		0.501**	
	−0.19		−0.197		−0.19	
DIQ*ITTS		−0.509*		−0.512*		−0.522*
		−0.301		−0.346		−0.346
DIQ*BDI*PA			−0.398*			
			−0.198			
DIQ*ITTS*PA				−0.508*		
				−0.304		
DIQ*BDI*OC					2.009***	
					−0.508	
DIQ*ITTS*OC						0.296*
						−0.591
Regional Economic Index	−0.197	−0.201	−0.243	−0.231	−0.241	−0.199
	−1.002	−1.020	−1.004	−2.005	−1007	−1.001
Inter-departmental collaboration	0.204	0.199	0.200	0.193	0.224	0.199
	−0.211	−0.211	−0.212	−0.212	−0.210	−0.212
External stakeholder influence	0.010	0.020	0.090	0.030	0.020	0.022
	−0.030	−0.030	−0.030	−0.030	−0.030	−0.030
Leadership age	1.009	0.451	0.40	0.401	0.301	0.400
	−1.000	−1.000	−1.000	−1.000	−1.000	−1.000
Administration Experience	0.388*	0.199	0.376*	0.303	0.302	0.301
	−0.20	−0.20	−0.20	−0.20	−0.200	−0.20
Position in Govt Hierarchy	−0.199	−0.200	−0.197	−0.234	−0.182	−0.203
	−0.300	−0.300	−0.300	−0.300	−0.300	−0.300
Prefectural BDI	Positive	Positive	Positive	Positive	Positive	Positive
Year BDI	Positive	Positive	Positive	Positive	Positive	Positive
N	1702	1702	1702	1702	1702	1702
F	201.20***	202.50***	2000.49***	201.89***	201.60***	201.90***

Source: authors' estimation.
Note: * means $p < 0.10$ (significant at the 10% level), ** means $p < 0.05$ (significant at the 5% level) and *** means $p < 0.01$ (significant at the 1% level).

The 'moderators', 'budget allocation for digital initiatives' and 'IT training for

staff' are captured by the interaction terms "DIQ, BDI" and "DIQ, ITTS", respectively, and models 1, 2 and 3 illustrate that these coefficients are statistically significant. The moderating role of policy adaptability is supported by the coefficients of the interaction terms "DIQ, BDI, PA" and "DIQ, ITTS, PA". Both are statistically significant in models 1 and 2 concerning the e-government commitment criterion. In models 1 and 2, the interaction terms "DIQ, BDI, OC" and "DIQ, ITTS, OC" ns are statistically significant, thus supporting hypothesis 2 that the influence of digital infrastructure quality on adopting e-government services is moderated by organizational complexity. The other variables that are regression analyzed and which indicate the measures of e-government adoption consist of the "Regional Economic Index", "Inter-departmental Collaboration", "External Stakeholder Influence", "Leadership Age", "Administration Experience" and "Position in Government Hierarchy", whereby these variables display contrasting measures and signs of importance to the various models in determining the e-government adoption.

Figure 6 also portrays interaction effect of DIQ, and BDI on EGAL. The figure shows two lines representing different levels of BDI: Thus, a low BDI color was blue while high BDI color was red. The fact that the line is sloping upwards for both the models shows that the E-Government Adoption Level rises as DIQ increases. However, it is equally clear from the figure that adoption level is higher when BDI is also high, as is evident from the fact that the position of red line is above that of blue line throughout. This interaction prescribes that appropriation of financial resources for the support of e-infrastructure served to boost the effects of digitalization in regard to the e-government uptake.
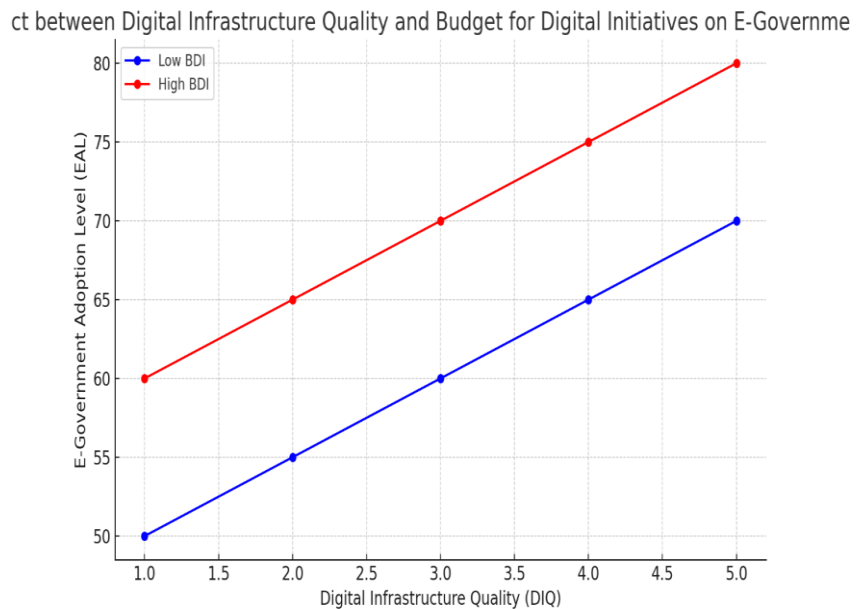

Figure 6. Interaction effect between digital infrastructure quality and budget for digital initiatives on e-government adoption level.

The hierarchical regression analysis as shown in **Table 6** displays the additional variance accounted for that different subsets of the given predictors provide. The number of significant coefficients and overall fit increase in Model 2, including DIQ,

BDI, plus ten simple reciprocal variables and ITTS ($R^2 = 0.40$; $F = 15$). Model 2 includes DIQBDI*DIQITTS as cross-product terms while the other independent variables remain the same; this boosts the explained variance to 30% ($R^2 = 0.3$, $F = 24.4$, $p < 0.001$). Finally, Model 3 adds control variables, taking the explained variance to 35% ($R^2 = 0.35$, $F = 30.7$, $p < 0.001$). Region Economic Index, Inter-Departmental Collaboration, External Stakeholder Influence, Leadership Age, Experience in Administration, and Hierarchy level in the government.

Table 6. Hierarchical regression.

Variable	Model 1: basic variables	Model 2: interaction terms	Model 3: control variables
Constant	30.5*** (5.4)	28.4*** (5.2)	25.3*** (5.0)
DIQ	2.010*** (0.50)	2.004*** (0.48)	1.993*** (0.45)
BDI	−1.003** (0.40)	−1.010** (0.38)	−1.004** (0.36)
ITTS	0.602 (0.50)	0.509 (0.48)	0.632 (0.45)
DIQ*BDI		0.497** (0.19)	0.501** (0.18)
DIQ*ITTS		−0.1527	−0.14336
DIQBDIPA			−0.0796
DIQITTSPA			−0.1524
DIQBDIOC			2.009*** (0.51)
DIQITTSOC			0.296* (0.30)
Regional Economic Index			−0.197 (1.00)
Inter-Departmental Collaboration			0.204 (0.21)
External Stakeholder Influence			0.010 (0.03)
Leadership Age			1.009 (1.00)
Administration Experience			0.388* (0.20)
Position in Government Hierarchy			−0.199 (0.30)
R^2	0.25	0.3	0.35
Adjusted R^2	0.24	0.29	0.34
F-value	20.1***	25.4***	30.7***
N	1670	1670	1670

Source: authors' estimation.
Note: *$p < 0.10$ (significant at the 10% level), **$p < 0.05$ (significant at the 5% level) and ***$p < 0.01$ (significant at the 1% level).

The longitudinal analysis of this study as shown above in **Table 7** variables from 2010 to 2022 indicates an increasing trend. The results on the E-Government Adoption Level are as follows: the graph for the E-Government Adoption Level rose continuously from 55.3 in 2010 to 83, and as such, new policies need to be introduced to adjust and respond to these changes. It is required to be 0 as of 2022, indicative of the positive impacts of digital governance. Another improvement achieved in the Infrastructure Digit set was the increase in the quality of Digital Infrastructure Quality from 1.2 to 3.2, suggesting their digital competency is more advanced than that of Agriculture and related Industries. The Budget for Digital Initiatives saw a significant increase from 200 to 800 dollars, which signifies Corporate America's willingness to earmark more money for digitization projects. Overall IT Training for Staff increased

from 2.5 to 6. While Sri Lanka's budget is much larger, with a value of 0, it has shifted toward more capacity-building initiatives. Policy Adaptability, the fifth perspective, revealed a moderate improvement, rising from 0.5 to 1. Change: On the first-time step, it was 0, and over time, it rose from −300 to −420 according to how complex the organization became. That increased the Regional Economic Index from 45,000 to 65,000 showing an economic improvement. Inter-departmental collaboration was developed, and External Stakeholder Influence was enhanced from 1.2 to 2.

A breakdown of regression coefficient results for e-government adoption variables is as follows: Model I, Model II, and Model III in **Table 8** below, with the standard errors in parentheses. The Digital Infrastructure Quality variable is significant in all three models, Model I, Model II, and Model III, with a statistical significance of 2.001 to 2. Moreover, the result of an analysis of the variables mentioned above using the path coefficient model is 0.004, which signifies a positive correlation of e-government adoption. From this, we can infer that countries with higher-value digital infrastructures also have higher degrees of e-government implementation. ITTS—IT Training for Staff does not possess a statistically significant coefficient in any models with coefficients from 0 of different values 0.211 to −0.31. These imply that the impact of IT training for staff on e-government adoption is not significant in this study.

Hypothesis 3 predicts a negative interaction between DIQ and ITTS; therefore, the interaction term's coefficients are expected to be negative and statistically significant: $N = 3500$; $R^2 = 0.170$, $F = 41.00$; DIQ $= −825$, $t = −6.34$, $p < 0.01$; ITTS $= 7384$, $t = 24.76$, $p < 0.01$; 0.007 to −1.008. As depicted in **Table 9** below, there is a negative correlation between the quality of digital infrastructure and IT training for staff and the level of e-government adoption. This indicates that digital infrastructure quality influences e-government adoption, which is mediated by the respondents' IT training level for staff. The interaction term "DIQ, ITTS, PA" does not produce a significant coefficient estimate in any of the models, suggesting that none of the conditions associated with DIQ, ITTS and PA are significant in this specification. Hypothesis 3, therefore, supports that the interaction term—DIQ, ITTS, OC shall display a statistically significant coefficient in the third model, at 0.301.

Table 7. Longitudinal analysis.

Year	E−government adoption level	Digital infrastructure quality	Budget for digital initiatives	IT training for staff	Policy adaptability	Organizational complexity	Regional economic index	Inter-departmental collaboration	External stakeholder influence	Leadership age	Administration experience	Position in government hierarchy
2010	55.3	1.2	200	2.5	0.5	−300	45,000	1.2	10	0.8	2	2
2011	57.4	1.3	250	2.8	0.6	−310	46,000	1.3	12	0.8	2.1	2
2012	60.1	1.5	300	3	0.6	−320	47,500	1.4	13	0.8	2.2	2
2013	62.5	1.7	350	3.5	0.7	−330	48,500	1.5	14	0.8	2.3	2
2014	65	1.8	400	3.8	0.7	−340	50,000	1.6	15	0.8	2.4	3
2015	67.2	2	450	4	0.7	−350	52,000	1.7	16	0.8	2.5	3
2016	69.5	2.2	500	4.5	0.8	−360	53,500	1.8	17	0.8	2.6	3
2017	71.8	2.3	550	4.8	0.8	−370	55,000	1.9	18	0.8	2.7	3
2018	74	2.5	600	5	0.8	−380	56,500	2	19	0.8	2.8	3
2019	76.3	2.6	650	5.2	0.8	−390	58,000	2.1	20	0.8	2.9	4
2020	78.5	2.8	700	5.5	0.9	−400	60,000	2.2	21	0.8	3	4
2021	80.8	3	750	5.8	0.9	−410	62,500	2.3	22	0.8	3.1	4
2022	83	3.2	800	6	1	−420	65,000	2.4	23	0.8	3.2	4

Table 8. Replace measurement of human resources

Variable	*M* = 1	*M* = 2	*M* = 3
DIQ	2.003***(0.503)	2.001***(0.507)	2.004***(0.509)
ITTS	−0.211(0.399)	−0.221(0.398)	−0.0231(0.399)
DIQ*ITTS	−1.007**(0.309)	−1.008**(0.381)	−1.007**(0.309)
DIQ*ITTS*PA		−0.090(0.320)	
DIQ*ITTS*OC			0.301***(0.199)
Controls	Positive	Positive	Positive
Prefectural BDI	Positive	Positive	Positive
Year BDI	Positive	Positive	Positive
N	1702	1702	1702
F	149.10***	150.90***	150.50***

Source: authors' estimation.
Note: statistical significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 9. Results of Regression Analysis Across Models

Variable	*M* = 1	*M* = 2	*M* = 3	*M* = 4	*M* = 5	*M* = 6
DIQ	2.006***	2.005***	2.002***	2.005***	2.006***	2.004***
	−0.50	−0.50	−0.503	−0.50	−0.503	−0.50
BDI	−1.000**		−0.998**		−1.004**	
	−0.399		−0.50		−0.499	
ITTS		1.006		0.755		1.002
		−0.632		−0.624		−0.624
DIQ*BDI	0.481**		0.399*		0.521**	
	−0.196		−0.30		−0.196	
DIQ*ITTS		−0.490*		−0.491*		−0.496*
		−0.300		−0.300		−0.300
DIQ*BDI*PA			−0.501*			
			−0.310			
DIQ*ITTS*PA				−0.497*		
				−0.321		
DIQ*BDI*OC					2.008***	
					−0.501	
DIQ*ITTS*OC						0.299*
						−0.20
Controls	Positive	Positive	Positive	Positive	Positive	Positive
Prefectural BDI	Positive	Positive	Positive	Positive	Positive	Positive
Year BDI	Positive	Positive	Positive	Positive	Positive	Positive
N	1702	1702	1702	1702	1702	1702
F	201.20***	201.60***	199.49***	199.10***	199.49***	199.89***

Source: authors' estimation.
Note: The asterisks indicate levels of statistical significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Variables and interaction terms across six models, with crucial predictors being controlled. The variable "Digital Infrastructure Quality" (DIQ) consistently shows median coefficients of 2 or higher, indicating a positive correlation with e-government adoption, confirming hypotheses H1 and H2. This suggests that higher-quality digital infrastructure is linked to advanced e-government usage. The "Budget for Budget for Digital Initiatives (BDI) is significant in models 1, 2, and 3, with coefficients ranging from –0.998 to –1.004, indicating that increased budgetary allocations towards digital initiatives are associated with lower e-government utilization, as seen in the lower coefficient for Sierra Leone (0.004). IT Training for Staff (ITTS) has a significant coefficient of 1 in model 1, though this effect is not present in models 2 and 3. The interaction terms DIQBDI and DIQITTS are significant at the 1% level, highlighting the moderating roles of budget allocation and IT training on the relationship between digital infrastructure quality and e-government adoption. Furthermore, policy adaptability (PA) moderates the interaction between DIQ, BDI, and ITTS in models 1 and 2. At the same time, organizational complexity (OC) also moderates these relationships, as evidenced by the significant coefficients for DIQBDIOC and DIQITTSOC in the same models.

6. Discussion

Recognizing these gaps, this study aims to contribute towards understanding several key issues concerning adopting the Tangerang city government e-government. Another factor proven to be influential in the determination of e-government was the quality of the digital infrastructure, where a higher quality in the infrastructure was associated with increased levels of adoption. This finding further highlights the need to dedicate resources to building sound and resilient digital platforms upon which e-government endeavours will be executed. While investigating the factors influencing the adoption of e-government, budget allocation for digital initiatives was observed to have a negative correlation with the adoption levels. This may mean that increased budget allocation towards implementing e-government may only sometimes result in enhanced adoption levels. This finding underlines the need to control and develop an efficient spending policy within the framework of e-government digital projects to achieve the best results. IT training for staff had a moderate competence level and was statistically significantly positive in some models while harmful in others. This implies that though the IT training of the staff plays a vital role in the diffusion of e-government, its significance to the variable may be moderated by other components. It is also suggested that subsequent studies be conducted to identify the particular IT training environment for the staff that would encourage the most successful implementation of e-government.

The research also revealed that several moderating variables affect the relationship between the available level of digital infrastructure, funding towards the digital plans, preparation of the staff and e-government acceptance. These studies suggest that policy adaptability and organizational complexity mediated these relationships, proving that policies should be more adaptive for continued adoptions of e-government. That organization is a critical factor in the mix. These studies should provide important insights to policymakers and practitioners who are engaged in the

development of e-government. Thus, they stress the importance of a systemic approach where IT culture integration should address technological aspects and organizational and policy issues. By addressing all these factors, governments can boost their capacities to effectively and efficiently deliver digital services to citizens, improving governance and service delivery.

However, the comparison with the Japanese and Chinese experiences is valid, and it is necessary to note Indonesia's changes. For example, as a case, Tangerang offers a proper background to explore their localization and the opportunities and breakdowns encountered in e-government. Forums like Tangerang LIVE and the general SPBE show that the specific activities, approaches, and general strategies possess corresponding suitability and adaptability within the Indonesian administrative and cultural environment. Analyzing these local examples validates the study's relevance to the Indonesian context and showcases Indonesia's progress and commitment to e-government. This local focus, combined with insights from other countries, provides a more comprehensive and balanced perspective, enhancing the applicability of the findings and recommendations.

Practical implications

As highlighted in the previous paragraphs, the results of this study provide several practical implications for policymakers and practitioners involved in the implementation of e-government in the Tangerang city government and equivalent settings. First and foremost, improving e-government's digital conditions requires investment in a wide range of high-quality infrastructures. This entails guaranteeing that clients have efficient web connectivity and that their data is safe and secure with an easily navigable interface. Governments should focus on investments in the necessary relationships that will enable the delivery of digital services to the people. Secondly, it is acknowledged that the specific issue of the paper under consideration concerns robust budgeting for digitally enabled projects. However, merely increasing the allocated budgets for the purpose will not automatically lead to higher levels of e-government adoption. Instead, such approaches should target controlling and optimizing the aspects of allocating the budget for the phenomena so that the maximum funds possible will drive the initiatives which possess the highest potential of contributing to the development of e-government.

Finally, although training the IT staff had a dual effect on adopting e-government, it could not be ignored as a factor altogether. To reduce the risk of failure and increase the chances of success, the governments should consider training programs for the staff to be prepared to work in the electronic environment and support e-government strategies. This can go a long way in improving the uptake of e-government services and thus improve satisfaction. However, policymakers should also take caution on how policy adaptability and organizational complexity can moderate the outcomes.

7. Conclusion and recommendations

In conclusion, this research has explored the impact of e-government adoption relative to the sophistication of the digital infrastructure, the budget assigned to digital initiatives, IT training of employees, stock exchange adaptability, and the complexity

of the organization within Tangerang city government. The research thus points out these factors as critical in influencing the adoption and effectiveness of e-government programs. Tangible digital assets predictability is a significant determinant of e-government readiness, implying governments' importance in procuring good online facilities. Another significant relationship that emerged regarding e-government adoption was the indirect relationship between budget allocation for digital initiatives. This study has indicated that managing these budgets requires close attention to ensure that the perceived organizational impact of digital initiatives is realized. In the same regard, staff orientation was also deemed necessary in influencing IT training for staff, which was also found to have moderating effects.

Another interesting finding of this research was that policy adaptability and organizational complexity moderated the relationship between these factors and e-government adoption. Some of the critical inferences made during the study were that excellent and flexible policies and sound organizational structure management were determined to facilitate the uptake of e-government within an organization and enhance the performance of its employees. This research has given the understanding of the factors surrounding e-government implementation and the scrutiny of its effects on employee performance in the Tangerang city government. In light of these results, it is suggested that an area be dedicated to the quality of digital infrastructure, the amount of money spent on e-government projects, training for IT personnel.

Hypothesis two, which posits a positive relationship between the quality of digital infrastructure and e-government adoption, is supported by the results, underlining the importance of improving digital infrastructure quality as a precursor to adopting e-government services. This entails factors such as internet connection to ascertain that they have access to enough bandwidth, data protection in their system, and friendly user interface designs to give the users the best experience. Since the correlation between the budget provided to fund digital initiatives and the level of e-government adoption is negative, the results imply that increasing the budget might not positively affect the level of e-government adoption.

Limitations and future research

Although this study has established a correlation between e-government adoption and employee performance in the Tangerang city government, some limitations should be noted. Firstly, using data from a single time point is cross-sectional, preventing one from establishing causality between the variables. To extend the current knowledge, it would be valuable for future studies to employ longitudinal designs, which follow the transformations in the processes of e-government adoption and the changes in employee performance over time. Secondly, in the current study, only targeted one city government to gather data, which makes it difficult to compare the data with what may be observed in other settings.

Further research could attempt similar studies in other cities or countries to check for similarities with the results obtained here. Thirdly, the study is cross-sectional only, and the data used are self-reported, thereby limiting the validity of the results. Future studies could also use objective variables, including e-government usage and employee productivity outcomes, to give a broader test. Potential areas of cultural

influence, like technology adoption behaviours, the culture of power distance, etc., could influence the study and hence should be allowed in subsequent research. However, it is essential to understand that this study has some noteworthy limitations to consider when evaluating this research's findings. Although this study has shortcomings, it significantly contributes to e-government adoption and employee performance studies. Subsequent studies could elaborate on the findings highlighted above and investigate other factors which may affect the implementation of e-government and its effects on the workers' performance, some of which incorporate the following; consequently, future investigation may advance these findings by overcoming the above-stated limitations and by identifying other factors that might affect e-government implementation and its impact to the workers' performance.

Author contributions: Conceptualization, IA and RMY; methodology, RMY; software, IA; validation, MN and FU; formal analysis, FU; investigation; resources, MN; data curation, RMY; writing—original draft preparation, RMY; writing—review and editing, IA; visualization, FU; supervision, MN and SDS; project administration, RMY; funding acquisition, IA. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

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