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Digital transformation and technical cooperation in local governments in Peru: a systematic review

Transformación digital y cooperación técnica en gobiernos locales del Perú: revisión sistemática

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ABSTRACT

This article systematizes how information systems can strengthen international technical cooperation in local governments in Peru. A systematic review following PRISMA guidelines was conducted in Scopus (2022–2025), and after screening, 49 studies were included. The evidence focuses primarily on applications in health and procurement, followed by the digitalization of administrative procedures and platforms aimed at local economic development. The reviewed studies report improvements in transparency, traceability, and cycle times; however, gaps in data quality and interoperability, institutional capacities, and operational continuity persist. Across the literature, four key capacities emerge: portfolio prioritization using reproducible criteria; execution monitoring through dashboards and alerts; results and impact evaluation based on verifiable evidence; and digital governance grounded in standards, APIs, and security. Accordingly, a data- and rules-based roadmap is proposed, configuring an architecture of trust to attract, implement, and ensure accountability for international cooperation at the municipal level.

Keywords: digital transformation; information systems; international technical cooperation; local governments; digital governance; systematic review

RESUMEN

Este artículo sistematiza cómo los sistemas de información pueden fortalecer la cooperación técnica internacional en gobiernos locales del Perú. Se realizó una revisión sistemática bajo PRISMA en Scopus (2022–2025) y, tras la depuración, se incluyeron 49 estudios. La evidencia se concentra en aplicaciones para salud y adquisiciones, seguidas por la digitalización de trámites y plataformas orientadas al desarrollo económico local. Los trabajos reportan mejoras en transparencia, trazabilidad y tiempos de ciclo, aunque persisten brechas de calidad e interoperabilidad de datos, capacidades institucionales y continuidad operativa. De manera transversal emergen cuatro capacidades clave: priorización de carteras con criterios reproducibles; monitoreo de la ejecución mediante tableros y alertas; evaluación de resultados e impacto con evidencia verificable; y gobernanza digital basada en estándares, APIs y seguridad. Se propone, así, una hoja de ruta sustentada en datos y reglas compartidas que configura una arquitectura de confianza para atraer, ejecutar y rendir cuentas de la cooperación internacional en el ámbito municipal.

Palabras clave: transformación digital; sistemas de información; cooperación técnica internacional; gobiernos locales; gobernanza digital; revisión sistemática

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1. INTRODUCTION

International technical cooperation has historically been a key driver of institutional strengthening in Latin America, enabling municipalities and local governments to access global resources, knowledge, and experiences. In general terms, this type of cooperation is defined as the exchange of technical and technological assistance among countries and institutions to improve state management capacity (Chiroque-Linares, 2024). Its central objective is to promote sustainable development and improve public services at the local level. Throughout history, various international initiatives have sought to support Latin American municipalities in their administrative modernization and in the provision of basic services (Morales Rocha et al., 2023). However, at present, growing demands for transparency and accountability require new management dynamics. The core problem lies in the need to incorporate advanced digital systems that enable more efficient strategic management of international technical cooperation, which is directly linked to questions regarding which technological approaches have been used, what benefits and limitations have been identified, and which emerging trends may guide new proposals (Seijas-Díaz et al., 2023).

In this context, digital transformation based on information systems becomes an essential element for the management of international cooperation in municipalities. From a conceptual perspective, e-government and smart city initiatives represent the technological evolution of public management, oriented toward efficiency, transparency, and citizen participation (Elagib et al., 2025). Theoretically, these approaches promote data interoperability, open access to information, and the use of intelligent platforms for monitoring international projects. In practice, they enable greater control and evaluation of external resources, as well as the optimization of decision-making. In addition, these systems directly influence organizational behavior by transforming how public officials manage information and how citizens interact with their governments. In conclusion, the application of digital technologies in international technical cooperation constitutes a practical pathway to ensuring more strategic and transparent management in local governments (Shack Yalta, 2002).

Recent literature shows that research on digital transformation in international technical cooperation within municipalities constitutes an emerging field. In recent years, trends have focused on the use of document management platforms (Ojeda-Mera et al., 2024; Villar, 2021), geographic information systems, business intelligence, and, more recently, applications based on artificial intelligence to support cooperation processes (Leite & Rezende, 2010; Plonski et al., 2007; Valles-Coral et al., 2023). The studies can be classified into three categories: (a) experiences in implementing information systems in international projects, (b) analyses of benefits and limitations in technological adoption, and (c) innovative proposals to strengthen the sustainability of cooperation in local governments. The value of this research lies in demonstrating how digital technology improves management processes. Nevertheless, limitations persist, such as the fragmentation of experiences, limited systematic documentation, and the lack of comparative studies in Latin America.

The present study focuses on a systematic review of the literature on explicit technological approaches—particularly information systems, digital platforms, e-government, and smart city initiatives—applied to international technical cooperation in municipalities (Burghouwt et al., 2017; Lulaj et al., 2022; Tupia & Bruzza, 2016). Unlike normative or purely theoretical research,

this study addresses only experiences and proposals with technological support. The scope of analysis corresponds to the Latin American context, where local governments face specific challenges such as limitations in technological infrastructure, digital divides, and difficulties in training staff to operate digital systems. These challenges justify the need to identify technology-based solutions that have demonstrated effectiveness and that can be adapted to the case of Peruvian municipalities, particularly San Martín.

Over the past five years, there has been sustained growth in studies on digital transformation applied to public management, including international cooperation (Carlsson-Wall et al., 2022). Several narrative reviews have explored digitalization in local governments and the impact of e-government on transparency. However, the number of systematic reviews that rigorously integrate the available evidence on information systems and their specific application in international technical cooperation remains limited. This gap reflects a necessary shift in focus—from isolated case descriptions to comparative and systematic analyses. Likewise, the diversity of studies identified demonstrates a richness of approaches, but also a dispersion of results, which hinders the construction of integrated models. Consequently, the main current limitation is the lack of methodological synthesis to guide future practical applications in local governments across Latin America (Leite & Rezende, 2010).

The purpose of this research is to systematize information system–based approaches to international technical cooperation in local governments in Latin America through a systematic review following PRISMA guidelines (Basulo-Ribeiro & Teixeira, 2024; de la Cruz-Campos et al., 2023). The methodological differentiation lies in the exclusive use of studies with explicit technological applications, excluding purely normative or conceptual approaches. To this end, the PRISMA methodology will be applied, ensuring transparency in the search, selection, and synthesis of the academic literature. The results are expected to have a significant impact by proposing a technological reference framework that enables municipalities to identify trends, overcome limitations, and design more effective digital strategies for international cooperation. In this way, the study seeks to serve as an academic means to strengthen the strategic management of municipalities such as San Martín, contributing both to the field of applied computing and to local public management. Although the review incorporates transferable evidence from international contexts, the synthesis and strategic implications are specifically oriented toward their potential application in Peruvian local governments.

2. MATERIALS AND METHODS

This systematic review aims to identify and analyze studies that apply digital transformation approaches based on information systems to the management of international technical cooperation in municipalities, with particular attention to the technological systems employed, the reported benefits and limitations, as well as emerging trends that guide new strategic proposals (Basulo-Ribeiro & Teixeira, 2024). The review followed a three-phase process—planning, execution, and reporting—in accordance with PRISMA guidelines and using the PICO strategy. The review process was supported by the use of Mendeley (version 1.19.8) for reference management, Microsoft Excel for tracking study selection, and draw.io (online version, accessed in August 2025) for the construction of the PRISMA flow diagram.

2.1. Review planning

To structure the search strategy and clarify key terms, the PICO framework was adapted to the context of this review (Table 1).

Table 1.
Application of the PICO method

Criterion	Search terms
Population (P)	Municipalities and local governments in Latin America.
Intervention (I)	Digital transformation approaches and information systems applied to international technical cooperation (digital platforms, e-government, smart cities, business intelligence, AI, etc.).
Comparison (C)	Different types of technologies and digital management models applied in international cooperation.
Outcome (O)	Technological approaches used, identified benefits and limitations, emerging trends, and gaps in the literature.

At this stage, a strategy was designed to identify empirical studies that address the research questions (RQs). Table 2 describes the questions that guide this systematic review.

Table 2.
Research questions and objectives

Research questions	Objective
RQ1: What information system–based digital transformation approaches have been implemented to strengthen international technical cooperation in local governments over the past five years?	Identify the most commonly applied technologies and systems and characterize the documented experiences.
RQ2: What benefits and limitations have studies reported in the use of information systems for the strategic management of international technical cooperation in municipalities?	Analyze strengths, limitations, and barriers in the implementation of these technologies.
RQ3: What emerging trends and opportunities in digital transformation can guide the design of strategic proposals for international technical cooperation in Peruvian municipalities?	Identify technological trends and gaps in the literature to support the development of new proposals.

2.2. Search criteria and strategy

The search strategy was designed based on the three research questions established during the planning phase, developing specific search strings for each question (see Table 3). These strings were executed independently in the Scopus database using the Advanced Search option. For each question, key terms and relevant synonyms were defined to maximize the retrieval of pertinent articles and ensure the reproducibility of the process. In addition, inclusion, exclusion, and search mode criteria were established, as described below.

The details of the search strings used for each question are shown in Table 3.

Table 3.
Search strings

Key criterion	Description
Search string	**Search string for RQ1:** `TITLE-ABS-KEY("digital transformation" OR "information systems" OR "e-government" OR "smart cities" OR "ICT" OR "information technology")`

	AND TITLE-ABS-KEY("international cooperation" OR "technical cooperation" OR "development cooperation") AND TITLE-ABS-KEY("local government" OR "municipalities" OR "government") **Search string for RQ2:** TITLE-ABS-KEY("information systems" OR "digital platforms" OR "e-government" OR "decision support system" OR "business intelligence") AND TITLE-ABS-KEY("international cooperation" OR "technical cooperation") AND TITLE-ABS-KEY("benefits" OR "challenges" OR "limitations") **Search string for RQ3:** TITLE-ABS-KEY("digital transformation" OR "emerging technologies" OR "artificial intelligence" OR "big data" OR "blockchain" OR "ICT") AND TITLE-ABS-KEY("international cooperation" OR "technical cooperation") AND TITLE-ABS-KEY("trends" OR "future directions" OR "opportunities")
Intervention criteria	Articles published between 2022 and 2025. Empirical studies, reviews, or proposals that explicitly include digital transformation or technological platforms. Publications in English or Spanish. Peer-reviewed and full-text articles.
Exclusion criteria	Publications prior to 2022. Purely normative or theoretical studies without technological application. Documents without full-text access. Narrative reviews without the application of new evidence. The search was applied to title, abstract, and keywords. Each string was designed to independently address one of the research questions, ensuring traceability and reproducibility.
Search mode	Applied to the fields of title, abstract, and keywords.

Each of the search strings presented was specifically designed to address one of the research questions formulated in this review (RQ1, RQ2, and RQ3). These strings were executed independently in the Scopus database using the advanced search option, in order to ensure traceability, reproducibility, and alignment of the bibliographic retrieval process with the objectives of the review.

2.3. Keywords and their relation to the research questions

Table 4 presents the keywords used in the search strategy, linked to each of the research questions posed.

Table 4.
Keywords, synonyms, and their relation to the research questions

Keyword / term	Synonyms/variants	Related to
Digital Transformation	ICT, Information Technology, Digitalization	RQ1, RQ3
Information Systems	Digital platforms, IS, DSS, BI systems	RQ1, RQ2
E-Government	Digital governance, GovTech	RQ1, RQ2
Smart Cities	Intelligent cities, urban ICT	RQ1
International Cooperation	Technical cooperation, Development cooperation	RQ1, RQ2, RQ3
Benefits & Limitations	Strengths, Challenges, Barriers	RQ2
Emerging Technologies	AI, Big Data, Blockchain, Cloud	RQ3
Local Government	Municipalities, Subnational government	RQ1, RQ2, RQ3

2.4. Relevant fields for data extraction

In the data extraction stage, the metadata fields to be collected were defined in order to systematize the analysis of the selected studies (see Table 5).

Table 5.
Relevant fields for data extraction

Field	Description
Reference	Article title, authors, full citation.
Publication	Type of publication (journal article, conference paper, preprint).
Year	Year of publication.
Technology	Type of system or digital approach (platform, DSS, BI, e-gov, AI).
Area of application	Municipality, region, country, type of cooperation.
Reported benefits	Documented advantages in cooperation management.
Reported limitations	Technological, economic, or organizational barriers.
Emerging trends	Technologies or models proposed in the studies.
Results	Documented impacts on efficiency, transparency, participation, etc.

2.5. Information sources

The search was conducted exclusively in the Scopus database, including peer-reviewed journal articles relevant to the objectives of the review, encompassing empirical studies, systematic reviews, bibliometric analyses, and technology-oriented studies. Search strategies were defined for each of the research questions and executed in August 2025. Filters were applied for publication year (2022–2025), document type (scientific articles), and access (Gold Open Access and Hybrid Gold). The selected records were exported in RIS format for analysis in Mendeley. To avoid duplicates, a cross-check was performed between the results obtained for each search string. Finally, a full-text review was conducted to ensure that each study met the established inclusion criteria.

3. RESULTS

3.1. Selected articles and general characteristics

After applying the search strategies defined for each of the research questions, an initial 392 records were identified for RQ1, 425 for RQ2, and 383 for RQ3. Subsequently, filters were applied for publication year (2022–2025), document type (scientific articles only), and access type (Gold and Hybrid Gold), reducing the sets to 10 articles for RQ1, 13 for RQ2, and 30 for RQ3.

Next, a cross-check was conducted among the three result sets to eliminate duplicate records. One article was duplicated between RQ1 and RQ2, two between RQ1 and RQ3, and one between RQ2 and RQ3. No articles were found in all three searches. After removing duplicates, a consolidated set of 49 unique articles was obtained, which constitutes the analysis base for this systematic review.

Table 6 summarizes the distribution of articles by research question and selection stage.

Table 6.
Distribution of articles by research question

Research question	Articles identified (without filter)	Since 2022	Scientific articles only	Gold + Hybrid Gold

RQ1	392	51	23	10
RQ2	425	63	30	13
RQ3	383	227	99	30

Note. The "Scientific articles only" column refers to documents that meet the required publication type (peer-reviewed journals), and the "Gold + Hybrid Gold" column shows the final articles selected for analysis.

The complete process of identification, filtering, deduplication, and eligibility assessment is detailed in Figure 1 (PRISMA diagram).

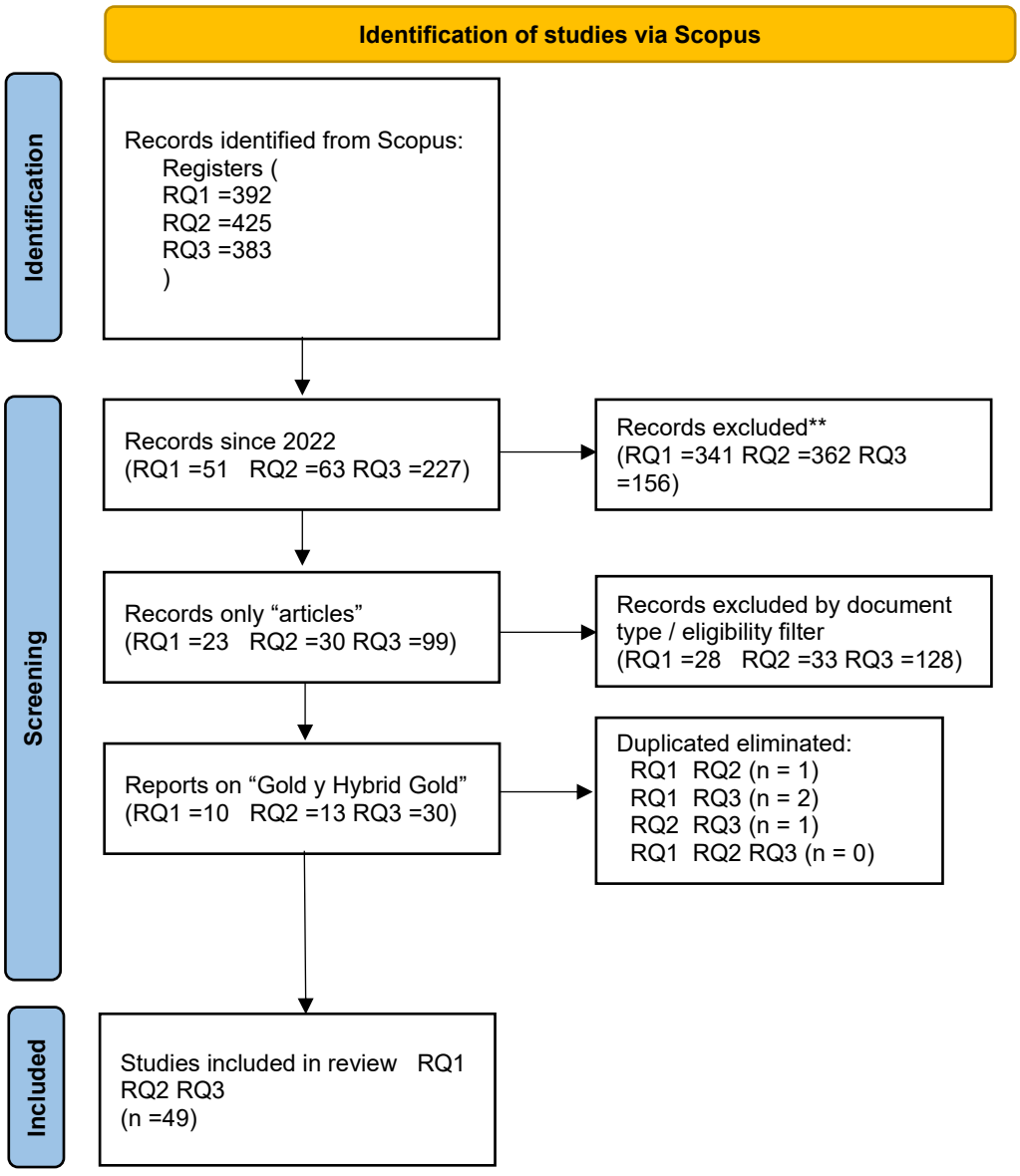


Figure 1. PRISMA flow diagram of the article selection process

Table 7 shows that scientific production increased between 2022 and 2024, with 2024 concentrating the largest number of studies across the three research questions. This pattern suggests growing academic interest in the role of information systems, digital platforms, and emerging technologies in international cooperation and public-sector digital transformation.

Table 7.
Distribution of selected articles by year and research question (2022–2025).

Year of publication	RQ1	RQ2	RQ3
2022	2	2	5
2023	2	2	8
2024	4	6	13
2025	2	3	4
Total	10	13	30

The year-by-year distribution also indicates a progressive diversification of the field, moving from studies focused mainly on digital infrastructure and information management toward approaches involving data governance, interoperability, decision support, monitoring, and emerging analytical capabilities. This evolution supports the view that information systems are increasingly being examined not only as operational tools but also as strategic resources for managing international technical cooperation.

3.2.RQ1: What information system–based digital transformation approaches have been implemented to strengthen international technical cooperation in local governments over the past five years?

These studies were classified inductively and exclusively into categories representing information system–based digital transformation approaches applied to technical cooperation in municipal contexts (T. Xu et al., 2024). The corpus shows a clear predominance of solutions oriented toward health and procurement (supply traceability, e-procurement, monitoring of funded projects), followed by initiatives for entrepreneurship and economic development platforms (prioritization and digital support for externally supported programs), and, to a lesser extent, the digitization of administrative processes (e.g., customs/procedures) (Yereshko et al., 2024). This organization allows for the observation of usage patterns, reported benefits, and the types of capabilities that need to be consolidated to scale these solutions in local governments. Table 8 summarizes the distribution of articles according to the established categories, their relative frequency, and representative studies in each case.

Table 8.
Technological approaches identified in RQ1 for international technical cooperation: inductive classification (titles, keywords, and abstracts)

Technological approach	Frequency	Percentage	Articles
Information systems in health and procurement	7	70%	(Elagib et al., 2025; Lee & Kim, 2025; Lesego et al., 2023; Perez et al., 2023; Rojas Cangahuala et al., 2025; Xie & Hu, 2024; Yereshko et al., 2024)
Digital platforms for entrepreneurship and economic development	2	20%	(Lesego et al., 2024; T. Xu et al., 2024)
Digitization of administrative processes (customs/licenses)	1	10%	(Rahman & Alam, 2022)
Total	10	100%	–

The evidence indicates a predominance of transactional and traceability solutions in health and procurement (≈70%), followed by platforms for entrepreneurship and economic development

(≈20%), and, to a lesser extent, digitization of administrative processes (≈10%) (Rahman & Alam, 2022). Technically, these are described as operational-analytical information systems that combine structured data capture, monitoring modules, and dashboards. The most consistent benefits are transparency, traceability, and reduced cycle times; however, the studies provide limited detail on data standards, integration interfaces, and portability across municipalities, suggesting isolated implementations that are difficult to reuse.

In terms of evaluation, process metrics (e.g., procurement times, milestone compliance) and system usage metrics (availability, errors) predominate, with scarce presence of baselines, systematic comparisons, or reproducibility studies (open data/code) (Lesego et al., 2023). Irregular documentation on data quality and governance (dictionaries, metadata, lineage) and limited tests of interoperability and performance under load are also observed. To enhance rigor, designs should incorporate from the outset a measurement plan (process and service indicators), publish data schemas and dictionaries, and perform replicable integration and load tests.

For international technical cooperation in municipalities, the findings converge on a practical message: information systems are the enabling core for attracting, executing, and reporting, but their impact depends on moving from isolated solutions to platforms with verifiable specifications. Operationally, strategic proposals should prioritize: (1) a common data catalog and dictionary (projects, agreements, procurements, indicators), (2) interoperable interfaces with exchange contracts and versioning, (3) monitoring and accountability modules aligned with donor formats, (4) security and continuity policies proportional to risk, and (5) an evaluation scheme combining process and service metrics. This shift strengthens trust, scalability, and sustainability in the Peruvian municipal context (Lesego et al., 2024; Rahman & Alam, 2022; Rojas Cangahuala et al., 2025; Xie & Hu, 2024).

3.3.RQ2: What benefits and limitations have studies reported regarding the use of information systems for the strategic management of international technical cooperation in municipalities?

The evidence converges on a clear message: digital trust has become a prerequisite for international technical cooperation to function at the municipal level. Recent literature is organized around four axes: digital security and policies (information governance, privacy, and operational continuity); information systems in health and procurement (end-to-end traceability and auditing); collaborative platforms and open science (structured data exchange and repositories); and a smaller set of other approaches with demonstrable value. The pattern is consistent: where controls, standards, and interoperability exist, externally funded projects achieve higher levels of transparency, efficiency, and accountability.

Table 9.
Grouping of RQ2 articles according to thematic categories.

Category	Frequency	Percentage	Articles
Digital security and policies in international cooperation	8	61.5	(Ali et al., 2024; Benis et al., 2024; Chen & Gao, 2022; González-Pérez et al., 2022; Houpert et al., 2023; James & Quaglia, 2024; Rodríguez-Ortega et al., 2025; Silva, 2025)
Information systems for health and procurement	3	23.1	(Chumak et al., 2024; Eminoğlu & Tarhan, 2025; Miyake et al., 2024)

Collaborative platforms and open science	1	7.7	(Lesego et al., 2023)
Other technological approaches	1	7.7	(Ullah et al., 2024)
Total	**13**	**100%**	–

The dominant block of digital security and policies (61.5%) sets the tone: control frameworks, data governance, risk management, and operational continuity are not optional, but the foundational design upon which cooperation projects are built. When municipalities establish clear roles and permissions, audit trails, versioned data-sharing agreements, and interoperability standards, coordination with donors improves and execution timelines are shortened.

In health and procurement (23.1%), the most effective systems share three characteristics: granular traceability (from request to payment), operational dashboards with actionable indicators, and early alerts for stockouts or budget deviations. The results point to reduced cycle times, fewer rework instances, and improved financial traceability—all critical for maintaining donor trust.

Collaborative platforms/open science (7.7%) demonstrate the value of data repositories and catalogs for sharing methodologies, results, and lessons among municipalities, facilitating organizational learning and low-cost replication. Although their relative weight is smaller, they act as multipliers when integrated with security policies and common standards.

Practically, the RQ2 set provides a clear roadmap for Peruvian municipalities: (1) institutionalize data governance and security controls proportional to risk; (2) deploy traceability and monitoring modules in procurement and health with explicit SLOs/SLAs; (3) formalize data-sharing agreements (versioned APIs, common dictionaries, and metadata); and (4) promote collaborative platforms that turn cooperation into a continuous improvement cycle rather than one-off funding. With these Information Systems foundations, technical cooperation becomes scalable, auditable, and sustainable at the municipal level.

3.4. RQ3: What emerging trends and opportunities in digital transformation can guide the design of strategic proposals for international technical cooperation in Peruvian municipalities?

The RQ3 trend map suggests a very concrete roadmap for municipalities: make better decisions (prioritization), monitor better (M&E with dashboards), anticipate (early alerts), and close the loop (results evaluation), all supported by digital governance that makes cooperation data interoperable and auditable. These lines do not compete with each other; they complement one another and, when implemented together, turn technical cooperation into an embedded digital capability rather than a set of isolated projects.

Table 10 summarizes the emerging technological trends and opportunities identified for RQ3. The studies were grouped inductively according to their main contribution to decision support, monitoring, evaluation, digital governance, and risk anticipation, allowing the relative weight of each strategic capability to be observed.

Table 10.
Emerging trends and opportunities (inductive and exclusive classification).

Category	Frequency	Percentage	Articles
Portfolio prioritization and selection (analytics).	8	26.7	(Al-Billeh et al., 2024; Liu & Xie, 2024; McGrath et al., 2024; Osman & El-Gendy, 2025; Papyshev & Yarime, 2023; Pilat et al., 2022; Ullah et al., 2024; Zhou et al., 2023)
Monitoring and management dashboards (M&E)	7	23.3	(Boostani et al., 2024; Chung & Sohn, 2023; Esteban et al., 2022; Mokgetse et al., 2024; Nie, 2023; Niu et al., 2024; Reyes Domínguez et al., 2024)
Results and impact evaluation	4	13.3	(Al Sabt & Farooqui, 2023; Luo, 2022; K. Xu, 2023; Ziyi, 2022)
Digital governance and institutional frameworks	4	13.3	(Gavião & de Oliveira, 2024; Jetsadanuruk & Chansanam, 2023; Ozturk, 2024; Yu et al., 2024)
Other emerging technological approaches	4	13.3	(Elagib et al., 2025; Qiang & Yuzhong, 2024; Rojas Cangahuala et al., 2025; Yin, 2022)
Prediction and early warning (risk/timelines/budget)	3	10.0	(Liu & Xie, 2024; Osman & El-Gendy, 2025; Yereshko et al., 2024)
Total	**30**	**100%**	–

The evidence from RQ3 is organized around four digital capabilities that collectively explain the majority of the identified proposals: portfolio prioritization (26.7%); monitoring and management dashboards (23.3%) (Papyshev & Yarime, 2023; K. Xu, 2023; Ziyi, 2022); results and impact evaluation (13.3%) (Niu et al., 2024; Osman & El-Gendy, 2025; Ozturk, 2024); and, digital and institutional governance (13.3%) (Esteban et al., 2022; Rojas Cangahuala et al., 2025). The convergence is clear: studies agree that international technical cooperation at the municipal level performs better when there is a continuous flow from deciding what to fund (portfolio), tracking execution (M&E), learning from outcomes (evaluation), and maintaining common rules (governance). The prioritization cluster proposes reproducible selection mechanisms—criteria, scores, and thresholds—to rank initiatives by public value, risk, and feasibility, with traceability of rules and justification of decisions to donors and citizens (Boostani et al., 2024; Pilat et al., 2022).

The monitoring and dashboards cluster describes solutions that integrate process and service indicators (processing times, budget execution, milestones, deliverables, system availability), with actionable panels and alerts for deviations. These proposals show consistent effects on cycle time reduction, decreased rework, and improved accountability (Esteban et al., 2022; Mokgetse et al., 2024). However, several studies highlight recurring gaps: incomplete data dictionaries, lack of indicator lineage, and poorly specified SLOs/SLAs, which complicates performance comparisons across departments and sustaining agreements with donors over time.

The results and impact evaluation appears as the natural closure of the cycle: before–after designs, comparisons with plausible counterfactuals, and reports of attributable effects allow moving from a compliance logic to a logic of verifiable public value. The best-rated studies document evidence repositories, data versions, and inclusion/exclusion criteria, facilitating audits and institutional learning (Luo, 2022; Ziyi, 2022). In parallel, the prediction and early warning cluster (10.0%) complements M&E by anticipating risks related to timelines, budgets, or performance through early signals; here, the need for data quality controls and periodic validations is emphasized to maintain the operational reliability of the alerts.

Finally, the digital and institutional governance cluster provides the "scaffolding" that enables the previous elements: data standards, APIs and versioned schemas, metadata and catalogs, well-defined roles and permissions, and continuity plans proportional to risk (Elagib et al., 2025; Yin, 2022). Without this framework, dashboards and evaluations remain as isolated islands; with it, they become a cross-cutting platform that integrates sectors (health, logistics, treasury, internal control) and external actors. The emerging approaches identified (13.3%)—sectoral pilots, lightweight architectures, specific use cases—function as a laboratory: they allow rapid iteration and scale only what demonstrates public value with sustainable operational costs.

4. DISCUSSION

The findings of this systematic review indicate that the contribution of information systems to international technical cooperation extends beyond the digitization of isolated administrative procedures. Across the three research questions, a common pattern emerges in which digital technologies progressively connect operational execution, information governance, decision support, monitoring, and accountability. RQ1 shows that current implementations remain concentrated in specific domains, particularly health and procurement, where information systems support traceability, structured data capture, monitoring, and administrative control (Lesego et al., 2023; Yereshko et al., 2024). RQ2 extends this finding by showing that technological value depends strongly on the institutional conditions surrounding these systems, especially security, data governance, interoperability, and operational continuity (Chumak et al., 2024; Ullah et al., 2024). RQ3, in turn, reveals a shift toward more analytical uses of information, including portfolio prioritization, management dashboards, early-warning mechanisms, and results evaluation (Esteban et al., 2022; Ozturk, 2024; Papyshev & Yarime, 2023). Taken together, these findings suggest that digital transformation in technical cooperation is evolving from isolated applications toward an integrated information infrastructure.

This evolution is particularly relevant from an Information Systems perspective. The reviewed studies suggest that the effectiveness of digital solutions is not determined only by the sophistication of the technology employed, but by the capacity of organizations to integrate data, processes, actors, and decision rules. The predominance of traceability and procurement systems identified in RQ1 demonstrates that transactional information remains the foundation of digital cooperation, particularly in contexts where externally funded programs require transparent monitoring of resources and supply chains (Lesego et al., 2023, 2024). However, the recurring limitations identified in RQ2 show that digitizing processes without adequate information governance can reproduce existing organizational fragmentation in digital form. Studies addressing cybersecurity, data quality, and digital governance reinforce the importance of common standards, reliable information exchange, and institutional arrangements capable of sustaining technological adoption over time (Mokgetse et al., 2024; Rojas Cangahuala et al., 2025; Ullah et al., 2024).

A second relevant finding concerns the central role of digital trust. Security policies, auditability, data-sharing mechanisms, traceability, and standardized information structures repeatedly appear as enabling conditions for digital cooperation. This is particularly important in international technical cooperation because municipalities must demonstrate accountability not only to internal administrative structures but also to external cooperating and financing

institutions. In this context, information systems operate as an interface between the municipality and the cooperating organization, making resource flows visible and providing evidence of implementation and results. The importance of security and information protection identified by (Chumak et al., 2024; Ullah et al., 2024), together with the relevance of repositories, collaborative platforms, and structured knowledge exchange highlighted by (González-Pérez et al., 2022; Houpert et al., 2023), supports the interpretation that technological infrastructure and institutional trust are closely interdependent.

The trends identified in RQ3 point to a further transition from information systems primarily designed to record and report toward systems capable of supporting and anticipating decisions. Portfolio prioritization, management dashboards, impact assessment, and predictive mechanisms form an increasingly integrated information cycle in which data are used throughout project selection, implementation, monitoring, and evaluation. Studies on artificial intelligence governance and data-driven decision environments show that these capabilities require not only analytical tools but also clear institutional rules and mechanisms for controlling technological risks (Al-Billeh et al., 2024; Papyshev & Yarime, 2023). Similarly, big-data applications and data-driven evaluation approaches demonstrate the potential of analytical infrastructures to strengthen decision-making, provided that information quality and governance mechanisms are adequately addressed.

For Peruvian municipalities, the implications are therefore organizational as well as technological. The evidence does not support the adoption of a single platform or emerging technology as a universal solution. Rather, it suggests the need for a shared information architecture in which projects, agreements, procurement processes, financing, indicators, and results can be represented through common data structures and exchanged through interoperable mechanisms. Research on digital government highlights the importance of institutional coordination and technological integration for improving public management (Rojas Cangahuala et al., 2025), while studies on data-driven traceability demonstrate the value of structured knowledge models for improving information quality and compliance (Mokgetse et al., 2024). On this basis, monitoring dashboards, early-warning mechanisms, portfolio prioritization, and evaluation modules could be incorporated progressively according to municipal capabilities and operational needs.

The review also exposes an important gap in the existing literature. Many of the identified contributions remain domain-specific and were developed in health, procurement, trade, education, finance, or environmental management rather than as integrated municipal cooperation platforms. For example, technological applications have been documented in pharmaceutical supply chains (Lesego et al., 2023, 2024), telemedicine and international health collaboration (Houpert et al., 2023; Rodríguez-Ortega et al., 2025), digital trade (Chen & Gao, 2022), and open science infrastructures (González-Pérez et al., 2022). Although these studies provide transferable capabilities, there is still limited evidence on how such technologies perform when integrated across the complete lifecycle of international technical cooperation within local governments. This fragmentation reinforces the need for future research focused on interoperable municipal architectures rather than isolated sectoral solutions.

Finally, the findings should be interpreted considering the methodological scope of the review. The search was conducted exclusively in Scopus, which may have excluded relevant contributions

indexed in other specialized databases. In addition, the heterogeneity of the application domains prevented a direct quantitative comparison of system performance and favored a thematic synthesis. Nevertheless, the convergence observed across the three research questions is consistent enough to identify a common Information Systems logic: effective digital cooperation requires the alignment of data governance, interoperability, monitoring, security, evaluation, and organizational capabilities. This alignment appears to be more decisive than the adoption of any specific technology and therefore represents a relevant direction for future municipal digital transformation strategies.

CONCLUSIONS

This systematic review shows that information systems can strengthen international technical cooperation in local governments when digital transformation is approached as an integrated organizational capability rather than the adoption of isolated technologies. The evidence reviewed across the three research questions identifies a progression from transactional systems for health, procurement and administrative processes toward more comprehensive capabilities for data governance, monitoring, decision support and evaluation. Transparency, traceability and improved process efficiency constitute the most visible benefits, while data quality, interoperability, institutional capacity, security and operational continuity remain the principal constraints.

The joint interpretation of RQ1, RQ2 and RQ3 suggests four capabilities around which a municipal digital strategy for technical cooperation can be organized: portfolio prioritization based on reproducible information, continuous monitoring through integrated indicators and dashboards, evaluation of results using traceable evidence, and digital governance capable of ensuring interoperability, security and accountability. These capabilities are interdependent. Analytical and monitoring tools generate limited value when data definitions are inconsistent, systems cannot exchange information or institutional responsibilities are unclear. Conversely, when governance, data and technological infrastructure are aligned, information systems provide a common environment for coordinating municipal units, cooperating organizations and other actors involved in project implementation.

For Peruvian municipalities, the findings support a gradual strategy based on a common information architecture for cooperation rather than the acquisition of independent technological solutions. Such an architecture should enable the structured management of agreements, projects, resources, procurement processes, indicators and results, while maintaining traceability throughout the project lifecycle. On this foundation, municipalities can progressively incorporate interoperable services, management dashboards, early-warning mechanisms and analytical tools according to their institutional maturity and operational needs. In this sense, the main contribution of the review is the identification of an architecture of digital trust, in which information becomes the mechanism that links technological capacity with transparency, decision-making and accountability.

Future research should validate this proposal through empirical implementations in Peruvian local governments and compare municipalities with different levels of digital maturity. Particular attention should be given to interoperability standards, data-quality models, cybersecurity, user

adoption and measurable effects on the management of international cooperation. Longitudinal evaluations would also be valuable to determine whether these systems improve not only administrative efficiency but also the municipalities' capacity to formulate competitive projects, attract cooperation resources, execute them effectively and demonstrate their contribution to local development.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest related to the development of the study.

AUTHORSHIP CONTRIBUTION

Conceptualization; Data Curation; Formal Analysis; Research; Methodology; Visualization; Validation; Writing - original draft; Writing - revision and editing: Valera-Mendoza, Carlos.

REFERENCES

Al-Billeh, T., Hmaidan, R., Al-Hammouri, A., & Al Makhmari, M. (2024). The Risks of Using Artificial Intelligence on Privacy and Human Rights: Unifying Global Standards. *Jurnal Media Hukum*, *31*(2), 333–350. https://doi.org/10.18196/jmh.v31i2.23480

Al Sabt, I., & Farooqui, M. O. (2023). Navigating the Convergence of Artificial Intelligence and Space Law: Challenges and Opportunities. *HighTech and Innovation Journal*, *4*(1), 55–64. https://doi.org/10.28991/HIJ-2023-04-01-04

Ali, V. E., Asika, M. O., Elebesunu, E. E., Agbo, C., & Antwi, M. H. (2024). Cognizance and mitigation of falsified immunization documentation: Analyzing the consequences for public health in Nigeria, with a focus on counterfeited COVID-19 vaccination cards: A case report. *Health Science Reports*, *7*(2). https://doi.org/10.1002/hsr2.1885

Basulo-Ribeiro, J., & Teixeira, L. (2024). Industry 4.0 supporting logistics towards smart ports: Benefits, challenges and trends based on a systematic literature review. *Journal of Industrial Engineering and Management*, *17*(2), 492. https://doi.org/10.3926/jiem.6180

Benis, A., Grosjean, J., Disson, F., Crisan-Vida, M., Weber, P., Stoicu-Tivadar, L., Staccini, P., & Darmoni, S. J. (2024). Empowering healthcare education: A multilingual ontology for medical informatics and digital health (MIMO) integrated to artificial intelligence powered training in smart hospitals. *Health Informatics Journal*, *30*(4). https://doi.org/10.1177/14604582241287010

Boostani, F., Golzary, A., Huisingh, D., & Skitmore, M. (2024). Mapping the future: Unveiling global trends in smart waste management research. *Results in Engineering*, *24*. https://doi.org/10.1016/j.rineng.2024.103485

Burghouwt, P., Maris, M., van Peski, S., Luiijf, E., van de Voorde, I., & Spruit, M. (2017). Cyber

targets water management. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *10242 LNCS*, 38–49. https://doi.org/10.1007/978-3-319-71368-7_4

Carlsson-Wall, M., Goretzki, L., Hofstedt, J., Kraus, K., & Nilsson, C.-J. (2022). Exploring the implications of cloud-based enterprise resource planning systems for public sector management accountants. *Financial Accountability and Management*, *38*(2), 177–201. https://doi.org/10.1111/faam.12300

Chen, Y., & Gao, Y. (2022). Comparative analysis of digital trade development strategies and governance approaches. *Journal of Digital Economy*, *1*(3), 227–238. https://doi.org/10.1016/j.jdec.2023.02.001

Chiroque-Linares, S. M. (2024). Uso de tecnologías de información para mejorar la calidad de atención en municipalidades. *Revista Científica de Sistemas e Informática*, *4*(1), e558. https://doi.org/10.51252/rcsi.v4i1.558

Chumak, O., Holovkin, S., Piroh, O., Pushkar, T., & Diegtiar, O. (2024). Information protection and cyber security in the public and financial sectors. *Edelweiss Applied Science and Technology*, *8*(5), 1164–1174. https://doi.org/10.55214/25768484.v8i5.1819

Chung, E., & Sohn, S. Y. (2023). Processing-in-Memory Development Strategy for AI Computing Using Main-Path and Doc2Vec Analyses. *Sustainability (Switzerland)*, *15*(16). https://doi.org/10.3390/su151612439

de la Cruz-Campos, J. C., Ramos-Navas-Parejo, M., Vázquez, C. R.-R., & Cevallos Uve, G. E. (2023). *From the Digital Divide to Digital Inclusion: An Ecuadorian Perspective* (pp. 243–262). https://doi.org/10.1007/978-981-99-7645-4_11

Elagib, N. A., Ahmed, B. M., Sulieman, H. M., Rahma, A. E., Ali, M. M. A., & Schneider, K. (2025). Capturing social sensing of farming activities for policymaking in fragile contexts. *Journal of Rural Studies*, *117*. https://doi.org/10.1016/j.jrurstud.2025.103638

Eminoğlu, Y., & Tarhan, Ç. (2025). Decadal evolution of GIS in disaster management and risk assessment. *International Journal of Engineering and Geosciences*, *10*(2), 173–196. https://doi.org/10.26833/ijeg.1544048

Esteban, S. A., Urquía-Grande, E., de Silva, A. M., & Pérez-Estébanez, R. (2022). Big Data, Accounting and International Development: Trends and challenges. *Cuadernos de Gestion*, *22*(1), 193–213. https://doi.org/10.5295/CDG.211513SA

Gavião, L. O., & de Oliveira, M. B. B. (2024). THE IMPACT OF THE UKRAINE WAR ON ANTARCTIC GEOPOLITICS THROUGH FUZZY COGNITIVE MAPS. *Austral: Brazilian Journal of Strategy and International Relations*, *13*(25), 132–165. https://doi.org/10.22456/2238-6912.128808

González-Pérez, L. I., Ramírez-Montoya, M. S., & García-Peñalvo, F. J. (2022). Technological Enablers 4.0 to Drive Open Science and Education: Input to UNESCO Recommendations. *RIED-Revista Iberoamericana de Educacion a Distancia*, *25*(2), 23–48. https://doi.org/10.5944/ried.25.2.33088

Houpert, R., Almont, T., Mésenge, C., Kleinebreil, L., Forlini, L., Magnone, B., Leroux, V., Vestris, M., Montabord, C., Carmenate, J., Galán, Y., Rubio, M. C., Enriquez, R., Burte, C., Gatimel, N., Bujan,

L., Kara, N., Edwige, O., Huyghe, É., … Véronique-Baudin, J. (2023). International cooperation and the challenge of internet accessibility in Caribbean territories: example of a collaborative platform between the University Hospital of Martinique and Ramón González Coro Hospital in Cuba, through the French PRPH-3 program. *BMC Medical Education*, *23*(1). https://doi.org/10.1186/s12909-023-04321-1

James, S., & Quaglia, L. (2024). Emergent regime complexity and epistemic barriers in 'bigtech' finance. *New Political Economy*, *29*(6), 872–885. https://doi.org/10.1080/13563467.2024.2359940

Jetsadanuruk, P., & Chansanam, W. (2023). Knowledge Structure, Characteristics, and Global Research Trends Study of Smart Education Research: Bibliometric Analysis. *International Journal of Emerging Technologies in Learning*, *18*(11), 4–24. https://doi.org/10.3991/ijet.v18i11.39313

Lee, J., & Kim, J. (2025). Analyzing Determinants' Priorities of Entrepreneurial Ecosystems for ICT Start-Ups in Sub-Saharan Africa: A Path Toward Sustainable Development. *Sustainability (Switzerland)*, *17*(5). https://doi.org/10.3390/su17052044

Leite, L. O., & Rezende, D. A. (2010). Municipal management based on the strategic use of information technology resources for government management: Formatting and assessing the model in a city. *Revista de Administracao Publica*, *44*(2), 459–493. https://doi.org/10.1590/s0034-76122010000200012

Lesego, A., Tsegaye, T., Were, L. P. O., Sakvarelidze, G., Garg, S., Morrison, L., Nigussie, S., Githendu, P., & Achoki, T. (2023). Assessment of the Global Fund-supported procurement and supply chain reforms at the Ethiopian Pharmaceuticals Supply Agency: A mixed-methods study. *BMJ Open*, *13*(12). https://doi.org/10.1136/bmjopen-2023-073390

Lesego, A., Were, L. P. O., Tsegaye, T., Idris, R., Morrison, L., Peterson, T., Elhussein, S., Antonio, E., Magwindiri, G., Dumba, I., Mtambirwa, C., Madzikwa, N., Simbi, R., Ndlovu, M., & Achoki, T. (2024). Health system lessons from the global fund-supported procurement and supply chain investments in Zimbabwe: a mixed methods study. *BMC Health Services Research*, *24*(1). https://doi.org/10.1186/s12913-024-11028-6

Liu, J., & Xie, J. (2024). The Effect of ESG Performance on Bank Liquidity Risk. *Sustainability (Switzerland)* , *16*(12). https://doi.org/10.3390/su16124927

Lulaj, E., Zarin, I., & Rahman, S. (2022). A Novel Approach to Improving E-Government Performance from Budget Challenges in Complex Financial Systems. *Complexity*, *2022*. https://doi.org/10.1155/2022/2507490

Luo, C. (2022). Construction of Enterprise English Adaptive Learning Platform Based on Big Data Analysis. *Scientific Programming*, *2022*. https://doi.org/10.1155/2022/7251081

McGrath, E., Herson, M. R., Kuehnert, M. J., Moniz, K., Szczepiorkowski, Z. M., & Pruett, T. L. (2024). A WHO remit to improve global standards for medical products of human origin. *Bulletin of the World Health Organization*, *102*(10), 707–714. https://doi.org/10.2471/BLT.24.291569

Miyake, S., Teske, S., Rispler, J., & Feenstra, M. (2024). Solar and wind energy potential under land-resource constrained conditions in the Group of Twenty (G20). *Renewable and Sustainable Energy Reviews*, *202*. https://doi.org/10.1016/j.rser.2024.114622

Mokgetse, T. L., Hlomani, H., Sigwele, T., & Zlotnikova, I. (2024). Leveraging Ontology-Based Knowledge Management For Improved Data Quality And Enhanced Trade Compliance In Livestock Traceability Systems In Botswana. *Interdisciplinary Journal of Information, Knowledge, and Management*, *19*. https://doi.org/10.28945/5409

Morales Rocha, J. L., Coyla Zela, M. A., Morillos Valderrama, S. O., & Quispe Mamani, D. (2023). Gobierno abierto en municipalidades del Perú como alternativa para generar confianza en los ciudadanos. *Revista Venezolana de Gerencia*, *28*(102), 459–476. https://doi.org/10.52080/rvgluz.28.102.2

Nie, Y. (2023). Application of Multimodal Multimedia Information and Big Data Technology in Teaching Chinese as a Foreign Language Course. *International Journal of Digital Multimedia Broadcasting*, *2023*. https://doi.org/10.1155/2023/2257863

Niu, H., Li, K. Y., Yu, T., Zhang, M., Ji, Z., Yu, P., Yi, X., & Liu, G. (2024). Worldwide Research Trends and Regional Differences in the Development of Precision Medicine Under Data-Driven Approach: A Bibliometric Analysis. *Journal of Multidisciplinary Healthcare*, *17*, 5259–5275. https://doi.org/10.2147/JMDH.S482543

Ojeda-Mera, C., Injante, R., Valles-Coral, M., Pinedo, L., Tejada, K., & García-Bautista, A. (2024). Current state of web accessibility in Latin America: an exploratory review of assessments and tools used. *Revista Espanola de Documentacion Cientifica*, *47*(1). https://doi.org/10.3989/redc.2024.1.1464

Osman, R., & El-Gendy, S. (2025). Interconnected and resilient: A CGE analysis of AI-driven cyberattacks in global trade. *Risk Analysis*, *45*(4), 846–862. https://doi.org/10.1111/risa.14321

Ozturk, O. (2024). The Impact of AI on International Trade: Opportunities and Challenges. *Economies*, *12*(11). https://doi.org/10.3390/economies12110298

Papyshev, G., & Yarime, M. (2023). The state's role in governing artificial intelligence: development, control, and promotion through national strategies. *Policy Design and Practice*, *6*(1), 79–102. https://doi.org/10.1080/25741292.2022.2162252

Perez, C., Aguirre, D., Neese, B., Vess, J., & Burkett, E. K. (2023). Evaluating Team Characteristics for Health Engagements in Three Countries in Central America: 2012-2017. *Military Medicine*, *188*(1–2), e351–e358. https://doi.org/10.1093/milmed/usab257

Pilat, N., Issa, F., Luo, X., Chong, A., Bromberg, J., & Kotsch, K. (2022). Joining Forces in Basic Science: ITS Meeting 2.0. *Transplant International*, *35*. https://doi.org/10.3389/ti.2022.10843

Plonski, G. A., Scavazza, B. L., & Sprenger, A. (2007). Innovation in a large public school system in Brazil: The knowledge network ("Rede do Saber"). *Portland International Conference on Management of Engineering and Technology*, 2121–2139. https://doi.org/10.1109/PICMET.2007.4349544

Qiang, W., & Yuzhong, Y. (2024). Exploring New Paths for the Internationalization of Vocational Colleges in the Era of Artificial Intelligence. *Journal of Curriculum and Teaching*, *13*(5), 103–110. https://doi.org/10.5430/jct.v13n5p103

Rahman, M. M., & Alam, K. (2022). Effects of globalization, energy consumption and ICT on health status in Australia: the role of financial development and education. *BMC Public Health*, *22*(1). https://doi.org/10.1186/s12889-022-13911-5

Reyes Domínguez, D., Infante Abreu, M. B., & Parv, A. L. (2024). Main Trend Topics on Industry 4.0 in the Manufacturing Sector: A Bibliometric Review. *Applied Sciences (Switzerland)*, *14*(15). https://doi.org/10.3390/app14156450

Rodríguez-Ortega, M., Ortega-Latorre, Y., Montano-Navarro, E., Casado-Collado, A. J., Nguepy, F. R., & Damou, F. (2025). Telemedicine as a counselling tool for nurses in Central Africa. *Journal of Advanced Nursing*, *81*(5), 2477–2486. https://doi.org/10.1111/jan.16406

Rojas Cangahuala, G., Chura Alegre, M., López Orozco, G., & Pinto Díaz, G. (2025). Digital Government and Public Management: Themes, influences, and international collaborations. *Revista Venezolana de Gerencia*, *30*(109), 247–268. https://doi.org/10.52080/rvgluz.30.109.16

Seijas-Díaz, J., Martell, K., Casas, R., Schrader, J., Cueto-Orbe, R., Rengifo-Amasifen, R., Barbachán-Ruales, E., & Torres-Silva, C. (2023). Development of an informative web application for the promotion of ecotourism: A case study. *ICST Transactions on Scalable Information Systems*. https://doi.org/10.4108/eetsis.4463

Shack Yalta, N. (2002). Indicadores de desempeño en los organismos públicos del Perú. *VII Congreso Internacional Del CLAD Sobre La Reforma Del Estado y de La Administración Pública, Lisboa.*, NI. http://unpan1.un.org/intradoc/groups/public/documents/CLAD/clad0043703.pdf

Silva, H. M. (2025). Discovery of the hole in the ozone layer: environmental awareness and fighting scientific fake news. *Ethics in Science and Environmental Politics*, *25*, 11–19. https://doi.org/10.3354/ESEP00217

Tupia, M., & Bruzza, M. (2016). An information security framework for services of M-Government from Peruvian local governments. *29th International Conference on Computer Applications in Industry and Engineering, CAINE 2016*, 91–97. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84991510820&partnerID=40&md5=f3f63b5dfb2035ec7acaa3707eeae3d1

Ullah, M. W., Alam, M. T., Sultana, T., Rahman, M. M., Faraji, M. R., & Ahmed, M. F. (2024). A systematic review on information security policies in the USA banking system and global banking: Risks, rewards, and future trends. *Edelweiss Applied Science and Technology*, *8*(6), 8437–8453. https://doi.org/10.55214/25768484.v8i6.3816

Valles-Coral, M., Injante, R., Hernández-Torres, E., Pinedo, L., Navarro-Cabrera, J. R., Salazar-Ramírez, L., Cárdenas-García, Á., & Huancaruna, E. (2023). Aggregation of institutional repositories for the analysis of the scientific performance of Peruvian universities. *Iberoamerican Journal of Science Measurement and Communication*, *3*(3). https://doi.org/10.47909/ijsmc.63

Villar, A. (2021). Acceso a la información pública y gestión documental: la experiencia uruguaya. *Palabra Clave (La Plata)*, *11*(1), e145. https://doi.org/10.24215/18539912e145

Xie, Y., & Hu, R. (2024). Assessing the technical efficiency performance of Chinese ports logistics:

Evidence from the DEA and fsQCA. *PLoS ONE*, *19*(4 April). https://doi.org/10.1371/journal.pone.0300655

Xu, K. (2023). Challenges, Opportunities and Future Paths: Environmental Governance of Big Data Initiatives in China. *Sustainability (Switzerland)*, *15*(13). https://doi.org/10.3390/su15139975

Xu, T., Xue, L., & Xiang, H. (2024). Regional gap and sustainable development of interpreting level in mainland China: A statistics and GIS-based study. *PLoS ONE*, *19*(3 March). https://doi.org/10.1371/journal.pone.0295505

Yereshko, K., Khoma, O., & Pyslytsia, A. (2024). DIGITALIZATION OF CUSTOMS PROCEDURES: CURRENT STATE AND PROSPECTS. *Journal of Vasyl Stefanyk Precarpathian National University*, *11*(2), 103–115. https://doi.org/10.15330/jpnu.11.2.103-115

Yin, Y. (2022). Research on Comprehensive Benefit Evaluation of Internationalized University Education Based on Big Data under the Background of Internet of Things. *Security and Communication Networks*, *2022*. https://doi.org/10.1155/2022/9866300

Yu, Y., Huang, J., Fang, Q., Li, J., Lou, Z., Liang, F., & Wu, M. (2024). Exploring the research progression and evolutionary trends of lung ischemia-reperfusion injury: A bibliometric analysis from 1979 to 2023. *Life Sciences*, *355*. https://doi.org/10.1016/j.lfs.2024.123000

Zhou, Z., Zhang, X., Tang, X., Grzybowski, A., Ye, J., & Lou, L. (2023). Global research of artificial intelligence in strabismus: a bibliometric analysis. *Frontiers in Medicine*, *10*. https://doi.org/10.3389/fmed.2023.1244007

Ziyi, X. (2022). International Law Protection of Cross-Border Transmission of Personal Information Based on Cloud Computing and Big Data. *Mobile Information Systems*, *2022*. https://doi.org/10.1155/2022/9672693