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Migration Control of Persons as a Process Influenced by Generative AI: An Exhaustive Systematic Review

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Abstract. In recent years, the use of generative artificial intelligence in migration control has increased steadily, driven by the need to optimize verification, security, and predictive analysis in border contexts. The objective of this paper is to determine the state of the art of research on Generative AI and its impact on Migration Control of Persons. A systematic and bibliometric review was conducted on 61 papers published between 2019 and July 2025 in IEEE Xplore, Scopus, Web of Science, ARDI, and Wiley Online Library. The studies are concentrated in Q1–Q2 journals and prioritize machine learning approaches applied to border surveillance, digital borders, and automated classification. The results reveal the centrality of topics such as "machine learning," "artificial intelligence," "border control," and "data protection," as well as the presence of highly specialized themes (Border Classification) and others that are marginal yet emerging (Mobility Analytics, AI Data Migration). Overall, the findings describe a methodologically robust field that is predominantly technocentric and security-oriented, with limited explicit consideration of human rights and Global South perspectives. It is concluded that advancing toward more transparent and accountable migration control requires aligning Generative AI with algorithmic governance frameworks and empirical assessments in real-world environments.

Keywords. Generative artificial intelligence, migration control, natural language processing, migration registry, systematic literature review.

1 Introduction

Migration control has become an increasingly complex process influenced by geopolitical, social, and technological factors. In this context, generative artificial intelligence and associated technologies such as natural language processing (NLP) are transforming how States manage migration flows, identity verification, risk analysis, and real-time decision-making.

These tools enable the automation of processes, the generation of reports, the interpretation of documents in different languages, and even the analysis of behavioral patterns in border environments. Their implementation represents a significant advancement in terms of operational efficiency and predictive capacity.

However, despite their growing use and potential impact, there remains a critical need for a systematic literature review that provides a comprehensive understanding of how generative AI is being applied in migration control, what benefits it offers, what ethical, legal, and technical limitations exist, and which research gaps persist.

This review seeks precisely to fill that gap and to provide a solid foundation that guides future research and responsible applications of these

emerging technologies in an area as sensitive as human migration.

First, the authors [4, 7, 10] demonstrate in their investigations that quantitative modeling and machine learning techniques allow the characterization of migration decisions and territorial patterns by integrating complex surveys and explainable models. Complementarily, other studies develop predictive algorithms to anticipate refugee flows and asylum applications in highly uncertain contexts, combining administrative and non-traditional datasets [11, 14, 19]. In addition, certain critical analyses of migration digitalization show how automation and edu-tech platforms reshape the governance of international students and the intellectual agenda of the migration field [13, 15].

On the other hand, studies focused on AI applied to migration management and communication highlight both its transformative potential and its political implications, showing that predictive tools, natural language processing, and algorithmic governance frameworks can reinforce or challenge existing institutional practices [5, 20, 23]. In this line, several contributions emphasize the need for ethical and data protection frameworks that regulate the use of Big Data, forecasting platforms such as EUMigraTool, and humanitarian decision-support systems [8, 9, 18]. In the domain of border control and surveillance, solutions based on IoT, thermal cameras, sensor networks, and facial spoofing detection mechanisms have been developed, achieving high levels of accuracy in intruder identification and biometric fraud mitigation [6,38,39]. Relatedly, adaptive authentication systems, risk detection mechanisms for mobile devices, and AI architectures for border management in the Global North have been proposed, consolidating a strongly securitized and technocentric approach [21, 32, 40]. In parallel, the legal-political literature underscores the tension between security and fundamental rights when analyzing the use of databases, algorithmic filters, and preregistration applications that may introduce new barriers to asylum access [12, 16, 24]. Likewise, certain studies examine how AI in refugee status determination and asylum management can reproduce biases, affect credibility assessments, and generate ethical risks for vulnerable populations [22, 34].

Papavasileiou and colleagues [77] evaluate airport e-Gate systems through a systematic review with thematic classification and comparative security analysis, identifying operational improvements, reduced waiting times, and strengthened migration control, although they recognize limited longitudinal and multicontinental validation as a constraint. Similarly, Gunawan and collaborators [65] examine border security through an intelligence-oriented approach using longitudinal bibliometrics (1985 to 2022) and co-authorship networks, demonstrating sustained growth and a research predominance of the United States, along with a transition toward digital surveillance; however, their exclusive reliance on Scopus restricts the inclusion of non-indexed regional production.

Complementarily, Khooshechin-Gilak and their team [66] map facial recognition applications in airports using a systematic review and technical classification, finding accelerated growth in the use of computer vision for migration control, although privacy risks, racial biases, and a lack of validation standards persist. In turn, Hidayat and co-authors [67] review facial recognition technologies for automated e-gate control, reporting improved accuracy and reduced passage time, but with limited validation in real-world scenarios with demographic and lighting variability.

In a related framework, Rönsch and collaborators [68] analyze the use of AI in migration management through a systematic review using Scopus and WoS, identifying applications in flow prediction and document fraud, although empirical validation is lacking and real governmental datasets remain scarce. For their part, Roman-Acosta and colleagues [69] examine human mobility dynamics through an interdisciplinary systematized review, identifying South–North patterns associated with refuge and social vulnerability, but with methodological dispersion and limited empirical evidence. In a different line, Delcea and associated researchers [71] use bibliometrics with Scopus to study AI applications in territorial analysis, recognizing recent field expansion and a predominance of machine learning, although with low Latin American integration and limited empirical validation.

Subsequently, Subbotin and their research team [72] investigate brain drain and researcher return in Russia using Scopus data (1996 to 2020), finding losses of scientific capital and emerging return trends in engineering, although limited by dependence solely on indexed publications. In addition, King and collaborators [74] review AI for deception detection based on multimodal physiological signals, highlighting experimental improvements but acknowledging risks of bias and the lack of validation in real environments.

Finally, Koroniotis and other authors [75] examine cybersecurity in smart airports through a systematic technical review, identifying vulnerabilities in critical environments, dependence on AI for mitigation, and operational risks, with the absence of validations under controlled attacks as the main limitation.

Although there are reviews on e-Gates, facial recognition, airport cybersecurity, and AI-based migration management, significant gaps persist: the absence of a systematic analysis specifically focused on Generative AI in Migration Control of Persons, the scarcity of longitudinal and multicontinental empirical validation, a bias toward Global North sources, weak alignment with human rights frameworks, and the lack of advanced thematic bibliometric integration.

This study is justified because it provides a systematic and bibliometric review dedicated to Generative AI in Migration Control of Persons, integrating evaluation criteria, quartile levels, theoretical foundations, and highly cited topics. It also incorporates critical analysis of algorithmic governance, biases, and human rights, expanding the evidence beyond Scopus and Web of Science and proposing a rigorous agenda for future research and public policy.

Accordingly, the objective of this review is to determine the state of the art of research on Generative AI and its impact on Migration Control of Persons. Within this framework, the paper is organized as follows; section 2 presents the theoretical background, section 3 describes the methodology employed, section 4 outlines and examines the results obtained, and section 5 presents the conclusions together with recommendations for future research.

2 Background

Given the growing development and adoption of generative artificial intelligence in migration control, it is necessary to review the fundamental concepts that support its application. Consequently, the theoretical background that enables a deeper understanding of the approach and scope of this systematic review is presented.

2.1 Generative artificial intelligence

Generative AI refers to the use of technology capable of performing tasks associated with human intelligence, such as learning from data, image and voice recognition, and natural language processing [5]. It also encompasses the ability of artificial intelligence systems to produce new and original content, including images, music, or text, from a given input dataset [14], 15].

Furthermore, generative artificial intelligence is linked to the development of computational systems capable of carrying out tasks that normally require human reasoning, such as complex decision-making in administrative contexts [22].

In addition, generative AI integrates technologies aimed at supporting decision-making and information management through facial and emotional recognition systems applied to border control and migration management [42].

Along these lines, generative artificial intelligence is conceived as an emerging technology capable of generating new data or representations from learned patterns, contributing innovation to complex analytical processes, especially when modeling, predicting, or simulating information derived from large volumes of historical data is required [70].

This technology allows the representation and anticipation of sophisticated processes through the creation of realistic synthetic data grounded in previously learned patterns [73].

Finally, generative artificial intelligence is associated with the development of tools for sentiment analysis that enable the interpretation of emotions through software, particularly on social networks such as Twitter, where the ability to understand user needs has become critical for organizations [76].

2.2. Migration control of persons

First, migration control of persons consists of the regulation and supervision of population movements between different regions or countries, directed toward managing the entry and exit of individuals and ensuring national security [4]. It also involves the implementation of policies and procedures aimed at efficiently managing migration flows while ensuring public order at borders [12]. Likewise, it includes the supervision and regulation of migratory movements through institutional dynamics and mechanisms that sustain pre-existing inequalities and reproduce social tensions [13].

At the same time, it comprises the use of technologies and systems to regulate and manage migration flows, optimize registration processes, and streamline the handling of asylum applications in order to meet operational and political objectives established for migration governance [20]. Operationally, this process encompasses the verification of traveler identity, the inspection of travel documents, and the application of security measures aimed at preventing threats such as identity fraud or human trafficking [21].

Moreover, it contemplates the implementation of mechanisms to oversee and direct the flow of migrants, refugees, and asylum seekers, with the purpose of guaranteeing national security, ensuring compliance with migration regulations, and reinforcing border control [34]. Finally, it involves the establishment of regulatory frameworks and administrative procedures that govern the movement of persons across borders, whether for employment, study, family reunification, or refuge, with the aim of preserving social, economic, and security stability within the territory [59].

2.3. Generative artificial intelligence and its articulation with migratory control of persons

The integration of generative artificial intelligence into migratory control systems substantively redefines traditional models of surveillance, verification and border management. Its capacity to learn complex patterns, generate synthetic representations and process multimodal information makes it possible to optimize critical processes such as biometric identification, document analysis and the anticipation of migratory flows. These systems, based on advanced deep learning models and generative architectures, strengthen the precision and speed of operational procedures, reducing margins of error and enabling more timely responses to risks associated with identity fraud, human trafficking or irregular mobility.

From a methodological perspective, generative AI enables computational mechanisms that transform migratory management, such as the generation of synthetic data for training surveillance models, the simulation of migratory scenarios for strategic decision making and the intelligent automation of administrative processes.

These capabilities are supported by theoretical foundations originating from pattern recognition, predictive analytics and probabilistic modeling, which provide scientific consistency to its application in migratory contexts. In this way, the convergence between generative AI and migratory control drives a transition toward more adaptive, preventive and evidence-based paradigms, in which migratory governance relies on technological tools capable of anticipating complex dynamics and optimizing the management of population flows.

3 Review Method

3.1 Research Protocol

A Systematic Literature Review (SLR) approach was adopted following the methodological guidelines of Kitchenham [62], which allow for the rigorous organization of the stages of planning, searching, selecting, critically assessing, extracting, and synthesizing the available evidence. Within this framework, the main question guiding the present review was: What is the state of the art of research on generative artificial intelligence and its influence or impact on migration control of persons?

To address this question, a systematic and exploratory process was developed to analyze the most relevant scientific literature published in the last seven years, with the purpose of identifying

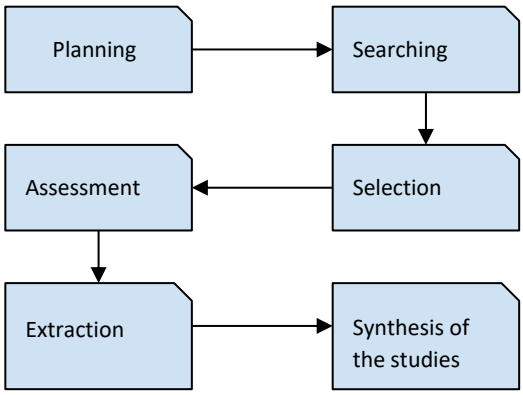

Fig. 1. Stages of the SLR

Table 1. Research Problems and Objectives

Research Question	Objective
RQ1: What criteria are used to measure or assess Migration Control of Persons?	To establish the criteria employed to measure or assess Migration Control of Persons in papers related to Generative AI.
RQ2: What distribution of quartile levels is observed in the journals where papers on the effect of Generative AI on Migration Control of Persons have been published?	To examine the quartile levels of the scientific journals in which papers on Generative AI and its impact on Migration Control of Persons have been published.
RQ3: What definitions of Generative AI and its application to Migration Control of Persons have been proposed, used, or implemented in the analyzed studies?	To analyze the most frequently used definitions of Generative AI in the context of Migration Control of Persons.
RQ4: Which topics concentrate the highest number of citations in papers addressing Generative AI and its influence on Migration Control of Persons?	To identify the most frequently cited concepts in papers on Generative AI and its impact on Migration Control of Persons through Bigram analysis.
RQ5: What thematic categories are identified in papers analyzing Generative AI and its influence on Migration Control of Persons?	To classify the thematic categories presented in papers on Generative AI and its influence on Migration Control of Persons.

predominant research trends, emerging theoretical foundations, developed technological applications, and the ethical implications associated with the use of generative AI in migration control and management systems.

In addition to this central question, complementary lines of analysis were formulated to determine the countries with the highest scientific production on the topic, the recurrent criteria used to evaluate migration control, the high-impact journals that disseminate these studies, and the concepts, models, and thematic categories most frequently addressed in the specialized literature.

The general framework of the methodological process is presented in Figure 1, which synthesizes the main stages that constitute the developed SLR, allowing for an organized visualization of the full workflow of planning, searching, selecting, evaluating, and synthesizing the scientific evidence analyzed.

In other fields, it has been demonstrated that the combination of systematic review and bibliometric analysis makes it possible to identify thematic patterns, conceptual cores, and the temporal evolution of research [64]. Therefore, its incorporation into the study of Generative AI applied to Migration Control is methodologically coherent and strengthens the strategic rigor of the analytical process employed.

3.2 Research Problems and Objectives

In this section, the research questions (RQs) are presented along with their respective objectives, which defined the thematic scope of the study and precisely guided the identification, extraction, and organization of empirical evidence throughout the systematic review process. Each RQ enabled the delimitation of specific dimensions of analysis, supported methodological coherence, and ensured that the review addressed both conceptual aspects and technological applications, as well as emerging challenges related to the use of generative artificial intelligence in migration control. The details corresponding to each question and objective are synthesized in Table 1.

3.3 Sources of Information and Search Strategies

To ensure the exhaustiveness, relevance, and methodological rigor of the corpus analyzed, high-impact and widely recognized scientific databases were selected, including IEEE Xplore, Scopus, Web of Science, ARDI, and Wiley Online Library. These platforms concentrate the most influential academic production in the fields of artificial intelligence, computer sciences, and migration studies, thereby guaranteeing the inclusion of highly relevant and rigorous primary literature. Likewise, Table 2 presents the descriptors,

Table 2. Search Descriptors and Their Synonyms

Descriptor	Description
generative artificial intelligence/ artificial intelligence/ ai/ machine learning/ natural language processing	Independent Variable
migration control/ migration management/ migration/ border control/ border patrol/ migration registry/ migration policy/ migration quality/ border security/ migration unit/ migration formalization/ migration regulation/ migration information registry/ migration status	Dependent Variable

Table 3. Information Source and Search Equations

Source	Search Equation	Quantity
IEEE Xplore	("Document Title":"generative artificial intelligence" OR "Document Title":"artificial intelligence" OR "Document Title":"AI" OR "Document Title":"machine learning" OR "Document Title":"natural language processing") AND ("Document Title":"migration control" OR "Document Title":"migration management" OR "Document Title":"migration" OR "Document Title":"border control" OR "Document Title":"border patrol" OR "Document Title":"migration registry" OR "Document Title":"migration policy" OR "Document Title":"migration quality" OR "Document Title":"border security" OR "Document Title":"migration unit" OR "Document Title":"migration formalization" OR "Document Title":"migration regulation" OR "Document Title":"migration information registry" OR "Document Title":"migration status") OR ("Index Terms":"generative artificial intelligence" OR "Index Terms":"artificial intelligence" OR "Index Terms":"AI" OR "Index Terms":"machine learning" OR "Index Terms":"natural language processing") AND ("Index Terms":"migration control" OR "Index Terms":"migration management" OR "Index Terms":"migration" OR "Index Terms":"border control" OR "Index Terms":"border patrol" OR "Index Terms":"migration registry" OR "Index Terms":"migration policy" OR "Index Terms":"migration quality" OR "Index Terms":"border security" OR "Index Terms":"migration unit" OR "Index Terms":"migration formalization" OR "Index Terms":"migration regulation" OR "Index Terms":"migration information registry" OR "Index Terms":"migration status") OR ("Abstract":"generative artificial intelligence" OR "Abstract":"artificial intelligence" OR "Abstract":"AI" OR "Abstract":"machine learning" OR "Abstract":"natural language processing") AND ("Abstract":"migration control" OR "Abstract":"migration management" OR "Abstract":"migration" OR "Abstract":"border control" OR "Abstract":"border patrol" OR "Abstract":"migration registry" OR "Abstract":"migration policy" OR "Abstract":"migration quality" OR "Abstract":"border security" OR "Abstract":"migration unit" OR "Abstract":"migration formalization" OR "Abstract":"migration regulation" OR "Abstract":"migration information registry" OR "Abstract":"migration status")	1044
Scopus	TITLE-ABS-KEY ("generative AI" OR "artificial intelligence" OR "AI" OR "machine learning" OR "natural language processing") AND ("immigration control" OR "migration management" OR "border patrol" OR "border control" OR "airport immigration" OR "immigration registration" OR "immigration policy" OR "inmigration registry" OR "inmigration policy" OR "inmigration quality" OR "border security" OR "inmigration regulation" OR "inmigration status")	6419
Web of Science	TI=(("generative artificial intelligence" OR "artificial intelligence" OR "AI" OR "machine learning" OR "natural language processing") AND ("migration control" OR "migration management" OR "migration" OR "border control" OR "border patrol" OR "migration registry" OR "migration policy" OR "migration quality" OR "border security" OR "migration unit" OR "migration formalization" OR "migration regulation" OR "migration information registry" OR "migration status")) OR AK=(("generative artificial intelligence" OR "artificial intelligence" OR "AI" OR "machine learning" OR "natural language processing") AND ("migration control" OR "migration management" OR "migration" OR "border control" OR "border patrol" OR "migration registry" OR "migration policy" OR "migration quality" OR "border security" OR "migration unit" OR "migration formalization" OR "migration regulation" OR "migration information registry" OR "migration status"))	286
ARDI	(TitleCombined:(\("generative artificial intelligence" OR "artificial intelligence" OR "AI" OR "machine learning" OR "natural language processing"\) AND \("migration control" OR "migration management" OR "migration" OR "border control" OR "border patrol" OR "migration registry" OR "migration policy" OR "migration quality" OR "border security" OR "migration unit" OR "migration formalization" OR "migration regulation" OR "migration information registry" OR "migration status"\)))	240
Wiley Online Library	""generative artificial intelligence" OR "artificial intelligence" OR "AI" OR "machine learning" OR "natural language processing"" in Title and ""migration control" OR "migration management" OR "migration" OR "border control" OR "border patrol" OR "migration registry" OR "migration policy" OR "migration quality" OR "border security" OR "migration unit" OR "migration formalization" OR "migration regulation" OR "migration information registry" OR "migration status"" in Title	26
	Total	**8015**

synonyms, and related terms used in the search strategy, which were defined according to principles of conceptual precision and thematic sensitivity to maximize the retrieval of pertinent studies and minimize bias during the source identification process.

Based on the previously established descriptors, the specific search equations

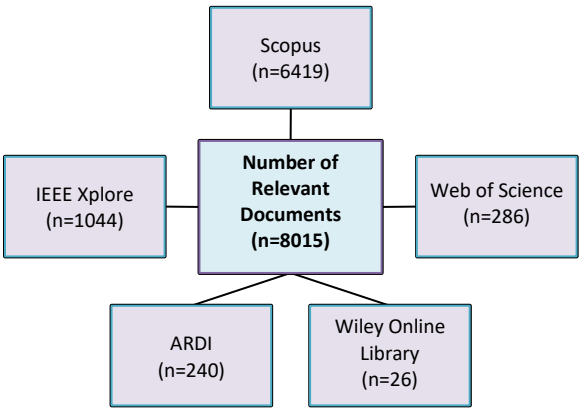

Fig. 2. Number of Results by Source

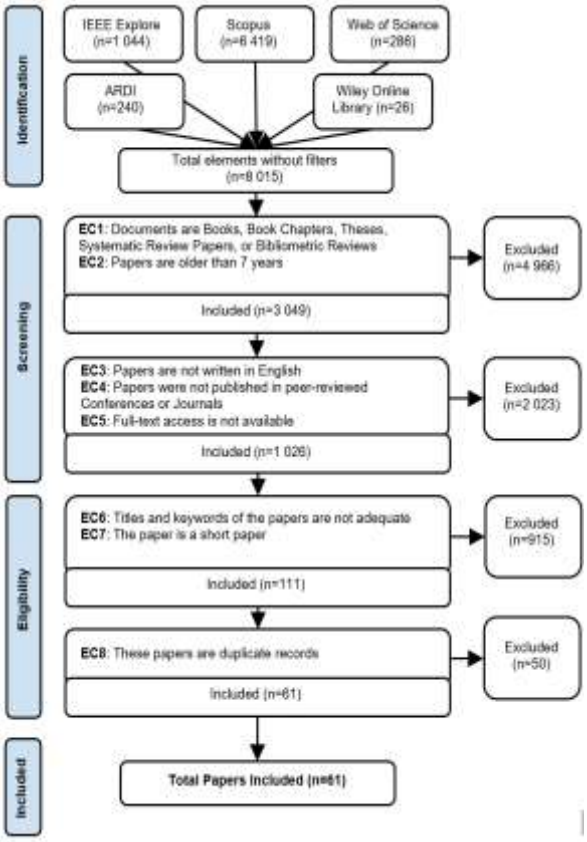

Fig. 3. PRISMA Flow Diagram

designed for each database are presented, rigorously adjusted to the Boolean operators, syntax, and query fields supported by each of the selected platforms.

3.4 Identified Studies

Based on the application of the previously defined search equations, an initial set of 8015 documents was identified. The distribution of these preliminary records by database is presented in Figure 2, which comparatively illustrates the contribution of each source to the total volume of retrieved documents, providing an initial overview of the scientific production associated with the topic.

3.5 Selection Criteria

To ensure methodological quality, thematic relevance, and the timeliness of the studies included, exclusion criteria (EC) were established to refine the initial corpus and ensure that only research directly related to the object of study was considered. These criteria made it possible to discard documents that did not meet the minimum requirements of scientific rigor, conceptual alignment, or full availability for analysis:

EC1: Books, chapters, theses, and review or bibliometric works were excluded.
EC2: Papers published more than seven years prior to the review were discarded.
EC3: Documents not written in English were not included.
EC4: Only papers published in peer-reviewed journals or conferences were considered; the rest were excluded.
EC5: Studies without full-text access were removed.
EC6: Documents whose titles or keywords did not demonstrate a direct relationship with the topic were discarded.
EC7: Short papers were not included due to their limited development.
EC8: Duplicate or non-unique papers within the analysis set were excluded.

3.6 Study Selection

The selection process was carried out in four sequential stages, in which the exclusion criteria (EC1 to EC8) were progressively applied. In the first stage (Filter 1), criteria EC1 and EC2 were applied; in the second stage (Filter 2), criteria EC3, EC4, and EC5 were applied; in the third stage (Filter 3), criteria EC6 and EC7 were considered;

Table 4. Quality Assessment of the Papers

Ref.	Type	QA1	QA2	QA3	QA4	QA5	QA6	QA7	Score
[1]	Journal	3	3	3	2	3	3	2	19
[2]	Journal	2	3	2	2	3	2	3	17
[3]	Journal	3	2	3	2	3	2	2	17
[4]	Journal	2	2	3	2	2	3	2	16
[5]	Journal	2	2	2	2	3	2	3	16
[6]	Journal	3	2	2	2	2	3	2	16
[7]	Journal	3	2	2	2	3	3	3	18
[8]	Journal	2	3	2	2	2	3	2	16
[9]	Journal	3	3	2	2	3	2	2	17
[10]	Journal	3	2	3	2	3	2	3	18
[11]	Journal	3	2	3	2	3	3	2	18
[12]	Journal	2	3	2	3	2	3	3	18
[13]	Journal	3	3	3	2	2	2	3	18
[14]	Journal	3	2	2	3	2	2	2	16
[15]	Journal	3	2	3	2	2	3	3	18
[16]	Journal	2	2	3	2	3	3	3	18
[17]	Journal	2	3	3	3	2	3	3	19
[18]	Journal	2	3	3	2	2	3	2	17
[19]	Journal	2	2	3	2	3	3	2	17
[20]	Journal	2	3	3	2	3	3	3	19
[21]	Journal	2	2	2	2	3	3	3	17
[22]	Journal	2	3	3	3	3	3	3	20
[23]	Journal	3	3	3	2	3	3	2	19
[24]	Journal	3	2	3	3	2	3	3	19
[25]	Journal	3	2	3	2	2	3	3	18
[26]	Journal	2	2	2	2	3	2	3	16
[27]	Journal	2	2	2	2	2	3	2	15
[28]	Journal	2	3	2	3	2	2	2	16
[29]	Journal	2	2	2	3	3	2	2	16
[30]	Journal	3	2	2	2	2	3	2	16
[31]	Journal	2	3	2	3	3	2	2	17
[32]	Journal	2	3	2	2	2	2	3	16
[33]	Journal	3	2	3	3	3	2	2	18
[34]	Journal	2	3	3	3	3	2	2	18
[35]	Dataset	2	3	3	2	2	3	3	18
[36]	Journal	2	3	3	2	2	2	2	16
[37]	Journal	2	2	2	2	3	2	3	16
[38]	Journal	2	3	2	3	2	2	2	16
[39]	Journal	3	3	3	3	3	3	3	21
[40]	Journal	3	2	3	3	3	2	2	18
[41]	Journal	3	3	3	2	3	2	2	18
[42]	Journal	2	2	3	3	2	3	3	18
[43]	Journal	3	2	2	2	2	3	2	16
[44]	Journal	3	2	2	2	3	2	3	17
[45]	Journal	2	3	2	3	3	3	3	19
[46]	Journal	2	3	3	3	2	2	3	18
[47]	Journal	3	3	2	3	3	3	3	20
[48]	Journal	2	2	2	3	3	2	3	17
[49]	Journal	2	3	2	2	2	3	3	17
[50]	Journal	3	2	3	3	2	2	3	18
[51]	Journal	3	2	2	3	2	2	3	17
[52]	Journal	3	3	3	2	3	2	2	18
[53]	Conference	2	2	3	3	3	3	3	19
[54]	Journal	2	3	2	3	2	2	3	17
[55]	Journal	2	3	3	3	2	2	2	17
[56]	Journal	2	2	2	3	2	3	3	17
[57]	Journal	2	3	2	3	3	2	2	17
[58]	Journal	2	3	2	2	2	3	2	16
[59]	Journal	2	3	2	3	3	3	2	18
[60]	Journal	3	3	3	3	3	2	3	20
[61]	Journal	2	3	3	2	2	2	2	16

and finally, in the fourth stage (Filter 4), criterion EC8 was applied.

As a result of this exhaustive filtering process, a final set of 61 studies was obtained for analysis. The complete flow of document selection, detailing the number of records retained and excluded at each stage, is presented in Figure 3, prepared in accordance with the PRISMA model [63].

3.7 Quality Assessment

To ensure the methodological soundness and scientific relevance of the studies included, a set of quality criteria (QA) was applied to systematically evaluate the conceptual clarity, methodological consistency, and analytical robustness of each selected investigation. These criteria include:

QA1: Does the study provide solid empirical evidence directly related to the topic under investigation?
QA2: Are the study objectives precisely formulated and clearly expressed?
QA3: Is the research context described in a complete and sufficiently detailed manner?
QA4: Is the selected methodological approach appropriate and consistent with the purposes of the study?
QA5: Is the data analysis conducted with the required depth and methodological rigor?
QA6: Are the results presented with clarity, good structure, and internal coherence?
QA7: Does the study provide pertinent and well-founded answers to the research questions posed?

Table 4 presents the scores obtained by the 61 selected studies according to these seven assessment criteria. Each item may take a value of 1 (low), 2 (medium), or 3 (high), which allows identifying the level of clarity, coherence, and scientific relevance of each contribution.

For inclusion in the final analysis, papers were required to achieve a minimum score of 11 points, thereby ensuring that the set of studies considered met rigorous standards of methodological validity and substantive contribution to the field under investigation.

After systematically applying the quality criteria (QA1 to QA7) to the 61 papers selected for this review, it was verified that all studies met the minimum methodological standards established.

Consequently, none of the papers were excluded, which allowed the entire corpus to be retained for the final analysis and ensured a

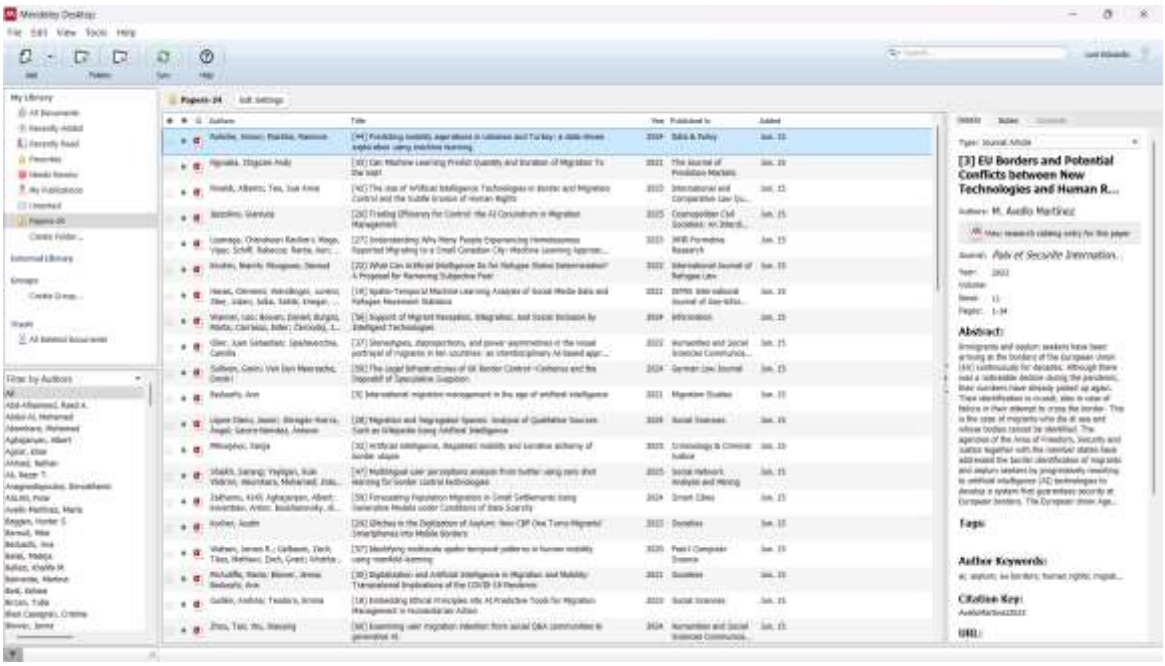

Fig. 4. Data Report Using Mendeley

comprehensive and representative evaluation of the state of knowledge in this field.

3.8 Data Extraction Strategy

Once the study selection process was completed, a systematic extraction of relevant data was carried out using Mendeley Desktop, a tool that enabled efficient organization, storage, and management of the 61 included papers.

During this stage, essential informational fields for the subsequent analysis were recorded, such as document title, ISSN, type of publication, year of publication, and other pertinent metadata associated with each study.

Since not all papers contributed evidence for every research question, Mendeley facilitated their classification and filtering according to their specific contribution to each RQ defined in this systematic review. Likewise, the structured processing of this information made it possible to obtain a refined dataset for the quantitative and qualitative analysis.

Figure 4 presents the report generated by Mendeley Desktop, where the extracted metadata and the general structure of the bibliographic repository used in this research are summarized.

3.9 Synthesis of Findings

As the final stage of this systematic review, an exhaustive synthesis of the findings obtained from the selected documentary corpus was carried out with the purpose of rigorously and substantively answering the research questions posed.

This process made it possible to delineate the current state of knowledge on the application of Generative Artificial Intelligence in Migration Control of Persons.

To achieve this, the 61 papers that constitute the final set of studies were examined in detail, organizing the relevant information according to the thematic dimensions defined in the methodological protocol. Given the heterogeneity of approaches, not all documents contributed equally to each research question; however, the analysis made it possible to identify consistent

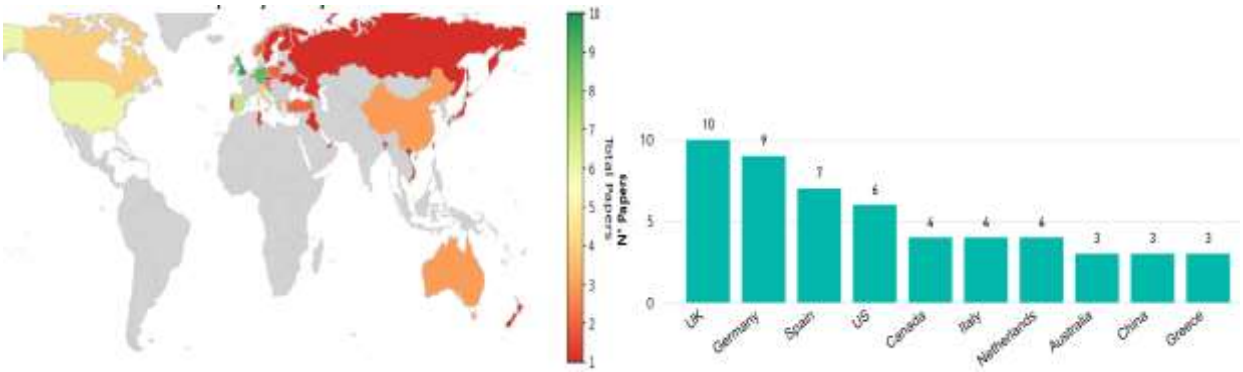

Fig. 6. Distribution of Published Papers by Country

Table 5. Global Contribution of Countries in Indexed Publications

Country	Total Papers	% Total Papers	Total Citat.	% Total Citat.	Citat./ Paper	Total H-Index
UK	10	12,2	98	17,0	9,8	1267
Germany	9	11,0	47	8,1	5,2	745
Spain	7	8,5	37	6,4	5,3	769
US	6	7,3	52	9,0	8,7	630
Canada	4	4,9	49	8,5	12,2	148
Italy	4	4,9	41	7,1	10,2	473
Netherlands	4	4,9	24	4,2	6,0	152
Australia	3	3,7	23	4,0	7,7	180
China	3	3,7	26	4,5	8,7	420
Greece	3	3,7	3	0,5	1,0	162
Austria	2	2,4	16	2,8	8,0	551
Belgium	2	2,4	26	4,5	13,0	64
Norway	2	2,4	26	4,5	13,0	631
Poland	2	2,4	0	0,0	0,0	96
Turkey	2	2,4	7	1,2	3,5	51
Bangladesh	1	1,2	7	1,2	7,0	0
Croatia	1	1,2	3	0,5	3,0	32
…	…	…	…	…	…	…
Total	82	100,0	578	100,0	215,3	8823

patterns, recurrent theoretical approaches, predominant methodologies, and significant gaps in the existing literature. The main results are presented through tables and figures that integrate the evidence collected and synthesize the most relevant trends observed in the reviewed studies.

Additionally, the tables and charts included in the results and discussion sections were generated with the support of the research assistant RAJ, developed by Dr. Javier Gamboa Cruzado and based on advanced artificial intelligence techniques.

4 Results and Discussion

In this section, the results obtained are presented and analyzed, situating them within the framework of the existing literature and in relation to the objectives established in the research. To conduct

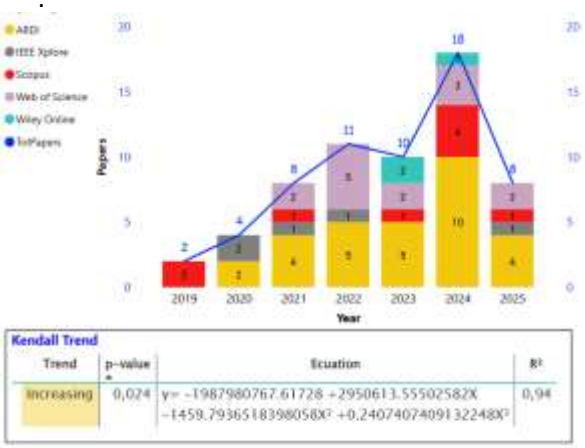

Fig. 7. Annual Evolution of Publications and Statistical Trend Using Kendall Trend

the review and analysis of the selected corpus, a mixed approach was employed that combined manual assessment with a structured processing of the data, whose methodological stages are represented in Figure 5.

The methodological procedure followed a coherent and structured analytical sequence. First, a systematic collection of information from specialized academic sources was carried out, ensuring the relevance and timeliness of the initial corpus. Subsequently, the pertinent data were selected according to the previously established inclusion criteria, thereby delimiting the valid documentary set for the analysis. In a third phase, the data were normalized and transformed to ensure their consistency, comparability, and methodological quality. Next, analysis and data mining techniques were applied to identify patterns, trends, and significant relationships within the corpus. Finally, the results obtained were critically interpreted and evaluated, allowing for the derivation of structured knowledge consistent with the central objectives of the research.

4.1 General Description of the Studies

A global overview of the studies analyzed is presented below, synthesizing the most relevant contributions and articulating the discussions that emerge from the reviewed corpus. This description enables the identification of predominant approaches, methodological trends, and theoretical perspectives that structure the field, while also offering guiding elements for future lines of research related to this topic.

Figure 6 and Table 5 present the geographic distribution of the 61 papers analyzed, both in terms of publication volume and accumulated citations, as well as the total H-index by country. This dual visualization allows comparison between productive concentration and scientific relevance, offering a robust panorama of which national systems lead the research agenda in the field under study.

As shown in the results, the leadership of the United Kingdom, Germany, Spain, and the United States suggests the presence of mature scientific ecosystems with stable funding policies, consolidated research groups, and international networks that support a sustained production of papers.

According to the findings presented, the high number of citations and the elevated H-index of countries such as the United Kingdom and Germany indicate not only quantity, but also theoretical and methodological centrality and influence in shaping the field. A second group of countries (Canada, Italy, the Netherlands, Australia, China, and Greece) also contributes relevant outputs, although in smaller volume, which may correspond to more focused excellence clusters dependent on specific projects or research centers.

The long tail of countries with one or two publications reflects an internationalization process that is still incipient and uneven, likely conditioned by gaps in research infrastructure, access to competitive funding, and proficiency in academic English. Finally, the North–South imbalance highlights that many local realities remain underrepresented, which may bias theoretical frameworks and proposed models toward high-income contexts, thereby limiting their external validity.

Papavasileiou and colleagues [77] point to a high institutional affiliation concentrated in the United Kingdom and Germany. It is worth noting that this configuration suggests consolidated scientific production hubs and mature academic networks. In contrast, Khooshechin Gilak [66] and

Delcea and their team [71] concur on China's leadership in publication volume and collaborations, followed by the United States and the United Kingdom, which consequently reveals a shift toward new centers of scientific gravitation. Although these results stem from different approaches and periods of analysis, taken together they portray a scenario in which Western Europe and China, along with the United States, constitute the predominant research hubs in the studied field.

These patterns suggest the need to promote North–South and South–South collaborations in order to transfer methodologies, data, and best practices to other business sectors and applied domains, reducing dependency on a few production hubs. Likewise, the geographic concentration underscores the importance of replicating and adapting these studies in underrepresented regions (Latin America, Africa, parts of Asia), assessing whether the models developed in advanced economies are generalizable to other productive structures and regulatory frameworks. Looking ahead, monitoring the temporal evolution of this distribution will make it possible to analyze the emergence of new research hubs and their potential impact on thematic and sectoral diversification of the field, in academic, corporate, and governmental contexts.

Figure 7 displays the annual evolution of the number of papers identified between 2019 and 2025, disaggregated by database and accompanied by the annual total curve. This representation, together with Kendall's trend test, allows assessment not only of the absolute variation in publications, but also of the presence of a statistically significant temporal trend

As shown in the results, the sustained increase leading up to the peak in 2024 (18 publications) demonstrates a maturation of scientific interest, likely driven by stronger editorial incentives, technical advances, and the expansion of funded projects. According to the findings presented, the diversity of databases (Scopus, Web of Science, IEEE Xplore, ARDI, Wiley) suggests an interdisciplinary field with high permeability across academic domains, reflecting the need for technical and applied approaches from multiple perspectives.

The p-value = 0.024 and $R^2 = 0.94$ confirm a statistically significant upward trend, indicating that the increase is not random, but rather the result of structural conditions such as data availability, favorable editorial policies, and thematic consolidation. The apparent decrease in 2025 should be interpreted with caution, since the review includes publications only up to July 18, 2025; therefore, it does not represent an actual decline but a temporal cutoff in the document capture period. This behavior suggests that the 2024 peak may be sustained or even surpassed, especially if institutional investments, research consortia, and technological transfer toward emerging applications continue.

In comparison with the work of Rönsch [68] and Hidayat and colleagues [67], there is convergence in the recurrent use of databases such as IEEE, Scopus, and ScienceDirect, which is worth emphasizing as an indicator of methodological consistency; consequently, the focus on specific keywords reinforces the comparability of findings. Although each study addresses particular approaches, the temporal distribution shows a steady growth of interest since 2020, and overall, ARDI and Web of Science stand out for their greater contribution to the consolidation of the field.

The patterns observed support the thematic expansion of the field and justify its extrapolation to business sectors such as logistics, manufacturing, telecommunications, healthcare, and smart services, where the evidence may accelerate technological adoption. Replicating this monitoring in underrepresented regions will enable assessment of convergence or divergence in the temporal evolution of scientific production, especially in emerging economies with lower bibliometric visibility. Follow-up beyond July 2025 will be essential to determine whether growth is sustained, allowing projection of future scenarios of innovation, research investment, and knowledge transfer across different scales and time horizons.

Figure 8 presents the Pareto distribution of accumulated citations per year, allowing identification of which temporal cohorts concentrate most of the scientific impact. This visualization combines the absolute number of citations with the accumulated percentage, facilitating a critical analysis of the concentration of academic recognition during the period studied.

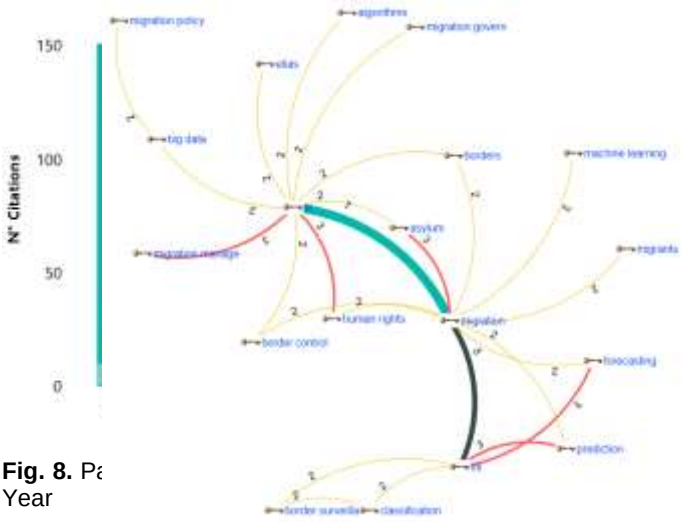

Fig. 8. Pa
Year

Keyword1	Keyword2	Weight
ai	migration	7
migration	ml	5
ai	human rights	3
ai	migration management	3
asylum	migration	3
forecasting	ml	3
ml	prediction	3
ai	algorithms	2
ai	asylum	2
ai	big data	2
ai	border control	2
ai	borders	2
ai	etias	2
ai	migration governance	2
big data	migration policy	2

Fig. 9. Bibliometric Keyword Network

Table 6. Distribution of Keywords by Quartile

Keyword	NQ	Q1	Q2	Q3	Total
ai	2	12	5	0	19
migration	3	12	3	1	19
ml	3	6	5	1	15
big data	2	3	0	0	5
border control	0	3	2	0	5
prediction	1	2	2	0	5
human rights	1	2	1	0	4
migration management	0	2	2	0	4
migration policy	0	4	0	0	4
asylum	1	1	1	0	3
forecasting	1	2	0	0	3
human migration	0	2	1	0	3
machine learning	0	3	0	0	3
migrants	0	2	1	0	3
algorithms	0	2	0	0	2
…	…	…	…	…	…
Total	37	216	83	9	345

As shown in the results, the years 2021 and 2022 account for approximately 70 percent of the citations, indicating that a reduced fraction of the temporal period explains most of the impact, in line with the Pareto principle.

According to the findings presented, the inclusion of 2023 increases the cumulative percentage to approximately 85 percent, demonstrating that the papers published in these three years constitute the core body of the field, likely because they introduced foundational conceptual and methodological frameworks. This pattern can be explained by an “optimal citation window” effect: the papers from 2021–2022 are recent enough to remain relevant, yet have had sufficient time to be disseminated, replicated, and extensively cited.

The lower contribution from 2019 and 2020 suggests that part of the early literature has been displaced by more recent contributions, whereas

Table 7. Migration Control Criteria

Criteria	Reference	Qty. (%)
Digital Borders	[15] [16] [24] [50]	4 (27)
Refugee flow	[56]	1 (6)
Border surveillance	[5] [6] [8] [11] [16] [30] [32] [39]	8 (53)
Migrant counseling services	[53]	1 (7)
Border Migration	[46]	1 (7)

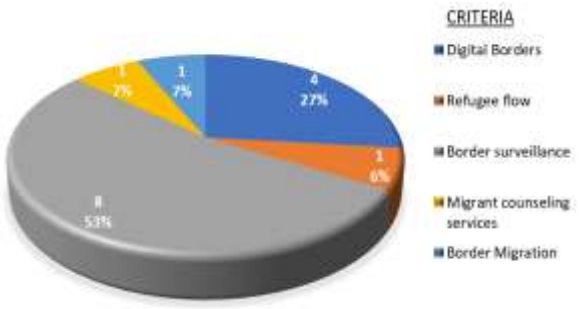

Fig. 10. Distribution of Migratory Control Criteria

the low number of citations in 2024–2025 is largely due to the short temporal window available for citation up to the cutoff date of the study. Taken together, the Pareto curve reveals a strong concentration of impact in a few years, which may generate excessive dependence on specific corpora and authors, increasing the risk of limiting the diversity of approaches if emerging perspectives are not incorporated.

These results encourage future research and business applications to examine in detail the high-impact literature from 2021–2023, while also paying attention to recent works that may introduce disruptive innovations in other sectors and organizational areas.

The pattern observed may replicate across other geographic regions and industrial domains; therefore, designing Pareto citation analyses in specific contexts (for example, logistics, healthcare, financial services, or digital government) would help quickly identify the key years and contributions for each setting. Finally, monitoring the evolution of this distribution in subsequent time horizons will make it possible to assess whether the influence of 2021–2022 persists, shifts toward new publication cohorts, or becomes more diversified, with direct implications for shaping research agendas, public policies, and long-term innovation strategies.

Figure 9 and Table 6 present the keyword co-occurrence network and the frequency of appearance by quartile, making it possible to identify the thematic cores that structure the literature. This combination of visualization and frequency counts provides a robust overview of the concepts that articulate the field and how they interrelate.

As shown in the results, ai and migration emerge as the most central nodes (19 occurrences each) and exhibit the strongest link (weight 7), indicating that the dominant axis of the field is the application of AI to the migratory phenomenon. According to the findings presented, the triad ai–migration–ml and its connections with forecasting, prediction, and big data reflect a clear orientation toward predictive modeling and large-scale data analytics, driven by the availability of administrative records and the pressure to anticipate migratory flows.

The strong association of migration with asylum, border control, and migration management/policy suggests that AI is primarily embedded within logics of governance and border control, where states seek to optimize decision-making under security and resource constraints.

At the same time, the presence of human rights as a keyword connected to ai and migration reveals a structural tension between algorithmic efficiency and the safeguarding of fundamental rights, suggesting that part of the literature adopts a critical and normative stance toward the use of automated decision-making systems.

The fact that most of these keywords appear in Q1 and Q2 journals shows that the debate is consolidating within high-impact venues, which reinforces the centrality of these topics but may also bias the research agenda toward regulatory frameworks and realities of the Global North, reducing visibility for peripheral contexts and the lived experiences of migrants.

In papers by Gunawan and colleagues [65], Hidayat and collaborators [67], and Delcea and their team [71], a clear convergence with the results presented can be observed. It is worth highlighting that all of them confirm the centrality of

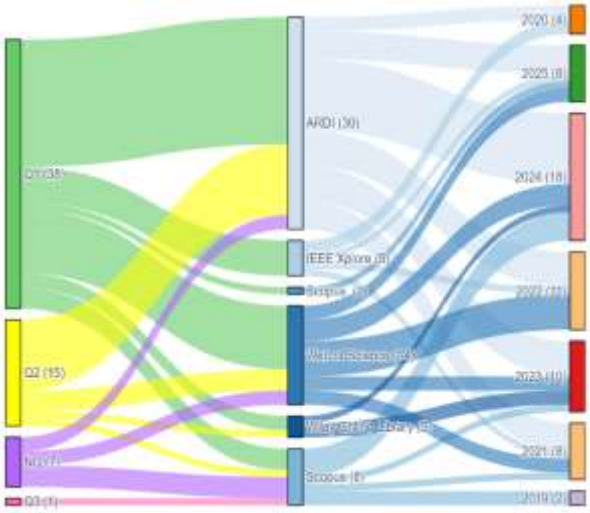

Fig. 11. Number of Papers by Quartile, Source, and Year

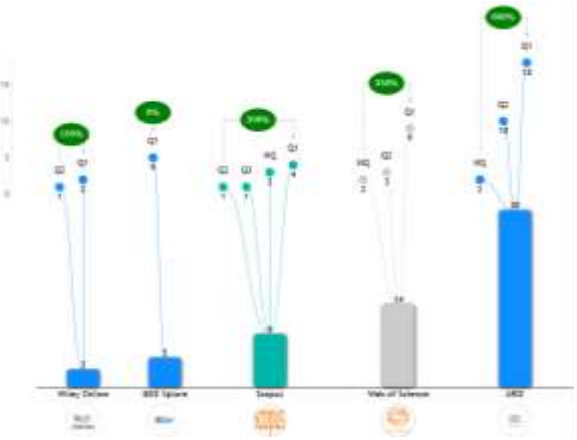

Fig. 12. Number of Papers by Source and Quartile

the term migration and its close association with technologies such as machine learning, surveillance, or border control; consequently, this recurrent pattern reinforces the idea that AI applied to migration management is primarily articulated around predictive analytics and enhanced surveillance mechanisms.

These thematic patterns are extrapolable to other sectors where AI is used to manage populations and resources (public safety, public health, social services, credit, or human resources), which requires design and evaluation frameworks that integrate a rights-based perspective from the outset. In geographic terms, the current concentration invites replicating keyword network analyses in underrepresented regions (Latin America, Africa, and border zones across the Global South) to capture specific challenges, local vocabularies, and distinct institutional arrangements.

Looking ahead, monitoring the evolution of this network will make it possible to detect the emergence of new technologies (generative AI, multimodal biometrics, intelligent surveillance) and to anticipate needs for regulation, algorithmic governance, and transparency applicable across different historical periods and institutional or corporate contexts.

4.2 Answers to the Research Problems

This section presents the answers to the research questions formulated in the study, based on the analysis of the final corpus composed of 61 scientific papers selected through a rigorous process. From this sample, the main trends, approaches, and gaps related to the use of generative artificial intelligence in Migration Control of Persons were examined.

The answers are organized according to each research question (RQ), accompanied by representative figures that facilitate their understanding. For each RQ, a critical interpretation of the findings is provided, along with their comparison to specialized literature and the implications these results generate for future research or for the development of more ethical and effective policies in the migration domain.

RQ1: What criteria are used to measure or assess Migration Control of Persons?

Table 7 and Figure 10 summarize the criteria used in the literature to evaluate Migration Control of Persons. This combination allows visualization of both the absolute frequency and the relative weight of each criterion within the set of analyzed studies.

As shown in the results, border surveillance accounts for 53 percent of the cases, indicating a clear security-oriented focus in the field, where the effectiveness of control is measured primarily by surveillance and monitoring capacity at the border. According to the findings presented, the relevance of digital borders (27%) reveals an ongoing

Table 8. Relevant Metrics by Source

Source	Nº Papers	Nº Citats.	Citats./ Paper	H-Index
ARDI	30	209	7	1365
Web of Science	14	157	11	2487
Scopus	9	12	1	259
IEEE Xplore	5	31	6	1450
Wiley Online	3	4	1	193
Total	61	413	7	5754

Table 9. Relevant Metrics by Quartile

Quartile	Nº Papers	Nº Citats.	Citats./ Paper	H-Index
Q1	38	319	8	5049
Q2	15	76	5	690
NQ	7	18	3	0
Q3	1	0	0	15
Total	61	413	7	5754

digitalization process of control mechanisms, including biometrics, interoperable databases, and risk-scoring systems, driven by the availability of advanced technologies and by political agendas centered on preventive threat management. The limited presence of criteria such as refugee flow and border migration suggests that migration flows and trajectories are used less as performance indicators of the system, possibly because they require more complex explanatory models and longitudinal data that are difficult to obtain. The low weight of migrant counseling services indicates that the dimension of migrant support and assistance is scarcely considered in control assessment, reflecting a structural bias toward operational efficiency metrics rather than protection and well-being metrics.

Taken together, the observed pattern shows an evaluation model strongly centered on border infrastructure and surveillance, with weak integration of humanitarian and rights-based criteria, which may create imbalances between security, legality, and human dignity.

The criteria identified in this review, centered on border surveillance and digital borders, align with the work of Khooshechin Gilak [66], who emphasize the use of facial recognition for security and control purposes. Hidayat and colleagues [67], consequently, reinforce this technocentric bias by highlighting authentication methods and operational threats; although their approaches contain nuances, altogether both contributions confirm that Migration Control of Persons is predominantly evaluated through security indicators, technological performance, and risk management.

These results suggest that evaluation frameworks should expand to incorporate indicators related to service quality, rights protection, and outcomes for migrants, similar to practices adopted in other data-intensive and control-intensive sectors (public security, financial services, healthcare, or human resources). The predominance of security-oriented criteria invites further exploration of how these weightings shift in other geographic areas, such as migration corridors of the Global South, and across different historical periods, where political, regulatory, and social priorities may differ.

Looking toward the design of AI-based policies and solutions, a future agenda should promote more balanced evaluation schemes that combine surveillance, digital management, and support services, enabling the responsible transferability of these criteria to other sectoral and organizational contexts.

RQ2: What distribution of quartile levels is observed in the journals where research on the effect of Generative AI on Migration Control of Persons has been published?

Figures 11 and 12 and Tables 8 and 9 show the relationship between quartiles, databases, and publication years for the 61 papers analyzed, along with their impact metrics (citations and H-Index). This combination makes it possible to evaluate not only where research on Generative AI and Migration Control of Persons is being published, but also the quality and relative influence of those publication channels.

According to the findings presented, Web of Science and ARDI function as dissemination hubs: WoS shows the highest citation intensity per paper (11) and the highest H-Index, while ARDI concentrates the largest volume of papers (30), suggesting complementarity between impact and coverage. As shown in the results, most of the production is concentrated in Q1 journals (38 of 61 papers, 62 percent) and accumulates 77 percent of the citations, indicating a clear publication strategy

Table 10. Definitions of Generative AI in Migration Control of Persons

Category	Criterion	Reference	Qty. (%)
Application of Migration Control	Migration governance, risk assessment, border control, administrative decisions	[13] [17] [24] [26] [34] [45] [49] [60]	8 (14)
Cognitive Simulation	Thinking, creativity, reasoning	[12] [21] [28] [35] [37] [40] [42]	7 (12)
Use of AI Algorithms	Use of machine learning, neural networks, deep learning	[5] [20] [22] [23] [32] [38] [46] [52] [53] [55] [56] [58]	12 (21)
Natural Language	Automatic text generation using AI	[18] [29] [39] [48] [50] [51]	6 (10)
Autonomous Content Generation	Automatic development of new works (text, image, music) through AI	[4] [6] [7] [8] [9] [10] [11] [14] [15] [16] [19] [25] [27] [30] [31] [33] [36] [41] [43] [44] [47] [54] [57] [59] [61]	25 (43)

targeting outlets with maximum visibility and methodological rigor.

Critically, the residual presence of Q3 and non-quartile journals (NQ) demonstrates that relevant research on generative AI in migration tends to be legitimized primarily within high-reputation circuits, likely driven by institutional pressure to publish in Q1–Q2 venues and by academic evaluation policies.

Furthermore, the strong relative growth of Q1 papers in ARDI, Scopus, and Web of Science reflects an "editorial upgrade" process in which researchers redirect their submissions to journals with stronger indicators, supported by competitive calls and international collaboration networks. Finally, the low density of publications in IEEE Xplore and Wiley, despite their strong citation indicators, suggests that engineering and computer science communities still have room to deepen the specific discussion on migration control beyond general technical contributions.

It is worth noting that Khooshechin Gilak [66] report that 46.15% of the papers were published in journals, highlighting IEEE Xplore and ScienceDirect as predominant sources. Hidayat and colleagues [67], consequently, concur by identifying IEEE Xplore as one of the principal publication channels on the topic. Although Roman-Acosta and their team [69] mention Scopus, Web of Science, and SciELO as recurrent databases, none of these contributions specify the quartile level of the sources, which limits a refined comparison of editorial quality. Taken together, prior evidence describes indexing bases but does not provide depth regarding quartile distribution.

These patterns reinforce the idea that future contributions on generative AI and Migration Control should prioritize Q1–Q2 journals and databases such as Web of Science, Scopus, and IEEE Xplore, while also exploring emerging journals in law, public policy, and social studies to broaden perspectives and audiences, including their application to other data-intensive business sectors (finance, healthcare, logistics, security). From a geographic standpoint, replicating this quartile analysis in underrepresented contexts will make it possible to identify visibility gaps and design co-authorship and training strategies that facilitate the inclusion of researchers from peripheral regions in high-impact journals.

Looking ahead, longitudinal monitoring of these metrics will help anticipate shifts in editorial hubs (for example, the emergence of new Q1 journals specialized in AI and migration governance) and transfer the lessons learned to other fields where generative AI is reshaping organizational decision-making and control processes.

RQ3: What definitions of Generative AI and its application to Migration Control of Persons have been proposed, used, or implemented in the analyzed studies?

Table 10 synthesizes the main definitions and theoretical bases employed by the studies addressing Generative AI in Migration Control of Persons. This classification makes it possible to identify which conceptual dimensions are prioritized and how the theoretical understanding of generative AI is framed within this domain.

As the results show, the dominant category is autonomous content generation (43%), indicating that most papers conceptualize generative AI primarily through its technical capacity to produce new texts, images, or representations, rather than through its institutional or regulatory

Bigram	Nº Bigrams
machine learning	37
artificial intelligence	20
border control	14
asylum seekers	12
data protection	12
european union	12
human rights	11
big data	10
fundamental rights	10
random forest	10
united states	10
member states	8
migration management	8
neural network	7
neural networks	7
border management	6
civil society	6
data collection	6
decision trees	6
deep learning	6
figure shows	6
gradient boosting	6
social media	6
time series	6
Total	**242**

Fig. 13. Top 20 Most Frequent Bigrams in the Reviewed Articles

embeddedness. According to the findings presented, the second most frequent category is the use of AI algorithms (21%), reflecting a strongly computational focus in which theoretical discussion is anchored in machine learning architectures, neural networks, and deep learning, rather than in sociolegal or ethical-political frameworks.

The smaller yet relevant presence of migration control application (14%) reveals that only a portion of the studies explicitly frame generative AI as an instrument for migration governance, risk assessment, or support for administrative decision-making, suggesting a certain disconnection between technical definition and the institutional context in which it operates.

References to cognitive simulation (12%) indicate an emerging interest in linking generative AI to processes such as thought, creativity, or reasoning, although still as a minority theoretical construct compared to purely functional definitions.

Finally, the category of natural language (10%) shows that the dimension of text processing and generation (chatbots, assistants, linguistic decision systems) is recognized, but it is not always explicitly connected to the interpretation risks, bias, and opacity that these models introduce into decision-making processes involving migrants.

The criteria identified in this review, centered on border surveillance and digital document control, align with the work of Khooshechin [66], who emphasize the use of facial recognition for security purposes in cameras and check-in points. Consequently, Generative AI and related technologies are functionally defined as tools supporting automated control. Hidayat and colleagues [67] reinforce this technical focus by highlighting authentication methods and operational threats in biometric systems, although they prioritize a risk perspective rather than a normative conceptualization.

In contrast, Koroniotis and their team [75] broaden the definitional framework by conceiving the smart airport as an infrastructure integrating AI, big data, and facial biometrics to automate operational decisions, shaping a systemic vision of AI application in Migration Control of Persons. Taken together, the definitions converge on an instrumental understanding strongly anchored in security, automation, and risk management.

These patterns suggest that future agendas should integrate, more systematically, sociotechnical, legal, and human rights

Table 11. Top 20 Most Frequent Bigrams in the Reviewed Articles

Bigram	≥15	≥5 <15	<5	Total
machine learning	5	9	23	37
artificial intelligence	3	5	12	20
border control	0	3	11	14
data protection	3	4	5	12
european union	2	2	8	12
human rights	4	3	4	11
big data	4	2	4	10
fundamental rights	0	2	8	10
random forest	2	3	5	10
united states	1	2	7	10
member states	1	1	6	8
migration management	3	2	3	8
neural network	0	4	3	7
neural networks	1	3	3	7
border management	1	0	5	6
Total	37	63	142	242

frameworks that connect content generation capabilities and algorithms with concrete migration control practices, something that is also applicable to other sectors intensive in automated decision-making (healthcare, credit, human resources, public security). From a geographic standpoint, replicating this definitional analysis in studies from the Global South would make it possible to determine whether the same technical emphases persist or whether conceptualizations emerge that are more centered on vulnerability and power asymmetries.

Over time, tracking the evolution of these categories will reveal whether generative AI becomes reconceptualized from a purely instrumental vision toward approaches centered on algorithmic governance and applied ethics, with direct effects on the design of public policies, corporate standards, and regulatory frameworks across different contexts.

RQ4: Which topics concentrate the highest number of citations in studies addressing Generative AI and its influence on Migration Control?

Figure 13 and Table 11 display the most frequent bigrams in the articles, disaggregated according to citation ranges (≥15, ≥5<15, and <5). This combination makes it possible to identify which topics are associated with the most influential works on generative AI and migration control.

As the results show, machine learning (5 occurrences in papers with ≥15 citations and 37 in total) and artificial intelligence (3 and 20, respectively) constitute the conceptual core of the most highly cited studies, demonstrating that machine learning approaches are the main theoretical and methodological drivers of the field. According to the findings presented, bigrams such as data protection, human rights, and big data appear several times in the ≥15 citation range, indicating that the most impactful papers combine algorithmic sophistication with discussions on privacy, fundamental rights, and large-scale exploitation of sensitive data, likely influenced by stringent regulatory frameworks, particularly in Europe.

The strong presence of terms such as European Union, member states, and fundamental rights suggests that a significant portion of the highly cited literature is produced within regulatory contexts where the tension between security and rights is institutionalized, which contributes to these studies becoming benchmark references.

In contrast, operational expressions such as border control, border management, and migration management tend to fall within the middle and lower citation ranges, possibly because many applied studies are more contextual, less theoretical, and therefore less cited outside their immediate sphere. Critically, the overall distribution (37 bigrams in ≥15-citation articles versus 142 in <5) reveals a pattern of impact concentration around a small subset of conceptual combinations, potentially generating path-dependence effects: the same frameworks are cited and replicated, while other potentially relevant approaches remain underrepresented.

In studies such as those by Gunawan and colegas [65], Delcea and colaboradores [71], and Hidayat and su equipo [67], it is noteworthy that topics such as machine learning, artificial intelligence, and facial recognition recur consistently as central conceptual axes. This thematic repetition suggests, therefore, that the most highly cited papers articulate Generative AI and Migration Control of Persons around advanced techniques of machine learning and biometric recognition. Although each paper emphasizes specific applications and contextual conditions,

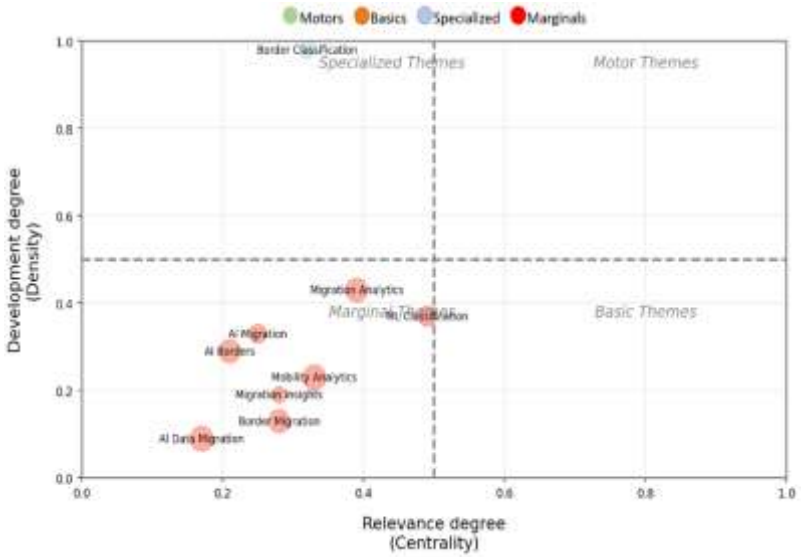

Fig. 14. Thematic Representation of Research on Generative AI and Migration

Table 12. Thematic Categories and Bibliometric Metrics

Topic	Density	Centrality	Total Citations	Total Documents	Category
Border Classification	0,98	0,32	99	14	Specialized
Migration Analytics	0,43	0,39	234	34	Marginals
ML Classification	0,37	0,49	169	23	Marginals
AI Migration	0,33	0,25	147	15	Marginals
AI Borders	0,29	0,21	224	28	Marginals
Mobility Analytics	0,23	0,33	264	36	Marginals
Migration Insigths	0,19	0,28	87	16	Marginals
Border Migration	0,13	0,28	224	28	Marginals
AI Data Migration	0,09	0,17	260	31	Marginals

together they converge in consolidating these topics as the dominant core of the scientific discourse in the field. It is also relevant that, in other technological contexts, such as API deployment through ML, similar patterns of thematic concentration based on recurrent keywords have been identified, allowing the inference of conceptual nuclei and associative traces within large research ecosystems.

In that study, terms such as “artificial intelligence”, “machine learning”, “internet of things”, and “industry 4.0” exhibited higher bibliographic co-occurrence, reinforcing the use of semantic mining to delineate dominant thematic foci [78].

These results indicate that future research and business solutions based on generative AI should explicitly integrate machine-learning components with considerations related to data protection and human rights—an approach that can be transferred to sectors such as finance, healthcare, human resources, digital marketing, or public security.

At the geographical level, the centrality of references associated with the European Union points to the need to develop similar studies in

other regions (Latin America, Africa, Asia) to understand how the relationship between technology, migration control, and rights varies under different regulatory frameworks and historical contexts. From a temporal perspective, monitoring these bigrams and their citation segments will make it possible to detect the emergence of new dominant topics (e.g., generative models, foundation models, or algorithmic accountability), which would have direct implications for public-policy design, algorithmic governance, and organizational innovation strategies.

RQ5: What thematic categories are identified in the studies that analyze Generative AI and its influence on Migration Control?

Figure 14 and Table 12 present the Callon thematic map constructed from keyword co-occurrence networks, where centrality (horizontal axis) indicates the relevance of each theme within the field, and density (vertical axis) reflects the degree of internal development of each topic.

This approach makes it possible to characterize the conceptual structure of research on Generative AI and Migration Control.

As shown in the results, Border Classification exhibits the highest density (0.98) but only moderate centrality (0.32), indicating a highly developed and cohesive theme that is nonetheless relatively specialized and weakly connected to other topics within the field.

According to the findings reported, the remaining themes fall into the Marginals category, with low or medium densities and moderate centralities, suggesting a fragmented field composed of emerging lines of research that are still in the process of theoretical and methodological consolidation.

Topics such as Mobility Analytics, AI Data Migration, and Migration Analytics accumulate high volumes of citations and documents, yet maintain limited density, indicating that they are widely used as descriptive labels or dispersed applications rather than well-structured conceptual frameworks.

The case of ML Classification, which shows the highest centrality (0.49) among marginal themes, suggests that classification techniques based on machine learning function as a “methodological bridge” across different research lines, although they have not yet evolved into an integrative theoretical nucleus on migration and algorithmic decision-making.

Taken together, the map reveals that research prioritizes technical and analytical innovations (classification, mobility analytics, migration data) over the construction of a “motor theme” capable of robustly articulating the technological, legal, and human-rights dimensions associated with migration control.

Delcea and colleagues [71] notably emphasize highly technical topics such as classification and random forest, which consequently reveals a clear orientation toward the use of algorithmic models in migration control.

These terms align with categories such as Border Classification, focused on automating border-related decisions, although they place ethical or humanitarian considerations in a secondary position; in sum, the predominant thematic categories reinforce a functional and technocentric understanding of Generative AI and its influence on Migration Control.

These patterns highlight the need to promote research agendas that transform certain marginal topics with high centrality (ML Classification, Mobility Analytics, AI Data Migration) into true motor themes, integrating technical, legal, and ethical dimensions—something transferable to other data-intensive sectors (finance, healthcare, public security, human resources).

The specialization of Border Classification suggests that technological deployment decisions may be guided by a highly technical subfield weakly connected to broader debates on governance and rights; replicating this thematic analysis in other geographic regions would help identify biases and gaps in different regulatory contexts.

From a temporal perspective, tracking the centrality and density of these themes will make it possible to determine whether the field converges toward a more balanced set of motor themes, which would have direct implications for the design of public policies, corporate standards, and regulatory frameworks in the application of generative AI to migration control and other organizational domains.

5 Conclusions and Future Research

This systematic review made it possible to characterize, based on 61 papers published between 2019 and July 2025, how Generative AI is reshaping Migration Control of Persons in terms of evaluation criteria as well as technological devices and discursive frameworks. Regarding RQ1, the findings confirm that the effectiveness of migration control is predominantly measured through border surveillance and digital borders criteria, which reflects the consolidation of a security-oriented paradigm supported by intensive surveillance infrastructures rather than indicators of inclusion or protection. This bias responds to political pressure to manage risks and flows in real time, as well as to the availability of biometric technologies, risk-assessment systems and interoperable platforms, while simultaneously pushing into the background dimensions such as migrant support or the quality of services provided. With respect to RQ2, the strong concentration of publications in Q1 and Q2 journals, indexed mainly in Web of Science, Scopus, IEEE Xplore and ARDI, shows that the debate on Generative AI and Migration Control of Persons is legitimized within circuits of high scientific reputation, reinforcing demanding methodological standards and global visibility. However, this same concentration reproduces structural asymmetries: it privileges agendas, regulatory frameworks and languages from the Global North, while reducing the presence of perspectives situated in peripheral contexts or in non-quartile-indexed journals (NQ), despite their relevance for understanding complex migratory realities. Thus, quartile patterns describe not only where research is published, but also who defines problem categories and what kinds of evidence are considered valid for guiding AI-based migration policies.

Regarding RQ4, the bigram analysis by citation counts reveals that the most influential papers are structured around machine learning and artificial intelligence, closely linked with notions such as data protection, human rights and big data, indicating that the core of the field combines algorithmic sophistication with regulatory and fundamental-rights concerns. The prominence of expressions associated with the European Union, member states and fundamental rights suggests that a substantial portion of the reference literature emerges in environments where the tension between security and rights is institutionalized, generating a relatively advanced framework of algorithmic governance but also a strongly Eurocentric orientation. At the same time, operational concepts such as border control, border management and migration management appear in intermediate or low citation ranges, reflecting that many applied studies remain contextual, fragmented and with limited theoretical reach beyond their immediate scope. Finally, with regard to RQ5, the Callon thematic map shows a field structured around a single highly specialized topic (Border Classification), with high density but moderate centrality, accompanied by a set of marginal topics such as Mobility Analytics, AI Data Migration or Migration Analytics, which accumulate many citations and documents but do not reach sufficient cohesion to become motor themes. This configuration suggests that research prioritizes technical innovations (classification, flow analytics, mining of migration datasets) rather than the construction of integrative frameworks that systematically articulate technological, legal, ethical and human-rights dimensions. The position of ML Classification as a marginal node with high centrality also indicates that machine-learning techniques function as a methodological bridge between different lines of work, although they have not yet crystallized into a robust theory of algorithmic decision-making in border contexts.

Taken together, the responses to RQ1, RQ2, RQ4 and RQ5 indicate that the impact of Generative AI on Migration Control of Persons unfolds within a mature scientific ecosystem, increasingly productive and strongly indexed in high-impact journals, yet still marked by a security-oriented and technocentric orientation. The integration of bibliometric analysis, text mining and qualitative assessment of the corpus provides a detailed map of criteria, publication channels, dominant topics and thematic categories, contributing to clarifying a dispersed field often treated in a fragmented manner by previous reviews. Nevertheless, relevant challenges persist: the limited incorporation of metrics centered on migrant well-being, the scarce presence of perspectives from the Global South, the weak articulation between generative models and

governance frameworks and the absence of rigorous empirical evaluations of the real performance of these systems in diverse border contexts.

The methodological limitations of this review, such as the restriction to papers published in English, the focus on peer-reviewed literature, the use of specific academic databases and the time window closed on July 18, 2025, imply that the findings should be interpreted with caution, especially when extrapolating to underrepresented regional contexts or to early-stage developments of generative AI outside the academic sphere.

Looking ahead, it would be pertinent to promote interdisciplinary and comparative research in regions of the Global South that explore alternative criteria, topics and thematic categories, including well-being, integration and support, and that contrast different regulatory regimes and governance models. Finally, it is advisable to extend this type of analysis to other data-intensive sectors, such as health, public safety, financial services and social protection, in order to identify common patterns and specificities in the ways Generative AI reshapes decision-making processes that directly affect rights and life trajectories.

References

1. **Aslan, P., Ertem Eray, T. (2019).** How to analyze big data: a study on understanding what the Turkish think about Syrian refugee crisis. Selçuk İletişim, 12(2), 763-780.
2. **Ahmed, N., Diptu, N. A., Shadhin, M. S. K., Jaki, M. A. F., Hasan, M. F., Islam, M. N., Rahman, R. M. (2019).** Artificial neural network and machine learning based methods for population estimation of Rohingya refugees: Comparing data-driven and satellite image-driven approaches. Vietnam Journal of Computer Science, 6(4), 439–455.
3. **Avello Martinez, M. (2023).** EU Borders and Potential Conflicts between New Technologies and Human Rights. Peace & Security – Paix et Sécurité Internationales, 11, 1-33.
4. **Baggen, H. S., Shalley, F., Taylor, A., Zander, K. K. (2023)**. The application of machine learning to rural population migration research. Population, Space and Place, 29, e2664.
5. **Beduschi, A. (2021).** International migration management in the age of artificial intelligence. Migration Studies, 9(3), 576–596.
6. **Bellazi, K. M., Marino, R., Lanza-Gutierrez, J. M., Riesgo, T. (2020).** Towards a machine learning-based edge computing oriented monitoring system for the desert border surveillance use case. IEEE Access, 8, 218304–218322.
7. **Best, K., Gilligan, J., Baroud, H., Carrico, A., Donato, K., Mallick, B. (2022).** Applying machine learning to social datasets: A study of migration in southwestern Bangladesh using random forests. Regional Environmental Change, 22(2), 1–12.
8. **Bircan, T., & Korkmaz, E. E. (2021).** Big data for whose sake? Governing migration through artificial intelligence. Humanities and Social Sciences Communications, 8, 241.
9. **Blasi Casagran, C., Stavropoulos, G. (2024).** Developing AI predictive migration tools to enhance humanitarian support: The case of EUMigraTool. Data & Policy, 6, e64.
10. **Bogusz, H., Winnicki, S., Wójcik, P. (2024).** What factors contribute to uneven suburbanisation? Predicting the number of migrants from Warsaw to its suburbs with machine learning. Annals of Regional Science, 72, 1353–1382.
11. **Bosco, C., Minora, U., Rosińska, A., Teobaldelli, M., Belmonte, M. (2024).** A Machine Learning architecture to forecast Irregular Border Crossings and Asylum requests for policy support in Europe: a case study. Data & Policy, 6, e81.
12. **Brouwer, E. (2021).** Schengen and the Administration of Exclusion: Legal Remedies Caught in between Entry Bans, Risk Assessment and Artificial Intelligence. European Journal of Migration and Law, 23(4), 485-507.
13. **Brunner, L. R., Tao, W. W. (2023).** Artificial intelligence and automation in the migration governance of international students: An

accidental ethnography. Journal of International Students, 14(1), 269-288.

14. **Carammia, M., Iacus, S. M., Wilkin, T. (2022).** Forecasting asylum-related migration flows with machine learning and data at scale. Scientific Reports, 12, 1457.
15. **Collins, F. L. (2023).** Geographies of migration III: The digital migrant. Progress in Human Geography, 47(5), 738–749.
16. **Forti, M. (2024).** Addressing Algorithmic Errors in Data-Driven Border Control Procedures. German Law Journal, 25(4), 635–645.
17. **Giang, N. H., Nguyen, T.-T., Tay, C. C., Phuong, L. A., Dang, T.-T. (2022).** Towards Predictive Vietnamese Human Resource Migration by Machine Learning: A Case Study in Northeast Asian Countries. Axioms, 11(4), 151.
18. **Guillén, A., Teodoro, E. (2023).** Embedding Ethical Principles into AI Predictive Tools for Migration Management in Humanitarian Action. Social Sciences, 12(2), 53.
19. **Havas, C., Wendlinger, L., Stier, J., Julka, S., Krieger, V., Ferner, C., Petutschnig, A., Granitzer, M., Wegenkittl, S., Resch, B. (2021).** Spatio-Temporal Machine Learning Analysis of Social Media Data and Refugee Movement Statistics. ISPRS International Journal of Geo-Information, 10(8), 498.
20. **Iazzolino, G. (2025).** Trading efficiency for control: The AI conundrum in migration management. Cosmopolitan Civil Societies: An Interdisciplinary Journal, 17(1), 35–46.
21. **Kalodanis, K., Rizomiliotis, P., Feretzakis, G., Papapavlou, C., Anagnostopoulos, D. (2025).** High-Risk AI Systems—Lie Detection Application. Future Internet, 17(1), 26.
22. **Kinchin, N., Mougouei, D. (2022).** What can artificial intelligence do for refugee status determination? A proposal for removing subjective fear. International Journal of Refugee Law, 34(3–4), 373–397.
23. **Kneuer, M., Roch, J., Heid, U., Kliche, F. (2025).** Solidarity versus security? Tracing shifts in the citizens' discourse during the 'migration crisis' in Germany. European Politics and Society, 1–24.
24. **Kocher, A. (2023).** Glitches in the Digitization of Asylum: How CBP One Turns Migrants' Smartphones into Mobile Borders. Societies, 13(6), 149.
25. **Kumi Kyeremeh, G., Abdul-Al, M., Qahwaji, R., Ali, N. T., Abd-Alhameed, R. A. (2025).** Fusion of hand biometrics for border control involving fingerprint and finger vein. IEEE Access, 13, 25858–25871.
26. **La Fors, K., Meissner, F. (2022).** Contesting border artificial intelligence: Applying the guidance-ethics approach as a responsible design lens. Data & Policy, 4, e36.
27. **Liyanage, C. R., Mago, V., Schiff, R., Ranta, K., Park, A., Lovato-Day, K., Agnor, E., Gokani, R. (2023).** Understanding why many people experiencing homelessness reported migrating to a small Canadian city: Machine learning approach with augmented data. JMIR Formative Research, 7, e43511.
28. **López-Otero, J., Obregón-Sierra, Á., Gavira-Narváez, A. (2024).** Migration and Segregated Spaces: Analysis of Qualitative Sources Such as Wikipedia Using Artificial Intelligence. Social Sciences, 13(12), 664.
29. **Maj, J., Ruszczak, B., Kubiciel-Lodzińska, S. (2024).** Towards algorithm-assisted career management – a challenge for new immigration countries. Predicting migrants' work trajectory using ensemble learning. Central European Business Review, 13(5), 1–22.
30. **McAuliffe, M., Blower, J., Beduschi, A. (2021).** Digitalization and Artificial Intelligence in Migration and Mobility: Transnational Implications of the COVID-19 Pandemic. Societies, 11(4), 135.
31. **Meister, M., Niebuhr, A., Peters, J. C., Stiller, J. (2023).** Local attributes and migration balance – Evidence for different age and skill groups from a machine learning approach. Regional Science Policy & Practice, 15(4), 794–826.
32. **Milivojevic, S. (2022).** Artificial intelligence, illegalised mobility and lucrative alchemy of border utopia. Criminology & Criminal Justice, 25(2), 630–648.

33. **Mukhamedova, F., Tyukin, I. (2024).** Machine learning analysis of the effects of COVID-19 on migration patterns. Scientific Reports, 14, 29815.
34. **Nalbandian, L. (2022).** An eye for an 'I:' A critical assessment of artificial intelligence tools in migration and asylum management. Comparative Migration Studies, 10, 32.
35. **Azizi, S. S., Ngwaba, C. A., Ekhator-Mobayode, U. E. (2021).** Can machine learning predict quantity and duration of migration to the USA?. The Journal of Prediction Markets, 15(1), 97–107.
36. **Nnawuchi, U., George, C. (2025).** Decoding accountability: The importance of explainability in liability frameworks for smart border systems. Discover Computing, 28, 64.
37. **Olier, J. S., Spadavecchia, C. (2022).** Stereotypes, disproportions, and power asymmetries in the visual portrayal of migrants in ten countries: An interdisciplinary AI-based approach. Humanities and Social Sciences Communications, 9, 410.
38. **Ortega-Delcampo, D., Conde, C., Palacios-Alonso, D., Cabello, E. (2020).** Border control morphing attack detection with a convolutional neural network de-morphing approach. IEEE Access, 8, 92301–92313.
39. **Othmani, M., Jeridi, M. H., Wang, Q.-G., Ezzedine, T. (2021).** Border trespasser classification using artificial intelligence. IEEE Access, 9, 72284–72298.
40. **Papaioannou, M., Zachos, G., Essop, I., Mantas, G., Rodriguez, J. (2022).** Toward a secure and usable user authentication mechanism for mobile passenger ID devices for land/sea border control. IEEE Access, 10, 38832–38849.
41. **Pitoski, D., Meštrović, A., Schmeets, H. (2024).** The complex network patterns of human migration at different geographical scales: Network science meets regression analysis. Applied Network Science, 9, 35.
42. **Rinaldi, A., Teo, S. A. (2025).** The Use of Artificial Intelligence Technologies in Border and Migration Control and the Subtle Erosion of Human Rights. International and Comparative Law Quarterly, 74(1), 61–89.
43. **Rodríguez Sánchez, A., Wucherpfennig, J., Rischke, R., others (2023).** Search-and-rescue in the Central Mediterranean Route does not induce migration: Predictive modeling to answer causal queries in migration research. Scientific Reports, 13, 11014.
44. **Ruhnke, S., Rischke, R. (2024).** Predicting mobility aspirations in Lebanon and Turkey: a data-driven exploration using machine learning. Data & Policy, 6, e47.
45. **Gugliotta, L., Elbi, A. (2024).** Will AI "subtly" take over decision-making in the EU migration context? Warnings and lessons from ETIAS and VIS. European Papers, 9(3), 1018–1047.
46. **Schutte, S., Vestby, J., Carling, J., others (2021).** Climatic conditions are weak predictors of asylum migration. Nature Communications, 12, 2067.
47. **Shaikh, S., Yayilgan, S. Y., Abomhara, M., others (2025).** Multilingual user perceptions analysis from Twitter using zero shot learning for border control technologies. Social Network Analysis and Mining, 15, 19.
48. **Zatonatska, T., Fareniuk, Y., Juščius, V., Martinkienė, J., Maksymchuk, O. (2024).** The development of the e-commerce market in poland in the conditions of intensification of migration processes. Marketing and Management of Innovations, 15(1), 160-177.
49. **Stewart, L. S. (2024).** The regulation of AI-based migration technologies under the EU AI Act: (Still) operating in the shadows?. European Law Journal, 30(3), Art. e12516.
50. **Sullivan, G., Van Den Meerssche, D. (2024).** The legal infrastructures of UK border control—Cerberus and the dispositif of speculative suspicion. German Law Journal, 25, 1308–1342.
51. **Tang, Y., Sun, Y., Han, Z., Soomro, S., Wu, Q., Tan, B., Hu, C. (2023).** Flood forecasting based on machine learning pattern recognition and dynamic migration of parameters. Journal of Hydrology: Regional Studies, 47, 101406.
52. **Thenuwara, S. S., Premachandra, C., Kawanaka, H. (2022).** A multi-agent based enhancement for multimodal biometric system at border control. Array, 14, 100171.

53. **Truong, L., Lee, S., Sawhney, N. (2024).** Enhancing conversations in migrant counseling services: Designing for trustworthy human-AI collaboration. Proceedings of the ACM on Human-Computer Interaction, 8(CSCW2), Article 495, 1-25.
54. **Unver, H. A. (2022).** Using Social Media to Monitor Conflict-Related Migration: A Review of Implications for A.I. Forecasting. Social Sciences, 11(9), 395.
55. **Vavoula, N. (2024).** Algorithmic accountability through the "human over the loop" in interoperable and EU AI-reliant large-scale IT systems for migration and security. European Papers, 9(3), 1228–1249.
56. **Wanner, L., Bowen, D., Burgos, M., Carrasco, E., Černocký, J., Codina, T., Danilins, J., Davey, S., de Lara, J., Dimopoulou, E., Egorova, E., Gebhard, C., Grivolla, J., Jaramillo-Rojas, E., Klusch, M., Mavropoulos, A., Moudatsou, M., Nikolaidou, A., Ntioudis, D., Vrochidis, S. (2024).** Support of migrant reception, integration, and social inclusion by intelligent technologies. Information, 15(11), 686.
57. **Watson, J. R., Gelbaum, Z., Titus, M., Zoch, G., Wrathall, D. (2020).** Identifying multiscale spatio-temporal patterns in human mobility using manifold learning. PeerJ Computer Science, 6, e276.
58. **Weber, H. (2020).** How Well Can the Migration Component of Regional Population Change be Predicted? A Machine Learning Approach Applied to German Municipalities. Comparative Population Studies, 45.
59. **Zakharov, K., Aghajanyan, A., Kovantsev, A., Boukhanovsky, A. (2024).** Forecasting Population Migration in Small Settlements Using Generative Models under Conditions of Data Scarcity. Smart Cities, 7(5), 2495-2513.
60. **Zhou, T., Wu, X. (2024).** Examining user migration intention from social Q&A communities to generative AI. Humanities and Social Sciences Communications, 11, 1083.
61. **Štular, B., Lozić, E., Belak, M., Rihter, J., Koch, I., Modrijan, Z., Magdič, A., Karl, S., Lehner, M., Gutjahr, C. (2022)** Migration of Alpine Slavs and machine learning: Space-time pattern mining of an archaeological data set. PLoS ONE 17(9): e0274687.
62. **Kitchenham, B., Charters, S. (2009)** Guidelines for Performing Systematic Literature Reviews in Software Engineering, Technical Report EBSE 2007-001, Keele University and Durham University Joint Report.
63. **Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Moher, D. (2021).** The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ, 372, n71.
64. **Gamboa-Cruzado, J., Crisostomo-Castro, R., Vila-Buleje, J., López-Goycochea, J., Nolasco-Valenzuela, J. (2020).** Heart attack prediction using machine learning: a comprehensive systematic review and bibliometric analysis. Journal of Theoretical and Applied Information Technology, 12(5), 1930–1944
65. **Gunawan, B., Nurisnaeny, P. S., Kaprisma, H., Ratmono, B. M. (2024).** Border security in intelligence perspective: A bibliometric analysis (1985–2022). En Proceedings of the International Seminar on Border Region (INTSOB 2023) (pp. 28–38). Atlantis Press.
66. **Khooshechin Gilak, M. (2023).** Systematic mapping review of facial recognition applications in airports. The 14th International Conference on Innovation and Research in Engineering Sciences, 1-17
67. **Hidayat, F., Elviani, U., Situmorang, G. B. G., Ramadhan, M. Z., Alunjati, F. A., Sucipto, R. F. (2024).** Face recognition for automatic border control: A systematic literature review. IEEE Access, 12, 37288–37309.
68. **Rönsch, A.M. (2024).** The use of artificial intelligence in migration management: A systematic literature review. SSRN, 1-17
69. **Roman-Acosta, D., Depablos-Machado, L., Buelvas-Sierra, R. B. (2024).** Contemporary dynamics of human mobility: a systematized review. Pensamiento Americano, 17(34), e-726.
70. **Villavicencio, H.E., Gamboa-Cruzado, J., López-Goycochea, J., Soto, L.S. (2024).** The

Role of Artificial Intelligence in the Diagnosis of Neoplastic Diseases: A Systematic and Bibliometric Review. International Journal of Online and Biomedical Engineering (iJOE), 20(4), pp. 43–68.

71. **Delcea, C., Nica, I., Ionescu, S., Cibu, B., Tibrea, H. (2024).** Mapping the Frontier: A Bibliometric Analysis of Artificial Intelligence Applications in Local and Regional Studies. Algorithms, 17, 418. https://doi.org/10.3390/a17090418
72. **Subbotin, A., Aref, S. (2021).** Brain drain and brain gain in Russia: Analyzing international migration of researchers by discipline using Scopus bibliometric data 1996–2020. Scientometrics, 126, 1-26.
73. **Andrade-Mogollon, T., Gamboa-Cruzado, J., Amayo-Gamboa, F. (2025).** Systematic literature review of generative AI and IoT as key technologies for precision agriculture. Computación y Sistemas, 29(2), 857–882
74. **King, S. L., Neal, T. (2024).** Applications of AI-enabled deception detection using video, audio, and physiological data: A systematic review. IEEE Access, 12, 135207–135240.
75. **Koroniotis, N., Schiliro, F., Moustafa, N., Gauravaram, P., Janicke, H. (2020).** A holistic review of cybersecurity and reliability perspectives in smart airports. IEEE Access, 8, 209802–209834.
76. **Alegre-Veliz, R., Gaspar-Ortiz, P., Gamboa-Cruzado, J., Rodríguez Baca, L., Grandez Pizarro, W., Menéndez Mueras, R., Chávez Herrera, C. (2022).** Machine learning for feeling analysis in Twitter communications: A case study in HEYDRU!, Perú. International Journal of Interactive Mobile Technologies (iJIM), 16(24), 126–142
77. **Papavasileiou, E., Paraskevas, A., Edmunds, J. (2025).** eGates in airports: A systematic literature review and future research directions. Journal of the Air Transport Research Society, 5, 100076.
78. **Rojas Valdivia, J., Gamboa-Cruzado, J., de la Cruz Vélez de Villa, P. (2023).** Systematic literature review on machine learning and its impact on APIs deployment. Computación y Sistemas, 27(4), 1107–1124.

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