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The Paradox of Public Service Digitalization: Electronic Signature Implementation for Family Card Document Issuance in Kuningan Regency

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ABSTRACT

This study examines public service transformation through e-government and the operational dependence that centralized digital systems create. It analyzes the implementation of e-signature policy in the issuance of Family Card documents at the Population and Civil Registration Office of Kuningan Regency, examines the paradox of public service digitalization, and evaluates local mitigation strategies during system disruptions. This study employed a descriptive qualitative approach within a post-positivist paradigm. Data were collected through an in-depth interview with an anonymized key informant, direct observation of service processes, incidental interviews with service applicants, and documentation. The findings show that e-signature implementation operates effectively under normal system conditions. This effectiveness is reflected in communication across various channels, support for biometric devices, system-based compliance among public officials, and a more concise bureaucratic mechanism. The main conceptual finding is algorithmic compliance (compliance by design), namely, compliance achieved by the Population Administration Information System, which prevents the issuance of final documents without e-signature authorization. However, service acceleration to under one hour remains significantly dependent on the central server and network stability. During system disruptions, final documents may remain as drafts, while local officials use temporary offline recording, backup connections, and procedural adaptation to maintain service continuity. This study recommends strengthening regional server nodes, developing a Crisis Management Standard Operating Procedure, and providing system-disruption mitigation training for service personnel.

Keywords: *Algorithmic Compliance; Bureaucratic Resilience; E-Signatures; Family Card Issuance; Public Service Digitalization.*

INTRODUCTION

The use of internet-based information technology in e-government has transformed public service patterns from conventional methods into digital services (Bachtiar et al., 2026). This transformation is an important issue in public administration because it is directly related to the demand for services that are faster, more effective, transparent, and accessible to the public. Technological development in Indonesia has prompted bureaucratic institutions to abandon manual procedures that previously prolonged administrative queues and slowed document completion (Ashari & Sallu, 2023). In this context, public service modernization is not limited to the use of digital devices. It also concerns the capacity of bureaucracy to adjust work procedures, resources, and service relations with the public.

This modernization is visible in population administration documents, including Family Card issuance. The Family Card has an important position because it functions as an administrative prerequisite for various public and social services provided by the state to citizens (Sihombing & Widjojo, 2025). Therefore, time efficiency in Family Card issuance is directly related to the certainty of service time for the public (Ditjen Dukcapil, 2025). To address this need, electronic signatures (e-signatures) are applied in the issuance of population documents. Their application aims to accelerate the authorization process, reduce dependence on manual signatures, and support more efficient administrative governance (Amalia et al., 2023). This innovation

also encourages a gradual shift toward more efficient management of official correspondence and supports paperless services.

The implementation of digitalization of population administration at the local level is based on the Minister of Internal Affairs Regulation Number 7 of 2019¹. In this study, Article 5 section (5) of the Regulation is positioned as the operational basis that population documents and electronic official correspondence documents are signed electronically. Meanwhile, Article 14 of the Regulation is positioned as a technical provision concerning document specifications, including the use of e-signatures, quick response codes (QR Codes), and barcodes. Thus, the regulatory reference is not treated as an object of doctrinal legal analysis. It is used to explain the operational legitimacy of e-signature implementation in population administration services. E-signature instruments also provide technical support within the national system, placing the document validation process under the authority of the authorized signatory ([JDIH Komdigi, 2025](#)).

The implementation of e-signatures at the Population and Civil Registration Office of Kuningan Regency is underway amid rising service demand. The population of Kuningan Regency reached 1,201,764 in 2024, thereby increasing the need for population administration services ([Anisah et al., 2025](#)). This condition makes digital service innovation important for preventing the accumulation of applications and accelerating document completion. However, at the operational level, digitalization still has constraints. Electronic services remain related to internet network stability, system performance, public officials' capacity, and the public's understanding of new service mechanisms.

The success of a public policy is not determined solely by the existence of regulations. A policy requires operational action by public officials to implement its stated objectives in practice ([Said et al., 2024](#)). Implementation is the process through which policy objectives are operationalized into bureaucratic actions experienced by the public ([Akib, 2010](#)). Therefore, this study uses the policy implementation theory of [Edwards \(1980\)](#), which consists of four main dimensions: communication, resources, disposition, and bureaucratic structure. These four dimensions serve as an analytical framework to assess how the Population and Civil Registration Office of Kuningan Regency operationalizes the e-signature policy in the issuance of Family Cards.

Several previous studies have discussed the digitalization of population administration, particularly regarding service time efficiency, the use of electronic official correspondence, and the reduction of manual procedures ([Amalia et al., 2023](#)). Other studies have also explained that public service digitalization can reduce document completion time and encourage bureaucracy to shift from conventional patterns to technology-based systems ([Ashari & Sallu, 2023](#)). However, some of these

¹Minister of Internal Affairs Regulation Number 7 of 2019, as amended by Minister of Internal Affairs Regulation Number 2 of 2023.

studies still treat digitalization primarily as a means of accelerating service delivery. The issue of local bureaucracy's dependence on centralized system structures has not been widely discussed in depth. In addition, the relationship between digital system design and the formation of public officials' compliance has not been sufficiently explained within the framework of policy implementation.

Based on this research gap, this study aims to analyze the implementation of the e-signature policy in the issuance of Family Cards at the Population and Civil Registration Office of Kuningan Regency using the four dimensions outlined by [Edwards \(1980\)](#). This study also aims to examine the paradox of public service digitalization. This paradox arises when e-signatures accelerate document completion yet create dependence on the stability of central servers and networks. Furthermore, this study evaluates the mitigation strategies adopted by local public officials during system disruptions, particularly through temporary offline recording, the use of backup connections, and procedural adaptation in service delivery.

METHOD

This study employed a descriptive qualitative approach within a post-positivist paradigm ([Sugiyono, 2025](#)). This approach was selected because the study seeks to understand the implementation process of the e-signature policy under naturally occurring service conditions. The study does not aim to test statistical relationships among variables. Instead, it explains how the policy is implemented, understood, and responded to by public officials and service applicants. The research locus was the Population and Civil Registration Office of Kuningan Regency. This institution was selected because it issues Family Cards and has implemented e-signatures since 2020.

The main research subject was identified through a key informant, namely a senior public official who understood the implementation process of the e-signature policy for Family Card issuance. The key informant was selected because the study required information from a party with direct knowledge of service workflows, authorization authority, system constraints, and technical handling measures within the institution. To maintain research ethics, the informant's real identity and specific position are not disclosed. All statements from the main informant in this article are represented using the nomenclature Informant 1.

Data were collected through in-depth interviews, direct observation, incidental interviews, and documentation ([Spradley, 2016](#)). The in-depth interview with Informant 1 was conducted to obtain information on policy communication, resource readiness, public officials' attitudes, bureaucratic workflows, system obstacles, and technical service handling. Direct observation was conducted to examine the service process in practice, including document completion times and system disruptions affecting service delivery. Incidental interviews were conducted with several service applicants encountered during observation in the service area. Data from incidental interviews

were not positioned as a statistical sample representing the entire population of Kuningan Regency. Instead, they were used as supporting data to examine whether the policy message regarding the benefits of e-signatures was understood by service applicants directly involved in the service process.

Triangulation was conducted by comparing the key informant's statements, direct observation results, incidental interviews, and documentation (Creswell & Poth, 2018). Through this method, findings regarding service success did not rely solely on statements from public officials. These findings were examined through direct observation of service processes and responses from applicants encountered in the field. Data on document completion time and system disruption were also treated as observational data and therefore used with caution within the limits of the research locus. Thus, findings on document completion in under one hour, system disruptions occurring once to twice a week, and recovery time of approximately two to three hours are analyzed as findings at the research locus. They are not intended as a national generalization of all population administration services in Indonesia.

Data analysis was conducted interactively through data reduction, data display, conclusion drawing, and verification (Miles et al., 2014). Data reduction was carried out by selecting information relevant to the research focus, particularly information related to the four dimensions of implementation proposed by Edwards (1980), the paradox of public service digitalization, and mitigation strategies for system disruptions. Data were presented in analytical descriptions that connected field findings with scholarly references. At the final stage, conclusions were drawn by examining the consistency among interview data, observation results, documentation, and the theoretical framework. These stages were used to ensure that the arguments remained consistent with the available empirical evidence.

RESULTS AND DISCUSSION

A. Evaluation of E-Signature Policy Implementation for Family Card Document Issuance in Kuningan Regency

Policy implementation is an important stage that determines whether policy objectives can be translated into service actions in practice. Edwards (1980) emphasizes that a policy requires an implementation process involving communication, resources, disposition, and bureaucratic structure. In this study, these four dimensions are used to assess the implementation of e-signatures in the issuance of Family Cards at the Population and Civil Registration Office of Kuningan Regency. The use of Edwards (1980) is also consistent with Akib (2010), who conceptualizes implementation as a process linking policy objectives to government action. Accordingly, this discussion remains within the field of public administration. Regulatory references are used only as the operational basis of the policy, not as objects of doctrinal legal analysis (Bahri et al., 2020).

Communication is the initial aspect of policy implementation. According of [Edwards \(1980\)](#), policy implementers and target groups need to understand the actions to be taken, the reasons for implementing the policy, and the procedures for its application. At the research locus, communication on the e-signature policy is carried out through tiered socialization, proactive service delivery to the public, and the use of the institution's digital media. This strategy shows that information is delivered not only through internal bureaucratic channels but also to the public as service recipients. This communication pattern was explained by Informant 1 as follows:²

"We initiated socialization at the subdistrict level, which was then followed up through technical guidance for village operators. In addition, we conducted proactive outreach services directly to the public. In addition to face-to-face services, we also optimized the official website of the Population and Civil Registration Office of Kuningan Regency and social media to disseminate every regulatory update, both through videos and information materials from the Directorate General of Population and Civil Registration and the Regency Government."

This statement indicates the transmission of information through several channels. To avoid reliance solely on statements from public officials, this study also used incidental interviews with several service applicants encountered in the service area. Field interactions showed that the observed applicants had a functional understanding of the benefits of e-signatures. This understanding was mainly related to the Head of the institution's reduced need for manual signatures and shorter queue waiting times. This finding is not intended to state that the entire population of Kuningan Regency has understood the policy. It shows that among the group of applicants directly involved in the observation, information regarding the benefits of e-signatures could be understood in practical terms. This condition differs from several previous studies that still found communication barriers, low digital literacy, inconsistent information, and weak socialization in digital services ([Prayuata & Maharani, 2024](#); [Septiyani et al., 2024](#); [Setyawan et al., 2025](#)). In this context, service assistance and communication help increase public acceptance of administrative digitalization ([Nainggolan & Hidayat, 2026](#)).

Disposition concerns the attitudes, acceptance, and tendencies of implementers in carrying out a policy. Classically, disposition is often understood as the commitment or willingness of public officials to implement a policy ([Edwards, 1980](#)). However, the findings of this study show that public officials' acceptance of e-signatures cannot be analyzed solely as organic awareness. In the practice of Family Card issuance at the Population and Civil Registration Office of Kuningan Regency, public officials' compliance is also influenced by procedural restrictions embedded in the system. This finding is formulated as algorithmic compliance

²Interview with Informant 1, Structural Official at the Population and Civil Registration Office of Kuningan Regency, December 19, 2025.

(compliance by design), namely a condition in which the digital system mechanism requires public officials to follow predetermined procedures because documents cannot be issued as final products without e-signature authorization. Informant 1 explained this condition as follows:

“Public officials understand this procedure very well. All physical population administration documents are now required to use e-signatures or barcodes. Operationally, the system is designed in that way, so operators cannot issue any document before obtaining e-signature authorization.”

Algorithmic compliance in this study is not intended to replace the disposition dimension proposed by [Edwards \(1980\)](#). The concept is used to explain a specific form of public officials' disposition shaped by digital structures. In other words, public officials' compliance is determined not only by personal willingness but also by the workflow of the Population Administration Information System, which limits the scope of procedural deviation. Thus, algorithmic compliance reveals the relationship between public officials' dispositions and digital bureaucratic structures. The concept concerns implementers' attitudes, which are influenced by the design of system workflows. Centralized digital integration also shows that the national system has a major influence on local bureaucratic work patterns ([Zainudin, 2025](#)). Local operational dependence on the central system was affirmed by Informant 1 as follows:

“We welcome this policy because the instruction to use e-signatures is national in character. When the central government has established this regulation, we at the local level are required to comply with it because the Population Administration Information System (SIAP) is managed centrally through one application that applies throughout Indonesia.”

Resources are also an important factor in policy implementation. [Edwards \(1980\)](#) positions resources as a requirement for implementation, including human resources, information, authority, and physical facilities. At the research locus, resource support is reflected in the renewal of service devices, particularly seven biometric devices used for recording applicants' basic data. In contrast to some previous findings that still recorded limitations in administrative service facilities ([Nampa, 2025](#)), the institution in this study has renewed its equipment to support the validity of population data. Informant 1 stated:

“In 2024, the fulfillment of facilities and infrastructure at the Population and Civil Registration Office of Kuningan Regency was facilitated by the Kuningan Regency Government. We received seven new devices for service needs, ranging from recording devices, iris scanners, to fingerprint scanners. So far, the Office has continued to renew its equipment to minimize technical constraints and improve the quality of services to the public.”

These biometric devices do not directly execute e-signatures. However, their presence remains relevant because they operate at the data recording stage to ensure the validity of population data before documents are submitted to the authorization stage. In other words, physical resources at the recording level function as initial supporting components for the validity of data processed in the system. Without valid basic data, the e-signature authorization process at the document issuance stage can be administratively disrupted. Therefore, the resources in this study are understood not only as technical equipment. They are also positioned as part of a service sequence that includes identity recording, document preparation, e-signature submission, and Family Card issuance.

Bureaucratic structure is reflected in the division of authority between operators and the Head of the Office. In the system in use, operators have the authority to input, review, and prepare draft documents. Meanwhile, final validation remains under the authority of the Head of the Office as the authorized signatory. This model shows that digitalization does not eliminate the validation hierarchy but changes the mode of authorization from manual to electronic. The placement of final authority with the authorized signatory is also consistent with the technical legitimacy of e-signatures in administrative systems (JDIH Komdigi, 2025) and is related to the function of the Family Card's function as a basic document in public service delivery (Ditjen Dukcapil, 2025). This authorization model also shows that the application of e-signatures in administrative services requires alignment among technological design, signatory authority, and the validity of digital processes (Balqiys et al., 2026). Given that the population of Kuningan Regency reached 1,201,764 in 2024 (Anisah et al., 2025), workflow simplification is important for maintaining service speed. This workflow was explained by Informant 1 as follows:

"Every employee, especially operators, has an individual user account in the nationally applicable SIAK system. Operators do not have the authority to issue final documents to the public before e-signature authorization is completed. If a file is printed without an e-signature, the system will issue it only as a draft, not as a final product. Therefore, their workflow is determined by the system at the stages of input, editing, and e-signature submission until the document can finally be issued."

"The authority to provide e-signatures rests solely with the Head of the Office. Operators only process file submissions, which are then forwarded through the system to the Head of the Office menu. After the Head of the Office verifies and approves the e-signature, the file is returned to the operator. Thus, the operator's function is limited to processing documents, while the exclusive right of final approval lies fully within the authority of the Head of the Office."

FAMILY CARD No.

Name of the Head of Family :		Village/Urban Village :	
Address :		Subdistrict :	
Neighborhood Unit/Community Unit :		Regency/City :	
Postal Code :		Province :	

No.	Full Name	Population Identification Number	Sex	Place of Birth	Date of Birth	Religion	Education	Occupation	Blood Type
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-

No.	Marital Status	Date of Marriage	Family Relationship Status	Citizenship	Immigration Documents		Parents' Names	
					Passport No.	KITAP No.	Father	Mother
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-

Issued on :
 COPY : I. Head of Family
 II. Neighborhood Unit
 III. Village/Urban Village
 IV. Subdistrict

HEAD OF FAMILY

Signature/Thumbprint

Electronic Signature (E-Signature) / QR Code



This document has been electronically signed using an electronic certificate issued by the Electronic Certification Center (BS/E), National Cyber and Crypto Agency (BSSN).

Figure 1. Family Card Bearing an E-Signature

The evaluation of the four implementation dimensions shows that e-signature implementation at the Population and Civil Registration Office of Kuningan Regency has operated effectively under normal system conditions. Communication is carried out through various channels. Physical resources have been renewed. Public officials' disposition is shaped by compliance with system-based procedures. The bureaucratic structure has also become more concise through the division of digital authority. However, this effectiveness remains limited because the issuance of the final document still depends on the stability of the central system and network. Accordingly, the success of implementation in this subsection needs to be analyzed alongside the issues that arise when the central server or network access is disrupted. This issue leads the discussion to the paradox of public service digitalization.

B. The Paradox of Public Service Digitalization in Service Acceleration and Dependence on a Centralized System

Conceptually, public service digitalization is directed toward accelerating processes, increasing cost efficiency, and strengthening procedural certainty in service delivery. In population administration, the use of information technology can reduce manual stages that previously slowed document completion (Ashari & Sallu, 2023). However, digitalization also creates new problems when local services are highly dependent on a centralized digital system. This dependence indicates

a paradox. First, e-signatures accelerate the issuance of Family Cards. Second, services encounter obstacles when the network or central server is disrupted. The tension between service acceleration and operational capacity limitations is also found in other studies of public service digitalization ([Rohman & Wulandari, 2026](#)).

At the research locus, service acceleration is reflected in the completion time of Family Card issuance, which can be completed in under one hour when the system functions normally. Based on direct observation, the service process from initial verification, file preparation, and e-signature submission to the issuance of the final document can occur within a relatively short time. This finding is consistent with previous studies showing that digital-based services can increase speed, facilitate access, and reduce the administrative burden on the public ([Prayoga & Eldo, 2024](#)). In addition, e-signatures support paperless processes because documents can be sent to applicants by email when applicants provide an email address ([Amalia et al., 2023](#)). Informant 1 explained the service workflow as follows:

"When an application is submitted by a member of the public, the file is verified and edited by the operator and then submitted to the Head of the Office to obtain an e-signature. After being signed, the document is returned to the operator's system for printing and delivery to the applicant. If the applicant provides an email address, the Family Card file can be sent directly so that the applicant can print it independently. The entire process takes less than one hour."

This statement indicates that service acceleration occurs because the authorization workflow no longer requires physical signatures on each document. Operators process documents, submit them for e-signature, and wait for verification from the Head of the Office through the system. Under normal conditions, this mechanism can reduce service duration and meet public expectations for fast administration ([Gollu et al., 2026](#)). However, such service speed is closely related to dependence on the central system. When the central system functions normally, the service workflow becomes more concise. Conversely, when the central server is disrupted or local network access is unstable, the issuance of final documents can be delayed.

This dependence constitutes the main aspect of the paradox of public service digitalization in this study. The Population Administration Information System used nationally provides standardization and procedural control. However, the use of a single system accessed by many regions also creates operational vulnerability when maintenance, server disruption, or network instability occurs. This study does not intend to conduct a technical diagnosis of the national system structure. It examines the effect of such disruptions on local service delivery. These operational obstacles were explained by Informant 1:

“Personally, there is no obstacle because operators only need to submit applications through the system. However, obstacles often arise from the system itself. Sometimes the e-signature authorization process cannot be conducted because the system is under maintenance, down, or affected by poor network conditions, considering that SIAK is a centralized application accessed simultaneously by all regions in Indonesia.”

This statement corresponds with the researcher’s direct observation, which recorded that system and network disruptions occurred on average once to twice a week at the research locus. The recovery time ranged from approximately two to three hours before services could resume normally. This finding shows that fast digital services remain vulnerable when supporting infrastructure is unstable. Thus, the issue does not lie in public officials’ personal attitudes but in operational dependence on the central system and network. This finding is consistent with several previous studies showing that network obstacles, system disruptions, and infrastructure limitations can hinder population administration services in various regions ([Rifani & Megawati, 2023](#); [Damayanti & Suparti, 2025](#)).

System disruption directly affects delays in final document issuance. This issue relates to algorithmic compliance, as explained in the previous subsection. When the system functions normally, the application design limits operators from issuing documents without e-signatures. However, when the network connection to the authorization system is disrupted, processed documents cannot be issued as final products and remain drafts. This condition shows that operators’ discretionary authority within the final issuance system is limited. In this context, algorithmic compliance functions as procedural control, but it also reveals vulnerability when the system mechanism that determines procedural sequence cannot be accessed. Similar findings are also reported in other studies, showing that network and system disruptions can prevent document completion from meeting expected service time standards ([Rizqiqa & Amalia, 2021](#); [Fitri & Malau, 2023](#)).

Nevertheless, limited discretion within the system does not mean that public officials lack the ability of take administrative action. A distinction needs to be made between discretion in issuing final documents within SIAK and discretion in temporary service outside the system. Within SIAK, operators cannot issue final documents without e-signature authorization. However, during system disruptions, public officials can still use limited administrative discretion to receive files, record applications, and prepare data for processing once the network is restored. This distinction is important so that algorithmic compliance is not analyzed as a condition that eliminates all bureaucratic adaptive capacity. Based on this condition, the local bureaucracy still requires public officials’ capacity to maintain service delivery when the digital system cannot function.

Accordingly, the paradox of public service digitalization in this study lies in the relationship between service acceleration and system vulnerability. The

findings show that e-signatures accelerate Family Card issuance when the system functions normally. However, such acceleration is strongly affected by the stability of the central server and network. Evaluation of digitalization should not be limited to the success of reducing service duration. It should also address system resilience during disruptions. Therefore, the discussion needs to proceed to the crisis mitigation strategies adopted by the local bureaucracy to maintain service continuity during system disruptions.

C. Strategies for Mitigating System Disruptions and Public Officials' Adaptive Capacity in Population Administration Services

Disruptions in the centralized administrative system create operational dilemmas for the local bureaucracy. Public officials are required to comply with the digital workflow established by the national system. At the same time, the public continues to require services even when the system is disrupted. Based on the findings in the previous sub-section, the main limitation is the lack of authority for operators to issue final documents without e-signature authorization. However, this limitation does not prevent the entire service process from proceeding. Local public officials can still take temporary measures for handling outside the final issuance system, particularly through offline recording, the use of backup connections, and procedural adaptations.

The first mitigation measure is temporary offline recording. When access to the authorization system is disrupted due to maintenance, server disruption, or network instability, public officials can still receive public applications and record the required data outside the application interface. The data are then prepared for input or further processing once the network is restored. Based on field identification, this procedure prevents queue accumulation and ensures that applications can still be recorded. This strategy does not replace the issuance of the final document through SIAK. It serves as a temporary procedure until the system can be used again. This handling pattern is important because previous studies show that network disruptions often lead to delayed document completion and noncompliance with service standards (Fitri & Malau, 2023; Rifani & Megawati, 2023).

The second mitigation measure is the provision of backup connections at the local level. Service disruptions do not always originate from the central server. In certain situations, public officials' access can also be obstructed by unstable local internet connections. To reduce this risk, the institution provides external modem devices as alternative channels when the primary connection is disrupted. These backup connections cannot resolve disruptions originating from the national server, but they can help when problems occur in the local network. Accordingly, the function of the modem needs to be understood proportionately. The device is not a solution for all forms of system disruption but an instrument

for mitigating local connectivity disruptions. The strengthening of such supporting facilities is consistent with the need to improve infrastructure in digital population administration services (Damayanti & Suparti, 2025).

The third mitigation measure concerns human resource readiness. Based on field statements and identification, public officials receive technical guidance on transitioning from manual to electronic service systems. This technical guidance is not always a form of advanced technical training in network engineering. However, it provides the procedural understanding operators need to deliver services, identify disruptions, and adjust workflows when the system is unavailable. Under disruption conditions, this procedural understanding is important because public officials must be able to determine temporary measures without exceeding the limits of their authority to issue final documents. Such readiness among public officials is also an important factor in previous studies of digital service implementation, which show that human resources affect the success of policy adaptation (Prayuata & Maharani, 2024).

These three strategies demonstrate bureaucratic resilience in managing system limitations at the local level. Offline recording enables public applications to continue to be received. Backup connections help address local disruptions. Technical guidance improves public officials' capacity to adapt procedurally. However, these strategies must still be understood as mitigation, not as a long-term solution to the problem of centralized system design. Offline recording cannot replace digital authorization. Modems cannot resolve disruptions to central servers. Technical guidance also cannot eliminate local dependence on the national system. Therefore, the effectiveness of local mitigation still requires broader policy support, particularly by strengthening central infrastructure, standardizing crisis procedures, and improving public officials' capacity.

Accordingly, this sub-section shows that the success of public service digitalization is not determined solely by the operational capability of the system. It is also determined by bureaucratic readiness to maintain services during system disruptions. Digitalization that relies heavily on a single computing center leaves local governments vulnerable when it is not accompanied by adequate backup mechanisms. Conversely, findings on offline recording, backup connections, and public officials' adaptation show that local bureaucracy has procedural adaptive capacity to maintain population administration services under limited conditions. These findings provide the basis for drawing conclusions and formulating policy recommendations that position service resilience as an important component of digital governance.

CONCLUSIONS AND SUGGESTIONS

The implementation of the e-signature policy in Family Card issuance at the Population and Civil Registration Office of Kuningan Regency shows that digitalization can improve service effectiveness when supported by policy communication, adequate resources, public officials' compliance formed through system-based procedures, and a clear bureaucratic structure. In the communication dimension, socialization through subdistrict channels, proactive services, and digital media helps service applicants understand the practical benefits of e-signatures. In the resource dimension, the renewal of biometric devices strengthens the validity of basic data before documents are submitted to the authorization stage. In the disposition dimension, this study identifies algorithmic compliance, namely a pattern of compliance arising from the system workflow's limitation on issuing final documents without e-signatures. In the bureaucratic structure dimension, the division of authority between operators and the Head of the Office streamlines the validation process without eliminating the authorization hierarchy.

However, this effectiveness also indicates the paradox of public service digitalization. E-signatures can accelerate Family Card issuance to under one hour when the system functions normally. Nevertheless, this speed depends significantly on the stability of the central server and network. System disruptions, maintenance, and unstable networks can halt the authorization process, leaving documents in draft status. Thus, digitalization not only increases efficiency but also creates a new dependence on infrastructure that is beyond the full control of local bureaucracy. This finding indicates that the success of digital services cannot be measured only by speed under normal conditions. It also needs to be measured by the capacity of the system and organization to continue providing services during disruptions.

Amid these limitations, the Population and Civil Registration Office of Kuningan Regency demonstrates mitigation capacity through temporary offline recording, backup connections, and procedural adaptation by public officials. Offline recording enables public applications to continue to be received when the system cannot be accessed. Backup connections help address local internet disruptions, although they cannot resolve disruptions at the national server. Meanwhile, technical guidance and public officials' procedural understanding help ensure that services continue without exceeding the authority to issue final documents through SIAK. This strategy shows that local bureaucratic resilience is an important component of digital governance, particularly when the central system is disrupted.

Based on these conclusions, the central government needs to improve the e-government system structure so that it is not overly dependent on a single server infrastructure center. A relevant policy option is of develop regional server nodes integrated with the national system. Strengthening regional server nodes is needed to reduce system access traffic load, accelerate disruption recovery, and minimize the

risk of widespread service interruption. In addition, the relevant ministry needs to formulate standards for handling system disruptions that local institutions can use as guidelines when digital service mechanisms are unable to operate normally. At the academic level, further research can focus on testing hybrid network security models, regional backup mechanisms, and the potential use of distributed technologies in public administration, with preliminary studies on blockchain as part of a research agenda rather than an immediate operational recommendation.

At the local level, implementing institutions need to institutionalize temporary offline recording procedures within a Crisis Management Standard Operating Procedure. This SOP is important to ensure that public officials have clear guidelines for receiving, recording, and processing public applications when the central system is inaccessible. In addition, technical guidance for public officials needs to be expanded from socialization on application use to network disruption simulation training, queue management when the system cannot be used, and post-disruption data recovery. Through these measures, public officials are not only compliant with system design but also have procedural adaptive capacity to maintain continuity of public services under conditions of system disruption.

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