A systematic literature review on the effect of information systems on the performance of government officials

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A B S T R A C T

The use of information systems (IS) in the public sector has significantly increased, especially with the introduction of the electronic government system (EGS), which makes it easier for citizens to access government services. Even though there has been a lot of investment in information technology (IT), it's still unclear how much these investments improve productivity. This study thoroughly examines research papers, journals, and conference reports from the past ten years to assess the effect of information systems on the performance of government workers in different areas. Following the reporting standard for systematic evidence syntheses (ROSES), a detailed search was conducted using databases such as Web of Science and Scopus. The study uses the PICo (population, interest, and context) strategy to identify key areas of focus, such as Skill development, return on investment (ROI), strategic decision-making, and innovative thinking. This research plays a crucial role in developing policies and guiding the deployment of information systems to enhance the effectiveness of government officials and other stakeholders. It also looks into factors and situations that might improve or weaken the impact of IS on performance in government contexts. The outcomes of this systematic review help in understanding the complex relationship between information systems and the performance of government workers more clearly. The findings provide valuable guidance for policymakers, government organizations, and scholars, offering strategies to make the most of information systems to improve government workers' performance and productivity.

1. Introduction

The utilization of information systems in the public sector has experienced a notable upswing in recent years. These systems, characterized as computer-based tools facilitating information collection, processing, storage, and distribution, play a pivotal role in organizational decision-making and control. Their significance has grown exponentially in the public sector, supporting a spectrum of activities ranging from administrative and operational tasks to policy formulation and service delivery. Governments employ information systems to manage citizen data, monitor program performance, and provide online services.

While incorporating information systems in the public sector yields various advantages, such as heightened efficiency, enhanced transparency, accountability, and improved service delivery, challenges persist. These challenges encompass cybersecurity risks, concerns regarding data privacy, and the necessity for continual investments in technology infrastructure and training (Bakar et al., 2022; Kasimin et al., 2013).

Research on the evolution of information systems in the public sector dates back to the 1980s, spanning over three decades (Bozeman and Bretschneider, 1986). The research focus has progressively shifted towards electronic government systems (EGS) since the mid-1990s, reflecting a heightened demand for these information systems (Torres et al., 2005). EGS, utilizing information technology to augment the efficacy of government services for citizens, employees, businesses, and agencies, is categorized diversely based on its intended use. This study acknowledges the classification outlined by Carter and Belanger

(2004). EGS is expected to yield various benefits, including cost reduction, efficiency gains, improved service quality, transparency, anti-corruption measures, accountability, democratization, and heightened national and business competitiveness (Bakon et al., 2020).

Nam (2014) identifies five types of e-government usage as follows:

1. Use of services: engaging in transactional services.
2. Use of general information: searching for general information.
3. Policy research: searching for information related to government policy.
4. Participation: taking part in decision-making and discussion processes.
5. Co-creation: collaborating in developing policies, information, and services with the government and citizens.

There is empirical support indicating that EGS can enhance government efficiency, and reciprocally, improved government efficiency can facilitate the delivery of EGS. Through the EGS, clients gain internet-based access to government information and services, surpassing traditional government-to-community communication channels. EGS has been posited as a catalyst for a transformative shift in the government-citizen relationship (Norris, 2010). However, the tangible benefits generated by EGS still need to be clarified (Goh and Arenas, 2020; Stanimirovic and Vintar, 2013).

Simultaneously, since the 1980s, the new public management (NPM) reform has underscored the imperative to enhance performance measurement and management (PMM) to bolster the effectiveness of public organizations (Anderson and Klaassen, 2012; Kroll and Moynihan, 2015). As indicated by various studies (Arnaboldi et al., 2015; Courty et al., 2005; van Helden and Johnsen, 2002), public organizations have initiated experimentation with performance measurement systems (PMSs). According to Choong (2013), a balanced and dynamic collection of metrics encompassing objective setting and data gathering, assessment, and reporting on action effectiveness defines a PMS. Both these approaches converge toward the overarching goal of augmenting the effectiveness and efficiency of government and private agencies.

Despite substantial government investment in information technology, questions persist about the productivity gains linked to IT investments (Pashutan et al., 2022; Hajli et al., 2015). Although government spending on computers has surged, empirical studies scrutinizing the impact of IT on public sector organizations are still being determined (Alghorbany et al., 2022). Few studies have quantified the influence of IT investment and utilization on the performance of public organizations (Lehr and Lichtenberg, 2003). This systematic literature review (SLR) aims to investigate the implementation gap in information systems within the public sector. The study will conduct a comprehensive literature review, focusing on three domains: system capabilities, interactions, and performance.

However, this SLR will establish comprehensive objectives to address the research questions in light of the gaps identified in the preceding study. The research framework for this SLR, depicted in Fig. 1, outlines the approach to answering the objectives.

Fig. 1: Performance measurement variables

2. Methodology

2.1. Formation of research questions

The PICo framework informed the development of research questions for this SLR. PICo is a learning technique that shapes SLR research questions and relies on qualitative synthesis to identify essential aspects or elements for SLR study questions (Lockwood et al., 2015). PICo revolves around three key concepts:

1. P (Population/problem)
2. I (Interest)
3. Co (Context)

Grounded in these principles, the three primary components—Government Officer (Population), the effect of information systems (Interest), and performance (Context)—were utilized to formulate the core research questions for this SLR, which are:

1. What is the level of EGS use among government officers?
2. What is the effect of information systems on government officer performance?
3. What is the impact of using EGS?

2.2. The review protocol - ROSES

The study implemented the ROSES review protocol to construct this SLR, Reporting Standard for Systematic Evidence Syntheses. The ROSES protocol review is recognized for aiding authors in developing a comprehensive and structured SLR (Haddaway et al., 2018). Notably, ROSES underscores its flexibility in methodology, rendering it applicable to various types of SLR analyses. This systematic literature review opted for the ROSES protocol due to its adaptable structure and methodology. Following the development of the ROSES protocol review, the SLR initiated the formulation of research questions, proceeded to systematic searching strategies, conducted article

quality assessments (quality appraisal), and concluded with data extraction and analysis of selected articles (data abstraction and analysis). The data is summarized utilizing the ROSES format, as illustrated in Table 1.

2.2.1. Identification

The identification process in this context involves locating and refining the keywords utilized in the Systematic Literature Review (SLR) article/reference search. Employing keywords enhances the precision of the articles and references gathered for the SLR bibliography, playing a pivotal role in the search process. In alignment with the research mentioned earlier questions, three main keywords were selected: EGS, government officer performance, and information system. The primary keyword was the basis for searching alternative keywords, synonyms, related terms, and word variants. This exploration was carried out using an online thesaurus, referring to past research keywords, consulting Web of Science (WoS) and Scopus databases, and seeking input from an expert.

The outcome of this identification process is presented in Table 1. Gusenbauer and Haddaway's (2020) study asserts that databases such as Web of Science and Scopus offer a more comprehensive search, produce more reliable results, and feature advanced search capabilities. The articles/references from these databases were located using advanced searching techniques involving fundamental operations like AND, OR, phrase searching, and truncation (Table 2). Based on the keywords, databases, and search strategies employed, 6,336 articles were successfully obtained. All these articles/references will undergo screening as part of the systematic search strategies.

2.2.2. Screening

A total of 6,336 items have been successfully identified and are now poised for screening. Screening involves the establishment of inclusion and exclusion criteria to selectively compile articles and references pertinent to the SLR. The first criterion utilized in this SLR is the year of publication, focusing on the last ten years (2012 to 2021). To ensure quality control, the SLR exclusively selects journal articles, mitigating potential internal confusion in reading and comprehension. Only articles published in Malay and English are included.

Table 1: Systematic searching strategies

Review protocol	
Identification	Article search: WoS and Scopus databases (n=6,336)
Screening	Year: 2012-2021; Language: Malay and English; types: articles only; Publication category: 5 selected fields (n=676)
Eligibility	Exclusion: focus on related topic towards SLR been discussed (n=28)
Quality appraisal	Evaluator experts have been selected. Reviewed into three quality categories – high, moderate, and low (n=12)
Data abstraction and analysis	Total articles for thematic analysis (n=12)

Table 2: The search strings

Database	WoS and Scopus
Search strings	TOPIC: Government officer performance OR government officer productivity OR government officer capacity OR government officer achievement OR public servant performance OR public servant productivity OR public servant capacity OR public servant achievement OR civil servant performance OR civil servant productivity OR civil servant capacity OR civil servant achievement OR government worker performance OR government worker productivity OR government worker capacity OR government worker achievement Refined by: TOPIC: (electronic government system OR electronic government OR information system OR information technology OR information, communication and technology)

Furthermore, inclusion in the SLR is confined to articles presenting relevant empirical data, excluding review articles, as the primary aim is to ascertain and identify the findings of prior studies rather than reviewing them. The inclusion criteria are centered on the focus of the findings, with selected articles aligning with Web of Science (WoS) categories associated with the topic, including management, environmental science, environmental studies, computer science information systems, and computer science interdisciplinary application. Following the screening process, 5,660 articles were excluded for not meeting the predetermined criteria, leaving 676 articles for the subsequent phases of the review process.

2.2.3. Eligibility

All the chosen articles are subjected to a second screening process known as eligibility screening. The primary objective of eligibility screening is to ensure the relevance and appropriateness of all selected articles for inclusion in this SLR. This process involves an assessment of the titles and abstracts of the selected articles. If, upon reviewing the title and abstract, it is deemed necessary to gather more information, the methodology, results, and discussion sections of the article will be consulted. Following this eligibility screening, 648 articles were excluded as they did not focus on EGS and Information and Communication Technology (ICT) as they pertain to government officers or bodies. Consequently, 28 articles were deemed eligible and selected for further quality evaluation.

2.2.4. Quality appraisal

Initially, it is imperative to evaluate the quality of the selected articles. This step is crucial to mitigate bias and pinpoint potential articles with methodological shortcomings (Seehra et al., 2016). Following the recommendation of Abas et al. (2022), two evaluators were designated among the researchers for this assessment. The evaluators will

categorize the articles into three quality tiers: high, moderate, and low. Only articles deemed high and moderate in quality will undergo further review. In assessing the quality of these twelve articles, the experts will scrutinize the methodology employed in each study.

2.2.5. Data abstraction and analysis

After the quality assessment of articles, the ensuing step involves the researcher extracting data on articles deemed of sufficient quality. Given the focus of this Systematic Literature Review (SLR) on reviewing previous study findings related to the performance of government officers and the impact of using Electronic Government Services (EGS), the data extraction process centers on three pivotal sections of the articles: the abstract, the study's results, and the research discussion. If necessary, other sections of the article containing pertinent data will be examined, and the extracted data will be systematically organized in a table to facilitate the subsequent analysis.

After extracting relevant data, the subsequent phase entails data analysis, during which a thematic framework emerges, and an in-depth analysis is conducted to extract findings according to cohesive themes. When commonalities or correlations arise among the findings, they are consolidated into a singular dataset, and a pertinent theme is delineated. Each identified theme subsequently undergoes a validation process rigorously assessed by subject matter experts.

3. Spatial and temporal analysis

After adhering to the review protocol, this section will analyze 12 selected articles. Based on Fig. 2, these articles are sourced from ten different nations: The United States, Spain, Indonesia, Malaysia, Ukraine, Turkey, Taiwan, Nigeria, Africa, and Belgium. Notably, the United States stands out with the most articles, contributing two, while a single article represents each nation.

Based on the publication year, the distribution of articles is as follows: one article was published in 2021, two articles in 2020, one article in 2019, two articles in 2017, one article each in 2016 and 2015, and two articles each in 2014 and 2012 (Fig. 3). Specifically, two articles were published in 2020, 2017, 2014, and 2012, totaling four articles across these years.

4. Thematic analysis

From the pool of 12 articles, four discernible themes have been extracted about the impact of information systems on the performance of government officers. These themes are a) Competency, b) Return on Investment (ROI), c) Strategic Decision Making, and d) Creative Thinking.

4.1. Competency

Competency emerges as a pivotal consideration in the implementation of e-government, playing a crucial role in system utilization and influencing government servants. The objective of e-government implementation is to elevate the standard of public services, aiming to reduce corruption, enhance time efficiency and transparency, boost revenues, cut costs, and provide citizens with more accessible means of engaging with public sectors (Jauhari et al., 2020; Chiang, 2012; Pang et al., 2016). The government recognizes IT as a catalyst for e-government initiatives, fostering convenience, accessibility, efficiency, transparency, and accountability. This responsiveness to citizen needs through a more effective service delivery system has been acknowledged (Bakar et al., 2014).
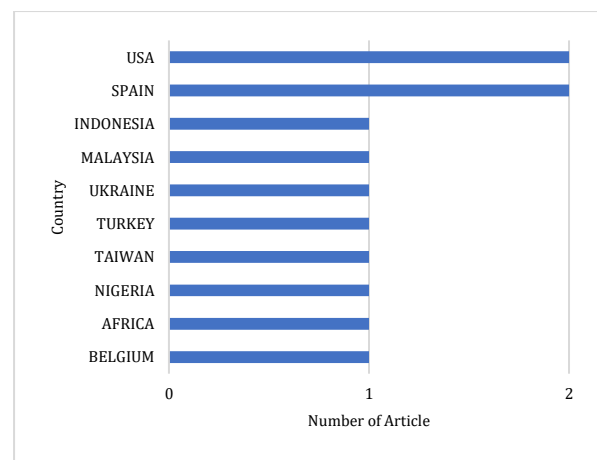

Fig. 2: Spatial distribution of the selected articles
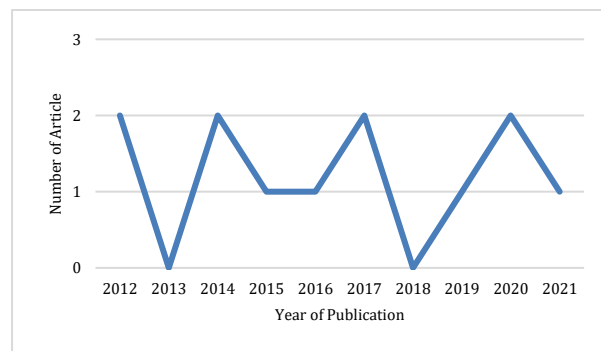

Fig. 3: Temporal distribution of the selected articles

Numerous government agencies, both public and private, have integrated IT into their daily operations, as evidenced by articles from Malaysia (Bakar et al., 2014), Turkey (Engin and Gurses, 2019), Africa (Macharia et al., 2015), and Spain (Muñoz et al., 2018). Adopting IT in routine work processes enables these entities to excel and streamline their operations, reducing the frequency of repetitive tasks (Jauhari et al., 2020). The improvement in the performance of public organizations in Aceh, Indonesia, has been linked to the adoption of e-government, showcasing

advancements in good governance principles, effectiveness, and efficiency.

Competency-related factors extend to performance measurement, with performance expectations identified as crucial for adopting Hospital Information Systems (HISs) in Turkey (Engin and Gurses, 2019). The benefits and gains offered by the system must be communicated to personnel to facilitate successful adoption. Enhancing their skill sets becomes imperative to ensure that employees remain competitive in handling IT development and use. Research conducted by the Royal Malaysian Customs (RMC) on the use of the Customs Information System (CIS) underscores the need for enhanced employee training, particularly in response to a limited understanding of the CIS among RMC officers and customers (Bakar et al., 2014).

Perceived behavioral control, facilitated by IT, plays a significant role in accepting online public services (Chiang, 2012). Institutions with knowledgeable, experienced, and resource-equipped personnel show improved intent to use HISs. Therefore, it is crucial to implement applications that make HIS users feel knowledgeable and competent during their initial use of the system, necessitating personnel training and the provision of necessary resources.

Effort is identified as the second most crucial factor influencing HIS competency. The usability of HISs is critical for their successful deployment, emphasizing the need for an intuitive interface and adequate training. Demographic factors, such as age, moderate the effect of facilitating conditions on usage behavior, with older workers exhibiting a more pronounced impact (Engin and Gurses, 2019). Age-related considerations include individualized training and situation-appropriate support for workers over 40 who may have started using information and communication technologies later in their careers.

Gender also plays a role in competency, particularly in performance expectations. Males exhibit significantly greater performance expectations for using HIS than females, while women express greater effort expectations. Experience further influences the intention to use HIS, with personnel less experienced in HIS showing a more significant effect than those with more experience (Engin and Gurses, 2019).

4.2. Return on investment (ROI)

The adoption of e-government has the potential to reduce administrative expenses, minimize the time spent by public employees on repetitive tasks, enhance the efficiency of existing public sector services, and broaden access to these services. Consequently, this chapter aims to provide insights into the policies adopted by regional governments in Spain to address the digital divide (Muñoz et al., 2018). Before integrating IT systems into public governance, a meticulous analysis of the active

implementation processes of modern information technologies is essential. This new system involves optimizing public services in electronic form and adhering to fundamental actions and principles while transforming public services into digital format. To heighten the efficacy of the process, the implementation of optimal low-budget measures is recommended, as a well-managed budget is identified as a crucial indicator for promoting sound governance principles (Jauhari et al., 2020; Goshovska et al., 2021).

A study from 2012 indicates that closer proximity between the agency head and the chief information officer (CIO) enhances IT security performance and reduces costs for federal agencies in gathering and sharing sensitive information (Khallaf and Majdalawieh, 2012). Government expansion, a pervasive phenomenon in most industrialized nations, is hypothesized by Pang et al. (2016) to correlate with increased IT investments by state CIOs and a subsequent decrease in state government spending. On average, a $1 increase in state CIO budgets is associated with a $3.49 decrease in state expenditures, and this result remains robust across alternative estimation methods and different measures for government size (Pang et al., 2016).

ICT enables businesses to reduce costs associated with coordinating, processing, and transmitting information. Improved information sharing between management and employees, as noted by Bayo-Moriones et al. (2017), fosters network building within a company and enhances employee involvement. Construction project challenges, such as incorrect deliveries, misallocating funds, and equipment misplacement, can be mitigated by developing construction technology and the Internet of Things (IoT). Technologies like radio frequency identification devices (RFID) tags assist in tracking and monitoring construction equipment, reducing costs associated with misplacing equipment and project delays (Oke et al., 2020).

E-government is found to have a positive and significant impact on the performance of government offices in Aceh, Indonesia, as well as on good governance practices (Jauhari et al., 2020). The ease and flexibility of updating and maintaining e-government applications contribute significantly to its positive impact on implementing good governance principles.

4.3. Strategic decision making

Strategic decision-making in managing employee performance requires aligning performance management systems with the organization's strategic objectives, as evidenced by Waeyenberg et al. (2017). Aligning performance planning, monitoring, and evaluation with strategic goals yields better outcomes, fostering informed judgments.

Analyzing a significant trend of empirical data provides organizations with data-backed visibility,

facilitating more thoughtful decision-making and reducing reliance on assumptions (Oke et al., 2020). Employing a hybrid human-computer approach in decision-making involving extensive sensor data was recommended due to the superior ability of computerized analytics to process large data volumes (Oke et al., 2020).

Incorporating performance expectations as a strategic step in employee performance management is crucial, according to Engin and Gurses (2019), as it significantly influences system adoption success. Clear communication about the system's benefits and returns to the personnel involved is essential before implementation. Providing mental preparation opportunities and ongoing promotional activities are also crucial for successful system adoption among healthcare personnel.

Social influence plays a significant role in strategic decision-making for system use, as indicated by Engin and Gurses (2019). Employees tend to follow recommendations or usage patterns of their coworkers and top executives regarding system utilization. This peer and leadership influence positively impacts personnel interest and engagement in using the system. Additionally, implementing a system correlates with increased employee engagement in self-managed teams (Bayo-Moriones et al., 2017).

4.4. Creative thinking

Integrating ICT in public administration has spurred innovative and creative thinking among employees across hierarchical levels. Research by Bayo-Moriones et al. (2017) indicated that lower-level employees experience increased autonomy in task organization and finding efficient approaches to fulfill their responsibilities. This integration allows government employees uninterrupted discourse, expanding their understanding and fostering new ideas. Placing the public CIO at the highest management level in federal agencies demonstrates a commitment to agile adaptations in response to a dynamic environment.

5. Discussion

Competency, as identified in this SLR, is a crucial theme reflecting the aspiration to enhance employee proficiency through implementing IT in the public sector. This adoption is envisioned to combat corruption, elevate transparency and time efficiency, reduce costs, and enhance citizen-government interactions (Jauhari et al., 2020; Chiang, 2012; Pang et al., 2016). Nevertheless, inefficiencies may persist due to unprepared workers, prompting the need for training programs that focus on ICT competencies (Mauldin, 2016). Many current training programs in public administration need a concentration on IT, highlighting an existing gap in preparing employees for digital demands (Mauldin, 2016). Moreover, enhanced IT training correlates positively with IT

security performance (Pang et al., 2016). Attitudes toward IT adoption are influenced by psychological traits like open-mindedness, self-efficacy, and interest in technology (Quadahi, 2008). Studies reveal that subjective norms and perceived behavioral control significantly impact the intention to use information systems (Lu et al., 2009).

The second central theme, return on Investment (ROI), in implementing e-government anticipates reducing administrative costs, streamlining public sector services, and fostering greater access (Muñoz et al., 2018). This incorporation is also expected to decrease coordination costs and introduce innovative economic activity coordination methods (Forman and Zeebroeck, 2012; Grimshaw et al., 2002). Despite the difficulty in quantifying intangible benefits, IT budget allocations play a vital role in agency performance (Hitt and Brynjolfsson, 1996).

Strategic decision-making emerges as the third theme, emphasizing the necessity for aligning civil servants' performance with organizational objectives (Abas et al., 2023; Berg, 2001). ICT facilitates better decision-making by enabling access to timely information (Berg, 2001). The adoption of ICT reshapes hierarchical structures, reducing the need for hierarchy and empowering employees (Dewett and Jones, 2001; Arnal et al., 2003; Rubery and Grimshaw, 2001; Basaglia et al., 2010; Venkatesh et al., 2010).

The final theme, creative thought, stems from ICT's introduction, enabling lower-level employees to exercise greater autonomy in task organization (Dewett and Jones, 2001). This shift influences how businesses manage information and knowledge, generating implicit knowledge (Leonardi and Bailey, 2008; Brynjolfsson et al., 2002; Grimshaw et al., 2002). However, pressuring employees to be more creative can alter job nature and increase complexity (Hoogervorst et al., 2002). Task diversity, associated with creativity, may increase due to job volatility arising from ICT adoption (Hoogervorst et al., 2002). ICT adoption also demands diverse skills to handle unpredictability in job roles (Venkatesh et al., 2010).

6. Recommendations

The findings of this study underscore the significance of competency, return on investment (ROI), strategic decision-making, and creative thinking as pivotal factors impacting government officers' performance. Researchers uniformly highlight the importance of performance measurement, IT facilitating conditions, and effort in addressing competency. Enhancing training in information systems is crucial, urging stakeholders to fulfill their responsibilities by bolstering staff competence through suitable training programs. Additionally, demographic factors such as age, gender, and experience significantly influence information system competency, warranting further research in these areas.

ROI emerges as a determining factor in government officers' performance. The

implementation of e-government, as revealed by studies in this SLR, can curtail administrative costs and reduce the time spent on repetitive tasks by civil servants. Furthermore, it enhances transparency, augments public sector services, and widens access to these services. However, measuring the financial aspects remains challenging, calling for studies to propose suitable financial evaluation measures.

Strategic decision-making involves managing performance expectations and navigating social influences among government officers. Nevertheless, various studies indicate that ICT diminishes the need for hierarchy, reshapes authority relationships, and allows employee decision-making, resulting in disparate decisions. A cohesive approach is necessary to integrate these findings into a comprehensive strategic plan for implementing information systems.

Effective utilization of information systems among government officers significantly boosts work efficiency, cost-effectiveness, and departmental sustainability by streamlining bureaucratic processes. Minimizing paperwork stages and reducing department bureaucracy is conducive to economic growth, aligning with the Sustainable Development Goal of fostering decent work and economic growth.

Implementing information systems can cultivate a workforce with robust creative thinking abilities but can also pose challenges by altering time management. Imposing pressure on employees to be more creative might affect their job nature and increase the complexity of their responsibilities. Balancing creativity with job demands becomes imperative for stakeholders to maintain an optimal work environment.

7. Conclusion

In conclusion, this study broadens the horizons of information systems research by delving into the impact of information systems on the performance of government officers within the public sector. Despite substantial investments in IT by public organizations, the public sector still needs to be explored in information systems research. By shedding light on this area, this research aims to stimulate further investigation among information systems scholars in the government context and attract fresh interest from diverse audiences to the field of information systems.

However, it is important to note limitations within this SLR. Two articles remained inaccessible despite extensive database searches and efforts to contact lead authors. Despite these limitations, the analysis unveiled four significant themes: efficiency, return on investment, strategic decision-making, and creative thinking. Additionally, this SLR underscores the implications of its findings regarding the impact of information systems on the performance of government officials. It is anticipated that these insights will assist stakeholders in formulating policies that align with information systems,

ultimately augmenting the performance of government officials.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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