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Policy Strategies for Public–Private Partnership on Broadband Infrastructure: A Systematic Literature Review

ABSTRACT: *This study aims to analyze the development of research themes in the public–private partnership (PPP) project policy strategy for broadband infrastructure from 2000 to 2021 and identify the most popular research topics. Systematic literature review (SLR) of 927 Google Scholar and Scopus publications, followed by bibliometric analysis, co-occurrence keywords, and in-depth qualitative approaches with content analysis, was performed. Articles are classified based on the source of publication, year of publication, country of origin, journal ranking, and research theme. This study finds that previous studies discussed the development of policy strategies and regulatory theory. Most articles were published in journals indexed under Q1, while only one was published under Q4. This study highlights the importance of government initiatives in developing broadband infrastructure through PPPs. The findings show that the policy strategy, legal framework, and regulations influence the success of PPP schemes. Private sector involvement can reduce costs and provide access to resources and expertise the public sector may still need to gain. This study suggests that policymakers encourage the participation of the private sector in broadband infrastructure projects and provide incentives for them, such as public funding. This study benefits governments or policymakers who intend to implement the PPP scheme to deliver public services.*

KEYWORDS: broadband infrastructure, government initiatives, policy strategy, public–private partnership

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INTRODUCTION

Background on the Importance of Broadband Infrastructure

To broaden connectivity and increase economic growth, broadband infrastructure is increasingly being developed worldwide. An increase in the penetration of information and communication technology (ICT) will reduce the gap in universal access on the one hand and on the other hand will support the digital platform market which accelerate economy and productivity (Ferro et al., 2007) as well as increase access to knowledge and education (Czernich et al., 2011). Internet access is currently becoming a universal right that supports daily activities (Adisti, 2017; Kusharjanto & Kim, 2011). It refers to changes brought by the use of digital technology, which generates processes and shares and transfers data and includes telecommunications networks, computer technology, and software engineering (Adamsky, 2017). Therefore, scholars view artificial intelligence as a vital tool for accelerating digital transformation (Khalifa et al., 2021).

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Therefore, based on the current situation, developed and developing countries aim to provide it as a public service (Huang et al., 2022). As ICT is part of the public sector, it enhances the growth of the economy in a country (Koutroumpis, 2009; Nguyen et al., 2022). The evolution of mobile technology has exerted an impact on all public areas, and rapid changes in mobile technology have resulted in the development of new capabilities in e-government and e-participation (Mishra, 2012; Vyas-Doorgapersad, 2022). Mobile phone and Internet connectivity have spawned the phenomenon of e-government, which aided in the transformation of public services (Burksiene et al., 2019).

The majority of countries organized the telecommunication sector in public/government agencies until the final decades of the 20th century (Hodge & Greve, 2010). This scheme was implemented to protect and guarantee its sector. People use digital media and the Internet for daily activities and remaining connected through digital devices will continue with the advance in technology (Bembe et al., 2019; Delponte et al., 2015). To improve the ICT infrastructure, public–private partnership (PPP) scheme is a significant arrangement for public service delivery through the development of public infrastructure in the current situation (Bohlin, 2009; Falch & Henten, 2010; Oswald et al., 2011).

Overview of PPP in Broadband Infrastructure

PPPs can be characterized as a long-term contract arrangement based on cooperation between a public authority and a private consortium with the objective of providing a mechanism for developing the public service (Fredebeul-Krein & Knoben, 2010). PPPs are agreements between a public agency and a private sector entity (Niu et al., 2022). These partnerships are used to finance, build, and operate projects for the public good. In the case of broadband infrastructure, PPPs can be used to expand access to high-speed Internet in underserved areas (Gerli et al., 2020; Niu et al., 2022; Wan et al., 2021). The public sector typically provides funding for the project, while the private sector provides expertise and resources (Valentín-Sívico et al., 2022). The public sector may also provide incentives such as tax breaks or subsidies to encourage private sector involvement (Steelyana, 2021). The private sector may also be responsible for building and maintaining the infrastructure (Zhou et al., 2022).

PPPs can be beneficial for both parties (Cordova & Stanley, 2021). The public sector can benefit from the private sector's expertise and resources, while the private sector can benefit from the public sector's incentives and access to public funds (Niu et al., 2022; Wan et al., 2021). These partnerships can also help to reduce the cost of broadband infrastructure, as the private sector can often build and maintain infrastructure more efficiently than the public sector (Valentín-Sívico et al., 2022). Overall, PPPs can be a useful tool for expanding access to broadband infrastructure in underserved areas (Gerli et al., 2020; Steelyana, 2021). They can help to reduce costs and provide access to resources and expertise that the public sector may not have (Valentín-Sívico et al., 2022; Zhou et al., 2022).

Challenges and Opportunity of PPPs in Broadband Infrastructure

In PPP projects, certain critical factors of the project are valuable strategies for better implementation such as the sharing of risks and capacity (Cheung et al., 2009). In recent years, scholars observe a steady growth in the number of PPP projects for broadband infrastructure (Gruber et al., 2014). One of the key challenges for the establishment of PPP schemes in many countries lies in the legal and regulatory frameworks. They refer to the basic platform to support the implementation of PPPs (Fife & Hosman, 2007). They provide direction for policymakers in considering certain strategies for procurement (Nucciarelli et al., 2010).

Purpose of the Study and Research Question

With the increase in the research on PPP projects in broadband infrastructure (Steelyana, 2021), this study conducts a literature review which is considered essential to determine the development of research themes in the policy strategy from 2000 to 2020 for countries in Europe, Asia, Pacific, Australia, and the United States (Xiao & Watson, 2019). Moreover, a literature review can identify the topics of research conducted in previous years and determine the direction for future research as needed (Okoli & Schabram, 2012).

The research gap in the field of policy strategies for PPP in broadband infrastructure can be determined through a systematic review and bibliometric analysis of the existing literature (Gerli et al., 2020; Niu et al., 2022). This may reveal areas where there is

a lack of research or areas where the current research is inconclusive or has limitations (Wan et al., 2021; Zhou et al., 2022). The research gap may include a lack of studies on the effectiveness of specific policy strategies in different regions or countries (Valentín-Sívico et al., 2022). There is a need to better understand the role of stakeholders in PPP in broadband (Cordova & Stanley, 2021; Tlili et al., 2022). These gaps can be used to guide future research and inform policymakers on areas that need further attention and investment (Fan et al., 2020).

It may lead to the research question for this study as what are the most effective policy strategies for promoting PPPs in broadband infrastructure development and how do these strategies compare across different countries and regions?

LITERATURE REVIEW

Overview of Policy Strategies for PPP on Broadband Infrastructure

An overview of the policy strategies for successful PPPs regarding broadband infrastructure includes the provision of incentives and support for private companies (Fan et al., 2020; Tlili et al., 2022), the implementation of net neutrality regulations, and the introduction of spectrum auctions (Goyal & Kumar, 2021). Additionally, governments may also provide financial support to build public infrastructure in order to facilitate the deployment of broadband services (Xu et al., 2021). These strategies are designed to reduce barriers to entry for private companies, stimulate investment in broadband infrastructure, and ensure equitable access to broadband services (P. Wang & Tian, 2021). Additionally, governments can also implement regulations that ensure that private companies are applying ethical and responsible practices when offering broadband services (Fan et al., 2020; Goyal & Kumar, 2021; Xu et al., 2021).

This study provided an effective method for thematically mapping out articles, which enabled a holistic view of this field. Government initiatives through policy strategy could promote the development of broadband infrastructure in their respective ways (Tlili et al., 2022; Xu et al., 2021). The review of the government initiative theme highlights evidence of significant contributions to the understanding of policy strategies for the development of broadband infrastructure (Cordova & Stanley, 2021; Goyal & Kumar, 2021). In the majority of cases, the most effective government policies are those that intend to use the potential of the investment of the private sector to promote broadband development (P. Wang & Tian, 2021; Xu et al., 2021).

Based on the review from previous papers and referred framework as presented in the chapter entitled Policy Approach in the *Broadband Strategies Handbook by the World Bank* (2012), the government or government initiatives play a role in broadband development through three major areas: (a) legal, regulatory policy reform, (b) specific policies and plans included in national broadband plan and policies for supply and demand (policies that promote demand and encourage uptake), and (c) policies that support private sector investment (Goyal & Kumar, 2021; P. Wang & Tian, 2021; Xu et al., 2021).

Bibliometric Analysis of the Literature Review of the Previous Literature

The current study is built on prior research regarding the body of knowledge related to government initiatives in PPP (Rejeb et al., 2022). The establishment of government policies for the PPP scheme may aid in the development of broadband infrastructure. One essential element in accelerating a fixed broadband penetration is the legal and regulatory frameworks (Yuliana & Asvial, 2019). The need for certainty regulations can address the lack of support on the regulatory framework for broadband infrastructure (B. E. Howell & Potgieter, 2020). In certain conditions, it makes the implementation of integrated broadband relatively challenging, and the less certain of the regulatory framework will be a key barrier to the success of PPP implementation (Ariyanti & Yuniarti, 2020). Broadband penetration significantly impacts economic development, healthcare, and quality of life in society (Steelyana, 2021). Technological innovation, especially the development of digital technology, is increasingly presented as potentially important in supporting these impacts (Marshall et al., 2022). Therefore, government policies should increase the engagement of domestic products to achieve major economic benefits from trade through broadband penetration (Djunaedi, 2021). Multi-stakeholder partnerships are an essential vehicle for solving complex societal problems (Rejeb et al., 2022; Zhou et al., 2022). Agreements that govern and government initiatives are used to enforce the affectivity of cooperation and partnership (Vayaliparampil et al., 2021). In literature on the public-sector accounting, the research on PPP demonstrates that the public policy strategy is part of the role of the

government in shaping the regulatory framework and plays an important role in catalyzing infrastructure development to the next level (Steelyana, 2021). Based on prior research, the current study explores the fundamental theory presented in this paper, which is discussed in the subsequent text (Herrera-Franco et al., 2021; Purnomo et al., 2020)

Regulation Theory

Fundamentally, regulatory theory defines three approaches, which are public interest, capture, and regulatory economic theories (Goodell et al., 2023). In PPP, two major parties collaborate in a scheme, namely, the public and private sectors. Specifically, the broadband market in PPP implementation has two viewpoints based on economic and public interest theories, which are related to governmental regulatory operations (Xu et al., 2021; Zhou et al., 2022). First, the public interest perspective suggests that the government actively influences markets for public (Cordova & Stanley, 2021). The description provided by the public interest theory is based on public perspective because the ultimate goal of the development of broadband infrastructure is to benefit society and improve public welfare (Ehrler et al., 2009; Mitrović, 2015). Second, economic theory denotes that government initiatives should support the development of broadband infrastructure, such as government/public policies intended to accelerate related projects (Picot & Wernick, 2007). Moreover, these two viewpoints are used to describe the government as an enabler or a rule maker (Fan et al., 2020; Tlili et al., 2022).

METHODOLOGY

Materials and Methods

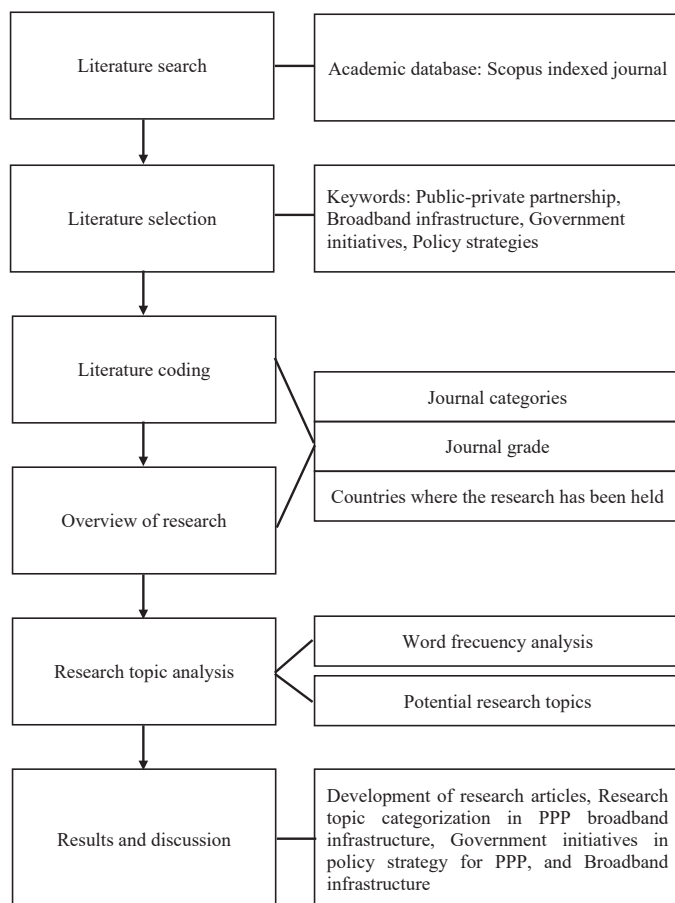
This study employed a qualitative method called contextualized systematic literature review (SLR) and bibliometric techniques, which are used to map themes and content for in-depth analysis. Figure 1 shows a flow diagram of an SLR that explains the stage of bibliometric analysis (Herrera-Franco et al., 2021). The study utilized a two-stage structured approach called Publish or Perish, and graphical evaluation was conducted using NVivo, which offers text mining functionality that can be used to build and visualize the co-occurring networks of key terms extracted from the metadata of a scientific literature. Figure 1 depicts the SLR method, which follows several steps (Goodell et al., 2023; Purnomo et al., 2020).

The first stage is a literature search or search process that is used to obtain relevant journal sources to answer research questions and other related references. The search process was carried out by exploring academic databases such as Scopus indexed journals. The second stage is literature selection. This stage is carried out to decide whether the data found are suitable for use in SLR research or not. Studies are eligible to be selected if they meet the following criteria: 1) data used in the 2000–2021 time period; 2) data obtained through the Google Scholar site and Scopus publications; and (3) the data used only relate to PPPs, broadband infrastructure, government initiatives, and policy strategies. The third stage is coding the literature and general description of the research. In this stage, research data are presented based on certain criteria such as journal category, journal value, and the city where the research was conducted. This stage can help classify empirical research in related fields and related topics. This is useful to assist in positioning the research and contributions provided. The fourth stage is research topic analysis which consists of analyzing word frequency and potential research topics. The research data source was taken from a Scopus indexed journal. The articles used have diverse characteristics in both writing style and diction. When the process of writing a journal article is underway, this can help the author identify journal keywords and the words that appear most frequently. Potential research topics on PPP project policy strategies come from various sources. Being aware of current issues in public affairs will help develop interesting research topics. The final stage is the results and discussion. At this stage, it is important to prepare a report that contains all the information related to the various stages of the summary and summaries of all the results are obtained.

Bibliometric Analysis: Methodology and Search Process

Bibliometric analysis evaluates topics of interest by tracking the number and keywords changes in time (Hassan & Usmani, 2022; van Raan, 2005). Google Scholar and Scopus are the commonly used databases for bibliometric analysis (M.-H. Wang et al., 2010).

Fig. 1: Flow diagram of a systematic literature review.
Source: Prisma, 2020.



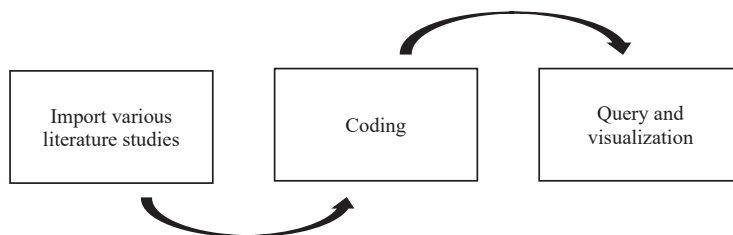
For data validation, data are cross-referenced with SCImago Journal & Country Rank (SJR). Hence, compared to the previous review papers, this study puts forward the idea of conducting an extensive bibliometric analysis that could benefit the research community and industry from various perspectives: An impediment to delivering a more solid perception of PPP, as discussed earlier and emphasized by Donthu et al. (2020), is the divergence of the extant categorizations, definitions, and terminologies. Although the discussed review studies have contributed to providing a wider outlook on this concept, there is a shortage of attention to the core practice of PPP (X. Wang et al., 2020). For instance, Nobanee et al. (2021) echoed this issue by pointing out the inadequate conceptual classifications associated with PPP, in which the practices, e.g., infrastructure and local development, and concepts, e.g., governance approach, are either mixed up or distinguished insufficiently. Therefore, we review the evolution and industrial application of PPP to not only capture the major drivers and milestones contributing to the development of this concept but also shape the grounds for better comprehension and interpretation of the results derived from the bibliometric analysis (Donthu et al., 2021; Moral-Muñoz et al., 2020).

Bibliometric analysis is a promising approach in this context, which is fueled by research in the field of library and information science in the presence of a large amount of bibliographic material, and thanks to the recent development of digital tools and rich databases, it is favored by many researchers (Esposito & Dicorato, 2020; Huang et al., 2022). There is a lot of scrutinies involved in this method, and in this paper, we choose the keywords co-occurrence and bibliographic merging, which fall into the category of science mapping (Agarwal et al., 2023; Chisika & Yeom, 2021). The first provides a substantially useful overview of a topic by analyzing the relationships between keywords used together in a document (Donthu et al., 2021; Huang et al., 2022). The latter concerns “the relationship between two items that both cite the same document,” and in this study, the items refer to sources, which is equivalent to a journal (Rosokhata et al., 2021). This examination not only facilitates the identification of journals with the highest contributions

to the topic but also reveals citation relationships between journals to enable thematic evaluation and classification of research around PPPs (Azami-Aghdash et al., 2020; Verger et al., 2020). To achieve these goals, the software Nvivo, which is characterized by strong analytical capabilities and deep visualization features, was used (Kumar et al., 2021; Rosokhata et al., 2021). NVivo offers a number of tools for flexible data organization and analysis. It may store a variety of data, including bibliometric data imported from reference manager software and transcripts of interview texts, videos, and photographs. The software allows several coders to work on the same data file. In conclusion, NVivo is a piece of software that aids in the organization and synthesis of research findings. Because of this, it is a useful tool for both theorizing and qualitative data analyses (N. Sinkovics, 2016; R. R. Sinkovics et al., 2008).

Of all the research stages, literature review is one of the research aspects that consumes the most energy and time. This is because literature review is an activity used by researchers to build a clear understanding of the area being studied and build arguments for the importance of the study, as well as providing direction for discussing research findings. The literature review process using Nvivo is carried out as illustrated in Figure 2.

Fig. 2: Nvivo Stage.
Source: (Endah et al., 2020).



In addition to the examination outlined and based on discussion regarding the evolution of PPPs, it is also useful to analyze the publication trends of studies that have been achieved, thereby facilitating an overview of the main patterns and trends in relation to impactful achievements (Mao et al., 2021; Park & Chung, 2021).

This study puts forward the goal of presenting an inclusive evaluation of the studies regarding PPP, and in order to achieve this goal and avoid leaning toward any particular direction, e.g., risk sharing and sustainability, the systematic search is conducted by using only one keyword, which is “public–private partnership” (Anwar et al., 2021; Azami-Aghdash et al., 2020; Park & Chung, 2021). In this regard and to ensure extensive coverage of materials and bibliometric data, the search string is combined with an asterisk (*) symbol—known as truncation—to include terminological variants pertaining to the ending part of the search phrase, such as plural form (Xue et al., 2022). Moreover, the search string is placed between two double quotation marks (“”) to satisfy an *exact* search and set a hard constraint for the search engine to consider the exact combination of the words that constitute the string (Rosokhata et al., 2021). Therefore, by taking the aforementioned points into account, we use “public–private partnership*” as the search string (Park & Chung, 2021). Not to mention the dash character (-) between the terms “public” and “private” has no bias effect on the search results, and this is treated either as a dash or as a space character by the search engine of Scopus, which is selected as the online database for this study. It is worthwhile to note that the search process scans the title, abstract, and list of keywords pertaining to each article based on the identified string (Anwar et al., 2021; Azami-Aghdash et al., 2020).

Data Collection

First step, the study uses Publish and Perish software. The following keywords were used:

- a. Public–Private Partnerships and Broadband Infrastructure
- b. Public–Private Partnership, Broadband Infrastructure, and Europe
- c. Public–Private Partnerships, Broadband Infrastructure, Africa, Asia, Pacific, and Australia

Data collection was completed in May 2022, which limited the period from 2000 to 2021. Furthermore, we downloaded full records of a total of 25,770 publications and obtained information on titles, abstracts, authors, document types, publication dates, journals,

Tab. 1: Data collection.

No	Source	Keywords	Date	Time	Results
1	Google	PPP and Broadband Infrastructure	May 3, 2022	18:15	15,300
2	Scholar	PPP, Broadband Infrastructure, and Europe	May 3, 2022	18:30	8,530
3		PPP, Broadband Infrastructure, Africa, Asia, Pacific, and Australia	May 3, 2022	19:40	1,940
Total					25,770

and references. The statistics of these records mainly include country of origin, subject matter, themes, and research institutions. Table 1 presents the steps for the collection of data from Google Scholar.

The total sample reached approximately 25,000 articles from Google Scholar for the period between 2000 and 2021. The study first identified articles published in academic journals that discussed PPP in relation to broadband infrastructure.

Data Selection: Inclusion and Exclusion Criteria

Initially, the study encountered a large number of irrelevant articles, specifically publications whose major debate was not only unrelated to the research question but also unrelated to PPP in broadband infrastructure (Gharaei et al., 2023). The total sample reached approximately 25,000 for the period between 2000 and 2021. First, the study identified articles published in academic journals that focused on PPP in broadband infrastructure (Cui et al., 2020). The study used the following inclusion and exclusion criteria to select the papers. First, the survey considered only articles published in English and indexed in Scopus. Second, the articles should only publish in Scopus-indexed journals. Third, papers that discuss only topics which related to keywords (Nobanee et al., 2021). The keywords that are connected directly to the study were imperative. All papers had to be added. The main discussion of the articles must be about PPP in broadband infrastructure that is undertaken in the countries of Asia, Pacific, Australia, USA, and Europe for the period 2000–2021. Fourth, articles were omitted in the case of duplication in the sense that one article is found in two or more academic databases (X. Wang et al., 2020). Fifth, scientific essays were excluded if they are in the form of a thesis or not published in a journal. Table 2 describes the prerequisite condition as per the inclusion–exclusion criteria.

The number of items selected was calculated using the keywords indicated in Table 1 of the search strategy followed by Table 2 for the inclusion–exclusion criteria. Finally, Table 3 encapsulates the more progressive elements after inclusion and exclusion and presents the final number of papers selected.

At the beginning of the online search, this study encountered a large number of irrelevant articles, especially publications whose major debate was unrelated not only to the research question but also to PPP broadband infrastructure (Donthu et al., 2020; Goodell et al., 2023). The total sample reached approximately 25,770 articles written in the period between 2000 and 2021.

The search for articles relevant to this topic was conducted extensively from June 2000 to June 2021. The study identified 927 articles in 24 journals whose main discussion was on Internet backbone with the PPP scheme. Out of the 927 articles, 420 were excluded because they were published in Scopus-indexed journals. Furthermore, 507 articles were also excluded because they did not discuss PPPs in broadband infrastructure for countries in Asia, Pacific, Australia, and Europe during the study period (Moral-Muñoz et al., 2020; Nobanee et al., 2021). The application of the third criterion did not change the number of articles because the study found no duplicate articles. Regarding the relevance criteria, articles that do not contain the search terms in the title or keywords were also excluded. The final number of articles included for analysis was 42.

Analysis Bibliometrics

Co-authorship analysis is used to find relationships between various studies based on research documents produced by researchers. Co-authorship networks are a tool to reveal the direction of collaboration and identify researchers and institutions leading research (Fonseca et al., 2016), and co-authorship network analysis can help overcome this, providing a substantial contribution to scientific development (Morel et al, 2009).

Tab. 2: Inclusion and exclusion criteria.

Parameter of Selection of a Paper	Inclusion Criteria	Exclusion Criteria	Rationale for Inclusion–Exclusion
Language	English	Rest of language	The researchers and the preponderance of the readership can readily understand English
Year	2000–2021	Published before 2000 and after 2021	Only a few articles were published before 2000, and investigations after 2021 are underway
Journal index	Indexed in Scopus and other academic databases	Other indexed articles	Articles must take samples from different citations such that a possibility exists that the same article is listed in various places. Therefore, duplicated articles in other citations must be excluded from the sample. The study uses Scopus as the threshold; therefore, the publications used are only international publications indexed under the Q1–Q4 categories (Scopus), whose validity was obtained through Scimagojr.com
Keywords	Keywords that are directly connected to the study. All papers should be added	No exclusion	The main discussion of the articles must be about PPP in broadband infrastructure. The article is only included if one of the three categories is fulfilled.
Duplication and completeness	No inclusion	Excluded	Duplicates that are found in two or more academic databases are excluded The study is checked for data completeness. If the entire article is unavailable or only an abstract is present, it is also excluded from the sample
Type of paper	Only papers published in journals	Scientific essays are a thesis or an article not published in a journal (unpublished literature)	Research articles, such as theses or unpublished papers, are excluded

Tab. 3: Final papers included in the sample.

Identification of New Studies via Databases and Registers		
Identification	Records identified: Databases (n = 927) Registers (n = 0)	Records removed before the screening: Records marked as ineligible by automation tools (n = 0) Records were removed for other reasons (n = 0)
	Record screened (n = 90)	Records excluded (n = 420)
	Reports sought for retrieval (n = 0)	Reports not retrieved (n = 507)
Screening	Reports assessed for eligibility (n = 43)	Reports excluded: unpublished literature (n = literature) (n = 1)
Included	New studies included in the review (n = 42) and reports of new included studies	

Citation analysis based on scientific and medical research databases can be validly applied in all scientific fields, including applied and technical sciences, social sciences, and humanities, but is also often debated. In science, research groups are natural “business” units and are, therefore, the most useful level of aggregation in citation analysis because scientific research is the result of teamwork. Garfield argues that a journal’s citation frequency is a function not only of the scientific significance of the material it publishes but also of the number of articles it publishes each year (Moed, 2005).

Co-citation analysis is useful for mapping the specialization of research subjects, and the single-link cluster method is applied for grouping co-cited articles. If all topics covered by a data set can be identified by co-citation clustering, it can only be partially answered by comparing the results for different sets of thresholds of (normalized) co-citation strength as some areas of research may lack consensual references. However, the findings suggest that co-citation clustering reflects research specialization although these can be divided into groups. It was also found that co-citation clustering only revealed part of the literature relevant to the research topic identified from the cited literature and that the interrelationships between clusters appeared to correspond to cognitive relationships at a higher level than research specialization (Jarneving, 2007).

The selected articles were processed using NVivo. NVivo is used to create bibliometric visualization maps and enables the development of a concept visualization map and co-occurrence analyses (Huang et al., 2022). Furthermore, using NVivo for bibliometric analysis enables the mapping of the research topic and describing the pattern of content analysis. It also offers text mining functionality, which can be used to build and visualize co-occurring networks of key terms extracted from the metadata of scientific literature (Goodell et al., 2023).

[illegible]

Based on the results of the autocoding analysis produced using NVivo, the selected papers are sufficiently in line with the formulation of problems and predetermined topics. The most common words that appeared are “broadband,” “public,” “private,” “government,” “policy,” “network,” “infrastructure,” and “PPP.”

Results

The following outlines are the summaries of the findings and the results of the analysis of the SLR.

Frequency Distribution of Articles by Research Topic

Out of the 42 selected articles, this study identified five themes, namely, government initiatives ($n = 19$; 45%), PPP framework ($n = 14$; 33.5%), PPP implementation ($n = 4$; 9.5%), technology option ($n = 3$; 7.3%), and value for money ($n = 2$; 4.7%). Table 2 indicates that the theme of government initiatives ranks highest ($n = 19$; 45%) and is more pronounced during the second period (2010–2015): 11 journals and third period (2015–2021): 5 journals which are followed by PPP framework 33.5%, PPP implementation 9.5%, technology option 7.3%, and value for money for 4.7%.

Table 4 provides a detailed explanation of each article and year of publication related to the themes, and Table 5 shows the distribution of theme. The number of articles in the period prior to 2010 are 7, where 2004 is the earliest year of the articles. Along with the development of this new measure, researchers began to pay attention to this topic as indicated by the relatively increasing number of articles over time since 2010–2015, which amounted to 22 or 52% of the total.

Frequency Distribution of Articles by Year, Publication Quality, and Country

According to the frequency distribution of articles by the year and publication quality, more than half ($n = 26$; 62%) were published in high-quality journals, which Scimago (SJR) indexed under Q1. Approximately 14% and 22% of the articles are mid-quality journals and indexed under Q2 and Q3, respectively. Furthermore, only 2% of the articles were from journals indexed under Q4.

The number of articles in journals indexed as Q1 has increased over time since 2010–2015, which reached 18 or 42% of the total; meanwhile, articles in Q2 journals have increased during the period 2016–2021 ($n = 3$; 7%), and those in Q3 journals have increased on the second period 2010–2015 ($n = 5$; 12%).

The United Kingdom has been the leading country focused on studies on PPP in broadband infrastructure for the past 20 years. It leads with a high intensity of 21 journals published on PPP broadband, which equals approximately 63.6%.

Frequency Distribution of Articles by Journal and Research Method

Table 6 presents the distribution of journal quality. The top-quality journals (Q1 ranking by Scimago) are 15 articles published in *Telecommunication Policy*, followed by two articles in *Communication and Strategies* and one in other journals, including those indexed in Q2, Q3, and Q4. 78.5% or approximately 33 studies used qualitative methods, followed by quantitative methods ($n = 6$; 14.5%) and mixed methods ($n = 3$; 7%).

Discussions

Key Policy Strategies for PPP in Broadband

This study found that crucial policy strategies need to be developed as part of government initiatives to enhance the PPP scheme’s implementation to support broadband infrastructure development (Gerli et al., 2020; Valentín-Sívico et al., 2022). In line with the

Tab. 4: Frequency distribution of articles by theme.

Themes	Years			Total	Total (%)
	< 2010	2010–2015	2016–2021		
Government initiatives	3	11	5	19	45
PPP framework	3	12	1	14	33.5
PPP implementation	1	1	2	4	9.5
Technology option	0	0	3	3	7.3
Value for money	0	0	2	2	4.7
Total	7	24	13	42	100

Tab. 5: Distribution of theme.

No	Theme	Authors	Total
1	Government initiatives	(Costa et al., 2010; Dwyer et al., 2011; Falch & Henten, 2008, 2010; Fredebeul-Krein & Knoben, 2010; Gillett et al., 2004; Girth, 2014; Given, 2010; Gyaase & Takyi, 2016; B. Howell & Sadowski, 2018; Li, 2012; Nucciarelli et al., 2010, 2013; Picot & Wernick, 2007; Qiang, 2010; H. Wang et al., 2019)	19
2	PPP framework	(Bembe et al., 2019; Drobot et al., 2010; Ehrler et al., 2009; Falch & Henten, 2010; Fife & Hosman, 2007; Fredebeul-Krein & Knoben, 2010; Ganuza & Vicens, 2011; Gómez-Barroso & Feijóo, 2010; Pant & Hambly Odame, 2017; Schneir & Xiong, 2016; Troulos et al., 2010; Williams et al., 2013; Williams & Falch, 2012; Droste et al., 2012)	14
3	PPP implementation	(Lattemann et al., 2009; Nucciarelli et al., 2010; Pant & Hambly Odame, 2017; Al-Shqairat et al., 2015)	4
4	Technology option	(Gomez-Barquero et al., 2019; Liolis et al., 2018; Neokosmidis et al., 2017)	3
5	Value for money	(Caiyun et al., 2019; Gerli et al., 2020)	2
Total			42

research question for this study, in discussions section, the paper analyzed the most effective policy strategies for promoting PPPs in broadband infrastructure development and the implementation of these strategies compared across different countries and regions (Steelyana, 2021), which is shown in Table 7.

Topics and journal articles related to government initiatives should be systematic, and comprehensive reviews of research focus with direct implications for the public policy and regulation (Esposito & Dicorato, 2020). In discussion, the topic of utilizing PPP research knowledge in public regulatory policy must be explained clearly, including the consequences resulting from the analysis of published research sources (Huang et al., 2022). In fact, PPPs have been used as a framework for commercial partnerships between governments and business leaders that have evolved and modified to suit societal needs, and as a result, PPPs are widely recognized as a business model (Chisika & Yeom, 2021). This section outlines the history of PPPs as well as key events that were instrumental in the transition to this business approach (Gillies, 2020; Shi et al., 2020). In this case, showing the stages, achievements, and phenomena related to the development of PPP are discussed in a timeline to provide a more real and concrete picture of the evolution of this model (Agarwal et al., 2023; Khawaja et al., 2021).

The most prominent application of PPP is the development of public infrastructure: Public–Private Partnerships in Broadband Infrastructure (Chisika & Yeom, 2021; Motamedi et al., 2021). As previously discussed, PPP was triggered by the community situation and the increasingly weak needs of the community so that broadband improvements were the main driver for this (Agarwal et al., 2023). This objective is in line with the development of several project sectors, and the bibliometric analysis results reveal the most important sectors, including, but not limited to, broadband, government initiatives, and policy strategy. In fact, the economic capacity and versatile characteristics of PPPs allow this business model to contribute to a wide range of sectors (Joudyian et al., 2021; Motamedi et al., 2021).

Tab. 6: Distribution of articles according to journal quality.

No	Scopus category	Journals (Scopus index categories)	Total
1	Q1	<i>Telecommunication Policy</i> (15); <i>Journal of Rural Studies</i> (1); <i>European Journal Business and Management</i> (1); <i>International Public Management Journal</i> (1); <i>Journal of Rural Studies</i> (1); <i>IEEE Communication Magazine</i> (1); <i>International Journal of Satellite Communications and Networking</i> (1); <i>Telematics and Informatics</i> (1); <i>Communications & Strategies</i> (2); <i>Government Information Quarterly</i> (1); <i>Computer Law & Security Review</i> (1)	26 Articles 12 Journals
2	Q2	<i>People, Process and Policy</i> (1); <i>Commonwealth and Comparative Politics</i> (1); <i>International Journal of Public Administration</i> (1); <i>Development Southern Africa</i> (1); <i>Journal of Infrastructure Systems</i> (1)	5 Articles 5 Journals
3	Q3	<i>International Journal Management and Network Economics</i> (1); <i>International Journal of Scientific & Technology Research</i> (1); <i>Journal Technology and Management Innovation</i> (1); <i>Information</i> (4); <i>International Journal of Project Organization and Management</i> (1); <i>International Journal of Business Governance and Ethics</i> (1); <i>Observatorio</i> (1)	10 Articles 8 Journals
4	Q4	<i>Central European Journal of International and Security Studies</i> (1)	1 Article 1 Journal
Total			42 Articles in 26 journals

Tab. 7: Theme and Journal Articles Related to Government Initiatives.

No	Government initiatives	Journal article
1	Legal, regulatory, and reform policies	(Amalia & Budhijanto, 2018; Cordova & Stanley, 2021; Dwyer et al., 2011; Given, 2010; Gyaase & Takyi, 2016; B. E. Howell & Potgieter, 2020; B. Howell & Sadowski, 2018; Li, 2012; Sadowski et al., 2013; Troulos et al., 2010)
2	Specific policies and plans	(Dwyer et al., 2011; Picot & Wernick, 2007; Kim et al., 2004)
2.1	National broadband plans and policies for supply and demand	(Dwyer et al., 2011; Frieden, 2005; Gyaase & Takyi, 2016; Kim et al., 2011; International Telecommunication Union, 2016)
2.2	Policies for supply and demand	(Costa et al., 2010; Gillett et al., 2004; Nucciarelli et al., 2010, 2013)
3	Policies that support private sector investment	(Irwin, 2003; Qiang, 2010; H. Wang et al., 2019)
3.1	Government initiatives to encourage private investment	
3.2	Universal service policy	(Dwyer et al., 2011; Ehrler et al., 2009; Falch & Henten, 2008, 2010; Qiang, 2010)
3.3	Subsidies as fiscal support	(Bauer, 2011; Cordova & Stanley, 2021; Falch & Henten, 2008; Gillett et al., 2004; B. Howell & Sadowski, 2018; Qiang, 2010)

Legal, Regulatory, and Reform Policies

Broadband is a specific infrastructure development that requires major support from the government, especially on policy strategy (Khawaja et al., 2021). The PPP scheme is well-suited for the establishment of solutions for the development of broadband infrastructure, particularly in rural areas (Joudyian et al., 2021). Notably, however, the success of the examples is heavily dependent on the regulatory, financial, legal, and political environments, as well as the desire of the public and private sectors to collaborate (Joudyian et al., 2021). As policymakers seek strategies for supporting broadband growth in their nations, certain general lessons may be learned from countries with established broadband networks and services (Agarwal et al., 2023; Chisika & Yeom, 2021; Khawaja et al., 2021).

Legal, regulatory, and reform policies discuss the key policies and regulatory trends that policymakers and regulators should take into consideration and discuss the roles that governments should play in promoting universal broadband access (Esposito &

Dicorato, 2020). Policymakers are responsible for making decisions on the mechanisms for public investment. Chisika and Yeom (2021) state that the legal amendments for specific policy areas need to be adjusted to reduce uncertainties in legal aspects, which are considered obstacles to PPP. Moreover, the political environment is considerably influenced as a fundamental structural and strategic element to the development of PPP regulations (Agarwal et al., 2023; Joudyian et al., 2021).

In the PPP scheme, public and private stakeholders collaborate in terms of funding and operation (Chisika & Yeom, 2021). Based on evidence, guidance for policymakers on establishing the PPP regulatory framework is scant (Motamedi et al., 2021); however, to establish regulatory commitment, specific regulatory frameworks should be established (Joudyian et al., 2021). A regulatory framework for PPP is a key element for many countries in the establishment of PPP and an open market system in the development of broadband infrastructure, as cited by several papers in this review (Joudyian et al., 2021; Khawaja et al., 2021; Motamedi et al., 2021).

Comparison of Legal, Regulatory, and Reform Policies across Countries

In certain countries, such as Indonesia, the legal and regulatory framework reform has been established as a platform for infrastructure development with the PPP scheme (Chisika & Yeom, 2021). The presidential regulation and government initiatives for the establishment of certain institutions aim to provide facilities and guarantees to the private sector on entering the infrastructure business (Gharaee et al., 2023). In specific cases, the PPP scheme can be conducted as part of the economic and disaster recovery plan mandated by the Congress, such as the reconstruction plan in Puerto Rico, after Hurricanes Irma and Maria devastated the island in September 2017 (Jiménez-García et al., 2020).

Adjusting the existing public procurement and investment regulation as well as its models has played a crucial role in triggering PPP in several countries. PPPs are good alternatives to building broadband infrastructure through the mutual partnership between private and public partners (Mao et al., 2021). Contributing regions: Although PPPs are not a new concept, they have not been practiced and developed evenly throughout the world (Kumar et al., 2021). Keyword analysis shows that countries and regions with more impactful and larger economies have made higher contributions to the implementation and conceptual development of PPPs, such as the United States, the United Kingdom, China, Europe, and Australia. Please note that this is by no means a ranking of the most contributing countries/regions, given the fact that this assessment is not based on a count of PPP projects associated with each geographic region (Anwar et al., 2021; Verger et al., 2020; Xue et al., 2022).

Specific Policies and Plans

The lack of broadband development policy has been the main challenge for governments and industries in developing broadband infrastructure (Gerli et al., 2020). One of the key challenges is the policies and strategies that encourage broadband network construction, particularly in communities with less interest in broadband (Niu et al., 2022; Wan et al., 2021). Moreover, investigation on the promotion of broadband is lacking: in this context, the significant effect of broadband in accessing major public sectors, such as education, healthcare, banking, and the environment (Valentín-Sívico et al., 2022). As such, specific policies and plans, which are included national broadband plans, should be established (Steelyana, 2021).

Certain countries developed national broadband plans and followed the policies for supply and demand to promote demand and encourage uptake (Gerli et al., 2020; Valentín-Sívico et al., 2022). Based on an evaluation of the supply and demand issues of a country, specific policies and strategies need to be established. This aspect included establishing specific, measurable goals for increasing broadband supply through infrastructure development as well as driving the demand for broadband services and applications (Steelyana, 2021; Wan et al., 2021). Setting precise goals or policies can offer a clear sense of direction, encouraging investment and providing a roadmap for a long-term activity (Gerli et al., 2020).

National Broadband Plans

A PPP is a funding model for public infrastructure projects and initiatives such as a new telecommunication system, public transportation system, airport, or power plant. Government agencies represent the public partner at a local, state, and national levels. The private partner can be a privately owned business, public corporation, or consortium of companies with a specific area of expertise. PPP is a broad term that can be applied to anything from a simple, short-term management contract – with or without private investment requirements – to a long-term contract that includes funding, planning, building, operation, maintenance, and divestiture. PPP projects (also known as P3 projects) are helpful for large ventures that require the procurement of highly skilled workers and a significant cash outlay to get started. They are also helpful in countries, such as the United Kingdom or the Philippines, which require the state to legally own any infrastructure that serves the public. While PPPs can cover a range of projects across various sectors, there are several sectors that are most associated with these types of initiatives. Here are a few examples: telecommunications, fund broadband networks, and other telecommunications infrastructure rollouts (Niu et al., 2022).

There are various PPP contract models based on funding and which partner is responsible for owning and maintaining assets at different stages of the government project. Example of PPP models includes (Saputra et al., 2022) design build (DB). The private-sector partner designs and builds the infrastructure to meet the public-sector stakeholder's specifications often for a fixed price. The private-sector partner assumes all risks. Operation and maintenance contract (O&M): the private firm, under contract, operates a publicly owned asset for a specific period. The public partner then retains ownership of the assets. Design–build–finance–operate (DBFO): the private-sector company designs, finances, and constructs a new infrastructure component and owns the operation and maintenance under a long-term lease. When the lease is up, the private-sector partner transfers the infrastructure component to the public-sector partner. Build–own–operate (BOO): the private party finances, builds, owns, and operates the infrastructure component perpetually. The public-sector partner's constraints are stated in the original agreement and through ongoing regulatory authority. Build–own–operate–transfer (BOOT): privatization is granted for financing, design, building, and operation of an infrastructure component (and to charge user fees) for a specific time, after which ownership is transferred back to the public-sector partner. Buy–build–operate (BBO): this publicly owned asset is legally transferred to a private-sector partner for a designated period. Build–lease–operate–transfer (BLOT): the private-sector partner designs, finances, and builds a facility on the leased public land. The private-sector partner operates the facility for the duration of the land lease. When the lease expires, assets are transferred to the public-sector partner. Operation license: the private-sector partner is granted a license or other expression of legal permission to operate a public service, usually for a specified term. (This model is often used in IT projects.) Finance only: the private entity partner, usually a financial services company, funds the infrastructure component and charges the public-sector partner interest to use the funds.

Broadband policies are becoming mainstream in several countries in terms of the implementation of competition frameworks. Broadband policies are also based on national broadband development plans and should be converted into national blueprints for broadband infrastructure (OECD, 2008). National road maps are a method for estimating projected goals and progress. However, they require a strategy for guiding progress and should be backed up by government regulations (Wan et al., 2021). At the infrastructural level, road maps are concerned with the implementation of the PPP regulatory framework with regard to civic or community-based policies, which focus heavily on digital access in rural areas and are non-financially viable (Niu et al., 2022; Wan et al., 2021). Alternatively, the stimulatory measures of many governments are most probably the establishment of national broadband systems that promotes market arrangement (Steelyana, 2021; Valentín-Sívico et al., 2022).

Comparison of National Broadband Policies across Countries

A majority of OECD members have established specific national broadband plans because digital connection is becoming increasingly essential for OECD nations, particularly in rural and isolated regions (Niu et al., 2022). However, these plans are limited to not only developed countries but also a few developing countries, which have endeavored to create national broadband policies (Valentín-Sívico et al., 2022; Wan et al., 2021). For example, Chile was the first Latin American country to announce a national broadband strategy (Gerli et al., 2020). The Turkish government recognized the importance of a vibrant telecommunications market and was eager to promote the spread of broadband. Lastly, Malaysia developed its information, communications, and multimedia service strategy in 2006, which outlined several broadband service goals (Gerli et al., 2020; Steelyana, 2021; Zhou et al., 2022). Indonesia

launched their five-year national broadband plan on 2015 with the Palapa Ring Project as the flagship initiative. A few countries, such as Brazil, Finland, France, Germany, Malaysia, Morocco, South Africa, Sweden, the United Kingdom, and the United States, have established national broadband strategies that contain specific development and publicly stated policy goals for the growth of the adoption and delivery of broadband services (Gerli et al., 2020; Niu et al., 2022; Valentín-Sívico et al., 2022).

Policies for Supply and Demand

A combination of the supply- and demand-side elements is critical for achieving maximum broadband penetration and adoption. It needs to coordinate both factors (supply and demand) in an economy to achieve their full potential if it is well coordinated (Fan et al., 2020). As a result, nations with high levels of broadband penetration employ comprehensive broadband strategies that coordinate the supply and demand sides (Tlili et al., 2022). The experience of countries with high-level penetration on broadband demonstrates that an effective broadband distribution requires a consideration of issues from the supply and demand sides (Valentín-Sívico et al., 2022; Zhou et al., 2022). Although supply-side policies encourage the construction of network infrastructure to support broadband services, demand-side policies intend to increase knowledge about and acceptability of broadband services to increase their usage (Gerli et al., 2020; Valentín-Sívico et al., 2022).

PPPs are a good method for building broadband infrastructure, especially in remote and rural areas (Xu et al., 2021). The provision of broadband infrastructure and services for private investment in rural areas is unappealing due to the low or even negative expected return rate (Rejeb et al., 2022). Moreover, certain elements are likely to be present in national broadband success stories. In fact, a majority of countries use a mix of policies, where supply-side ones focus on encouraging investment from the private sector in networks, especially during the early years (Agarwal et al., 2023; Khawaja et al., 2021). Alternatively, demand-side policies focus on how governments can support broadband demand and uptake (Chisika & Yeom, 2021). Therefore, policies and regulatory frameworks could support the operation of an efficient market and include demand-side policies and programs (Donthu et al., 2021).

Comparison of Supply and Demand Policies across Countries

Certain countries recommend the combination of supply- and demand-side policies. In the European Union (EU), the European Commission formulated policies by establishing an open and competitive single market through 2010 (Agarwal et al., 2023). Furthermore, several national broadband initiatives are being implemented across the EU such as Ireland, Spain, Sweden, the United Kingdom (Gerli et al., 2020), and Greece (Esposito & Dicorato, 2020) to expand coverage, particularly in rural and non-viable areas. In contrast to the EU, the Korean Ministry of Information and Communications also acts as a regulator of the telecommunications industry (Huang et al., 2022). The main objective of the Korea Information Infrastructure-Government was to construct a backbone network (X. Wang et al., 2020). In terms of competition, platform competition between multiple providers and hands-off policies in terms of retail prices resulted in relatively low price levels, which aided broadband uptake (Agarwal et al., 2023). The Ghana National Telecom Policy, which is a policy tool for regulating the market, provides the following opportunities to the private sector (Khawaja et al., 2021).

Evidently, the regulatory framework of the government renders possible the PPP initiative in Ghana (Motamedi et al., 2021). The United States takes a different approach than those of Korea and Europe and mainly relies on the benefits of platform competition (Rosokhata et al., 2021). Despite efforts to stimulate broadband expansion through local public initiatives, the role of the government of the United States in advancing broadband deployment may be regarded as relatively passive (Verger et al., 2020). However, in terms of broadband distribution, and particularly its leadership role in ICT, one may argue that this approach ignores the benefits of integrating public and private activities (Anwar et al., 2021).

Policies That Support Private Sector Investment

The previous sections have discussed the key drivers for encouraging the broadband development (Verger et al., 2020). The first section discusses government initiatives on the legal and regulatory framework, and the second section offers a detailed observation on how the government may develop specific plans and policies to foster the broadband development (Cui et al., 2020; Gharaee et al., 2023). This section discusses the literature that discussed other government initiatives to enhance private investment (Azami-Aghdash et al., 2020; Verger et al., 2020).

Government Initiatives That Encourage Private Investment

Private investment is pivotal in the development of broadband infrastructure because a country may rely heavily on it despite the development of sophisticated regulatory policies and specific plans (Tlili et al., 2022). Broadband access is recognized as a driver of economic growth, which promotes efficiency and overcomes geographic market constraints. According to data from the World Bank, a 10% increase in the penetration of selected ICT could boost GDP per capita growth by up to 1.38 percentage points (Xu et al., 2021). Financial resources are limited, and many sectors face competing demands (Saputra, Mu'ah, et al., 2022). Thus, infrastructure needs to be fully supported by a funding mechanism in broadband infrastructure, that is, a universal regulation on the funding mechanism (Gerli et al., 2020). The ITU has announced that each country member should implement regulations that support the infrastructure development. Although technology options are costly, universal regulations should be established if broadband infrastructure is to be extended and developed (Niu et al., 2022; Wan et al., 2021).

As such, interorganizational collaboration is critical due to these interdependencies; nevertheless, working across organizational boundaries is far from easy (Steelyana, 2021; Zhou et al., 2022). As a result, policymakers are considering the provision of direct assistance for broadband growth and carefully consider costs and advantages (Valentín-Sívico et al., 2022). The broadband development goals of governments cannot be met by a regulatory reform or private sector investment (Valentín-Sívico et al., 2022). In such cases, policymakers can use fiscal support to fill the gaps in the broadband development (Saputra et al., 2023). Fiscal assistance may be provided to a company or end users through various channels, including cash subsidies, in-kind subsidies, tax incentives, capital contributions, risk assumptions, and other fiscal resources (Niu et al., 2022; Zhou et al., 2022).

Based on the literature, the study noted the limited number of government initiatives that may encourage private investments such as the universal service policy and subsidies as fiscal support. The subsequent sections will discuss these two initiatives.

Universal Service Policy

The government has defined broadband as a legal right for citizens and has been considered a universal service obligation (Xu et al., 2021). The government frames broadband development in the context of providing equal treatment to citizens and ensuring that Internet services increase in terms of accessibility, affordability, and continuity (Cordova & Stanley, 2021; Fan et al., 2020; Tlili et al., 2022). Universal access could be achieved if a coherent and comprehensive national broadband plan is implemented (Steelyana, 2021; Zhou et al., 2022). This strategy indicates that the government considers intervention in the sector necessary and appropriate to achieve public goals such as universal services (P. Wang & Tian, 2021).

The universal access and service fund is one of the key funding mechanisms for the development of broadband infrastructure and for the provision of universal broadband access. National governments establish this funding mechanism to encourage access to universal telecommunications (Fan et al., 2020; Goyal & Kumar, 2021; Xu et al., 2021). Investment in competitive conditions requires positive business cases, and the USO could provide funding (Esposito & Dicorato, 2020). Certain countries convert or plan to make broadband provision a universal service obligation and reform their universal service policies (Donthu et al., 2021; Moral-Muñoz et al., 2020).

In the past, many nations defined universal service funds (USFs) as priorities for the provision of voice telephony (Xue et al., 2022). The USF expanded its definitions and scope to include broadband or Internet access (Kumar et al., 2021; Park & Chung, 2021). The fund was intended to assist rural and remote areas as well as less commercial ones. For example, the EU and the United States

increased funding for USFs to accommodate broadband. Certain countries made plans to set broadband availability as a requirement for universal services and reformed their universal service policies accordingly (Jiménez-García et al., 2020; Mao et al., 2021).

Subsidies as Fiscal Support

In certain situations, regulatory change and private sector investment are insufficient for a government to achieve its broadband growth goals (Kumar et al., 2021). Thus, governments may turn to fiscal assistance to fill the gaps in broadband expansion under such circumstances (Anwar et al., 2021; Azami-Aghdash et al., 2020). Moreover, governments may support a company or its consumers in the form of monetary subsidies, in-kind grants, tax exemptions, capital contributions, risk bearing, and other fiscal resources (Park & Chung, 2021).

Subsidies are a common form of direct intervention from governments in telecommunications markets. Subsidies are likely to exist whenever the final price paid is less than the cost of goods or services provided (Kumar et al., 2021; Mao et al., 2021). For a certain period of time, several companies may cross-subsidy one set of consumers using profits from another set (Azami-Aghdash et al., 2020; Jiménez-García et al., 2020). Subsidy involves direct government contribution to compensate for the difference between regular costs (Saputra, Subroto, et al., 2022). Innovation in the PPP scheme is essential for the sustainability of projects and considers the use of subsidies for improving the broadband access (Gharraee et al., 2023; Niu et al., 2022). In particular, it focuses on the considerations that policymakers should give to the subsidy design to ensure that subsidies are allocated appropriately (Gerli et al., 2020; Steelyana, 2021; Valentín-Sívico et al., 2022).

Conclusions

Summary of Findings

This study aims to observe the development of research themes in policy strategies in relation to PPP projects for broadband infrastructure from 2000 to 2021 and to identify the most popular topic of research conducted in countries in Europe, Asia, Pacific, Australia, and the United States. Using SLR, the study found that previous studies discussed the development of policy strategies and regulation theories. This review included 42 high-quality articles published in Scopus-indexed journals through Scimago—SJR. Specifically, the selected papers consist of 26 articles (62%) published under the Q1 category and six (14%) and nine (22%) articles indexed under Q2 and Q3 categories, respectively. Furthermore, only one article (2%) was published in a journal indexed under the Q4 category. This covers articles published from 2000 to 2021.

The findings are consistent with the notion that the policy strategy is highly influential in the PPP scheme for the development of broadband infrastructure. Moreover, the review found that government initiatives are the major theme cited in the literature. This finding indicated that the government played a significant role in the PPP scheme for the development of broadband infrastructure. Furthermore, the major role of governments lies in public interest as the top priority. Government initiatives emphasize the promotion and authorization environments that provide legal and policy frameworks for the acceleration of the PPP scheme.

In many countries, the policy strategy provides directions for the infrastructure of the telecommunication sector to increase broadband penetration. The result indicates that the studies on the PPP scheme in the literature on broadband infrastructure mainly highlighted the legal and regulatory framework as the basic point for enhancing Internet development. Its application in many countries can be considered as lessons learned for the development of broadband infrastructure through the PPP scheme, which is relatively specific per country.

This study is beneficial to governments or policymakers that intend to implement the PPP scheme to deliver public services: in addition, countries that are implementing the PPP scheme. This paper could support governments in reviewing their policy strategy frameworks for the implementation of the PPP scheme, especially in broadband infrastructure, to support the development of the ICT sector. There are several implications that can be taken as recommendation to the policymakers and to broadband infrastructure development.

Implications for Policymakers

From policymakers' perspective, PPPs could be a financing scheme for increasing access to broadband infrastructure in underserved areas, which has important policy implications. PPP schemes may have access to resources and knowledge that the public sector does not, which could enhance efficiency by lowering costs. In addition to providing public funding for these projects, policymakers should consider encouraging private sector participation in broadband infrastructure projects. Policymakers should also ensure that the public sector has access to the resources of the private sector and the capacity to implement PPP.

Despite their challenges, many public authorities and private partners continue to use PPPs to procure infrastructure and services. The following are some of the justifications given to validate the need for PPPs. The value for money test compares P3 private-partner bids to a hypothetical public sector comparable bid intended to represent the costs of a completely public option. P3s are often justified based on risk transfer from the public to the private sectors. P3s are assumed to be able to transfer more risks to the private sector than traditional procurement because P3 partners have an incentive to minimize these risks to maximize their profits. P3s are also seen to encourage innovation, since private partners are typically more agile and have more experience with new technologies than the public sector. P3s can also be used to keep infrastructure projects off the public-sector balance sheet, therefore allowing them to achieve more of their goals without incurring additional costs.

Implications for PPP on Broadband Infrastructure

From the infrastructure development perspective, PPPs have implications for broadband development by reducing costs and providing access to private resources and expertise that the public sector may not have. Additionally, PPP could support expanding access to high-speed internet in underserved, rural, and remote areas. Private sector involvement in broadband infrastructure projects can be incentivized by the public sector and by providing public funds for these projects. These implications could support PPP in ensuring that the public sector can benefit from the private sector's expertise and resources.

The implication of this research is that due to the combination of private funding and the large scale of organizations involved in PPP projects, this is highly recommended for completing complex projects. From a commercial point of view, this implies that the economic and financial aspects of PPPs must be justified by both parties. The main implication of this research is aimed at the situation of society and the increasingly weak needs of society so that improving broadband and public services is the main driver for this. This aim is in line with the development of several project sectors and the results of bibliometric analysis.

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