

Digital Budgeting Transformation and Future Challenges: A Bibliometric Analysis

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Abstract: In the contemporary era, digital budgeting has become increasingly significant in enhancing operational efficiency, fostering transparency, and promoting stakeholder participation within budget management. This study endeavors to scrutinize prevailing research trends pertaining to digital budgeting by conducting a comprehensive analysis of publications indexed in the Scopus database. Utilizing bibliometric data analysis and Nvivo 12 Plus, our investigation facilitated the delineation of noteworthy findings. The study underscores a substantial surge in research interest surrounding digital budgeting, along with the noteworthy contributions from diverse countries to the research literature. The revealed insights affirm that digital budgeting transcends geographical boundaries, constituting a global phenomenon with diverse contextual applications and practices across the globe. Furthermore, the findings illuminated a broad spectrum of research topics related to digital budgeting, encompassing aspects such as the utilization of digital platforms, public participation, budget oversight, local-level budget management, and digital democracy. While acknowledging the immense potential of digital budgeting, it is imperative to recognize the challenges accompanying its implementation. These challenges encompass issues of data security, policy adaptation, organizational culture, constrained human resources, and system integration. This study advocates for a multidisciplinary approach as essential for mitigating the impediments and challenges inherent in the effective implementation of digital budgeting.

Keywords: *Digital budgeting; budget control; participatory budgeting; digital governance*

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INTRODUCTION

The imperative for digital transformation in governance and administration is underscored by its potential to significantly enhance operational efficiency, transparency, and accountability in the administration of public funds (Kuziemski & Misuraca, 2020; Valle-Cruz et al., 2022). The utilization of technologies such as e-budgeting systems and data analysis software empowers governments to optimize budget allocations, mitigate the risk of corruption, and facilitate expedited delivery of public services with heightened quality (Justice et al., 2006; Oktaviani et al., 2019). Furthermore, digital transformation fosters increased public engagement in decision-making processes, advances governance practices, and offers innovative solutions for addressing intricate governance challenges (Irani et al., 2023; Scupola & Mergel, 2022).

Numerous research currently underscore the transformative potential of digital budgeting in reshaping the conventional framework of budget management. This approach empowers

governments, organizations, and enterprises to incorporate cutting-edge technologies such as artificial intelligence, advanced data analytics, and cloud-based platforms, thereby facilitating more informed and timely budgetary decisions (Jeong & Oh, 2019; Tseng et al., 2023; Weiss, 2023). Beyond its optimization of resource allocation, digital budgeting enhances the precision of financial planning, reduces risks, and fosters transparent reporting. Moreover, it serves as a catalyst for broader public engagement in the budget decision-making process, heightens accountability, and opens avenues for innovative fund management practices (Iasulaitis et al., 2019; Ivanova et al., 2022). This potential has prompted global exploration and implementation of digital budgeting solutions by various organizations and governments, aiming to enhance efficiency and effectiveness in financial resource management.

Digital Budgeting possesses the potential to enhance adaptability in addressing swiftly evolving external environments. Through real-time access to data and the capacity for dynamic budget adjustments, organizations can proactively respond to alterations in economic conditions or community needs (Effah & Nuhu, 2017; Foth et al., 2015). Furthermore, Digital Budgeting plays a pivotal role in minimizing budgetary waste, pinpointing savings opportunities, and enhancing overall financial performance (Bogoslavtseva et al., 2020; Touchton et al., 2019). It transcends mere operational efficiency, extending to the creation of enduring value by leveraging data and technology to inform policy decisions, enhance the quality of public services, and realize more sustainable development goals (Omar et al., 2017; Tsindeliani et al., 2021).

While numerous research endeavors have delved into the realm of digital budgeting, the majority tend to concentrate on specific facets or limit their scope to particular regional or organizational contexts (Bolgov & Chugunov, 2020; Graça, 2023; Lühmann & Bogo, 2022; Mellon et al., 2017; Roja & Urs, 2023; Sharma et al., 2022; Spada et al., 2016; Stortone & De Cindio, 2015; Weiss, 2023). These studies record how successful digital budgeting implementations have been in various countries. Surprisingly, there is a shortage of comprehensive research projects that systematically assess current global research documents or publications within the sphere of digital budgeting. This cavity presents a notable research opportunity to address this by conducting an exhaustive study encompassing the latest developments, trends, and innovations in digital budgeting across diverse countries and sectors. Such a study holds the potential to furnish a more profound understanding of best practices, regional variations, and global impacts. Additionally, it can contribute to the identification of emerging trends and challenges in the continually evolving digital landscape. The outcomes of research simultaneously evaluating the global literature on digital budgeting can serve as a valuable source of insight for stakeholders, practitioners, and researchers seeking to enhance efficiency and effectiveness in budget management during the digital age.

This study seeks to address the research gap within the domain of digital budgeting that prior researchers have left. The research endeavor aims to articulate crucial research questions: (1) What characterizes the prevailing research trends in digital budgeting, encompassing recent advancements and predominant research emphases? (2) How can future challenges associated with digital budgeting practices be discerned through a comprehensive evaluation of existing research literature? By addressing these research questions, this study anticipates offering valuable insights into the contemporary landscape of digital budgeting, thereby aiding in the identification of prospective research trajectories and the development of solutions for challenges emerging in budget management amid the evolving digital era.

LITERATURE REVIEW

Governance: Digital Transformation and Adoption

The surge in interest surrounding digital transformation and adoption in governance underscores the need to comprehend the impact of digital technologies on governance structures, processes, and practices across diverse sectors, including government, non-profit organizations, and businesses (Janowski, 2015; Jia & Chen, 2022; Zuiderwijk et al., 2021). Extensive research indicated that digital transformation has instigated profound changes in governance practices (Castro & Lopes, 2022; Chohan & Hu, 2022; Janssen et al., 2018). For instance, e-government systems have empowered governments to deliver more efficient and transparent public services, fostering citizen participation in decision-making processes (Abu-Shanab, 2019; Gao & Lee, 2017;

Manoharan et al., 2021). Nonetheless, the literature also reveals various challenges associated with digital transformation and adoption in governance. A recurring concern is data security and privacy, particularly in the context of utilizing big data and the Internet of Things (IoT) (Alharbi et al., 2021; Thompson et al., 2020; Wu, 2014).

Furthermore, attention is directed toward regulatory and policy considerations, prompting inquiries into the appropriate regulation of digital technologies to ensure compliance with ethical and legal norms (Rose et al., 2018; Weerakkody et al., 2014; Xin et al., 2022). Despite the associated challenges, additional literature indicates that the adoption of digital transformation in governance presents significant opportunities to enhance efficiency, accountability, and participation in decision-making processes (Lee-Geiller & Lee, 2019; D. Lee et al., 2021). As organizations and governments increasingly seek to comprehend the potential of digital technologies, the importance of more comprehensive research in this domain escalates, shaping the trajectory toward more effective and responsive governance (Jiang et al., 2022; Ravšelj et al., 2022).

Budgeting Practices

Budgeting practices hold significant importance in the realms of financial management and business planning (Bartocci et al., 2023; Mauro et al., 2021). Explorations into these practices have yielded valuable insights. The evolution of budgeting practices from the conventional focus on annual calculations to a more adaptive and closely aligned approach with business strategy has been observed (Bahr & Lennerts, 2010). Additionally, research findings indicate that digital technology has fundamentally transformed the execution of budgeting practices (Mærøe et al., 2021). Further emphasis has been placed on the utilization of advanced budgeting software and data analysis tools to enhance accuracy, visibility, and efficiency in the budgeting process (Halilovic & Cicic, 2013). Collaborative budgeting approaches facilitated by online platforms have emerged, fostering collaboration across diverse departments or divisions within organizations, promoting enhanced communication, and expediting the decision-making process (Hina Khalid et al., 2017; Pulkkinen et al., 2023).

Concurrently, budgeting practices within the realm of government management and administration have garnered substantial relevance and significance (Callaghan & Horne, 2023; Davidson, 2023; Franklin & Ebdon, 2020; J. Lee et al., 2023; Musadat, 2023; Pereira & Roder Figueira, 2021; Soukop et al., 2021). These practices possess distinctive characteristics that set them apart from the private sector, particularly with respect to transparency, accountability, and public service considerations (Ferry & Eckersley, 2015; Muthomi & Thurmaier, 2021). Additional insights reveal the presence of diverse models and approaches employed in government budgeting, including the utilization of the performance-based budgeting model. These models aim to enhance the efficiency and effectiveness of public fund utilization and assess the attainment of public service outcomes (Fitz Verploegh et al., 2022; Kong, 2005). Furthermore, certain research underscores the intricacies associated with government budgeting practices, particularly in the context of budget uncertainty, policy changes, and escalating demands for increased transparency in public fund management (Ahrens & Ferry, 2021; Chugunov et al., 2019).

There is an ongoing discourse regarding the role of citizen participation in government budgeting processes, with certain research underlining the significance of engaging citizens in budget prioritization to ensure alignment with public needs. Nonetheless, this literature acknowledges challenges in implementing contemporary and transparent budgeting practices within government (Ewens & van der Voet, 2019; Manes-Rossi et al., 2023). These challenges encompass shifts in organizational culture, human resource training, and capacity, as well as technical issues related to budget data collection, analysis, and reporting (Alsharari, 2020; Ewens & van der Voet, 2019). Presently, budgeting practices are associated with the concept of e-budgeting, which is perceived to hold substantial potential in the governance context by fostering increased budget transparency and facilitating public participation in the budget planning and monitoring process. This, in turn, is expected to enhance accountability and effectiveness in the utilization of public funds (Valle-Cruz et al., 2022).

RESEARCH METHOD

This study employed a bibliometric analysis approach utilizing data sourced from the Scopus Database. Scopus was chosen because it is one of the best and most reputable journal document databases in the international academic world. Compared to other reputable indexers, Scopus has the advantage of a wider range of social and humanities topics, so it is more comprehensive when conducting bibliometric-based studies. The initial step involved filtering the data to focus on the term "digital budgeting" in the article title, abstract, and keywords, ensuring the relevance of the collected data to the research topic. Further refinement occurred exclusively by using the keyword "digital budgeting" to prevent unwanted data bias. The research refrained from limiting document type, publication year (all year), or publication affiliation during the search process, ensuring the completeness of the collected data.

Following the completion of filtering, the research amassed a total of 78 pertinent documents. Subsequently, this data underwent analysis using the *Vosviewer* tool to conduct bibliometric analysis, enabling an examination of research trends, including changes in topic popularity over time and the identification of key concepts in the literature. Additionally, *Nvivo* software was utilized to map themes related to digital budgeting based on the content of the collected publications. These steps collectively facilitate an in-depth understanding of current research trends and potential challenges in the practice of digital budgeting. Consequently, this study contributes valuable insights into the development and direction of research pertaining to digital budgeting within the context of government management and administration.

RESULTS AND DISCUSSION

Research trends in the discourse on digital budgeting

Research trends in the discourse on digital budgeting encompass the examination of document quantity, document distribution based on the author's country affiliation, and the mapping of interconnected themes within the domain of digital budgeting.

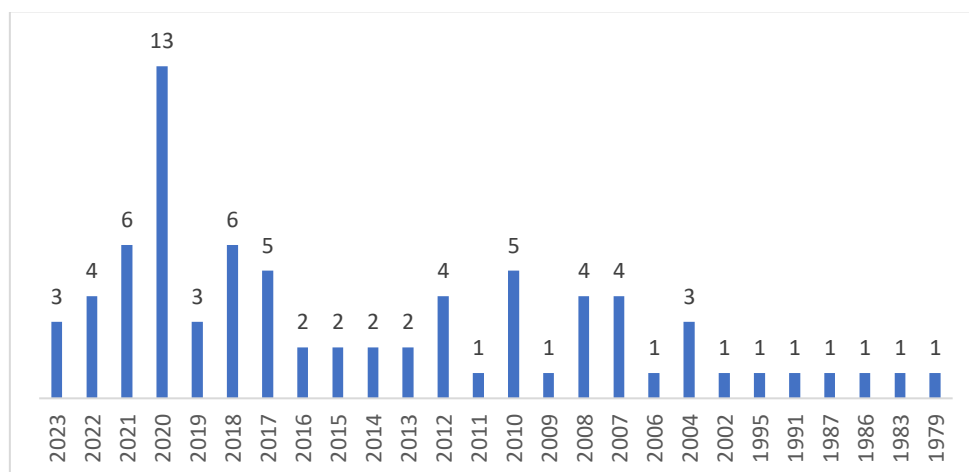


Figure 1. Total number of publication documents

Figure 1 illustrates the progression of research interest in the field of digital budgeting over the past few decades. The association with the topic began as early as 1979, although comprehensive discussions did not emerge at that time. The quantity of research documents on digital budgeting demonstrates fluctuations from 1979 to 2023, with a pronounced surge since the early 2000s. Notably, 2020 witnessed the highest number of documents, while certain years exhibited a more limited volume, indicating shifts in research interest.

In addition to the research above trends concerning the quantity of published documents, there are also trends related to the distribution of documents based on the author's country affiliation.

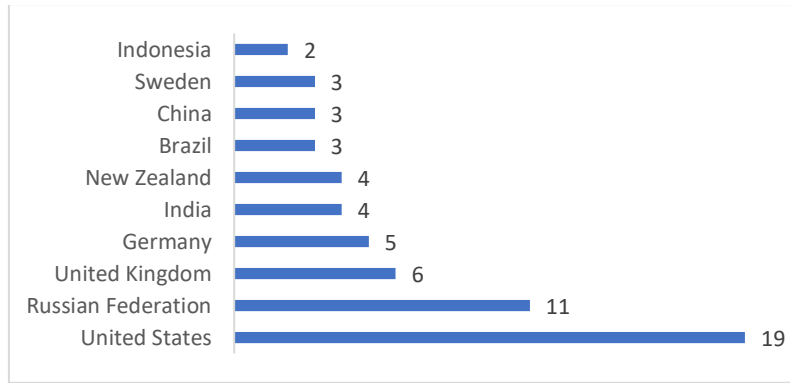


Figure 2. Total number of documents by author's country affiliation

Numerous countries and regions actively contribute to the research literature on digital budgeting. The United States leads with 19 publications, followed by the Russian Federation with 11 documents, and the United Kingdom with 6 documents. Additionally, Germany, India, and New Zealand each have 5, 4, and 4 documents related to digital budgeting, respectively. Brazil, China, and Sweden contribute 3 documents each, while Indonesia has 2 documents in its contribution to the research literature on this topic.

Apart from the research trends based on the total number of documents published each year and the total number of documents based on the author's country affiliation, another noteworthy trend pertains to the relationship between research topics in the discourse of digital budgeting.

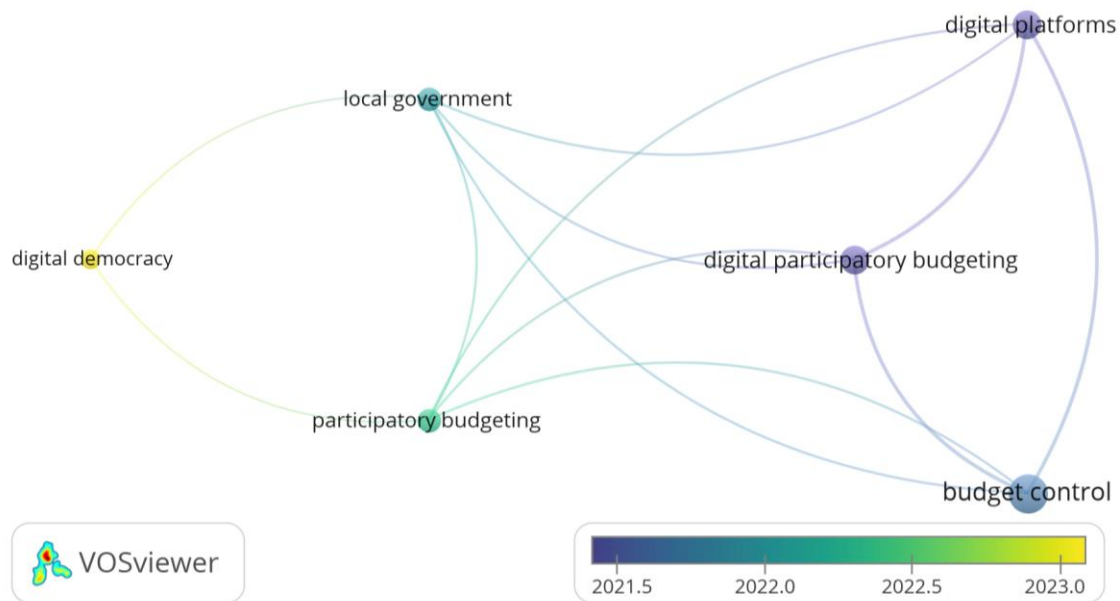


Figure 3. Research topics related to digital budgeting

Research topics pertaining to digital budgeting encompass diverse facets that elucidate the influence of digital technology on budget management. These encompass digital platforms, investigating the utilization of digital software and systems in budget planning. Digital participatory budgeting underscores heightened public involvement facilitated by digital technology. Budget control addresses oversight efficiency through the integration of digital technology. Participatory budgeting emphasizes public involvement in the budgeting process, facilitated by digital platforms. Furthermore, local government delves into budget management at the local level, while digital democracy shapes recent research trends by examining the impact of digital technology on democracy.

Implementing digital budgeting: barriers and challenges

Introducing digital budgeting into an organization or government presents significant potential for enhancing efficiency, transparency, and accountability in budget management. However, as is common with many technological innovations, several challenges must be overcome. The implementation of digital budgeting can encounter various barriers and challenges in different countries. The following outlines five key barriers and challenges frequently encountered:

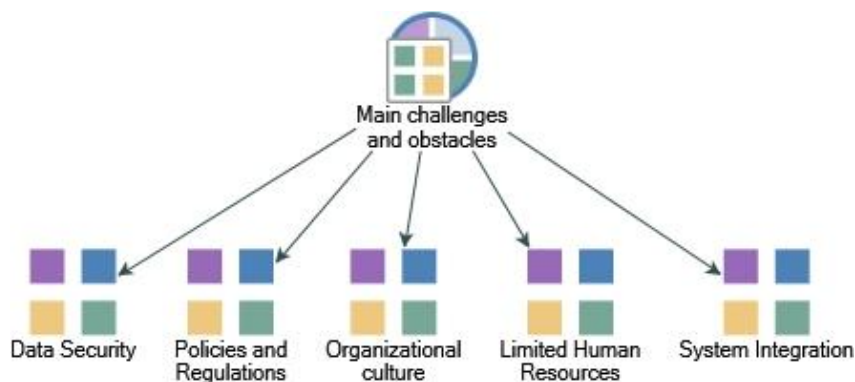


Figure 4. Barriers and challenges in adopting digital budgeting

The implementation of digital budgeting encounters several significant challenges. First and foremost, ensuring data security is imperative to mitigate the risks associated with hacking and security breaches. Second, navigating policy and regulatory changes is essential to support the required digital transformation. Third, fostering changes in organizational culture is necessary for the acceptance and effective utilization of digital technology. Fourth, addressing constraints related to limited human resources and the necessity for comprehensive training is crucial. Lastly, overcoming the technical obstacle of integrating complex systems across organizations or governments is a pivotal aspect of successful implementation.

Discussion

Figure 1 illustrates the research trends in the discourse on digital budgeting, revealing a substantial growth in research interest over the past few decades. While digital budgeting emerged in 1979, its comprehension and application were not fully structured at that time. However, since the early 2000s, there has been an exponential increase in the total number of publications, underscoring the significance of digital technologies in budget management. Concurrently, Figure 2 provides an overview of countries' contributions to the research literature on digital budgeting, with the United States leading in the number of documents, indicating a significant role in shaping the development of digital budgeting concepts and practices. Countries such as Russia, the UK, Germany, and India are also actively contributing to research in this area, highlighting the global nature of interest in adopting digital technologies for budget management.

Implicit in this research trend are several crucial implications for issues related to digital budgeting. Firstly, the heightened research interest reflects the increasing relevance of using digital technologies in budget management, which is gaining serious attention in the academic realm. Secondly, the diverse contributions from different countries signify that digital budgeting is a global phenomenon, encompassing various contexts and practices worldwide. Furthermore, this trend may signify a paradigm shift in budget management, with a growing adoption of digital technologies to enhance efficiency, transparency, and participation in the budget process. This shift could prompt further advancements in digital systems, regulations, and policies supporting digital budgeting practices across various levels of government and organizations. Consequently, these research trends underscore the importance of continued exploration into the potential and challenges of applying digital technologies in budget management.

Figure 3 illustrates various research topics associated with digital budgeting, each highlighting distinct facets of budget management practices employing digital technologies. Initially, digital platforms involve digital software and systems to streamline budget planning and management processes, enhancing efficiency and fortifying transparency (Menendez-Blanco & Bjørn, 2022). Figure 3 shows the trend of studies on digital budgeting over the past 3 years (2021-2023). The topic of digital democracy being the focus of the attention of many authors in 2023 shows that the study of digital budgeting is closely related to digital democracy. There is public participation in the digital realm towards the government budgeting process. Most authors relate and conclude that digital budgeting is an important part of the practice of digital democracy, which has now become a necessity in democratic countries with the increasing information technology.

Subsequently, digital participatory budgeting underscores the significance of heightened public engagement through digital platforms, enabling citizens to contribute to budget allocations and gain a better understanding of public finance processes (Coleman & Cardoso Sampaio, 2017). Lastly, budget control concentrates on methodologies and tools facilitating more effective budget oversight using digital technologies, encompassing real-time monitoring and automated reporting (Frow et al., 2010; Shu et al., 2023). Fourth, participatory budgeting reinforces the active involvement of the public in the budgeting process through digital platforms, fostering increased participation and transparency in budget allocations (Touchton et al., 2019). Fifth, local government addresses budget management at the community level, where digital technologies play a pivotal role in enhancing local financial governance and efficiency (Mærøe et al., 2021; Stortone & De Cindio, 2015). Finally, digital democracy underscores the influence of digital technologies on political participation and decision-making, encompassing endeavors to enhance transparency and public engagement in budgeting processes (Touchton et al., 2019). Overall, gaining a comprehensive understanding of these topics is essential for developing more effective, transparent, and participatory digital budgeting practices in government and organizational contexts.

The evolving research trends encompassing diverse facets of digital budgeting, such as the utilization of digital platforms, public participation, budget oversight, local-level budget management, and digital democracy, carry significant implications for forthcoming investigations in this field. Future research endeavors could delve more comprehensively into the intricate dynamics of digital budgeting practices and their repercussions on budget governance, public participation, and democratization processes. Additionally, research exploring the role of emerging technologies, innovation trends, and evolving challenges in the evolution of digital budgeting practices holds relevance. In this regard, interdisciplinary studies can furnish more holistic insights.

While the implementation of digital budgeting holds substantial potential for enhancing efficiency, transparency, and accountability in budget management, it is crucial not to overlook the attendant challenges. Foremost among these challenges are critical data security concerns (Blum, 2020). In a digital landscape susceptible to hacking threats and security breaches, prioritizing robust data security measures is imperative. Organizations and governments must allocate resources to develop advanced security systems, incorporating data encryption, real-time monitoring, and staff training to identify potential risks. Moreover, policy and regulatory changes should align with and support the digital transformation in budget management (Loeber, 2018). Collaboration between the government and relevant agencies is necessary to formulate a legal framework facilitating the incorporation of digital technologies into the budgetary process. It encompasses the establishment of rules for leveraging digital platforms, regulations governing data protection, and guidelines regarding privacy.

Furthermore, effecting a cultural shift within organizations to foster openness to digital technologies is pivotal but not without its challenges (Nguyen et al., 2022). It entails adopting a collaborative approach within the organization, fostering innovation, and altering the mindset of staff accustomed to traditional budget management methods. Addressing human resource limitations is equally imperative (Riauan et al., 2022). Offering comprehensive training on digital tools and technologies employed in digital budgeting is essential. Governments and organizations must invest in staff training to enhance their digital literacy and facilitate optimal utilization of these technologies in budget management. The integration of complex systems requires special attention as well. Organizations should formulate a comprehensive integration strategy,

potentially enlisting the aid of consultants or IT experts, to ensure seamless interaction among various systems within the digital budgeting ecosystem.

A recommended course of action for the future is to bolster collaboration between the government, private sector, and academia in devising suitable and sustainable solutions to surmount these challenges. Adequate resources should be earmarked to address these challenges, particularly in terms of data security and human resource training. Additionally, periodic assessments of policy and regulatory changes are necessary to ensure the legal framework remains pertinent in the digital age. With commitment, diligence, and meticulous planning, the realization of digital budgeting implementation holds the promise of delivering substantial benefits in future budget management.

The digital age, as affirmed in this study, requires governments to be more open, transparent, and democratic in budgeting. There must be opportunities for the public to be involved in the government's budgeting process so that decisions on the allocation of public funds are fair and balanced. The problem is that many democracies like Indonesia have weak commitments. This issue will be a challenge in the future because although many studies show the urgency and positive impact of digital budgeting, such as e-democracy, for the progress of the country, it is practically difficult to implement due to the government's reluctance to adopt the concept perfectly. The concept of digital democracy only becomes an empty concept because, basically, the government deliberately does not accommodate public aspirations. Public involvement is only a formality of democracy, but the substance of the message is ignored.

CONCLUSION

The research trends in digital budgeting underscore a notable surge in academic interest regarding the integration of digital technologies in budget management. Over recent decades, there has been a remarkable escalation in the overall number of publications, signaling the ascension of digital budgeting as a topic of heightened relevance and scholarly attention. The diverse contributions from different countries affirm that digital budgeting is a global phenomenon, embracing varied contexts and practices across the globe. This shift signifies a transformative move in budget management, progressively embracing digital technologies to augment efficiency, transparency, and participation in the budgetary process. Future research endeavors should delve deeper into comprehending the intricate dynamics of digital budgeting practices and their repercussions on budget governance, public participation, and democratization processes. Recommendations for future research encompass further exploration of the role of new technologies and emerging innovation trends in shaping digital budgeting practices. Interdisciplinary studies are imperative to provide more comprehensive insights into unlocking the full potential of digital budgeting.

Nonetheless, the implementation of digital budgeting is not without its challenges. Paramount among these challenges is the imperative prioritization of data security, necessitating robust measures. Accommodating policy and regulatory changes, fostering essential organizational culture shifts, addressing limitations in human resources, and navigating the intricacies of system integration present key hurdles. Overcoming these challenges mandates unwavering commitment, meticulous planning, and prudent investment in infrastructure, policies, and human resource training. Recommendations for the future encompass fortifying collaboration between the government, private sector, and academia to formulate fitting and sustainable solutions. Adequate resources must be earmarked to confront these challenges, particularly in the realms of data security and human resource training. Periodic evaluations of policy and regulatory changes are also imperative to ensure the legal framework remains pertinent in the digital age. With a solution-oriented approach, the realization of digital budgeting can evolve into a tangible and advantageous reality in future budget management.

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