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# Digitalisation of Border Control through Autogate and the Emerging Configuration of Immigration System Resilience in Indonesia

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**Abstract**

This article examines Indonesia's autogate policy not only as a digital service innovation, but as a component of immigration system resilience. Drawing on policy implementation [1234]Public Administration Doctoral Studies, Universitas Prof. Dr. Moestopo (Beragama) theory by Edwards III, Sabatier & Mazmanian, e-government literature on the design reality gap, system resilience thinking, and the information security CIA triad, the study analyses how autogate is designed, regulated, and operated at major international airports. Using a qualitative descriptive approach based on documentary and literature review, it maps legal foundations, organizational arrangements, and technical narratives surrounding automated border control. The findings show that autogate has improved processing times, standardized procedures, and strengthened traceability through digital logs, thereby supporting efficiency, accountability, and internal control. However, recurrent system downtime, biometric errors, incomplete system integration, and heavy dependence on infrastructure reveal significant vulnerabilities in confidentiality, integrity, and availability of data. Fragmented governance across immigration, airport operators, cybersecurity, and communications authorities reinforces a design–reality gap, limiting coordination, local ownership, and adaptive capacity. The article concludes that autogate currently functions as a double-edged innovation, symbolizing digital modernization while only partially reinforcing immigration system resilience. It recommends clearer mandates, stronger cross-sector coordination, improved data governance, and investment in human resources and risk-based oversight to align automated border control with a more robust, rights-sensitive model of digital immigration governance.

**Keywords:** Digitalisation, Border Control, Autogate, Immigration System Resilience

## INTRODUCTION

Over the past two decades, many states have adopted automated border control technologies to manage rising cross-border mobility while maintaining national security[1]. Indonesia has followed this trend through the gradual deployment of autogate systems at major international airports, beginning at Soekarno Hatta International Airport around 2014M[2]. Autogates rely on electronic passport readers, biometric verification (fingerprint and facial recognition), and online databases to automate immigration inspection at designated checkpoints (Tempat Pemeriksaan Imigrasi, TPI)[3]. Officially, the policy is framed as part of broader digital transformation and public service reform, in line with Law No. 25/2009 on Public Service and Law No. 6/2011 on Immigration, which mandate the use of information technology to enhance efficiency, transparency, and security[4].

In practice, however, the implementation of autogate technology has been accompanied by recurrent problems such as system downtime, inaccurate biometric readings, incomplete integration with other border control systems, and limited eligibility that initially covered only Indonesian citizens[5]. The system has also generated new queues when passengers are rejected by the gates and must be redirected to manual counters[6]. These issues highlight unresolved weaknesses in information security, data integrity, and institutional coordination, and raise questions about the extent to which autogates genuinely strengthen immigration system resilience rather than simply symbolizing digital modernization[7].

The COVID-19 pandemic further exposed vulnerabilities in Indonesia's border governance. Rapidly changing regulations, overlapping mandates, and fragmented decision making across agencies created uncertainty for travelers, migrant workers, and foreign investors[8]. At the same time, post-pandemic reopening has re-intensified global mobility and heightened risks of illegal entry, document fraud, and transnational crime, particularly in a geographically dispersed archipelagic state[9]. These dynamics underscore the need to frame autogate not only as a service innovation, but

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1 N. Saunders, *Security, Digital Border Technologies, and Immigration Admissions: Challenges of and to Non-Discrimination, Liberty and Equality*, 24, no. 2 (2025): 155–75, Scopus, https://doi.org/10.1177/14748851231203912; S. Singler, *Performativity, Pragmatism and Border Control Technologies: Democratising the Ontologies of Border Criminology*, 12, no. 2 (2023): 13–24, Scopus, https://doi.org/10.5204/ijcjsd.2893.

2 Nursanto et al., "Enhancing Public Wellbeing Through Autogate at Soekarno-Hatta International Airports," *Return: Study of Management, Economic and Bussines* 3, no. 3 (2024): 149–57.

3 M. Jansen et al., "Stop Guessing in the Dark: Identified Requirements for Digital Product Passport Systems," *Systems* 11, no. 3 (2023), Scopus, https://doi.org/10.3390/systems11030123; A. Vahidi et al., "RFID-Based Material Passport System in a Recycled Concrete Circular Chain," *Journal of Cleaner Production* 442 (2024), Scopus, https://doi.org/10.1016/j.jclepro.2024.140973.

4 Undang-Undang Republik Indonesia Nomor 25 Tahun 2009 Tentang Pelayanan Publik (2009); G. A. Nursanto, "Policy Diffusion, Digitalisation, and Governance Gaps in the Implementation of Indonesia's Golden Visa Programme," *Journal Of Global Strategic Studies* 5, no. 2 (2025): 114–30.

5 Nursanto et al., "Enhancing Public Wellbeing Through Autogate at Soekarno-Hatta International Airports," 2024.

6 K. Kalodanis et al., "High-Risk AI Systems—Lie Detection Application," *Future Internet* 17, no. 1 (2025), Scopus, https://doi.org/10.3390/fi17010026; S.S. Thenuwara et al., "A Multi-Agent Based Enhancement for Multimodal Biometric System at Border Control," *Array* 14 (2022), Scopus, https://doi.org/10.1016/j.array.2022.100171.

7 A.K. Jain et al., "Design, Simulation and Performance Evaluation of a Risk-Based Border Management System," *Sustainability (Switzerland)* 15, no. 17 (2023), Scopus, https://doi.org/10.3390/su151712991; D. Yang et al., "Advances and Prospects in Smart Border Studies Based on a Bibliometric Analysis," *Tropical Geography* 45, no. 1 (2025): 155–67, Scopus, https://doi.org/10.13284/j.cnki.rddl.20230929.

8 S. Seyfi et al., "COVID-19 and International Travel Restrictions: The Geopolitics of Health and Tourism," *Tourism Geographies* 25, no. 1 (2023): 357–73, Scopus, https://doi.org/10.1080/14616688.2020.1833972.

9 K.A. Grépin et al., "Effectiveness of International Border Control Measures during the COVID-19 Pandemic: A Narrative Synthesis of Published Systematic Reviews," *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 381, no. 2257 (2023), Scopus, https://doi.org/10.1098/rsta.2023.0134.

as part of a broader strategy for immigration system resilience that integrates security, institutional robustness, and human rights sensitive crisis response[10].

Existing studies on autogate implementation in Indonesia have predominantly focused on technical and service dimensions. As for example for examine time savings and user constraints at Soekarno–Hatta, noting efficiency gains but also persistent technical errors and limited user coverage[11]. Other work emphasizes user satisfaction and service quality without systematically addressing information security, inter-agency interoperability, or resilience under crisis conditions[12]. More recent analyses highlight the need to connect autogate with biometric- and intelligence-based surveillance and with global standards such as ICAO Doc 9303, yet stop short of conceptualizing it within a comprehensive immigration system resilience framework[13].

To address these gaps, this study draws on four main strands of literature. First, policy implementation theory particularly Edwards III and Sabatier & Mazmanian is used to analyze how communication, resources, implementer disposition, bureaucratic structures, and institutional capacity shape the success or failure of technology-intensive policies[14]. Second, e-government and digital public service literature, especially Heeks's "design reality gap," provides a lens for understanding misalignments between technological design and local institutional context[15]. Third, system resilience theory is applied to conceptualize immigration system resilience in terms of the capacity to absorb, adapt to, and recover from technical disruptions, security threats, and mobility shock[16]. Finally, information security frameworks, particularly the CIA triad confidentiality, integrity, and availability are used to assess the robustness of the digital infrastructure underpinning autogate operations[17].

The study aims to analyze how Indonesia's autogate policy is designed, regulated, and framed as an instrument for immigration system resilience, to evaluate the effectiveness of its implementation from a resilience perspective and to identify, through documentary and literature analysis, the technical, organizational, and governance factors that support or hinder its operation at major international airports. On this basis, the study seeks to formulate analytically grounded policy recommendations for strengthening digital immigration governance, with particular attention to information security, inter-agency coordination, and risk-based border management[18]. The main contribution lies in integrating public policy implementation theory, e-government perspectives on the design–reality gap, system resilience thinking, and information security (CIA triad) into a single

[10] J. S. del Rio, "Automated Border Control E-Gates and Facial Recognition – Risks and Opportunities," *Computers & Security* 63 (2016): 144–54.

[11] A. Usman et al., "The Impact of Service Orientation and Airport Service Quality on Passenger Satisfaction and Image: Evidence from Indonesia," *Logistics* 7, no. 4 (2023), Scopus, https://doi.org/10.3390/logistics7040102.

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[15] R. Heeks, *Most E-Government-for-Development Projects Fail: How Can Risks Be Reduced?* (Institute for Development Policy and Management, University of Manchester, 2003).

[16] I. Linkov et al., "Resilience Metrics for Cyber Systems," *Environment Systems and Decisions* 33, no. 4 (2013): 471–76.

[17] J. Andress, *The Basics of Information Security: Understanding the Fundamentals of InfoSec in Theory and Practice* (Syngress, 2014).

[18] Saunders, *Security, Digital Border Technologies, and Immigration Admissions: Challenges of and to Non-Discrimination, Liberty and Equality*, 2025; Singler, *Performativity, Pragmatism and Border Control Technologies: Democratising the Ontologies of Border Criminology*, 2023.

analytical framework, thereby shifting the focus from narrow concerns with service efficiency towards a broader, resilience-oriented understanding of digital immigration governance in Indonesia[19].

## METHOD

This study employs a qualitative descriptive approach, which is appropriate for capturing the complex interplay of technological, organizational, and regulatory factors in the implementation of autogate as a public policy innovation. Rather than testing hypotheses through variable manipulation, the research aims to understand how the policy is formally designed, framed, and justified, and where gaps emerge between the normative design of the system and broader expectations of immigration system resilience.

The analysis is based primarily on document and article review. The corpus includes legal and policy instruments (such as Law No. 6/2011 on Immigration and relevant Ministerial Regulations on immigration inspection and IT-based supervision), internal guidelines and standard operating procedures for autogate operation, and, where available, technical reports and system-related documentation. These are complemented by scholarly articles and research reports on automated border control, e-government in immigration, and system resilience, which provide theoretical and comparative perspectives for interpreting the Indonesian case.

All materials are analysed using thematic analysis. Documents and academic sources are coded to identify recurring patterns related to implementation factors (communication, resources, implementer disposition, bureaucratic structure), system resilience (security, integrity, surveillance capability, technological robustness), and broader public policy challenges (fragmentation, overlapping mandates, and local ownership). Themes are iteratively refined through cycles of open, axial, and selective coding, allowing the construction of an integrated analytical narrative. Validity is strengthened through source triangulation between legal texts, policy documents, and academic literature, as well as by maintaining an analytical audit trail that documents key interpretive decisions. Nonetheless, the study acknowledges that its reliance on secondary and documentary data limits access to operational details and frontline perspectives; consequently, the findings are interpretive and analytical rather than statistically generalizable.

## RESULTS AND DISCUSSION

The analysis shows that autogate implementation in Indonesia emerged as a policy response to growing passenger volumes, the demand for more efficient immigration inspection, and the imperative to enhance border security through digital technologies. Comparable global discussions on "smart borders" and automated border control similarly frame e-gates as a capacity response to mobility pressures while pursuing stronger control functions[20]. Initially piloted at Soekarno–Hatta International Airport around 2014 for Indonesian e-passport holders, the system has gradually been extended to other airports and, in certain phases, to selected categories of foreign nationals, with reported benefits in processing efficiency alongside persistent operational constraints[21]. The

[19] Edwards, *Implementing Public Policy* (Congressional Quarterly Press, 1980); Heeks, *Most E-Government-for-Development Projects Fail: How Can Risks Be Reduced?* (Institute for Development Policy and Management, University of Manchester, 2003); Linkov et al., "Resilience Metrics for Cyber Systems," 2013.

[20] Yang et al., "基于文献计量的智慧边境研究进展与展望"; Singler, *Performativity, Pragmatism and Border Control Technologies: Democratising the Ontologies of Border Criminology*, 2023.

[21] Nursanto et al., "Enhancing Public Wellbeing Through Autogate at Soekarno-Hatta International Airports," 2024.

program is grounded in Law No. 6/2011 on Immigration and aligned with public service modernization mandates reflected in Law No. 25/2009 on Public Service[22].

The implementation is shaped by a constellation of actors whose roles are complementary yet potentially conflictual, consistent with the wider governance challenge of coordinating border control technologies across institutional boundaries[23]. The Directorate General of Immigration designs the technical policy, procures and maintains the autogate system, develops standard operating procedures, and coordinates with external agencies. Airport operators provide physical infrastructure and manage terminal flows; meanwhile, cybersecurity and communications authorities shape requirements for information security and data governance. Such multi-actor environments are frequently identified as a risk factor for fragmented accountability and uneven operational performance in digital border systems[24].

From a resilience perspective, the autogate system generates both strengths and weaknesses for immigration governance. On the positive side, evaluations and operational accounts indicate that autogate can shorten processing time compared to manual inspection and standardize checks through biometric verification, which aligns with broader findings that automated border control can enhance throughput and procedural consistency[25]. At the same time, a consistent theme in the literature is that automation changes the "control ecology" of the border: it improves traceability and consistency, but also reshapes discretion and the practical detection of anomalies[26].

However, the same digital infrastructure introduces vulnerabilities. Automated border control is sensitive to network connectivity, software stability, and hardware reliability; when disruptions occur, systems may revert abruptly to manual processing, generating congestion and operational stress[27]. Technical and biometric errors particularly false rejections are widely documented challenges in automated border control, including in facial recognition deployments at e-gates, with implications for user trust and operational continuity[28]. This also raises a governance and ethics dimension: scholars note that digital border controls can amplify risks to non-discrimination, liberty, and equality when error-handling, oversight, and accountability mechanisms are weak[29].

A further risk is over-reliance on automation that may marginalize manual judgement and *human-in-the-loop* profiling practices. While the autogate strengthens standardized verification, critical border criminology and ethics-focused work emphasizes that border technologies are not neutral tools; they reconfigure practices, incentives, and power relations, and can create new "blind spots" if organizational learning and risk-based oversight are not strengthened in parallel[30].

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[22] Undang-Undang Republik Indonesia Nomor 25 Tahun 2009 Tentang Pelayanan Publik, 2009; Undang-Undang Republik Indonesia Nomor 6 Tahun 2011 Tentang Keimigrasian (2011).

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[25] Nursanto et al., "Enhancing Public Wellbeing Through Autogate at Soekarno-Hatta International Airports," 2024; del Rio, "Automated Border Control E-Gates and Facial Recognition – Risks and Opportunities."

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[27] Thenuwara et al., "A Multi-Agent Based Enhancement for Multimodal Biometric System at Border Control," 2022.

[28] del Rio, "Automated Border Control E-Gates and Facial Recognition – Risks and Opportunities"; Thenuwara et al., "A Multi-Agent Based Enhancement for Multimodal Biometric System at Border Control," 2022.

[29] Saunders, *Security, Digital Border Technologies, and Immigration Admissions: Challenges of and to Non-Discrimination, Liberty and Equality*, 2025; Saunders and Sager, *Symposium Introduction: The Ethics of Border Controls in a Digital Age*, 2023.

[30] Singler, *Performativity, Pragmatism and Border Control Technologies: Democratising the Ontologies of Border Criminology*, 2023; Singler and Babalola, *Digital Colonialism Beyond Surveillance Capitalism? Coloniality of Knowledge in Nigeria's Emerging Privacy Rights Legislation and Border Surveillance Practices*, 2025.

A more granular assessment using the confidentiality, integrity, availability (CIA) triad further highlights systemic risks. Autogate processes highly sensitive biometric and biographic information, and comparative work on digital border technologies emphasizes the importance of strong safeguards, auditability, and accountability mechanisms to prevent misuse or unauthorized access, especially as systems scale and interoperate across agencies[31]. Where integrity depends on accurate and synchronized records, the literature stresses the need for robust identity management, multi-factor checks, and resilient interoperability to prevent false matches, missed alerts, or inconsistent decisions under peak loads or during disruptions[32]. Finally, availability is undermined when systems lack redundancy and resilient recovery pathways an issue that becomes more salient under crisis conditions, as shown by broader evidence on border control measures and institutional strain during the COVID-19 era[33].

Overall, the results suggest that Indonesia's autogate policy has produced meaningful improvements in service efficiency and procedural standardization, consistent with global automated border control trajectories[34]. Yet these gains can be offset by persistent vulnerabilities in reliability, biometric accuracy, governance fragmentation, and the broader accountability and rights-sensitive dimensions of digital border controls[35]. Strengthening immigration system resilience, therefore, requires not only technical upgrades but also clearer cross-sector governance, robust data/security controls, and an operational model that integrates automation with risk-based oversight and institutional learning[36].

## CONCLUSION

This study set out to move the discussion of Indonesia's autogate policy beyond a narrow focus on service efficiency, situating it instead within a broader framework of immigration system resilience. By combining policy implementation theory, e-government perspectives on the design reality gap, system resilience thinking, and information security (CIA triad), the analysis shows that autogate has indeed delivered tangible benefits in terms of faster processing times, enhanced traceability through digital logs, and stronger internal control mechanisms at major international airports. These gains support the narrative of bureaucratic reform and digital public service modernization promoted by the Ministry of Law and Human Rights and the Directorate General of Immigration.

At the same time, the findings reveal persistent implementation constraints that limit autogate's contribution to immigration system resilience. Using Edwards III's framework, the study identifies shortcomings in policy communication, uneven resource capacity (especially specialized IT support at site level), ambivalent implementer disposition, and fragmented bureaucratic structures that distribute responsibilities across multiple agencies without a clear integrator. These factors help

[31] Saunders, *Security, Digital Border Technologies, and Immigration Admissions: Challenges of and to Non-Discrimination, Liberty and Equality*, 2025; Saunders and Sager, *Symposium Introduction: The Ethics of Border Controls in a Digital Age*, 2023.

[32] Thenuwara et al., "A Multi-Agent Based Enhancement for Multimodal Biometric System at Border Control," 2022.

[33] Grépin et al., "Effectiveness of International Border Control Measures during the COVID-19 Pandemic: A Narrative Synthesis of Published Systematic Reviews," 2023; Seyfi et al., "COVID-19 and International Travel Restrictions: The Geopolitics of Health and Tourism," 2023.

[34] Nursanto et al., "Enhancing Public Wellbeing Through Autogate at Soekarno-Hatta International Airports," 2024; del Rio, "Automated Border Control E-Gates and Facial Recognition – Risks and Opportunities."

[35] Saunders, *Security, Digital Border Technologies, and Immigration Admissions: Challenges of and to Non-Discrimination, Liberty and Equality*, 2025; Saunders and Sager, *Symposium Introduction: The Ethics of Border Controls in a Digital Age*, 2023.

[36] Singler, *Performativity, Pragmatism and Border Control Technologies: Democratising the Ontologies of Border Criminology*, 2023.

explain recurrent system downtime, inconsistent handling of technical failures and exceptional cases, and difficulties in maintaining up-to-date, high-quality data across interconnected systems.

From a resilience perspective, autogate emerges as a double-edged innovation. On one side, automated biometric checks, digital logging, and more standardized procedures strengthen certain aspects of security, accountability, and service reliability. On the other, heavy dependence on network connectivity, software stability, and electricity, coupled with biometric reading errors and suboptimal integration with intelligence and watch-list systems, introduces new vulnerabilities. Over-reliance on automation also risks marginalizing manual profiling and professional judgement, potentially creating "blind spots" in border surveillance, particularly in a context where identity management is challenged by common names and overlapping biographic profiles.

These implementation and resilience issues are closely linked to structural governance problems. Autogate sits at the intersection of immigration, aviation, cybersecurity, and data protection, yet institutional arrangements remain fragmented, with overlapping mandates and limited local ownership among front-line actors. This fragmentation reinforces the design–reality gap: policy narratives emphasize digital modernization and headline efficiency, while risk analysis, long-term sustainability, and alignment with institutional capacity receive less attention. Unless these governance deficits are addressed, autogate will struggle to evolve from a symbolic marker of digital progress into a robust pillar of immigration system resilience.

In light of these findings, the study recommends a shift from a purely technology-centric approach towards a resilience-oriented model of digital immigration governance. This entails clarifying mandates and accountability across agencies; strengthening cross-sector coordination and data governance; investing in human resources, especially at the front line and IT support levels; and embedding risk-based thinking into the design, operation, and evaluation of autogate systems. Future research should complement this documentary analysis with fieldwork, including interviews and observations at immigration checkpoints and airport authorities, to capture front-line experiences, user perceptions, and informal coping strategies during disruptions. Such work would help refine the resilience framework and provide more actionable guidance for integrating automated border control technologies into a coherent, adaptive, and rights-sensitive immigration system for Indonesia.

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