



The Ugandan Journal of Management and Public Policy Studies (UJMPPS)

June 2025, Vol. 25, No. 2, pp. 1-24

ISSN: 2078-7049 (Print), 2959-4316 (Online)

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Published by Uganda Management Institute

Trends and Patterns in Public-Private Partnership in Developing Countries: A Bibliometric Analysis

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Article History

Received: December 23, 2024

Revised: April 22, 2025

Accepted: June 03, 2025

Abstract

This article aims to analyse the trends, patterns, and development of public-private partnerships (PPPs) in developing economies over the years. This study employs bibliometric techniques using data extracted from the Scopus database. Five hundred nine (509) articles were carefully selected and examined using performance analysis, science mapping, and network visualization tools (VOSviewer) to identify trends, collaborative networks, and thematic clusters in PPP research. The research shows that interest in PPPs in developing countries has grown significantly since the early 2000s. Additionally, five (5) thematic clusters emerged: the dynamics of PPPs in developing nations; infrastructure and risk management; sustainable development; governance and critical success factors; and challenges related to water supply and corruption. The study indicates that PPPs are vital for closing infrastructure gaps, while effective risk management, governance, and capacity building are crucial. These insights are relevant to policymakers and practitioners, emphasising PPPs as a strategic approach for closing infrastructure gaps and enhancing service delivery in developing countries. As a result, balanced collaboration between the public and private sectors is essential to tackling challenges in these areas. The study enhances the theoretical understanding of PPPs by identifying key success factors and governance frameworks that promote their effectiveness. It also offers a new bibliometric perspective on PPP research in developing nations, thereby addressing a significant gap in the current literature.



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Keywords: Public-Private Partnership (PPP), Developing Countries, Bibliometric Analysis, Risk Management, Sustainability

1.0 Introduction

Public-private partnerships (PPPs) are viewed as a strategic tool for infrastructure development and public service delivery in many countries. Created during the public sector reforms of the 1980s and 1990s, PPPs were seen as an innovative way to meet growing demand for better infrastructure and efficient public services amid limited government financial resources (Broadbent & Laughlin, 2003; Hodge & Greve, 2007; Chileshe, Kavishe & Edwards, 2023). Studies show that PPPs are helpful when the government lacks enough resources and capabilities to handle large projects (Lam, 1996; Buse & Walt, 2000; Leigland, 2018; Osei-Kyei, & Chan, 2015; Ameyaw & Chan, 2015; Ameyaw & Chan, 2016; Bayliss & Van Waeyenberge, 2018; Ahmadabadi & Heravi, 2019; Muhammad & Johar, 2019). This partnership combines various resources, expertise, and innovation essential for economic growth and development (Jamali, 2004; Zhang, 2005; Leigland, 2018; Ameyaw & Chan, 2016). As a result, the concept and practice of PPPs have evolved to suit various economic, social, and political contexts worldwide.

In essence, developed countries have widely utilized PPPs to build and manage transportation infrastructure such as ports, bridges, railways, roads, airports, and tunnels, along with healthcare facilities, hotels, and schools. These partnerships leverage private sector efficiency to enhance public services (Osborne, 2000; Klijn & Teisman, 2003; Grimsey & Lewis, 2004; Yescombe, 2007). There is significant variation in PPP implementation across regions due to differing market challenges and opportunities. For example, the United Kingdom led the way with successful PPP projects through the Private Finance Initiative (PFI), establishing a model for other European nations (Osborne, 2000; Shaoul, 2005; Yescombe, 2007; Kivleniece & Quelin, 2012). Hodge and Greve (2007) and Broadbent and Laughlin (2003) also note that North America has focused on transportation and municipal services, including initiatives such as the Trans-Canada Highway and the Chicago Skyway. Meanwhile, India and China rely on PPPs to address major infrastructure gaps in transportation and urban development (Zhang, 2005; Liang & Rowlinson, 2010; Farquharson, Mästle, & Yescombe, 2011; Xiong, Whetsell, Zhao, & Cheng, 2021; Asumadu, et al., 2023). These regional and contextual differences emphasize the flexibility of the PPP model to various economic environments and development needs.

Conceptually, PPPs are defined as “collaborative arrangements between the public and private sectors to finance, construct, and operate infrastructure such as public transportation systems, parks, and schools” (Koppenjan & Enserink, 2009; Hodge & Greve, 2007; Hai, Toan & Tam, 2022). PPPs leverage the advantages of both sectors to combine private sector capital and operational efficiencies with the government’s regulatory oversight and protection of the public’s interests (Klijn & Teisman, 2003; Grimsey & Lewis, 2004; Yescombe, 2007; Kwofie, Afram,

& Botchway, 2016; Leigland, 2018). The partnership enables the implementation of large-scale infrastructure projects while promoting innovation and accountability. However, PPPs require careful balancing to address potential conflicts of interest and ensure fair risk distribution, which remains an important area for further research and policy development.

In developing countries, PPPs are vital for closing the infrastructure gap and promoting sustainable development. Governments in these nations have limited financial resources, which restrict their ability to fund large-scale infrastructure projects (Guasch, 2004; Zhang, 2005; Estache, 2006; Babatunde Perera, Zhou & Udejaja, 2015; Chileshe et al., 2023; Komakech & Ombati, 2023). Therefore, PPPs serve as an effective tool to attract private sector investment and professionals for building and maintaining public infrastructure such as roads, hotels, bridges, water supply systems, hospitals, and energy projects (Ameyaw & Chan, 2013; Ameyaw & Chan, 2015a; Osei-Kyei, & Chan, 2015; Koppenjan & Enserink, 2009; Nduhura et al., 2022; Kavishe & Chileshe, 2022; Asumadu, Quaigrain, Owusu-Manu, ..., 2023; Komakech & Ombati, 2023). Buse and Walt (2000) and Jamali (2004) highlighted successful PPP projects in developing countries like the Lekki Toll Road in Nigeria and the Queen Mamohato Memorial Hospital in Lesotho, demonstrating that PPPs can deliver high-quality infrastructure and services in resource-limited settings.

Some scholars argue that PPPs benefit both the public and private sectors by combining public oversight with private sector efficiency and innovation (Grimsey & Lewis, 2004; Hodge & Greve, 2007; Yescombe, 2007; Koppenjan & Enserink, 2009; Farquharson, Märtle & Yescombe, 2011; Ahmadabadi & Heravi, 2019). However, there is limited comprehensive knowledge about how these dynamics unfold in different political and economic contexts, especially in developing countries where institutional capacities and regulatory frameworks may be weak. Although the use of PPPs to address critical development challenges in developing countries has increased, the understanding of how they are implemented and their effectiveness remains limited and underexplored in existing studies, which mainly focus on isolated case studies or specific aspects like risk management and key success factors (Jin & Doloi, 2008; Spielman et al., 2011; Ameyaw & Chan, 2013; Heravi & Hajihosseini, 2012; Chang, 2013; Babatunde et al., 2015; Ameyaw & Chan, 2015b; Ahmadabadi & Heravi, 2019; Osei-Kyei & Chan, 2017). The fragmented nature of previous research restricts the ability to develop a comprehensive understanding of broader trends and patterns in public-private partnership (PPP) research.

Yet, PPPs present an opportunity to leverage private sector expertise and capital to meet public infrastructure needs, especially when government resources are limited (Ameyaw & Chan, 2015a; Osei-Kyei & Chan, 2017a). While Asumadu et al. (2023) examined these elements, their insights were fragmented, and they did not provide a comprehensive perspective. The success of PPPs depends on various factors, including governance structures, risk allocation mechanisms, and

stakeholder engagement processes. Additionally, studies by Kavishe and Chileshe (2022) and Kukah, Badu, Owusu-Manu, and Edwards (2023) emphasized the importance of international cooperation in enhancing PPP outcomes. However, the ways these collaborations manifest in developing countries and their effects on research productivity and innovation remain poorly understood. To address these knowledge gaps, this research uses bibliometric analysis to explore four key research questions: (i) RQ1: How has the volume of PPP research in developing countries changed over time? (ii) RQ2: Which articles and journals are most influential in studying PPPs in developing countries? (iii) RQ3: What is the level of collaboration among researchers and countries in PPP studies across developing nations? and (iv) RQ4: What are the emerging themes and topics in PPP research within developing countries? The article is organized as follows: (a) introduction; (b) research methods and protocols outlining the bibliometric approach; (c) presentation of results (covering RQ1, RQ2, RQ3, and RQ4); (d) discussion; and (e) finally conclusion, contributions of the study, and future research directions.

2.0 Research Methods and Materials

This study primarily employed the bibliometric method/analysis. Researchers (such as Aria & Cuccurullo, 2017; Kumar, Sharma & Salo, 2019; Fontoura & Coelho, 2020; Linnenluecke et al., 2020; Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021; Mageto, 2022; Komakech, Ombati & Kikwatha, 2024) frequently apply this approach to examine publication trends, authors' work, and influential scientific publications within a specific field. Initially, it was used in library and information science as a statistical tool to analyse library books and communication (Kumar et al., 2019; Kirby, 2023). This method helps identify gaps and emerging concepts in a specific area of research, providing valuable insights for future studies. Bibliometric analysis has become increasingly popular in business research fields such as logistics (Mageto, 2022), finance (Goyal & Kumar, 2021; Bartolacci, Caputo & Soverchia, 2020; Kumar et al., 2019), supply chain (Farooque, Zhang, Thürer, Qu, & Huisinigh, 2019; Fontoura & Coelho, 2020; Komakech et al., 2024), and Smart Factory (Strozzi, Colicchia, Creazza & Noè, 2017). For instance, a study by Donthu et al. (2021) indicates that the number of bibliometric studies in business and social sciences increased from 437 in 2010 to 1950 in 2020, with an annual growth rate of 10-16%. However, despite the crucial role of PPPs in addressing infrastructure and public service challenges in developing countries, there are no bibliometric studies on PPP research in these nations. This reveals a significant gap that this study aimed to address.

Donthu et al. (2021) describe bibliometrics as a popular and thorough method used by researchers and decision-makers to explore and analyse large volumes of scientific data. Bibliometric analysis includes two main techniques: (a) performance analysis, which offers a descriptive overview of research components to understand the field's development, identify research gaps, and suggest future directions (Mageto, 2022; Donthu et al., 2021; Cobo, López-Herrera, Herrera-Viedma, &

Herrera, 2011; Farooque et al., 2019; Komakech et al., 2024); and (b) science mapping, which investigates structural connections and intellectual interactions among research elements using methods like co-citation analysis, citation analysis, co-word analysis, bibliographic coupling, and co-authorship analysis (Linnenluecke et al., 2020; Donthu et al., 2021; Aria & Cuccurullo, 2017; Van Eck & Waltman, 2010; Cobo et al., 2011). These techniques are further developed through three network analysis approaches: network metrics, visualization, and clustering (Mageto, 2022; Donthu et al., 2021; Zupic & Čater, 2015). As a result, researchers follow the four steps outlined by Donthu et al. (2021) to perform bibliometric analysis. These steps include:

Step 1: Define the Aims and Scope

The overall goal of this study was to provide a comprehensive overview of PPP research in developing countries, with a focus on identifying trends and patterns. All papers published in Scopus up to 2023 were included in the analysis to ensure relevant literature was not excluded. Scopus was selected as the primary database for this bibliometric analysis because it is a well-established, reputable source that contains reliable academic articles from various disciplines. Farooque et al. (2019) emphasize that Scopus covers more papers than other leading databases, such as Web of Science and Google Scholar. Additionally, previous and current research by scholars such as Farooque et al. (2019), Mageto (2022), Donthu et al. (2021), Kumar et al. (2019), Mokhtar, Genovese, Brint & Kumar (2019), Danese et al. (2020), and Komakech et al. (2024) indicates that Scopus is often the central database used for bibliometric analyses in business and management research. The scope of this content includes examining the number of research articles published (RQ1), identifying the most impactful articles and journals (RQ2), conducting network analysis of authors and countries (RQ3), and uncovering emerging themes in PPP research within developing countries (RQ4).

Step II: Choosing the Techniques for Bibliometric Analysis

The second step of the bibliometric analysis involved selecting suitable methods that aligned with the research questions and objectives. Once the specific goals of the analysis, such as mapping research trends and identifying influential works and collaboration patterns, are defined, and the choices of Scopus and period made, appropriate methods are applied. Scopus data was used to evaluate the number of research articles, with science mapping and network analysis employed. The performance analysis assessed research productivity and impact, including publication counts and citations (Donthu et al., 2021; Aria & Cuccurullo, 2017; Komakech et al., 2024). Science mapping was also used to examine relationships between research elements through co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis. Finally, network analysis and visualization tools created visual representations of these relationships, illustrating nodes and thematic clusters with VOSviewer. Literature also notes that network analysis is commonly used to explore collaboration patterns among authors and institutions (Komakech et

al., 2024; Van Eck & Waltman, 2023; Mageto, 2022; Donthu et al., 2021; Luo et al., 2018; Van Eck & Waltman, 2010).

Step III: Data Collection and Cleaning

The data was obtained from the Scopus database using a search strategy that included the keywords “PPP,” OR “public private partnership,” OR “public-private partnership,” OR “public private partnerships,” “developing countries,” OR “developing nation,” OR “low developing countries.” This search yielded 673 documents, which were later refined. Articles published after 2023 (07 records), those publications not in English (05 records), and those categorized as “in the press” (19 records) were excluded. Additionally, only journal articles were considered (122 excluded), but all subject areas were included because PPPs are multidisciplinary. The titles, abstracts, and keywords of each paper were then examined, and 11 articles were excluded because they either lacked relevant keywords or were duplicate entries of existing records. The authors carefully cleaned the data to remove duplicates and errors. This process resulted in a dataset of 509 articles for analysis. The bibliometric data, including author names, publication titles, journals, abstracts, keywords, author affiliations, sources, and citations, were exported and saved in BibExcel as a CSV comma-delimited file for analysis with VOSviewer. Scholars (Van Eck & Waltman, 2023; Mageto, 2022; Donthu et al., 2021; Luo et al., 2018) argue that VOSviewer enables precise data analysis and straightforward visualization of results.

Step IV: Run the Analysis and Report the Findings

This is the final step of the bibliometric analysis. The analysis aimed to gain valuable insights into PPP research in developing countries. It was conducted using BibExcel and Microsoft Excel, while science mapping and network analysis were performed with VOSviewer. VOSviewer was preferred over other tools like Pajek and Gephi, as it supports three key visual mapping outputs: overlay, density and network visualizations. Van Eck and Waltman (2023) explain that VOSviewer was mainly designed to analyse bibliometric networks, creating, visualizing, and exploring maps based on any network data. This analysis provides a detailed understanding of the research, helps identify significant contributions, and highlights potential future research areas. It also shapes conclusions, guides recommendations, and promotes domain-specific knowledge (Komakech et al., 2024). The results were interpreted to provide insights into the development of PPP research in developing countries, based on an analysis of the network's nodes and links. Each colour in the network signifies a thematic cluster. These clusters group related keywords, thereby identifying specific themes within the research field. Each cluster's nodes indicate thematic areas, while the links reveal their interrelationships, an approach supported by prior bibliometric analyses and science mapping literature (Cobo et al., 2011; Zupic & Čater, 2015; Aria & Cuccurullo, 2017; Kumar, Sharma, & Salo, 2019; Donthu et al., 2021; Kirby, 2023; Komakech et al., 2024). The subsequent section details and interprets the study's key findings.

3.0 Presentation of Results

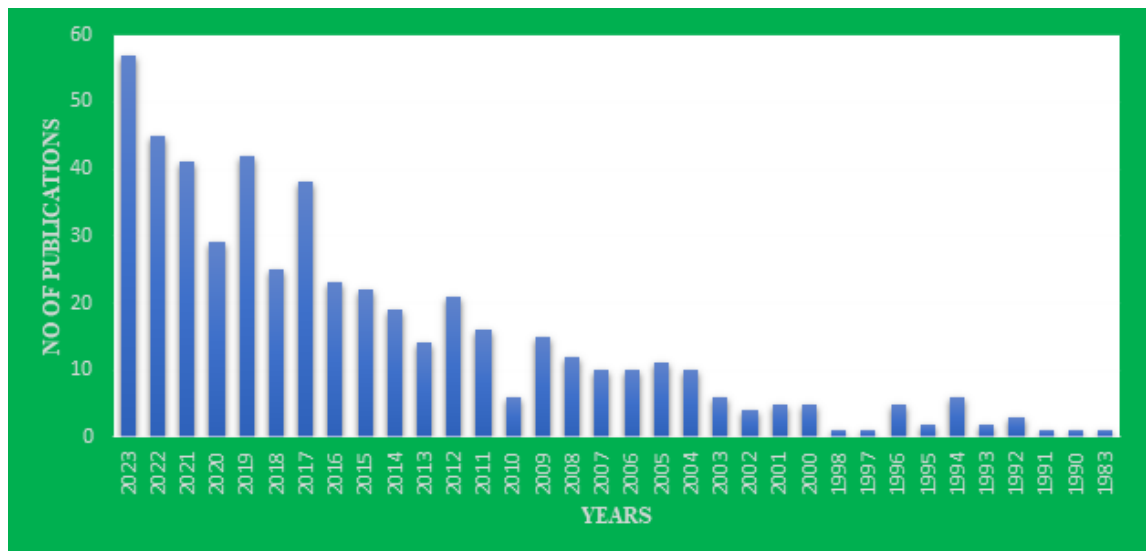
3.1 PPPs Publication Trends from 1983-2023

Our first research question (RQ1) sought to identify the publication trends of PPP studies in developing countries.

Graph 1 illustrates the publication trends from 1983 to 2023

Graph 1 shows the trend in publications on PPPs in developing countries from 1983 to 2023. From the graph, we see limited research activity (23 publications) between 1983 and the mid-1990s. There are only a few publications in notable years like 1983, 1990, and 1991, likely due to low academic attention or awareness of PPPs in developing countries. Between 2000 and 2007, the number of publications gradually rose to a peak of 15 in 2009. This period aligns with the increased recognition of PPPs as a viable option for infrastructure development and public service delivery in developing countries through New Public Management (NPM). It indicates growing academic and policy interest in understanding the benefits and challenges of PPPs.

Graph 1: PPPs Publication Trends from 1983-2023



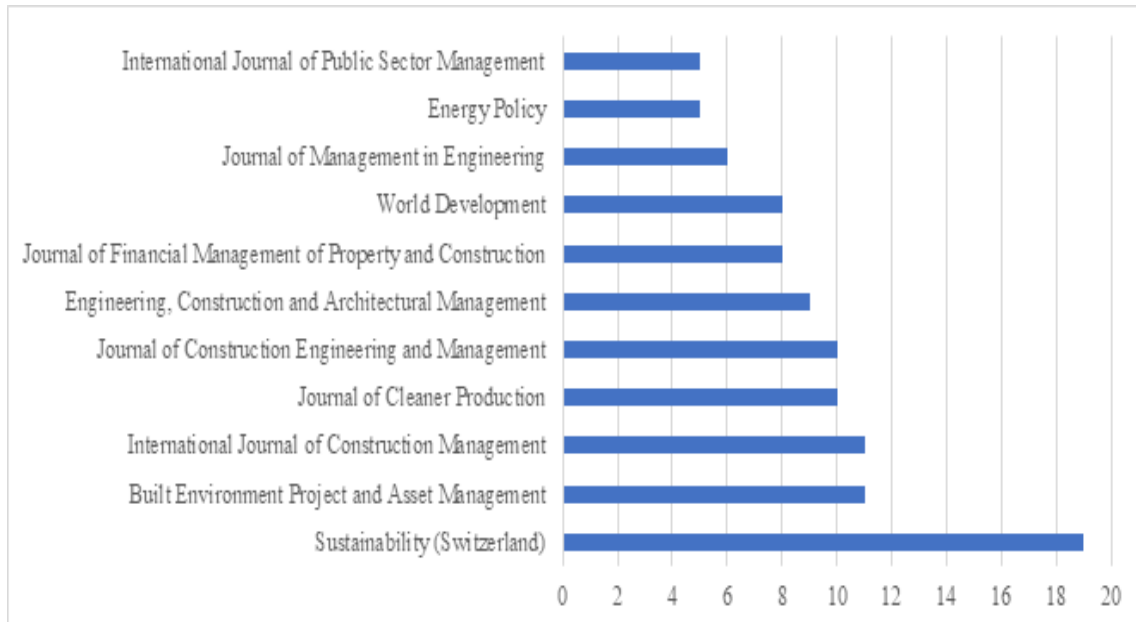
Source: Extracted from Scopus Data, March 2024, N=509

Despite the challenges posed by the COVID-19 pandemic, research activity from 2020 to 2023 remained substantial. For instance, 2023 recorded the highest number of publications at 57, followed by 45 in 2022 and 41 in 2021. The increasing number of publications over the past two decades indicates that PPPs are now recognized as a valuable tool for infrastructure development and public service delivery. The increase in publications in recent years underscores the importance of research and collaboration in shaping the role of PPPs in post-pandemic recovery and sustainable development.

3.2 Top 11 Influential Journals

Our second research question (RQ2a) identifies the most influential journals in studying PPPs in developing countries. Graph 2 shows an analysis of journal contributions to PPP research in these countries from 1983 to 2023.

Graph 2: The Top 11 Journals Contributing to the Study



Source: Extracted from Scopus Data, March 2024,

N=283

Out of 509 papers, 22.0% (102) were published in just 11 journals. Leading the field is Sustainability (Switzerland) with 19 publications, followed by Built Environment Project and Asset Management and International Journal of Construction Management, each with 11 publications. The Journal of Cleaner Production and Journal of Construction Engineering and Management each recorded at least 10 publications during the study period. Energy Policy and International Journal of Public Sector Management had at least five (5) publications each. The distribution of these publications shows that PPP research is complex and multidisciplinary, covering areas such as sustainability, construction management, financial viability, engineering, policy, and governance. The wide range of topics and numerous publications in these journals highlight the complexity and multidisciplinary nature of PPP projects, especially in developing countries.

3.3 PPPs' Most Influential Articles

Our second research question (RQ2b) aimed to identify the most influential articles in studying PPPs in developing countries. Table 1 shows the 10 most cited papers from 1983 to 2023. Zhang's (2005) article ranks as the most cited publication.

Table 1: Most Cited Articles in PPPs in Developing Countries between 1983 and 2023

S/N	Authors	Title	Year	Citations
	Zhang, X., (2005)	Critical success factors for public-private partnerships in infrastructure development	2005	484
	Jamali, D., (2004)	Success and failure mechanisms of public-private partnerships (PPPs) in developing countries. Insights from the Lebanese context	2004	195
	Ameyaw E.E., & Chan A.P.C., (2015a)	Evaluation and ranking of risk factors in public-private partnership water supply projects in developing countries using fuzzy synthetic evaluation approach	2015	156
	Panayides P.M., Parola F., & Lam J.S.L., (2015)	The effect of Institutional Factors on public-private partnership success in ports	2015	93
	Valipour A., Yahaya N., Md Noor N., Kildiene S., Sarvari H., & Mardani A., (2015)	A fuzzy analytic network process method for risk prioritization in freeway PPP projects: An Iranian case study	2015	79
	Ibrahim A.D., Price A.D.F., & Dainty A.R.J., (2012)	The analysis and allocation of risks in public-private partnerships in infrastructure projects in Nigeria	2006	74
	Osei-Kyei R., & Chan, A.P.C. (2017b)	Developing a project success index for public-private partnership projects in developing countries	2017	68
	Babatunde, S.O., Perera, S., Zhou L., Udeaja C., (2015)	Barriers to public-private partnership projects in developing countries a case of Nigeria	2015	67
	Sharma, C., (2012)	Determinants of PPP in infrastructure in developing economies	2012	64
	Forsyth, T., (2005)	Building deliberative public-private partnerships for waste management in Asia	2005	62

Source: Primary Data, Extracted from Scopus Database, March 2024,

N=509

The article offers a comprehensive examination of the key factors that determine the success of PPP initiatives in developing economies. Through an extensive review of the literature, case studies, and expert interviews, Zhang (2005) study identifies five key success factors: (i) a favourable investment environment, (ii) economic viability, (iii) a reliable concessionaire consortium, (iv) a sound financial package, and (v) appropriate risk allocation through dependable contractual arrangements. The results emphasize the crucial role of efficient procurement processes and strong risk management in achieving sustainable and successful PPP outcomes worldwide. The study contributes to the advancement of infrastructure systems and the efficiency of public service delivery mechanisms. The study by Jamali (2004) ranks second with 195 citations. It focuses on PPPs, especially in the Lebanese telecommunications sector. Jamali notes the growing interest in PPPs because of their potential to enhance public service delivery through private sector involvement. She presents both quantitative and qualitative analyses that highlight the benefits and challenges of PPP initiatives. Jamali outlines advantages such as reduced costs, access to private financing, and improved service delivery, while also recognizing the conceptual ambiguities

surrounding PPPs. She stresses that government involvement, strong regulations, and effective communication and coordination among partners are crucial factors for success.

Forsyth (2005) argues that PPPs should serve as platforms for establishing and replicating norms of environmental concern and political accountability. He emphasizes the importance of thorough groundwork, comprehensive feasibility studies, and the development of legal and regulatory frameworks in developing countries to promote effective PPPs. Similarly, Ameyaw and Chan (2015), with 156 citations, studied major risks affecting PPP water supply infrastructure projects and aimed to develop a risk allocation model for such projects in developing countries. An international survey of PPP experts identified the top five risks as foreign exchange rate, corruption, water theft, non-payment of bills, and political interference. Using survey results and fuzzy synthetic evaluation techniques, they found that financial/commercial, legal and socio-political, and technical risks were especially significant in PPP water projects.

Conversely, Valipour, Yahaya Noor, Kildiene, Sarvari, and Mardani (2015) emphasize the importance of careful planning and resource management, highlighting failure factors such as financial mismanagement and inadequate risk assessment. They underscore the need for well-structured contracts to prevent conflicts and achieve project goals. The authors suggest that proper risk allocation between public and private partners could reduce risks and enhance project success. They conclude that effective risk management and allocation are essential for the sustainability of PPP water projects in developing countries. The study by Valipour et al. (2015), which has 97 citations, analyses risk prioritization in Iranian freeway PPP projects. They employ the fuzzy analytic network process (FANP) to account for interdependencies and feedback among risks, which is vital for effective risk management. Their approach includes literature review, interviews, and surveys with 82 stakeholders across public and private sectors, revealing 27 principal risks across financial, legal, political, market, operational, organizational, and force majeure categories. A case study of the Isfahan–Shiraz freeway highlights challenges, including limited capital and poor design, emphasizing the necessity of a robust risk management framework. The results demonstrate the effectiveness of the FANP method in prioritizing risks, primarily financial, legal, and political ones, thereby supporting decision-making. This research provides valuable guidance for stakeholders seeking to improve PPP success in developing economies.

Among key contributions, Osei-Kyei and Chan (2017), with 86 citations, develop a project success index (PSI) for PPP projects in developing countries using fuzzy synthetic evaluation. They recognize the ambiguity of "success" and propose a quantifiable model to measure it. Success is divided into three main categories: (a) meeting cost and technical specifications, (b) profit, and (c) local development and dispute reduction (LDDR). In their study, Osei-Kyei and Chan (2017) employ mean ranking, factor analysis, and fuzzy evaluation to analyse data from PPP practitioners in Ghana. Their findings identify nine key success criteria, grouped into three

categories, forming a comprehensive PSI. They emphasize that clear goals, fulfilling stakeholder expectations, comprehensive risk control and strict adherence to project timelines and budgetary allocations are crucial for PPP success.

Ibrahim, Price, and Dainty (2006), with 74 citations, investigate risks in Nigerian infrastructure PPPs. They highlight the growing reliance on PPPs to meet public infrastructure needs due to limited public funds and the need for efficient resource use. Their study identifies and categorizes risk factors into external (exogenous) and internal (endogenous). A survey of Nigerian construction professionals assesses these risks and their allocation across various sectors. The top three risks identified are "unstable government", "inadequate experience in PPP" and "availability of finance". Their findings align with Ameyaw and Chan's (2015) study on water projects, emphasizing the necessity of strong risk management to attract private sector involvement. Most endogenous risks should be assigned to the private sector, while political and site acquisition risks should stay with the public sector, and relationship-based risks should be shared. Lastly, Babatunde, Perera, Zhou, and Udeaja (2015), with 67 citations, address specific barriers to PPP implementation in Nigeria, such as political and legal challenges. They propose that overcoming these barriers through policy reforms and capacity building is essential for effectively executing PPP projects. This aligns with Sharma (2012), who, with 64 citations, examines the determinants of PPP and emphasizes the importance of macroeconomic stability and good governance in attracting investments.

3.4 Country Collaboration Network

Furthermore, the third research question (RQ3a) investigated country collaboration in studying PPPs in developing regions. Figure 1 illustrates the connections between countries actively engaged in PPP research within developing nations. Only countries with at least five publications are included. The figure highlights the need for increased collaboration to enhance PPP knowledge and practices. The UK and the US are depicted as central hubs, with numerous connections to other countries. UK researchers frequently collaborate with scholars from developed countries, such as Sweden, France, and Spain, as well as developing countries like Nigeria, to share knowledge and adopt best practices. Australia is also a key player, maintaining strong links to Uganda, Tanzania, Russia, Malaysia, Singapore, and the UK. China shows extensive connections within Asia, including Japan, South Korea, and Vietnam. South Africa acts as a significant hub in African PPP research, working closely with Tanzania and Uganda to promote knowledge transfer and capacity building.

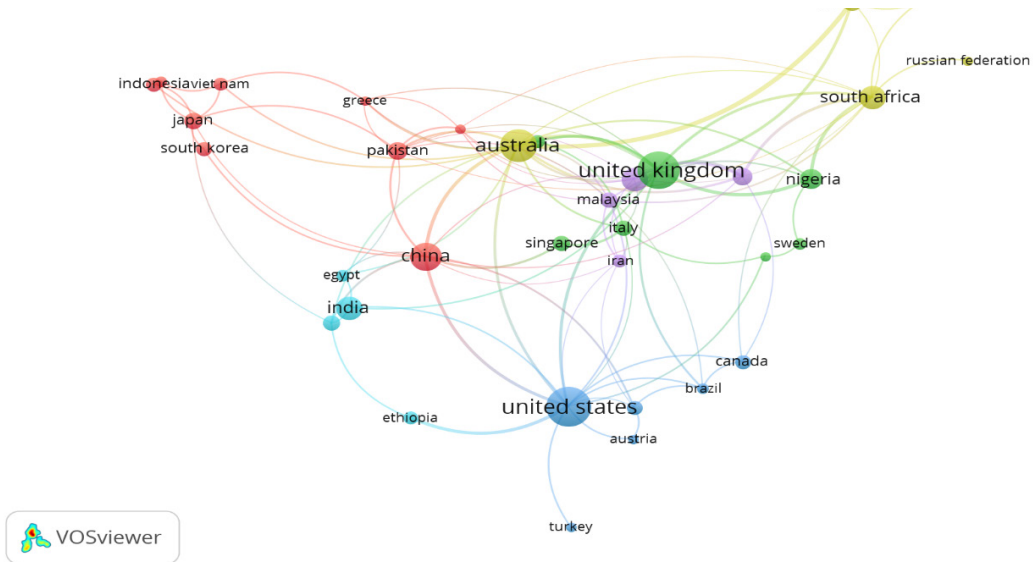


Fig. 1: Country Network of PPP Research in Developing Countries Author Affiliation

3.5 Co-Authorships Network / Trends

The third research question (RQ3b) investigated emerging themes and trends in PPP research in developing countries. Figure 2 shows the most prolific authors in this area.

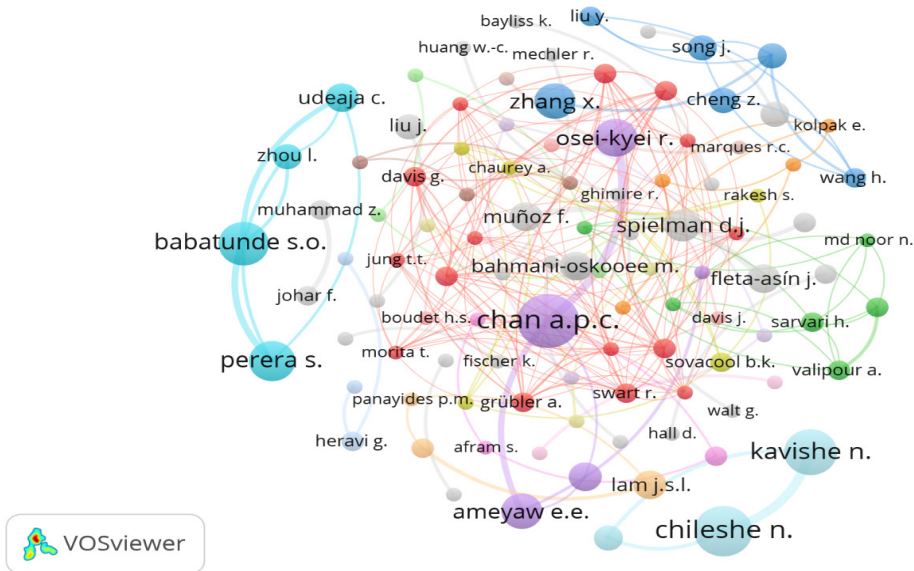


Fig. 2: Co-Authorship Network in PPP Research in Developing Countries

The co-authorship network displays collaboration patterns among scholars studying PPPs in developing nations. Node size reflects each author's connectivity, and the lines indicate co-authorship links. Thicker lines represent stronger collaborations. Key researchers in this network include Chan, Chileshe, Kavishe, Babatunde, and Zhang, who have made significant contributions

to PPP research in these regions. For example, Chan focuses on risk management and the private sector's role in PPPs, working with colleagues like Ameyaw, Osei-Kyei, and Zhang on empirical studies and best practices across Asia and Africa.

Chileshe is recognized for her work in capacity building, success factors, and governance, especially in Tanzania and other African countries, where she often collaborates with Kavishe and Edwards. Babatunde specializes in sustainability and success factors, mainly in Nigeria and West Africa, working with scholars such as Perera and Udejaja. The network emphasizes the importance of interdisciplinary collaboration across fields like construction management, finance, governance, and sustainability to deepen understanding and improve PPP implementation. Leading authors such as Chileshe, Chan, and Babatunde, along with emerging scholars including Lam, Edwards, Spielman, Li, Song, and Wang, play vital roles in advancing PPP research and practice. Overall, the network highlights the ongoing need for international and regional cooperation to address emerging challenges and optimize PPP outcomes, fostering sustainable development and infrastructure growth in developing countries.

3.6 Author Keywords Co-occurrence

The fourth research question (RQ4) investigated emerging themes and topics in PPP research within developing countries. In Figure 3, we provide an overview of the main topics and relationships that have shaped PPP studies over the past forty years.

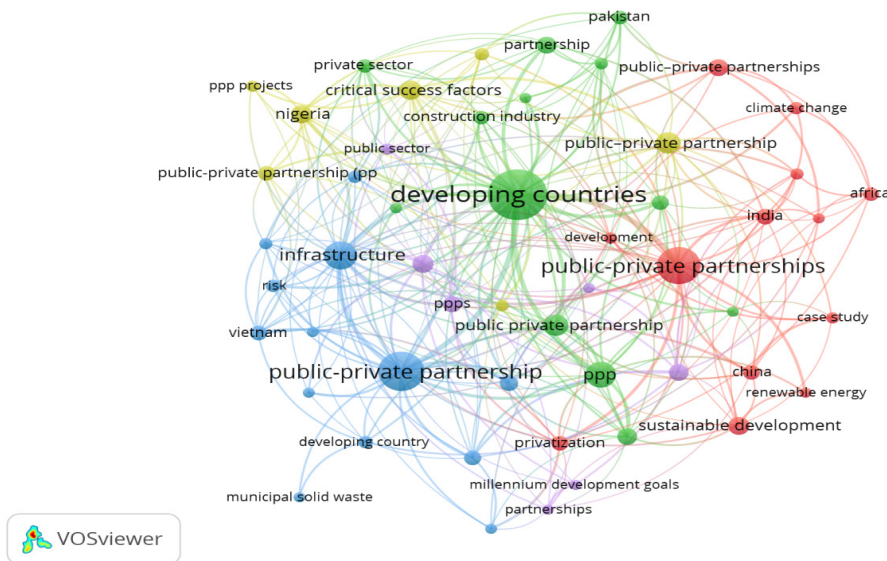


Fig. 3: Author Keywords Co-occurrence in PPP Research in Developing Countries

We performed keyword co-occurrence analysis to explore the complexities of these concepts. Out of the 509 articles published between 1983 and 2023, a total of 1,329 author keywords were

identified across the collected literature. These keywords appeared with various frequencies, ranging from 1 to 10,000 occurrences. Given the substantial volume of author-supplied keywords (1,329) identified across titles, abstracts, and keyword fields, the researcher applied a minimum occurrence threshold in VOSviewer to visualize the co-occurrence patterns of these keywords. As a result, only terms appearing at least five times were retained, yielding a refined set of 53 keywords for analysis. These 53 keywords with at least five (5) occurrences were used in VoSviewer to create five (5) clusters, as shown in Figure 3. Each cluster is represented by a different colour (Red-1, Green-2, Blue-3, Yellow-4, and Purple-5) and indicates a distinct thematic research area. In the network, each node represents a keyword, and the links between nodes indicate the relationships among the keywords. Based on the data, the researcher performed bibliometric and content analyses to identify, examine, and discuss the clusters.

4.0 Analysis of Research Clusters

4.1 Cluster One (1): Developing Countries and PPP Dynamics

The term "developing countries" is the main keyword in Cluster 1, emphasizing its significance in PPP research. This keyword is closely connected to other key terms such as public-private partnerships, the construction industry, the private sector, Tanzania, housing, project management, and sustainability. Its prominent position in the network highlights the importance of understanding PPP dynamics within developing nations, where infrastructure development and public service delivery face major challenges. Literature also discusses how PPPs can help solve these issues by utilizing the resources and expertise of the private sector to address limitations within the public sector (Heravi & Hajihosseini, 2012). However, adopting PPPs in developing countries also involves notable political, financial, and operational risks that can hinder project success (Ibrahim et al., 2006; Osei-Kyei & Chan, 2015; Ameyaw & Chan, 2015a). Additionally, Kukah et al. (2023) found that although PPPs are seen as a way to close the infrastructure gap, they still face obstacles because of the public sector's distrust of private motives, which can slow collaborative efforts.

Sustainability is a key factor to consider when implementing PPPs in developing countries. PPPs are often promoted as a way to achieve sustainable development by blending environmental and social goals into infrastructure projects. Babatunde et al. (2022) highlighted the importance of sustainability practices in Nigerian PPP projects and emphasized the need for comprehensive sustainability frameworks within PPP contracts. Valipour et al. (2015) stressed the importance of careful planning and resource management. The authors also emphasized that well-structured agreements are crucial in preventing conflicts and ensuring that performance targets are met. However, Hinton (2022) noted that private entities are profit-driven and that profit motives might conflict with sustainability goals. This dual perspective underscores the importance of striking a balance between profit incentives and sustainability objectives to ensure the long-term success of PPP projects.

The construction industry in developing countries has significantly benefited from the PPP model, as it provides essential investment and expertise for large-scale projects that governments may not be able to afford on their own. Chileshe et al. (2022) identified key success factors for Kenya's PPP infrastructure and housing projects, highlighting effective project management and stakeholder engagement as vital. Conversely, some scholars argue that the complexity of PPP contracts and the lengthy duration of these projects can cause delays and cost overruns. Olojede et al. (2023) examined the roles of public sector organizations in PPP procurement, noting that improved procurement practices could address these issues. This highlights the urgent need for better procurement and project management practices.

This cluster also emphasized the crucial role of public-private partnerships (PPPs) in infrastructure development across various countries. For example, Asumadu et al. (2023) analysed urban slum infrastructure projects in Ghana, stressing the importance of innovative financing mechanisms alongside traditional methods to overcome financial challenges in PPP initiatives. Meanwhile, Chileshe et al. (2022) discussed significant capacity-building challenges in Tanzanian PPP projects, highlighting the need for strong public sector capabilities to manage and implement these partnerships effectively. This reflects a consensus on the importance of PPPs in infrastructure development while recognizing different perspectives on trust and financing issues.

4.2 Cluster Two (2): Infrastructure and Risk Management

The core of cluster two covers various topics, including the need for infrastructure projects, risk allocation, waste in municipalities, risk assessment, and regulation within PPPs in Ghana, Vietnam, and Sri Lanka. For example, Hai et al. (2022) emphasized the issue of risk assessment and how inadequate evaluation contributed to project failures in developing countries with limited institutional capacity. Additionally, public-private partnerships in Ghana and Vietnam have demonstrated that PPPs can generate substantial investment in infrastructure; however, they require careful planning and the implementation of risk-sharing mechanisms to mitigate financial and operational risks. The authors agree with Babatunde et al. (2022) that regulatory frameworks should be established to ensure proper protection and incentives to meet project goals.

Ameyaw and Chan (2015b) emphasized the importance of a comprehensive risk management framework to mitigate political and financial risks in Ghanaian PPPs. Afzal et al. (2023) concluded that effective risk management is a crucial factor in emerging markets for lowering capital costs and increasing project feasibility. On the other hand, in Tanzania Chileshe et al. (2023) identified inadequate skills and knowledge as significant risk factors and further recommended that capacity-building programmes are essential for managing risks. Overall, the literature highlights the vital role of risk management in PPPs for ensuring success and sustainable outcomes in developing countries. Additionally, Sharma (2012) assessed the role of risk management in PPP infrastructure projects, using both qualitative and quantitative approaches, including case studies and statistical

analysis. The study highlighted key risks and effective risk management allocation, emphasizing that a well-designed risk management framework is crucial for mitigating failure risks and supporting sustainable development. Furthermore, government support and clear contract management were found to improve risk management practices.

Most research in the area of PPPs concentrates on infrastructure development, where collaboration between public and private sectors is crucial for creating and maintaining key infrastructure such as roads, airports, railways, schools, bridges, public housing, hospitals, water supply systems, and energy projects (Grimsey & Lewis, 2004; Koppenjan & Enserink, 2009; Farquharson et al., 2011; Sovacool, 2013; Ameyaw & Chan, 2015; Kwofie, et al., 2016; Leigland, 2018; Hai et al., 2022; Ruiters & Amadi-Echendu, 2022; Tariq & Zhang, 2022; Nduhura et al., 2022; Kazemi et al., 2023; Komakech & Ombati, 2023; Ricart, 2024). For instance, Kazemi et al. (2023) proposed a new PPP model to enhance energy storage system deployment, which could also serve as a future method for advancing sustainable energy solutions through PPPs.

Evidence indicates that PPPs in the renewable energy sector can encourage sustainable development and deliver clean energy with low carbon emissions. For example, Pandyaswargo et al. (2022) emphasized the importance of socio-techno-economic assessments in designing suitable renewable energy systems for remote areas in developing countries. Additionally, Ameyaw and Chan (2015) and Koppenjan and Enserink (2009) highlighted successful cases, such as the Lekki Toll Road in Nigeria and the Chengdu No. 6 Water Plant in China, demonstrating successful PPP implementations in developing countries. These examples illustrate that PPPs are vital for providing high-quality services in the construction industry.

4.3 Cluster 3: Public-Private Partnerships and Sustainable Development

The third cluster addresses the relationship between PPPs and sustainable development, focusing on renewable energy, China, India, climate change, and capacity building. Previous studies (Grimsey & Lewis, 2004; Estache, 2006; Yescombe, 2007; Sovacool, 2013) have shown that PPP projects in renewable energy, waste management, water supply, and conservation include key elements of sustainability, especially environmental sustainability. Koppenjan and Enserink (2009) stressed the importance of integrating sustainability considerations into the planning and implementation of PPP projects. Contributing to this discussion, Buse and Walt (2000), Zhang (2005), and Ameyaw and Chan (2015) advocate for governments to adopt green technologies to boost energy efficiency and reduce negative environmental impacts throughout the project lifecycle. The examples of the As-Samra Wastewater Treatment Plant in Jordan and the Gujarat Solar Park in India serve as good illustrations of environmentally sustainable PPPs. Therefore, PPPs can leverage private sector creativity and investment to develop infrastructure and services that achieve sustainable development goals in developing countries, promoting environmental sustainability by reducing adverse effects and enhancing resource utilization.

Effective capacity building is essential for successful PPP implementation, especially in developing countries where the public sector's capacity is often limited. Chileshe et al. (2022) highlighted significant capacity-building challenges in Tanzanian PPP projects and emphasized the importance of training and development programmes to strengthen public sector capacity. Kukah et al. (2023) advised that capacity-building initiatives should be comprehensive and tailored to the specific needs of each project and country. However, studies indicate that current capacity-building efforts are ineffective and fail to address the fundamental causes of capacity gaps. Therefore, more targeted and effective capacity development strategies need to be incorporated into the knowledge transfer programme.

4.4 Cluster 4: Governance and Critical Success Factors

This cluster focuses on governance and critical success factors in PPP projects, especially in countries like Nigeria and Tanzania. Effective governance is vital for the success of PPPs. Research indicates that robust governance structures are crucial for effectively managing PPP projects, promoting transparency, and enhancing accountability. For example, Chileshe and Kavishe (2022) developed a framework to enhance PPP governance in Tanzanian construction projects, emphasizing stakeholder engagement and a robust legal framework. Similarly, Babatunde et al. (2022) stressed the importance of governance in lowering risks and boosting project outcomes in Nigerian PPPs. However, some argue that overly strict governance frameworks could restrict innovation and flexibility, which are essential for adapting to changing project conditions. Identifying the critical success factors (CSFs) for successfully implementing PPP projects is necessary. For instance, Zhang (2005) identified five key CSFs: a supportive investment climate, economic feasibility, a trustworthy concessionaire team, a solid financial package, and proper risk sharing through reliable contracts. Additionally, Chileshe et al. (2022) noted that capacity building and institutional support are crucial for the success of PPPs in developing countries. Although Osei-Kyei and Chan (2017a) recognized the benefits of general CSFs, applying these findings in different settings is limited because each project and context has unique variables.

The effectiveness of procurement processes is vital for the success of PPP projects. Olojede et al. (2023) conducted a study on the involvement of public sector organizations in PPP project procurement. The study emphasized the importance of transparent and efficient procurement processes in ensuring project success and fostering confidence in the private sector. Despite this, procurement in PPPs faces numerous challenges, including bureaucratic delays and limited capacity within public institutions. Zhao et al. (2023) emphasized the importance of enhancing procurement processes through capacity building and adopting best practices to improve the efficiency and success of PPP projects.

4.5 Cluster 5: Water Supply, Corruption, and Millennium Development Goals

Cluster 5 includes research on PPPs related to water supply, corruption, public sector involvement, and MDGs. Ruiters and Amadi-Echendu (2022) examined PPPs as an investment model for water infrastructure in South Africa. Their findings highlight the importance of sustainable and transparent partnerships for long-term success. However, PPP initiatives face significant challenges, including corruption and inefficient public sector operations. Tariq and Zhang (2022) conducted a comprehensive analysis of water PPP project failures in sub-Saharan Africa and identified corruption and poor governance as key issues. Corruption remains a major obstacle in implementing PPPs in developing countries. Cuadrado-Ballesteros and Peña-Miguel (2022) analysed the link between corruption and PPPs in infrastructure projects, demonstrating that corruption can significantly reduce project outcomes and efficiency. Babatunde et al. (2022) argued that integrating anti-corruption measures and increasing transparency in PPP contracts can help reduce corruption and improve project results.

Similarly, Chileshe et al. (2022) emphasised that capacity building is a key method for improving the management and execution of PPP projects in developing countries. These findings were supported by Osei-Kyei and Chan (2018), who emphasized that capacity building in the public sector is crucial for the long-term success of PPPs, as it facilitates better oversight and project management. Finally, the fifth cluster illustrates the complexity of PPPs in developing countries. Although PPPs have great potential to fill infrastructure gaps and support sustainable development, their success depends heavily on effective risk management, strong governance, and customized capacity-building programmes. Combining private sector innovation and resources with public sector oversight can lead to more effective PPP project outcomes. However, issues like corruption, limited finances, and other local factors must be carefully managed. The results underscore the importance of adopting a flexible and integrated approach to PPP implementation, enabling the effective advancement of the SDGs in developing nations.

5.0 Conclusion

This extensive bibliometric analysis of Public-Private Partnership (PPP) research in developing countries from 1983 to 2023 uncovers several key insights into the evolving landscape of PPP studies. The research indicates that the number of PPP studies has increased over the past four decades, reflecting the growing recognition of PPPs as a means to address infrastructure gaps and promote sustainable development in resource-constrained settings. The study highlights the rising academic and policy interest in understanding the benefits and challenges of PPPs. The cluster analysis identifies five main themes: developing countries and PPP dynamics, infrastructure and risk management, sustainable development, governance and critical success factors, and water supply and corruption. These themes represent core areas of PPP research, demonstrating the diverse nature of PPP projects. The findings support the notion that PPPs have a multidimensional

impact, effectively combining private sector resources and expertise with public oversight to address financial and operational challenges. Notably, the study highlights the importance of robust risk management frameworks, effective stakeholder engagement, and comprehensive sustainability practices in ensuring the success and longevity of PPP initiatives.

Governance is a key theme, emphasizing that robust governance structures are essential for effectively managing PPP projects, ensuring transparency, and maintaining accountability. The literature also emphasizes the importance of dynamic and responsive governance models that can strike a balance between the rigidity necessary for oversight and the flexibility required for innovation. Capacity building is another vital theme, recognized as essential for PPP success, especially in developing countries where public sector expertise and capacity are limited. Therefore, customized capacity-building initiatives are necessary to support more effective PPP implementation by developing the technical and managerial capabilities of public sector personnel.

The analysis also highlights collaboration patterns among researchers and countries, showing a trend toward international and regional cooperation in PPP research. These collaborations are crucial for knowledge sharing, addressing common challenges, and improving PPP frameworks. However, the study also points out challenges such as corruption and inefficiencies in the public sector as major obstacles to PPP success. Therefore, implementing effective anti-corruption measures and ensuring transparency in PPP contracts are essential to gain stakeholder trust and sustain long-term PPP initiatives. Success in PPP depends on good risk management, transparent governance, customized capacity-building efforts, the trust and skills of PPP partners, and the integration of sustainability goals.

5.1 Contributions of the Study

The study has several scientific contributions to the body of knowledge on PPPs, including:

The study offers a thorough and systematic bibliometric analysis of PPP research in developing countries over four decades, highlighting key trends, influential works, and collaboration patterns. This extensive time span provides insight into the evolution and dynamics of PPP studies, demonstrating how research focus and output have shifted in response to various socio-economic and political changes.

The research highlights the interdisciplinary nature of PPP research by mapping out the thematic clusters within the literature. The thematic clusters, including developing countries and PPP dynamics, infrastructure and risk management, sustainable development, governance and critical success factors, and water supply and corruption, provide insights into the diverse applications and challenges of PPPs in developing countries. By categorizing and analysing these themes, the study reveals the multidimensional impact of PPPs. It offers a deeper insight into how such partnerships can be leveraged to address targeted development challenges.

The study identifies the importance of collaboration among researchers and countries in advancing PPP knowledge and practices. The network analysis of co-authorship and country collaborations identifies the hubs of research activity and reveals the global nature of PPP studies. This finding is essential for fostering international cooperation and knowledge transfer, which are necessary for tackling the complex and context-specific challenges of PPPs in developing countries.

Finally, the study's methodological contribution lies in applying advanced bibliometric techniques and tools, such as VOSviewer, to visualize and analyse the structural links within the PPP research field. This rigorous approach ensures a high degree of precision and trustworthiness in the results, establishing a benchmark for future bibliometric research in similar areas.

5.2 Future Research Directions and Limitations

Further inquiry is warranted into how advanced digital innovations, including blockchain, AI, and IoT, may contribute to optimizing efficiency and fostering transparency in Public-Private Partnership (PPP) projects across developing economies. Researchers can also conduct long-term empirical investigations to explore the outcome trajectories of PPPs, focusing on sustainability, economic impact, and social risks and benefits, in order to gain a comprehensive understanding. Political and economic stability should be considered when designing resilient frameworks and evaluating the effectiveness of capacity-building programmes and training for public sector officials involved in PPP projects. Exploring innovative financing mechanisms, such as green bonds and social impact bonds, can help identify alternative solutions to financial challenges. Additionally, analysing the policy and regulatory environments that shape the success of PPPs and the effectiveness of capacity-building initiatives for public officials is essential. While the bibliometric method offers a broad overview, it may overlook nuanced and contextual insights provided by qualitative methods. Furthermore, relying solely on Scopus as a database may limit the scope of the literature review. Therefore, future studies should adopt a more diverse and inclusive methodological approach to address these limitations and gain a deeper understanding of PPP dynamics in developing countries.

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