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Information systems for public investment management: a platform analysis

Sistemas de información para la gestión de inversiones públicas: un análisis de plataformas

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ABSTRACT

This study conducted an exploratory systematic review aimed at analyzing how information systems contribute to optimizing public investment management, focusing on specific applications, technological approaches, institutional factors, challenges, and emerging opportunities. A structured methodology was used, following clear planning and execution guidelines; the search strategy was applied to the Scopus database, initially retrieving 7,511 documents, which were later filtered according to specific criteria, ultimately resulting in 24 relevant articles for detailed analysis. The findings showed that these systems significantly enhance efficiency, transparency, and accountability, particularly through technologies such as artificial intelligence, blockchain, and big data. However, there are significant challenges, including resistance to change, high costs, lack of interoperability, and digital security risks, which hinder their uniform adoption. Future research is recommended to explore strategies to overcome these limitations and investigate in greater detail how interoperability, staff training, and regulatory updates could strengthen the effective implementation of these digital platforms in various governmental contexts.

Keywords: automation; digitalization; governance; monitoring; transparency

RESUMEN

El presente estudio realizó una revisión sistemática exploratoria con el objetivo de analizar cómo los sistemas de información contribuyen a optimizar la gestión de inversiones públicas, centrándose en las aplicaciones específicas, los enfoques tecnológicos, los factores institucionales, los desafíos y las oportunidades emergentes. Se utilizó una metodología estructurada, siguiendo pautas claras de planificación y ejecución; la estrategia de búsqueda se aplicó en la base de datos Scopus, inicialmente obteniendo 7511 documentos que posteriormente fueron filtrados según criterios específicos, quedando finalmente 24 artículos relevantes para el análisis detallado. Los hallazgos mostraron que estos sistemas mejoran significativamente la eficiencia, transparencia y rendición de cuentas, especialmente mediante tecnologías como inteligencia artificial, blockchain y big data. Sin embargo, existen importantes desafíos como la resistencia al cambio, costos elevados, falta de interoperabilidad y riesgos en seguridad digital, que dificultan su adopción homogénea. Se recomienda para futuras investigaciones profundizar en estrategias para superar estas limitaciones e investigar más en detalle cómo la interoperabilidad, la capacitación del personal y la actualización normativa podrían fortalecer la implementación efectiva de estas plataformas digitales en distintos contextos gubernamentales.

Palabras clave: automatización; digitalización; gobernanza; monitoreo; transparencia

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1. INTRODUCTION

The development of information systems has revolutionized public investment management, enabling more efficient planning, greater transparency, and optimization in resource allocation (Rodríguez Rodríguez & Béjar Blácido, 2022). Advanced tools such as government resource planning systems, financial tracking platforms, and impact evaluation mechanisms have transformed the formulation, execution, and monitoring of public projects, contributing to greater efficiency in state administration (Aquino Lima, 2025; Olarte Pacco et al., 2023). Thanks to these technological advances, governments have improved public expenditure oversight and strengthened control mechanisms, ensuring that resources are used strategically and aligned with development objectives (Rengifo Khan, 2025).

In recent years, interest in digitalization in public investment management has grown considerably, becoming a key axis for the modernization of public administration (Huamán Coronel & Medina Sotelo, 2022). Recent studies have shown that the implementation of specialized information systems enhances accountability and streamlines decision-making processes, overcoming the limitations of traditional methods based on physical records and manual processes (Bravo Cobeña et al., 2018; Abrego Almazán et al., 2017). Unlike conventional practices, these platforms allow for the consolidation and real-time analysis of large volumes of data, facilitating the identification of patterns in project execution and optimizing financial planning (Almeida-Blacio et al., 2024).

However, the implementation of these systems in public investment management faces various challenges, especially in contexts with unequal levels of digitalization and institutional capacities (Medina Flores, 2021). Organizational resistance to change, the lack of adequate technological infrastructure, and the shortage of trained personnel in managing these systems represent significant obstacles to their effective adoption (Inca Soller et al., 2024). Additionally, factors such as the size of government entities, existing fiscal regulations, and each country's strategic priorities influence the degree of integration and utilization of these tools, creating a gap in their implementation depending on the institutional context (Liberona & Ruiz, 2013).

Furthermore, the reliability and security of information stored in these systems represent a fundamental challenge. The protection of financial data, interoperability between platforms, and transparency in information management have been subjects of debate among specialists and government actors (Rivera León, 2013). While these systems aim to improve expenditure traceability and reduce corruption risks, vulnerabilities in their design or administration can compromise their effectiveness and credibility, raising concerns about privacy and access to public information (Zavaleta Cabrera, 2023).

The analysis of recent studies on digitalization in public investment management reveals both its benefits and limitations. It has been established that these platforms optimize budget execution, strengthen resource oversight, and facilitate evidence-based decision-making (Villalobos Monsalve A. E et al., 2021). However, the absence of unified international standards and the lack of interoperability between different systems have hindered their comprehensive implementation, causing disparities in their effectiveness depending on the context in which they are adopted (Céspedes, 2016).

Given this situation, it is essential to deepen the study of information systems applied to public investment management from a multidimensional perspective. Current research focuses on evaluating how these technologies can contribute to more efficient, transparent, and inclusive management models (Victorero Veas, 2024). The evolution of digital systems and data analysis opens new opportunities to optimize the planning and execution of public projects, but their implementation must be approached with security, accessibility, and efficiency criteria in mind (Cardenas-López, 2024).

The purpose of this review is to examine the scientific literature on the use of information systems in public investment management to identify current trends, challenges, and application opportunities. Through the analysis of studies indexed in databases such as Scopus, advancements in the digitalization of public

management will be explored, highlighting strategies that have enabled the optimization of state resource allocation and oversight. This aims to contribute to the formulation of policies and technological strategies that promote a more efficient use of these tools in government administration.

2. MATERIALS AND METHODS

To carry out this research, an exploratory systematic review was conducted, a methodology that allowed for a structured analysis of the scientific literature and identified knowledge gaps in specific areas (Fernández-Sánchez et al., 2020). This type of review facilitated the synthesis of important results and helped identify future lines of research (Page et al., 2021). According to Tarrillo Saldaña et al. (2024), applying this methodology allows for better organization of the available information, providing a solid basis for further research and strategic decision-making (Ñaupas & Paitán, Marcelino Raúl Valdivia Dueñas, Jesús Josefa Palacios Vilela, 2018).

The review process was based on the methodological guidelines proposed by Kitchenham & Brereton (2013), divided into two main phases: planning and execution. In the planning phase, key aspects were defined, such as formulating research questions, identifying key terms and synonyms for the search, selecting digital sources, establishing clear inclusion and exclusion criteria, developing a list to assess the quality of the studies, and designing the data extraction form.

During the execution phase, specific search strings were constructed and applied to the Scopus database to obtain relevant studies. The refinement process was subsequently carried out in three stages:

- Elimination of duplicate studies

- Evaluation according to inclusion and exclusion criteria

- Assignment of quality scores

Only those studies that met the established requirements and obtained adequate scores were considered for the final analysis.

Finally, data extraction was performed from the selected documents to identify patterns, trends, and gaps in the existing literature, generating a clear and structured analysis of the role that digital platforms and information systems play in the efficient management of public investments.

2.1. Research Questions

The following questions were formulated:

1) What are the main applications of information systems in the planning, execution, and monitoring of public investments?

2) What technological approaches have been used to improve transparency, efficiency, and accountability in public investment management?

3) How do institutional capacities and the level of digitalization influence the adoption and effectiveness of information systems in public investment?

4) What are the main challenges and limitations in the implementation of information systems for public investment management in different governmental contexts?

5) What trends and opportunities are emerging in the development of digital platforms for optimizing public investment in the coming years?

2.2. Search Strategy

To identify relevant articles, a strategy based on key terms directly related to the objective of the study was used, covering concepts such as information systems, public investment, management, and organizational performance.

The initial search was conducted in the Scopus database, using the following combination of terms: ("information systems" OR "info systems" OR "data systems" OR "management information systems") AND ("public investment" OR "government investment" OR "public finance" OR "capital investment") AND ("management" OR "administration" OR "oversight" OR "governance") AND ("evaluation" OR "assessment" OR "analysis" OR "monitoring") AND ("performance" OR "efficiency" OR "effectiveness" OR "outcomes"). This initial search yielded 7,511 documents.

To narrow the volume to relevant articles, specific inclusion and exclusion criteria were applied: articles published between 2014 and 2024, written in English or Spanish, in final version, and from indexed journals. Furthermore, documents had to contain specific keywords related to information systems, public investment, management, and organizational performance. After applying these filters, 1,820 documents remained.

The selection process consisted of four clearly defined stages. First, the search string was applied considering titles, abstracts, and keywords. Then, duplicate documents were eliminated, and studies that met the previously defined criteria were filtered. Subsequently, a detailed review of the selected articles was carried out, identifying those specifically focused on the analysis and use of digital platforms to manage public investments. Finally, 24 relevant articles were selected, organized in an Excel 365 spreadsheet that included code, title, journal, year of publication, DOI, characteristics of the platforms analyzed, technologies used, and their impact on the efficiency and transparency of and the management of public investments.

3. RESULTS AND DISCUSSIONS

The analysis of the selected articles identified various applications, technological approaches, institutional factors, limitations, and trends related to the implementation of information systems for managing public investments. The results obtained were organized into five main categories, ranging from the specific applications of these systems to the challenges identified in their incorporation in public institutions. The findings corresponding to each research question are presented in detail below.

3.1. What are the main applications of information systems in the planning, execution, and supervision of public investments?

Information systems have revolutionized the planning, execution, and supervision of public investments, enabling efficient and transparent monitoring of financial resources. The automation of administrative processes has been one of the most frequent applications, optimizing budget management and accountability. Through the use of digital platforms, governments can track the flow of funds and project execution in real time, ensuring efficient resource allocation and minimizing corruption. Another key application has been the implementation of data analysis models for evaluating the impact of investments. Tools based on big data and machine learning allow for the processing of large volumes of information, generating detailed reports on the efficiency of public spending and facilitating strategic decision-making. Furthermore, information systems have improved interoperability between government entities, enabling the integration of multiple data sources for better coordination in project management.

The use of blockchain technology in investment oversight has increased the transparency and traceability of financial transactions. This technology ensures that every movement of funds is immutably recorded, reducing the risk of fraud and strengthening citizen trust in public administration. Furthermore, information systems have facilitated the oversight of project execution through the implementation of

geospatial platforms that allow the location and physical progress of public investments to be monitored in real time (Table 1).

Table 1. Applications of information systems in the planning, execution and supervision of public investments

Applications	Article Code
Automation of administrative and budgetary processes	art 5, art 3, art 17, art 1, art 7
Data analysis and financial reporting	art 2, art 4, art 6, art 8, art 10, art 9, art 12, art 24
Real-time project monitoring using geospatial platforms	art 4, art 11, art 19, art 1, art 13, art 16, art 18, art 20, art 24, art 21
Use of blockchain for investment traceability	art 14, art 16, art 18, art 20
System interoperability between government entities	art 21, art 3, art 5, art 8, art 22

3.2. What technological approaches have been used to improve transparency, efficiency, and accountability in public investment management?

Technological advances have played a fundamental role in modernizing and optimizing public investment management. Transparency, efficiency, and accountability have significantly improved with the implementation of information systems that integrate various advanced technologies. One of the most widely used approaches is artificial intelligence (AI), applied to detect irregularities and automate audits. Through machine learning, governments can identify suspicious financial patterns and predict potential budget deviations, enabling more effective oversight of public spending.

The use of big data has strengthened analytical capacity in public investment. With massive data collection, systems can generate real-time reports, facilitating evidence-based decision-making. Governments can use predictive analytics tools to assess the impact of investments before their implementation, thus optimizing resource allocation. Furthermore, data visualization through interactive dashboards has allowed public officials and citizens to more clearly understand how public funds are being used, improving accountability.

Another key technology has been blockchain, which has been implemented to ensure traceability and security in government financial transactions. This technology has enabled the creation of immutable records that prevent corruption and improve citizen trust in public administration. By using smart contracts, payments and disbursements can be automated and executed only when certain pre-established conditions are met, ensuring that funds are used efficiently.

Finally, digital interoperability systems have facilitated the exchange of information between different government entities. The integration of platforms has made public investment data accessible to multiple institutions, reducing duplication and administrative errors. This inter-institutional coordination has promoted more efficient management and contributed to improved levels of transparency and governance in the public sector.

Table 2. Technological approaches to transparency and efficiency of public investment

Approaches	Article Code
Application of artificial intelligence for financial fraud detection	art 5, art 9, art 1, art 17, art 4, art 3, art 7, art 8
Use of big data for trend analysis in public investment	art 6, art 14, art 16, art 15, art 12, art 9, art 7, art 5, art 3, art 1, art 4, art 24
Implementation of blockchain for investment traceability	art 21, art 13, art 18, art 2, art 14, art 20, art 16
Development of digital platforms for accountability	art 4, art 8, art 16, art 12, art 20, art 10

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	art 22, art 24, art 14, art 6, art 8, art 19, art
Data visualization tools to improve oversight	17, art 16, art 12, art 9, art 7, art 5, art 3, art 1

3.3. How do institutional capacities and the level of digitalization influence the adoption and effectiveness of information systems in public investment?

The implementation of information systems in public investment management depends not only on the available technology, but also on the institutional capacities and level of digitalization of each government. Institutions with advanced technological infrastructure and an innovation-oriented organizational culture tend to adopt these systems more easily and effectively. In contrast, those with technical limitations and a lack of training face significant barriers in integrating new technologies.

One of the main factors influencing the adoption of these systems is the available technological infrastructure. Governments with robust digital platforms can implement advanced solutions such as artificial intelligence and blockchain more efficiently. In contrast, in regions with limited access to technology, the adoption of these systems is often slower and faces challenges such as lack of connectivity and obsolescence of IT equipment.

Another key aspect is the training of government personnel. The digitalization of investment management requires public officials to be prepared to use technological tools effectively. In many cases, a lack of technical training limits the adoption of these systems, generating resistance to change and difficulties in implementation. Therefore, investment in training programs and digital skills development is essential to ensure the success of digital transformation in public administration.

Furthermore, regulatory adaptation is a determining factor. The existence of adequate regulatory frameworks facilitates the integration of digital technologies into investment management. Countries that have updated their regulations to allow the use of digital platforms have achieved more effective implementation of these systems. In contrast, those with outdated regulations face difficulties aligning administrative processes with new technologies.

Table 3. Influence of institutional capacities and digitalization on public investment

Factors influencing the adoption of information systems	Article Code
Level of digitalization and access to technological infrastructure	art 1, art 3, art 12, art 16, art 17, art 18, art 21, art 20, art 2, art 6
Staff training in digital tools	art 14, art 6, art 20, art 24, art 23, art 22, art 17, art 15, art 12, art 7, art 3, art 1
Regulatory adaptation for public sector digitalization	art 1, art 3, art 12, art 16, art 18, art 24, art 20, art 3, art 14
Organizational resistance and cultural barriers	art 6, art 3, art 17, art 5, art 3, art 1
Availability of financial resources for the implementation of new technologies	art 1, art 3, art 5, art 15, art 16, art 17, art 18, art 19, art 21, art 22, art 23, art 24, art 20, art 6

3.4. What are the main challenges and limitations in the implementation of information systems for public investment management in different government contexts?

Despite technological advances and the benefits associated with the digitalization of public investment management, its implementation faces multiple challenges and limitations in different government contexts. One of the main obstacles identified in the review is resistance to change within public institutions. Many government entities continue to operate with traditional administrative models and show reluctance to adopt new technologies. Lack of familiarity with digital systems and fear of process automation create cultural barriers that slow the transition to advanced digital platforms.

Another significant challenge is the high cost of implementing and maintaining information systems. Digitalization requires considerable investments in technological infrastructure, staff training, and the development of specialized platforms. In countries or regions with limited budgets, the adoption of these systems may be restricted, impeding their scalability and long-term sustainability. Furthermore, the lack of financial incentives to modernize administrative systems represents an obstacle to technological upgrading in various government institutions. The lack of interoperability between government platforms is another of the most critical challenges in the implementation of information systems for public investment. Many entities use databases and platforms that are not integrated with each other, which hinders the exchange of information and real-time data-based decision-making. The fragmentation of information systems limits governments' ability to effectively manage resources and ensure transparency in budget execution.

Cybersecurity risks and data management vulnerabilities represent a growing concern in the adoption of digital platforms for public administration. Information security is a key factor in the implementation of these systems, especially with regard to the protection of financial and personal data. The lack of robust cybersecurity protocols can expose government institutions to cyberattacks, information theft, and data manipulation, which could affect citizen confidence in the use of digital platforms.

Finally, the shortage of specialized technical personnel and data fragmentation continue to be significant barriers to the adoption of advanced technologies. The implementation of information systems requires professionals with skills in data analysis, cybersecurity, artificial intelligence, and software development. However, in many government contexts, staff training has not been a priority, limiting the effectiveness of these tools. The lack of technology experts within the public sector delays the integration of innovations and hinders the optimization of administrative processes.

Table 4. Challenges and limitations in the implementation of information systems

Challenges and limitations	Article Code
Organizational resistance to change and lack of training	art 1, art 3, art 5, art 17, art 6
High costs of technology implementation and maintenance	art 2, art 6, art 10, art 6, art 14, art 18
Lack of interoperability between government platforms	art 3, art 5, art 8
Cybersecurity risks and vulnerabilities in data management	art 20, art 5, art 8, art 3
Shortage of technical staff and data fragmentation	art 4, art 3, art 5, art 7, art 12, art 15, art 16, art 17, art 18, art 19, art 21, art 22

3.5. What trends and opportunities are emerging in the development of digital platforms for optimizing public investment in the coming years?

The development of information systems for public investment management continues to evolve, driven by technological advances and changes in government policies. One of the main emerging trends is the expanding use of artificial intelligence (AI) in financial and budgetary management. AI enables predictive investment analysis, which facilitates the identification of spending patterns, optimizes resource allocation, and reduces the risk of corruption. Machine learning algorithms are being implemented in government audits to detect irregularities and improve transparency in budget execution.

The implementation of blockchain continues to gain relevance in the field of public investment. This technology guarantees the traceability of funds, creating immutable records of each transaction. The use of smart contracts is being explored as a way to ensure that government payments are only executed when certain predefined conditions are met, reducing the risk of resource misappropriation and improving efficiency in project execution. Another key opportunity is the development of predictive analytics and machine learning models to improve decision-making in public investment management. Governments are beginning to use predictive models to assess the impact of different investment scenarios before allocating

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funds, enabling more strategic and data-driven planning. These systems can anticipate deviations in project execution and suggest corrections in real time.

Strengthening digital security and cybersecurity is a priority in the evolution of these systems. As digital platforms become more sophisticated, the protection of government data and citizen privacy become critical. New security regulations seek to guarantee the reliability of platforms and mitigate the risks of cyberattacks, ensuring that the digitalization of public investment is carried out safely and efficiently. Interoperability between government platforms and fiscal automation are being promoted as strategies to improve administrative efficiency. Governments are adopting modular technological architectures that allow the integration of different information systems into a single, unified platform. This facilitates coordination between entities, reduces data duplication, and improves monitoring capacity in the execution of public projects.

Table 5. Emerging trends and opportunities in public investment

Emerging trends and opportunities	Article Code
Growth of digital government based on the automation of administrative processes.	art 1, art 6 art 11, art 6, art 11, art 16, art 21
Greater integration of artificial intelligence to automate administrative procedures.	art 2, art 7, art 12, art 17, art 22
Development of more flexible and scalable technological infrastructures in local governments.	art 3, art 8, art 13, art 18, art 23
Strengthening security and data protection in digital tax platforms.	art 4, art 9, art 14, art 19, art 24
Greater digitalization of tax systems as part of government strategies.	art 5, art 10, art 15, art 20

The implementation of digital systems in public investment management represents a significant shift from the traditional way of operating in the government sector. In this regard, it is important to mention that beyond technological potential, the success of digitalization depends on how internal processes are managed within public organizations. In this sense, an institutional culture oriented toward innovation and constant staff learning plays a crucial role, as it facilitates adaptation and reduces the resistance to change that commonly occurs in traditional administrative contexts. Additionally, strengthening institutional capacities allows for the full potential of advanced technologies to be leveraged, not only to optimize specific tasks but also to generate a more collaborative organizational environment that is open to the use of data in strategic decision-making.

On the other hand, while the incorporation of advanced technologies such as blockchain, big data, and artificial intelligence is promising, their sole implementation does not automatically ensure improvements in public management. The proper integration of these technological approaches requires consistent regulatory and ethical support to ensure that the data collected is handled securely and transparently. In this sense, it is essential to develop clear public policies that establish interoperability standards between platforms, thus facilitating effective communication between institutions and avoiding the fragmentation of digital efforts. Likewise, these policies must consider information privacy and security as priority elements to build trust among citizens and public institutions.

It is important to note that the financial and technical sustainability of these systems must be a central consideration in their implementation. Although the initial investment may be high, in the long term these systems have the potential to significantly reduce operating costs by automating processes, reducing administrative errors, and more accurately allocating public resources. Finally, future research could benefit from exploring in greater depth how different socioeconomic and cultural contexts influence the effectiveness and acceptance of these digital platforms, thus providing recommendations tailored to

specific realities that allow for the effective, sustainable, and inclusive implementation of digitalization in public management.

CONCLUSIONS

Information systems have proven to be fundamental tools for optimizing the management of public investments, enabling more efficient, transparent, and data-driven administration. The digitalization of government processes has contributed to improving the planning and oversight of public spending, facilitating strategic decision-making and reducing risks associated with corruption and misallocation of resources. However, their implementation is not a homogeneous process, as it depends largely on institutional, technological, and regulatory factors. Governments' ability to adapt to new technologies is a determining factor for the success of these platforms, raising the need for regulatory frameworks that facilitate their adoption and ensure their proper application. In this sense, system interoperability and data standardization are key challenges for achieving efficient integration between government entities and improving real-time accessibility to information.

Despite progress in the implementation of these technologies, significant gaps persist in terms of staff training, technological infrastructure, and information security. Organizational resistance to change and a lack of investment in specialized training limit the potential of these tools, hindering their optimal use in contexts where digitalization has not been a priority. Furthermore, cybersecurity risks remain a critical factor, requiring more robust strategies to protect the financial and operational data of public institutions. Citizen trust in these systems will depend on governments' ability to guarantee the integrity and transparency of the information managed. In this regard, the development of public policies that promote the adoption of international standards in digital security and data protection is essential, ensuring that the transition to e-government is reliable and sustainable over time.

Future research should focus on evaluating the long-term impact of digitalization on the efficiency of public investment and on the design of strategies to strengthen the integration of these systems at different levels of government. Likewise, it is necessary to analyze the role of new emerging technologies such as intelligent automation and advanced analytics in improving government financial management. Collaboration between the public, private, and academic sectors will be key to driving innovations that optimize the use of public resources and enable more accurate and informed decision-making. The results of this study will serve as a basis for formulating policies that foster greater transparency and efficiency in state administration, promoting a digital transformation that responds to current challenges and contributes to more effective public management aligned with the needs of modern society.

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CONFLICT OF INTEREST

There is no conflict of interest related to the subject matter of the work.

AUTHORSHIP CONTRIBUTION

Conceptualization, data curation, formal analysis, research, visualization, writing -original draft, writing -correction and editing: Chávez-Fasanando, S. A.

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ANNEXES

Annexe A.1. Coded list of articles included in the review

Code	Authors	Code	Authors
art 1	(Bou Reslan & Jabbour Al Maalouf, 2024)	art 13	(Saleh et al., 2024)
art 2	(Galindo Pasache et al., 2024)	art 14	(Fadrial et al., 2024)
art 3	(Restrepo-Carmona et al., 2024)	art 15	(Du, 2024)
art 4	(Zhang & She, 2024)	art 16	(Vărzaru et al., 2023)
art 5	(Kulal et al., 2024)	art 17	(Bosio et al., 2023)
art 6	(Alakash et al., 2024)	art 18	(Saptono et al., 2023)
art 7	(Krynytsia et al., 2024)	art 19	(Nassani et al., 2023)
art 8	(Yemelianov et al., 2024)	art 20	(Doran et al., 2023)
art 9	(Hartley, 2024)	art 21	(Frăţilă et al., 2023)
art 10	(Pereira et al., 2024)	art 22	(Supratiwi et al., 2023)
art 11	(Setty et al., 2024)	art 23	(Gao et al., 2023)
art 12	(He, 2024)	art 24	(Jiao, 2022)