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Algorithmic Border Control and Biometric Immigration Governance: A Bibliometric Mapping of Scholarly Literature

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ABSTRACT

Immigration management increasingly relies on biometric identity verification, algorithmically assisted assessment, and interconnected information systems. Although these technologies are widely discussed, their institutional implications remain distributed across migration studies, public administration, political geography, information systems, and legal scholarship. This article maps the development and conceptual configuration of research on algorithmic border control and biometric immigration governance through a bounded bibliometric-informed review. A deliberately selected corpus of 46 identifiable journal articles was assembled from publisher records and DOI-bearing bibliographies available through 5 November 2026. Publication-year frequencies and a manually coded two-label conceptual co-assignment network were examined alongside qualitative synthesis. The review identifies recurring linkages among identity, rights, governance, digital infrastructure, surveillance, asylum, and algorithmic decision support. Across the selected studies, technical identification and administrative efficiency are repeatedly connected to disputes about data quality, institutional responsibility, proportionality, and effective opportunities for review. The analysis further indicates that interoperability cannot be assessed solely by information-sharing capacity, because erroneous or contested records may be circulated across agencies. A governance agenda is proposed around identity assurance, accountable automated assessment, lawful data exchange, procedural remedies, and implementation capacity. Because the sample is purposive, the findings do not estimate global publication totals, citation impact, or VOSviewer-derived keyword clusters. The article contributes a transparent conceptual map and a set of empirically testable questions for immigration policy and public administration research.

Keyword: Algorithmic Borders; Biometric Identification; Immigration Governance; Bibliometric Mapping

INTRODUCTION

Immigration administration has become increasingly dependent on informational infrastructures that connect encounters at checkpoints to decisions

taken in consulates, asylum offices, police units, and institutions responsible for public services. Traditional questions about where a territorial border is located are consequently complemented by questions about how a person becomes legible to an administrative system, which pieces of information are treated as authoritative, and how a record travels between agencies. Fingerprint matching, facial recognition, automated identity resolution, digital travel documents, and algorithmically assisted assessment are not equivalent technologies. Nevertheless, each can influence who is recognised as eligible to enter, remain, work, request protection, or receive a service. Their significance therefore extends beyond technical convenience to the everyday organisation of authority in immigration governance.

The emergence of digital borders changes the relationship between physical crossing and administrative permission. Decisions may begin before departure through a visa platform, continue during transportation through passenger information exchanges, and remain consequential after arrival through electronic residence verification. A digitally mediated status check may produce a momentary decision from distributed records rather than merely retrieve an unchanging administrative label. This distinction is important because data correction, interagency access, and temporary database malfunction can affect the practical exercise of a right even when the formal legal status of an individual has not changed. Research on immigration status systems illustrates why apparently routine software transactions warrant independent examination as governmental acts (Jablonowski, 2025).

Biometric identification has often been presented as an answer to uncertainty about names, documents, or identity continuity. Yet its institutional value depends on much more than a successful scan. Data need to be captured under difficult conditions, linked to a correctly defined person, stored securely, interpreted within lawful procedures, and corrected when records conflict. Decisions based on biometric data may be particularly consequential for people whose documents are missing, whose travel histories are fragmented, or whose legal position is disputed. The relevant policy issue is not whether biometrics are inherently beneficial or harmful, but whether the entire identification process satisfies standards of reliability, proportionality, contestability, and public accountability (Beduschi, 2019; Vecellio Segate, 2024).

Artificial intelligence introduces a further layer of administrative complexity. Algorithmic applications can help prioritise cases, flag inconsistencies, compare images, estimate patterns, or support fraud detection; however, their output is conditioned by the training environment and by the institutional purposes embedded in the system design. When predictions are converted into action, it may become difficult to locate responsibility among programmers, contracting firms, supervisory agencies, and front-line officers. The literature increasingly distinguishes the capacity to process data at scale from the separate obligation to explain and justify coercive or exclusionary decisions. This distinction becomes especially important when affected persons have limited opportunities to challenge underlying information (Beduschi, 2021; Molnar, 2019).

Immigration governance is not reducible to the border police. Protection authorities, education offices, local government, humanitarian organisations, employers, and health providers can also participate in the production or exchange of information used to establish migration status. A policy intended to deliver a service efficiently may become a channel for immigration surveillance if systems are connected without safeguards that preserve the original purpose of data

collection. The same person may be represented simultaneously as a traveller, an asylum applicant, a service user, and a potential enforcement target. A governance analysis therefore requires attention to purpose limitation, institutional role boundaries, and the social effects of data sharing (Humphris et al., 2025).

The research conversation has expanded beyond the early language of smart borders to more differentiated questions of datafication, algorithmic power, humanitarian identity, and the practical construction of database accuracy. Security-centred studies may examine information processing and decision speed, while critical border research addresses agency, discrimination, and the consequences of being made continuously traceable. Work on refugee support places identification within a different institutional setting, where inclusion in a database may enable assistance but also produce enduring exposure to surveillance. These perspectives overlap empirically even when they employ different vocabularies and methods, creating a strong rationale for mapping the structure of the literature rather than relying on isolated exemplary articles (Madianou, 2019; Weitzberg et al., 2021). A recent synthesis emphasises that a focus on the operation and consequences of digital systems is more informative than treating technology as an unexplained black box (Godin et al., 2025; Witteborn, 2022).

Existing scholarship offers several related but not identical syntheses. A review of migration governance conceptualisation places sovereignty, security, and migrant rights along a contested continuum. Another bibliometric study maps a much wider intersection of digital technologies and migration, including digital inclusion, communication, labour platforms, and electronic government. The narrower question of algorithmic border control and biometric immigration governance deserves separate attention because border enforcement systems join technological classifications to the legal power to admit, reject, register, remove, or restrict. A focused corpus can make those combinations visible without claiming to represent the entire universe of digital migration scholarship (Collrin & Bauder, 2025; Pak Güre, 2026).

This study defines algorithmic border control as the deployment of rule-based or statistical computational processes that materially inform mobility screening, identity verification, risk assessment, or immigration adjudication. Biometric immigration governance refers to the institutions, rules, procedures, and power relations involved in collecting and using bodily identifiers for immigration-related purposes. The two domains intersect but are not interchangeable. Some biometric systems employ simple matching processes rather than contemporary machine learning, while algorithmic governance can operate entirely on biographical or behavioural data. Keeping the concepts analytically distinct prevents the common mistake of treating every digitised administrative process as artificial intelligence.

Three questions guide the article. The first asks how publications in a transparently assembled set of relevant journal articles are distributed over time. The second asks which conceptual terms appear repeatedly in the curated corpus and how these terms are linked by shared classification. The third examines what the thematic distribution implies for future research on institutional accountability, data protection, and immigration services. The purpose is to develop a defensible picture of a selected intellectual conversation and to propose a research agenda appropriate for public administration and governance studies, rather than to claim statistical coverage of all database-indexed publications.

A bibliometric approach is suitable for identifying the visible characteristics of a document set, but its inferences are dependent on how that set was constructed. Performance analysis can summarise years and publication outlets, while conceptual mapping can show the relationships produced by a consistent coding rule. Neither method automatically establishes policy effectiveness, validates a technological claim, or measures the treatment of actual migrants. For those questions, publication metadata must be supplemented with substantive interpretation and field-level evidence. The distinction between quantitative description and interpretive synthesis is therefore a central design principle of the study (Donthu et al., 2021; Zupic & Čater, 2015).

The contribution is threefold. Conceptually, the article differentiates identification, surveillance, algorithmic assessment, and institutional governance rather than compressing them into a single account of digitalisation. Methodologically, it demonstrates how a bounded, DOI-verifiable corpus can support descriptive bibliometric mapping when direct database exports are unavailable, provided that its limitations are made explicit. Practically, it translates academic themes into questions that an immigration administration can ask when procuring, connecting, evaluating, or auditing digital systems. These include who can access records, how incorrect matches are corrected, what is communicated to affected individuals, and whether human review can alter an automated recommendation. The question of digital mediation also links the specific immigration literature to scholarship on digital migrants and the broader intellectual organisation of migration studies (Collins, 2023; Pisarevskaya et al., 2020).

The analysis also adopts a geographically cautious perspective. A large share of the influential literature examines European border infrastructures or asylum processes in wealthier destination states. Such concentration provides insight into mature administrative systems but does not automatically describe the institutional conditions of archipelagic states, transit countries, or regions with different legal and fiscal capacities. For Indonesia, the relevance lies primarily in transferable governance questions—interagency interoperability, identity assurance, oversight, and fair service delivery—rather than assumptions that European technical or legal arrangements should simply be copied. Comparative studies must first establish the applicable authorities, implementation settings, and rights protections.

RESEARCH METHOD

The study uses a bounded bibliometric-informed literature mapping design supplemented by interpretive thematic synthesis. Its units of analysis are published journal articles that directly address digital migration governance, biometric identification, border surveillance, algorithmic immigration or asylum decision-making, or closely connected questions of data justice. A purposively assembled corpus was checked against publisher landing pages, recognised journal records, and DOI-bearing bibliographic information available through 5 November 2026. The dataset is intended to be inspectable rather than presented as a census. It does not derive from a downloaded Scopus or Web of Science export, and no claim is made that VOSviewer processed source-level keyword or citation files.

Publication details were transcribed into a structured record with the fields author, year, title, journal, persistent identifier where available, and two primary concept labels. Sources were included when a journal publication could be

identified and its subject connected to the research questions. Methodological publications were retained separately in the bibliography to explain science-mapping choices; they were not counted as immigration research observations. A small number of older articles were retained because they define the conceptual history of biometric borders. This explicit separation between focal documents and methodological references prevents inflation of the yearly distribution and avoids making the field appear more productive simply because it cites its analytical tools.

The literature identification was targeted, not exhaustive. Publisher searches, the reference lists of recent reviews, and checks of specialised journal issues were used to assemble the working bibliography. Search expressions combined immigration, migration management, border control, asylum, biometrics, artificial intelligence, algorithm, datafication, surveillance, interoperability, and digital identity. The terms were applied in varying combinations to locate relevant substantive studies, after which bibliographic details were checked manually. As there is no preserved full search log covering every retrieval attempt and rejected search result, the total number initially encountered is not estimable. Reporting an invented PRISMA identification or exclusion count would misrepresent the evidence (Page et al., 2021).

Table 1. Research focus using an adapted PICOC framework

Component	Operational scope
Population	Peer-reviewed scholarship on immigration, asylum, border control, and migration administration
Intervention	Algorithmic assessment, biometric identity, digital surveillance, and interoperable data systems
Comparison	Comparisons across technologies, institutional settings, jurisdictions, and governance perspectives
Outcome	Publication-year patterns, coded conceptual proximity, and governance-oriented knowledge gaps
Context	International research literature available through 5 November 2026, with a bounded selected corpus

Source: Authors' analytical specification, 2026.

Table 1 clarifies that the study maps scholarly treatment of technologies rather than estimating the operational effectiveness of any specific immigration system. The population is academic publications, not border crossings, travellers, countries, or government agencies. The intervention entry groups technologies because the literature frequently examines them as connected infrastructures, but the coding process preserves distinctions among algorithmic assessment, biometric identity, and institutional information exchange. The outcome is therefore a structured description of a knowledge domain and the problems researchers identify in it. This configuration also explains why conventional causal comparison is not the primary objective of the study.

The context component establishes a temporal boundary and an important inferential limit. A paper published after the stated cut-off cannot be included, while older papers may remain analytically useful when they introduce concepts still used in current debates. The framework further permits studies of refugee assistance or internal service delivery when digital identity practices are directly linked to immigration governance. It does not, however, justify including every article about social media use by migrants or every technical paper about generic facial recognition. Such exclusions are conceptually necessary if the mapping is to

illuminate immigration authority rather than drift into an unrestricted account of digital society.

Table 2. Transparent Corpus Construction and Coding Rules

Stage	Procedure	Interpretive safeguard
Identification	Targeted journal searches and DOI-bearing reference checks	No unlogged records are assigned invented counts
Relevance screening	Read titles and available abstracts for links to immigration governance	Broader digital-migration studies are included only when directly informative
Eligibility	Retain identifiable peer-reviewed journal research	Books, reports, and news are not included in focal frequency counts
Extraction	Record author, year, title, venue, DOI, and two theme labels	References are distinct from bibliometric performance data
Mapping	Count records by year; construct title-informed co-label links	Networks are author-coded proxies, not a VOSviewer co-word export
Synthesis	Interpret substantive implications for public administration	Descriptive frequencies do not establish real-world policy effects

Source: Research protocol and manually audited article list, 2026.

Table 2 makes the operational basis of the mapping explicit. The recorded focal set is a selection of published articles assembled for a focused examination of the topic; it is not an estimate of all records that a comprehensive database search would retrieve. Each included paper receives exactly two concept labels, drawn from a fixed coding dictionary. This rule standardises the construction of the thematic map and makes the counting procedure reproducible from the metadata compiled for the document. It also simplifies some complex articles: a paper concerned with identity and rights may simultaneously discuss infrastructure, surveillance, and governance, but its two labels represent principal emphases rather than every possible topic.

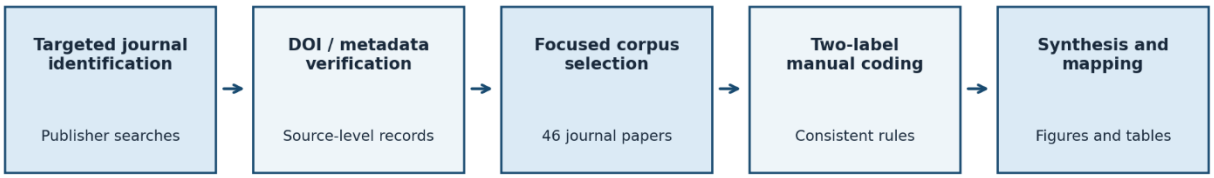


Figure 1. Auditable stages of the bounded bibliometric-informed review
Source: Authors' research workflow, 2026

The coding convention was selected to reduce arbitrary network density in a small corpus. Concepts are assigned after reading the paper title and the available description, rather than generated by counting every occurrence of a word in an abstract. The resulting network therefore indicates co-assignment by the authors of this manuscript, not the literal co-occurrence of author-supplied

keywords, bibliographic coupling, or co-citation relationships. Any future study that obtains a full indexed export should analyse the actual author-keyword fields and reference lists using dedicated mapping software. That more comprehensive work may produce different clusters and must not be presumed identical to the present visualisation.

Figure 1 depicts five stages: locating relevant journal articles, checking publisher or DOI records, defining the eligible focused dataset, assigning consistent metadata and conceptual labels, and producing descriptive maps with interpretive synthesis. This sequence is deliberately different from a standard PRISMA chart containing numerical counts for every excluded record. The documented process does not preserve every unsuccessful search and every rejection decision, so such totals cannot be recovered responsibly. What the figure can establish is the decision logic through which the present corpus becomes a bounded object of analysis. Its reproducibility depends on making that object available rather than on claiming undocumented search completeness.

The final stage integrates two complementary forms of evidence. Descriptive mapping answers questions about the selected papers themselves, such as their dates and assigned topic distribution. Interpretive synthesis addresses the institutional claims and unresolved questions raised in those papers, including the tension between administrative assurance and procedural justice. In an extended project, an independently repeated systematic search could be preregistered, with an auditable query history, deduplication log, double screening, database export, and sensitivity tests across citation indexes. Those steps are recommended as a next phase and are not presented here as having already occurred.

For each focal journal article, the publication year is treated as the final journal-year designation when available, rather than necessarily the first online publication date. This is important for articles whose DOI contains the year of acceptance or online publication even though the issue is assigned to a later year. The displayed frequencies therefore describe the stated bibliography using one consistent convention, not the timing of web publication. No citation count, h-index, citation burst, institutional ranking, collaboration score, or total-link-strength metric is calculated because the required full, source-level bibliographic export was not retrieved. Such indicators would otherwise invite unsupported precision.

The visual network is derived from a small concept-pair matrix. Each article is assigned a pair of labels, and one undirected edge is added between those labels. Node size represents the number of focal papers carrying a label, while edge thickness denotes the number of shared label assignments. The two labels are selected from an internally consistent vocabulary covering identity, digitalisation, rights, governance, surveillance, algorithmic systems, asylum, infrastructure, services, and broader migration. This approach does not infer causality and cannot distinguish positive from negative evaluation of a technology. It is used only as a compact representation of conceptual adjacency within the selected materials.

Quality was assessed at the metadata level by ensuring that the publications could be identified and that their titles were not duplicated in the focal set. The analysis does not use a numerical quality score to rank substantive findings, because qualitative field studies, legal analysis, conceptual argument, and bibliometric reviews require different standards of appraisal. A transparent quality statement is more informative than assigning every article an identical

'Yes' score to questions about publication existence or affiliation. To support future verification, references include persistent DOI links wherever these were available in the records examined. For one specialised review lacking a confidently resolved DOI in the working metadata, the journal and issue information is retained without inventing one. This choice also acknowledges the difference between a bounded scoping exercise and a formally exhaustive systematic review (Munn et al., 2018).

RESULTS AND DISCUSSION

1. Publication Distribution and the Boundaries of Bibliometric Inference

The curated thematic corpus comprises 46 journal articles. This is a count of the selected papers described in the methods, not the output of an unrestricted Scopus or Web of Science search. Its earliest articles provide conceptual background on digital and biometric borders, while the most recent studies are associated with contemporary questions of algorithmic adjudication, data quality, and interoperable status checks. The corpus includes research from migration studies, political geography, international political sociology, information systems, data studies, public management, and law. This disciplinary breadth is important because the same institutional object can be conceptualised as a surveillance infrastructure, an administrative decision process, a technological assemblage, or a problem of rights and accountability.

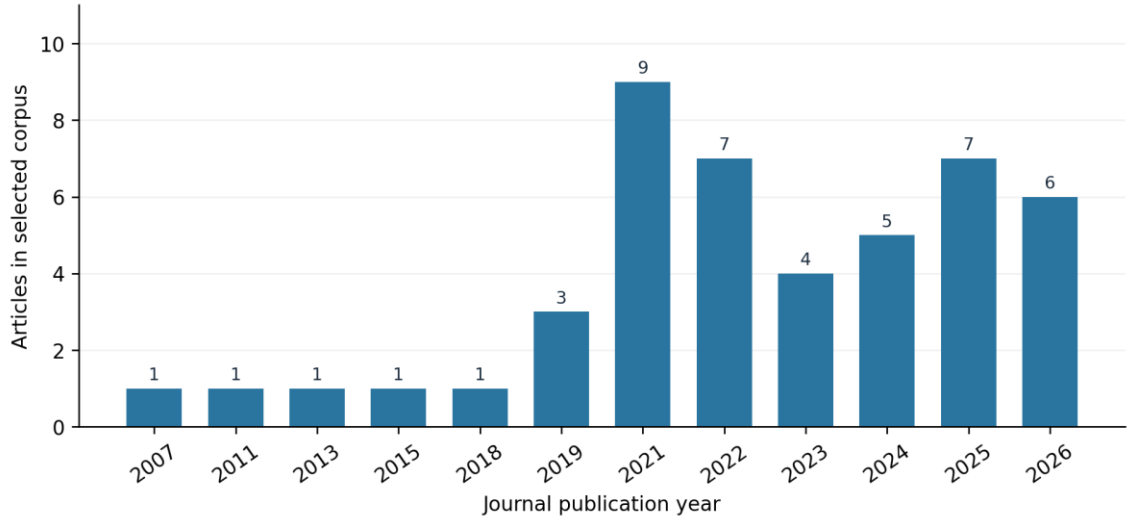


Figure 2. Publication years represented in the selected thematic corpus
Source: Authors' coding of 46 selected journal articles, 2026

Figure 2 shows the number of papers from each journal publication year in the assembled dataset. Its distribution reflects both the substantive development of the research conversation and the selection strategy, which deliberately foregrounded contemporary studies while retaining a small number of earlier conceptual works. The taller bars in recent years should therefore be interpreted as evidence of the composition of this corpus, not as independently verified growth rates for the whole international field. The plot is nonetheless useful for making the temporal orientation of the document set explicit and for preventing an unexamined assumption that every bibliometric study must begin with an exhaustive citation index.

The publication-year pattern also creates a methodological warning. A review that concentrates on one recent special issue, for example, may show a conspicuous peak even if overall scholarly production across the field remained

stable. Likewise, a study conducted late in a calendar year does not necessarily contain every article formally dated to that year, and online-first articles may later be assigned a different issue year. For a genuinely longitudinal interpretation, future work should run the same search equation against a fixed database, preserve its export date, examine indexing delays, and repeat the analysis using consistent document types. The present figure is transparent about its narrower function.

At the earlier end of the set, research treated the border as a distributed network of surveillance practices rather than a simple line on a map. Work on European databases associated irregular migration controls with new forms of identification and remote monitoring, while studies of pre-emptive mobility governance examined the administrative ambition to coordinate information before a person physically crossed a frontier. These contributions remain relevant because present-day discussions of interoperable identity records continue to revisit the same questions about legibility, anticipation, and differentiated mobility, even though new software changes the speed and scale of the processes (Broeders, 2007; Broeders & Hampshire, 2013). Historical analyses of securitised biometric borders and the changing meaning of smart-border technology reinforce the value of examining continuity as well as recent software innovation (Muller, 2011; Pfeifer & Seuferling, 2026).

The next phase of the conversation broadened the conceptual vocabulary. Some papers linked borders to the digital infrastructures that migrants themselves use in planning journeys and negotiating uncertainty. Others examined how the politics of identification is inseparable from the conditions of displacement, where an identity record can allow someone to obtain services while simultaneously fixing a category that limits movement. These concerns complicate a simple distinction between state technology and migrant technology: the same communication environment may enable information exchange for individuals and extend the visibility of their movements to institutions. The literature therefore calls for careful specification of whose interests each platform serves (Latonero & Kift, 2018; Nedelcu & Soysüren, 2022). Studies of biometric bordering and digital–nondigital assemblages further show that migrants negotiate technologies whose practical operation combines electronic and paper-based procedures (Metcalfe, 2022; Canzutti & Tazzioli, 2023).

The recent publications develop a stronger interest in the everyday work performed by information systems. Instead of assuming that digital data are immediately reliable, researchers ask how imperfect records are corrected, how front-line users handle contradictions, and how bureaucratic discretion interacts with software-generated representations. These questions are especially pertinent in asylum settings, where the evidentiary status of personal-device contents or biometric matching is often disputed. A digital record becomes authoritative through organisational decisions as well as computational processes; the research challenge is to document how those decisions occur and who may contest them (Argyriou & Leese, 2026; Dekker et al., 2026).

2. Thematic Terms and Co-Assignment Patterns

The coding procedure assigns two primary concept labels to each article. Identity captures work on biometrics, verification, citizenship status, and registration. Digitalisation denotes the reshaping of mobility through information platforms and digitally mediated infrastructures. Rights includes privacy, discrimination, due process, agency, data justice, and participation. Governance

covers institutional authority, coordination, policy implementation, and administrative rationalities. Other labels specify surveillance, algorithmic assessment, asylum procedures, infrastructure, services, and migration as broader objects of inquiry. These categories are an interpretive framework designed for this article; they are not presented as keywords automatically harvested from commercial indexing databases.

Table 3. Author-Coded Thematic Labels in The Selected Corpus

Concept Label	Assigned Articles	Share of Corpus (%)
Identity	19	41.3
Rights	19	41.3
Governance	15	32.6
Digital	14	30.4
Surveillance	7	15.2
Algorithm	6	13.0
Asylum	5	10.9
Infrastructure	4	8.7
Service	2	4.3
Migration	1	2.2

Source: Two author-assigned labels per study (n = 46), 2026

Table 3 displays the frequency with which each label was assigned to focal publications. Because every article receives two labels, adding the frequency values yields twice the number of articles, and adding percentages yields approximately two hundred per cent. The table must therefore not be interpreted as a mutually exclusive classification of studies. Its strength is that it shows the topics that appear as principal concerns in the bounded set. Identity-related and rights-oriented work is prominent because the selected literature includes studies of fingerprinting, remote identity proofing, humanitarian identification, data justice, and the bureaucratic consequences of an incorrect or contested record.

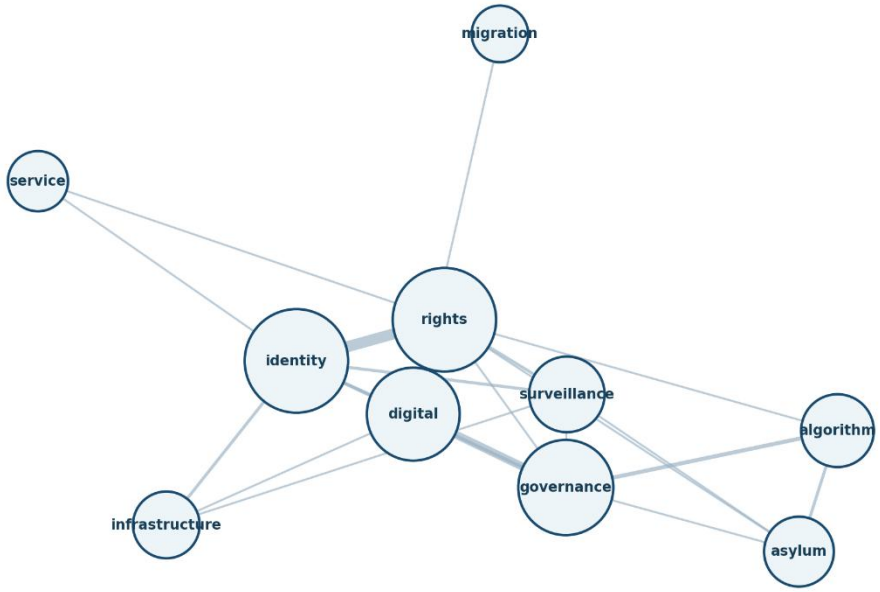


Figure 3. Concept Co-Assignment Network from a Manually Coded Article Set
Source: Authors' concept-pair matrix from 46 journal articles, 2026

The apparent balance among themes should also be read in relation to coding decisions. A study classified under algorithm and asylum might discuss surveillance extensively, while a paper labelled identity and rights might also concern administrative interoperability. A more exhaustive mapping based on authors' keywords, abstracts, controlled index terms, and full-text topic modelling could portray different relative emphases. For the present study, consistency is preferred to an elaborate but unverifiable statistical appearance. The categories provide a practical map for organising substantive discussion, not a claim to have discovered natural or universally stable clusters in migration scholarship.

Figure 3 presents a network in which each node is one of the predefined thematic labels and each connection represents at least one paper jointly assigned to the corresponding concepts. Larger nodes indicate labels that appear in more articles, while stronger edges indicate more repeated conceptual pairing. This graph makes the study's coding decisions visible and permits inspection of which subjects have been treated together. In contrast to a standard VOSviewer map derived from bibliographic metadata, the present coordinates do not encode total-link-strength values, citation relationships, scholarly collaboration, or bibliographic coupling. They represent a limited and transparent conceptual graph constructed from the documented article list.

The substantive message of the graph lies in the connections across familiar disciplinary divisions. Research on biometrics often moves from identification procedures to questions of rights. Work on algorithmic screening connects technical promises to asylum determination and the governance of discretion. Research on digital infrastructures links border enforcement to institutional coordination and the politics of data sharing. These connections suggest that future studies should resist treating accuracy, administrative efficiency, and fairness as independent questions. A technically accurate biometric match may still be used for a purpose that lacks legal authority, while a procedurally defensible decision can be undermined by unreliable identification data.

The literature provides an important caution against treating network centrality as normative priority. A large node can indicate a frequently coded concern without demonstrating that it receives adequate empirical treatment. A relatively small label may refer to a policy question that is crucial but underdeveloped, such as the ability of a person to correct an inaccurate record in real time. Similarly, an edge connecting surveillance and rights indicates conceptual association, not evidence that a surveillance system protects or violates rights. Direction, mechanisms, and consequences require close reading of the respective studies and additional empirical research.

3. Biometric Identification and the Construction of Administrative Identity

Biometric systems promise continuity of identification across names, languages, documents, and administrative settings. In immigration administration, however, continuity is achieved by combining biological measurements with enrolment rules, database identifiers, matching thresholds, and agency procedures. The apparently stable digital identity is therefore an institutional accomplishment that can be compromised by poor enrolment, changing legal status, mistaken linkage, or an inaccessible correction channel. Research on digital identity in humanitarian settings shows that inclusion and recognition can be intertwined with surveillance, and that an effective identity system cannot be judged solely by its capacity to register people (Madon & Schoemaker, 2021; Martin & Taylor, 2021). Arguments about data justice and the

translation of persons into machine-readable records offer complementary perspectives on these procedural vulnerabilities (Masiero & Bailur, 2021; Scheel, 2023).

The practical conditions under which bodily identifiers are collected deserve closer attention than is often found in policy proposals. A traveller may have worn fingerprints, a person rescued at sea may be injured or exhausted, and a refugee may encounter an officer without an interpreter or adequate explanation. These situations can affect data capture, informed participation, and the interpretation of system warnings. When a database treats its measurement as definitive, differences between a living body and a standardised biometric template may become bureaucratic errors attributed to the individual. The administrative challenge is to preserve a pathway for human assessment without allowing discretionary exceptions to become arbitrary or discriminatory.

Institutional interoperability creates both benefits and risks. A shared infrastructure can reduce repeated enrolment, help resolve conflicting identifiers, and support coordination among authorised offices. At the same time, broad connections among databases may encourage secondary uses of personal information that were not apparent when the data were originally collected. Research on European identification infrastructures shows that interoperability changes the administrative construction of identity itself, replacing relatively separate records with increasingly connected mechanisms of verification and cross-checking. Governance must therefore specify the legal basis, access control, audit trail, retention schedule, and remediation responsibilities across every institution that participates in an identity exchange (Leese, 2022).

The distinction between registration and recognition matters especially for populations whose relationship with the state is unsettled. Biometric collection may verify that a person has been encountered previously without establishing citizenship, lawful residence, family connection, or eligibility for protection. It can also entrench a disputed category when different authorities treat one historical record as conclusive evidence. Research from humanitarian and displacement contexts illustrates how digital identity systems can create new dependencies and exclusions if their classification rules are poorly aligned with lived social and legal realities. The appropriate governance unit is consequently the complete decision pathway, not merely the scanner or database (Schoemaker et al., 2021; Weitzberg, 2025).

An accountable identity system should provide multiple layers of assurance. Technical validation addresses false positives, false negatives, cybersecurity, and service reliability. Administrative validation examines who collected the record, under what authority, and whether procedural safeguards were respected. Legal validation considers proportionality, purpose limitation, and rights to information or correction. Social validation asks whether a person can actually use the system under circumstances of disability, displacement, language barriers, or limited digital access. When these layers are examined together, the research agenda moves from the narrow promise of frictionless border processing toward the reliability and legitimacy of immigration decisions.

4. Algorithmic Assessment, Asylum, and Administrative Discretion

Algorithmic decision support in immigration governance spans heterogeneous practices. Some applications perform relatively narrow document classification or identity matching, while others produce probability scores, risk flags, or recommendations that may shape officer attention and case prioritisation.

The legal consequences depend on how the output is used, rather than solely on whether the underlying method is labelled artificial intelligence. A recommendation that an officer routinely accepts can be functionally decisive even if formal responsibility remains with a human decision-maker. Research on migration-related AI therefore emphasises the need to investigate operational integration and the practical meaning of human oversight (Bircan & Korkmaz, 2021; Nalbandian, 2022). A specialised review of generative AI and migration control likewise identifies the importance of examining which uses of machine learning are actually embedded in operational procedures (Monteza-Urcia et al., 2025).

Asylum procedures present particularly high stakes because the interpretation of evidence may affect international protection, detention, transfer, or removal. Digital evidence extracted from a personal device can appear to offer objective information about location, identity, or travel history, yet it is never complete by default. Devices may be shared, content may have multiple explanations, and the absence of a record is not necessarily evidence that an event did not occur. Scholars have examined how the introduction of smartphone extraction becomes politically and administratively acceptable through security narratives and technological promises, even when fundamental questions about proportionality and evidentiary reliability persist (Josipovic, 2024; Scheel, 2024).

The governance of algorithmic evidence requires attention to three distinct points at which error can enter. The first is input selection: some observations, languages, identities, or contexts may be omitted or misrepresented in the data. The second is computation: a model may be calibrated to an inappropriate population or asked to predict an outcome that cannot be reliably inferred. The third is administrative interpretation: officers may attribute more certainty to the result than the system can justify. None of these problems disappears by adding a generic statement that humans remain responsible. Effective human review requires access to underlying evidence, authority to depart from automated recommendations, and reasons that affected individuals can understand.

A narrow focus on computational bias is also insufficient when the policy objective itself is contested. A highly accurate system built to detect an immigration category can reproduce exclusion if that category is legally unjustified or applied inconsistently. Conversely, an instrument intended to improve administrative consistency may still generate uneven outcomes if the data available for different populations vary systematically. The key research question is therefore how technical classifications interact with policy design, institutional incentives, and the lived circumstances of affected people. Assessing the governance of an algorithm entails examining the rules of use and the accountability of decision-makers, rather than only comparing model-performance statistics.

The relationship between software and discretion has become a major area of recent inquiry. Research on asylum decision-making questions the apparent objectivity attached to technological outputs, while other work describes how officials assemble records into provisional accounts of an applicant. These studies draw attention to the difference between evidence supporting a claim and data being treated as a substitute for the claimant's account. The administrative significance of a digital trace is established through interpretation, training, organisational routines, and potentially adversarial procedures. The protection of procedural fairness must address that entire interpretive chain (Ozkul, 2025).

5. Datafication, Surveillance, and Transnational Governance

Datafication converts movement, identity, and interaction into records that may circulate beyond the moment and purpose of initial collection. A border crossing can become part of a much longer sequence of automated checks, identity comparisons, and institutional assessments. This expansion alters the spatial and temporal meaning of immigration control. It also changes the resources required for oversight: supervisory bodies need to understand not only one agency's legal mandate but also the interfaces, contractors, retention policies, and onward transfers through which information travels. Research on digital migration infrastructures urges analysts to investigate actual data practices rather than assume that a technological system operates as its official documentation describes (Glouftsios & Scheel, 2021; Leese et al., 2022).

Surveillance is not confined to a checkpoint or a camera. It can operate through identity databases, smartphone searches, interlinked service registries, and the repeated verification of a person's status in everyday transactions. The consequences extend to people who do not physically cross a national frontier during the period of observation. An individual may face administrative barriers in employment, housing, or healthcare because another agency relies on immigration-related information. For that reason, the governance boundary is often not geographic but informational: it concerns which institution may know, infer, disclose, correct, or act on particular data. Research on the creation of non-publics and on biometric policing demonstrates why surveillance must be analysed as a form of institutional power rather than a single technological device (Dijstelbloem & Broeders, 2015; Wienroth & Amelung, 2023).

Research on migrants' digital subjectivities is important because affected individuals do not passively absorb the categories assigned to them. They navigate official applications, exchange information, question records, and sometimes attempt to avoid harmful identification practices. These forms of agency do not invalidate the need for lawful identity checks, but they demonstrate why administrative systems must be evaluated in relation to unequal bargaining power. A procedure that is simple for a citizen with stable documents and digital access may be experienced very differently by an undocumented migrant or asylum seeker. This perspective broadens the concept of digital inclusion beyond mere connectivity (Tsagarousianou, 2024; Witteborn, 2021).

Transnational cooperation compounds the challenge of assigning responsibility. A record entered by one authority may be consulted by another institution subject to different laws, operating procedures, and correction mechanisms. Where international organisations or technology vendors provide infrastructure, contracting arrangements can further fragment oversight. The practical questions include which government controls the purposes of collection, who has the power to amend a record, whether audit logs are shared with supervisors, and how individuals are informed about cross-border data transfers. The wider literature on migration governance shows that these questions sit within enduring tensions among sovereignty, regional coordination, institutional capacity, and individual rights. Studies of biometric capacity building in Nigeria demonstrate how external technical assistance can simultaneously reorganise domestic immigration enforcement priorities (Singler, 2024).

The relationship between data quality and policy legitimacy is especially consequential. An agency may establish a strong technical process for standardising names, faces, and fingerprints without knowing whether the source information accurately describes the person's legal position. Another agency may

be able to view data immediately but lack the authority or context needed to interpret them. In such cases, greater interoperability can increase the circulation of an error rather than improve the decision. An institutionally robust model must therefore attach provenance, uncertainty, and correction procedures to records and must clarify how conflicting information is resolved. Recent work on the ambiguities and organisational disorder of European data borders demonstrates why the aspiration to perfect information should not obscure the politics of classification and control (Aradau et al., 2026).

6. Policy Implications and Research Priorities

The main governance implication is that immigration digitalisation should be evaluated as an institutional system. Procurement assessment should examine not only the supplier's promised accuracy or throughput but also compatibility with law, administrative appeal, records management, cybersecurity, accessibility, and independent oversight. An agency should specify the intended purpose of each application and identify decisions that must remain open to meaningful human review. Performance reporting should distinguish outputs such as the number of registrations or completed checks from outcomes such as fewer unresolved identity disputes, timely corrections, fairer service access, and defensible decisions. A completed transaction is not automatically an effective immigration service.

Table 4. Governance Questions Arising From The Thematic Synthesis

Domain	Operational question	Relevant evidence to collect
Identity assurance	How are mismatches, enrolment failures, and disputed identities reviewed?	Error logs, correction outcomes, review time, accessible alternatives
Algorithmic decisions	Can officers explain, challenge, and override automated recommendations?	Decision records, model documentation, override rates, appeal outcomes
Data interoperability	Which bodies access data, under what legal basis and purpose?	Access logs, data-sharing rules, retention and deletion records
Rights and inclusion	Can affected persons know about and remedy consequential data errors?	Notices, language support, complaint pathways, remediation audits
Institutional coordination	Who owns cross-agency incidents and conflicting records?	Responsibility matrices, incident reports, interagency protocols
Public evaluation	Do systems improve lawful service outcomes, not just transaction counts?	Service indicators, independent evaluations, stakeholder evidence

Source: Authors' policy synthesis of the selected literature, 2026.

Table 4 translates conceptual findings into operational questions that can be applied in a public-administration setting. For example, the outcome of an identity-matching system should be evaluated not only by the number of matches completed but also by the frequency, duration, and consequences of mismatches that require manual resolution. Similarly, a risk-scoring application should be

assessed through the records documenting how officials use its recommendations and how an affected person can challenge the factual basis of a decision. Such evidence would allow administrators to identify weaknesses that remain invisible in aggregate technical-performance reports.

The table also separates legal compliance from institutional capability. A written rule about data protection may exist while front-line employees lack a workable process for correcting cross-agency records. An organisation may report human oversight while officers cannot meaningfully examine or override a model output. Public evaluations should therefore examine the connection between formal rules, daily routines, and consequences for travellers or migrants. Audit design needs to test the practical availability of safeguards under high workloads, at remote service locations, and for individuals with limited access to technology or legal assistance.

For an archipelagic immigration administration, interoperability may appear especially attractive because border posts, international transport nodes, local offices, and national decision centres need timely information. Yet geographic dispersion also increases the importance of reliable networks, clear fallback procedures, and consistent staff training. Systems that fail safely when connectivity is interrupted can be more important to rights and operational continuity than an apparently seamless interface available only under ideal conditions. Comparative governance research should examine how administrative authority is coordinated across ports, airports, land crossings, consular units, and central databases while respecting each institution's mandate. Research on technology-assisted migrant access to public services emphasises that system design should be informed by user needs and administrative accessibility (Concilio et al., 2022).

Data sovereignty should not be understood as a purely national storage question. The practical distribution of authority depends on contractual rights to access system architecture, audit data, retrain models, export records, and terminate a vendor relationship without losing essential public services. Procurement rules need to establish who owns the underlying identity records, which subcontractors may process them, and whether an independent authority can inspect system design when a dispute arises. Such issues are especially important where commercial or international technology providers maintain complex platforms that public organisations may otherwise treat as opaque service packages. Governance competence includes the capacity to question and verify suppliers' claims.

CONCLUSION

This article has mapped a bounded and verifiable set of journal publications on algorithmic border control and biometric immigration governance. The analysis distinguishes the temporal distribution of selected studies, the frequency of explicitly assigned conceptual labels, and a simplified network of connections among those labels. It does not present the dataset as an exhaustive Scopus or Web of Science retrieval or claim that an automatically extracted VOSviewer map was produced. Within those boundaries, the literature depicts immigration digitalisation as an institutional transformation in which identity records, algorithmic decisions, interagency information exchange, and rights-protection mechanisms increasingly depend on one another.

The most significant conceptual finding is that technical reliability and administrative legitimacy cannot be evaluated separately. A biometric system may

improve the continuity of identification while leaving unresolved problems of inaccurate linkage, inaccessible corrections, or secondary data use. Algorithmic assessment may increase the speed of screening yet weaken procedural fairness when its reasoning is difficult to contest. Interoperability can support coordination while circulating errors across institutional boundaries. These tensions indicate that successful immigration governance requires explicit authority, accountable human review, data quality controls, transparent correction channels, and independent assessment of how technology affects real decisions.

For public policy and administrative research, the article offers a research agenda that joins system design to governance outcomes. Future studies should use auditable bibliometric exports for comprehensive mapping and combine this with comparative organisational research, privacy-sensitive administrative datasets, and the perspectives of front-line personnel and affected migrants. In the Indonesian context, potential work includes interagency coordination at immigration service points, identity assurance across dispersed border locations, accountability for automated recommendations, and evaluation of digital service accessibility. The central contribution is not a claim that digital border technologies are uniformly effective or harmful, but a structured basis for investigating the conditions under which they become reliable, lawful, and accountable instruments of governance.

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