

Review

Public-Private Partnership: A Bibliometric Analysis and Historical Evolution

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Abstract: The broad and extensive application of public-private partnership (PPP), as well as the divergent documented definitions and experiences, have led to a translucent perspective of PPP and strained academia and industry to reach a consensus on the major practice of this concept. Early contractor involvement (ECI), governance tools, and relational contracting are only a few of the frameworks attributed to PPP. This issue has received limited attention from researchers, despite the focus of review studies on different disciplines of PPP. Hence, this paper puts forward the idea of conducting a comprehensive review to not only shed light on the major practice of PPP but also provide a wider outlook on this concept based on the research carried out since 1979. A narrative review is initially accomplished to identify the major drivers and milestones that have contributed to the evolution of PPP. Employing bibliometric analysis in the following phase assists in conducting a multi-dimensional assessment of studies published within the last five decades. The economic and societal practices of PPP throughout its evolution path signified the dominant application of this concept as a business model. The bibliometric analysis revealed that PPP has contributed to various sectors, i.e., urban development, public infrastructure, transportation, health, and education, just to name a few. In addition, economic and organizational management of PPP was revealed as a major research stream that was accompanied by sustainable development. As a matter of fact, economic and environmental sustainability are the major cross-disciplinary elements that form an interplay between the drivers and attributes of PPP. Value for money (VfM), technology, and innovation, along with smart infrastructure (SI) and smart cities (SCs), are identified as the major directions for the future research agenda associated with PPP.

Keywords: public-private partnership; public service provision; public infrastructure; bibliometric analysis



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1. Introduction

Provision of public services, development of urban areas, and rehabilitation of deteriorated infrastructure are only a few of the governmental agendas that demand extensive resource mobilization locally and nationwide. In this regard, the expansion of societies and advancements in living standards have burdened public authorities with even more sophisticated responsibilities. While achieving these goals is particularly resource-intensive, public-private partnership (PPP) have favored governments by involving the private sector not only as an executive axle but also as a means of sponsorship [1]. The advantages of this approach are, however, not limited to the financial aspects, as it has demonstrated promising values in partnership enhancement between the public and private sectors,

better risk management, and clearer government policies, just to name a few [2]. PPP, with extensive application in public infrastructure projects, is commonly referred to as an arrangement that engages private parties for the provision of public services under a contractual agreement [3]. A partnership of this form arguably involves distinct characteristics that distinguish PPP from the traditional approach, where the government is the main investor in the project. According to this model, the public and private sectors normally form a long-term contract in which, for instance, the contractor is in charge of supplying the fund, designing, building, operating the facility, and some other commonly considered responsibilities [4,5]. It is worthwhile to mention that PPP is recognized as an innovative alternative that suits ‘particularly complex contracts’, and embraces various decisions, e.g., project ownership, risk sharing, etc., that potentially vary across different project types [6,7].

According to the benefits delivered by PPP, many nations and public authorities have employed this approach over the last couple of decades, and this has led not only to variation in terminologies but also to the development of distinct experiences and definitions. For instance, P3 (in North America), Private Participation in Infrastructure (in Korea), and Private Finance Initiative (PFI) (originated in Britain but also used in Japan and Malaysia) are some of the most prominent terms that refer to the same subject [5]. The variation in the conceptualization of PPP, however, is rather divergent. In the United States of America (U.S.A.), the National Council for Public-Private Partnerships defines PPP as “a contractual arrangement between a public sector agency and a for-profit private sector concern, whereby resources and risks are shared for the purpose of delivery of a public service or development of public infrastructure” [4]. From a more holistic standpoint, the United Nations Economic Commission for Europe (UNECE) acknowledges PPP as a broad approach that comprises sharing the risk and responsibilities between public and private parties and leads to higher efficiency and quality in the provision of public services [8]. It is worthwhile to note that academicians and practitioners have highlighted and practiced various forms of agreements and contractual arrangements as an alternative to PPP. From a contractual perspective, Build-Operate-Transfer (BOT) is among the preliminary forms of PPP that was exercised by Hong Kong in the late 1950s for the construction of a vehicle tunnel [9]. Under this form of contractual agreement, the project investor (denoted as the *franchisee*) not only supplies the project fund but is also responsible for the construction and operation of the facility in the expectation of earning the revenue generated over a specified period of time [10]. PPP is also recognized as an innovative model that can be realized through various approaches. Inspired by the importance of constructing a collaboration on the basis of trust between partners, a research work regarding project partnering acknowledges that such collaboration could be achieved through relational contracting and recognizes this approach as a chapeau to PPP [11]. As a matter of fact, PPP is claimed to benefit from some of the principles of relational contracting or relational project delivery arrangements (RPDA), e.g., project partnering, alliancing, etc., even though the distinction between PPP and available alternatives in this context is rather blurry [12,13]. A review study highlights PPP as an approach towards early contractor involvement (ECI), accompanied by other 25 identified approaches to this concept, and presents a seven-tier framework for ECI implementation in which PPP is considered a project delivery arrangement [14].

The available definitions, approaches, and terminologies attributed to PPP are not limited to the concepts aforementioned in the above discussion, such as relational contracting, ECI, and so forth. There are numerous debates, categorizations, definitions, and practices pertaining to PPP that hinder deriving a concrete general comprehension of this concept [4]. Not to mention that this problem is also influenced by the distinct development of PPP in various nations, alongside its international application, which broadens the perceptions and characteristics of this mode of partnership. In other words, there is no consensus on how PPP is conceived or “what a PPP actually is” [15]. This signifies a lack of theoretical consistency within the realm of PPP. Linder [16] has recognized PPP as a governance tool

that acts as an instrument for six distinct purposes, i.e., risk shifting, restricting public service, power sharing, etc. This study, on the other hand, raises concern regarding another major attitude toward PPP by highlighting that it is also considered a novel tool for exercising conventional forms of privatization. PPP is also acknowledged as a means of contracting in favor of infrastructure projects [15,17]. There is a plethora of other distinct definitions that add building blocks of confusion to the translucent understanding of PPP. To that essence, PPP is merely recognized as a multi-dimensional topic, and scholars have put significant effort into investigating this topic from various perspectives and within different contexts, such as waste management [18], risk assessment [19], procurement and contracting [20], and so forth. On the other hand, there are a limited number of studies that seek to deliver a more solid perception of the major practice of PPP and to review this concept from a more holistic perspective. Hence, the main objective of this paper is *to study the industrial evolution of PPP and review the research carried out by academicians in order to represent a more transparent perspective on this concept*. To realize this goal, the following questions guide the phases of this study: (1) What major rudimentary elements, stimuli, and milestones have contributed to the development of PPP throughout history? (2) What are the fundamental themes and areas that have shaped the status quo of PPP literature?

To address the first research question, this paper primarily proposes to conduct a narrative review in order to explore and illustrate the evolution of PPP throughout history and present a generic outlook on this mode of partnership through the analysis of credible scientific studies and early reports discussing the structural development of PPP. In this regard, Section 4 of this study seeks to present a more transparent comprehension of PPP by elaborating on the major practices of this concept, especially as a commercial alternative. In practice, and according to the former discussion on the lack of consistency in the extant definitions, studying the decisive principles and milestones that have contributed to the evolution of PPP throughout the last couple of centuries favors identifying the fundamental pillars of this concept and paving the way for a better conceptualization of PPP. While this phase maintains a solid link with the assessment of the real-world practice of PPP, it is also of significance to reflect the academic efforts surrounding this model and enrich the industrial implications of PPP with illumination of the major areas that have been directed by the researchers. Given the reflection of this concern in the latter research question, the second phase aims at carrying out an extensive investigation of PPP literature through Sections 5 and 6, which is achieved by employing the ‘bibliometric analysis’ approach. To best benefit from the advantageous quantitative attributes of this method as well as fulfill the inclusiveness criteria regarding the findings and inferences, this phase incorporates the records of the scientific studies accomplished within the last five decades. This approach not only paves the way for thematic evaluation of the research works regarding PPP but also enables revealing the less investigated aspects of this model. Hence, the second phase is concluded by recommending a concise research agenda [in Section 7] that assists scholars in directing future research on PPP.

To accomplish this paper, Section 2 explains the methods utilized to conduct the literature review and, more importantly, to address the devised research questions. Section 3 provides a background study pertinent to the former review studies that have been particularly carried out by bibliometric analysis. Section 4 investigates the structural development of PPP over the last couple of centuries, and by capturing the fundamental milestones, it illustrates a timeline corresponding to the evolution of this model. In Section 5, the bibliometric analysis method is expounded, and it is accompanied by the preliminary numerical results of the literature search. In Section 6, the results of the bibliometric analysis are demonstrated and interpreted through extensive discussions. Section 7 presents an overall discussion of the results, and ultimately, by taking advantage of the bibliometric analysis, a research agenda for future academic efforts concerning PPP is recommended in this section. Section 8 concludes the paper.

2. Research Methods

According to the scope of this paper and in order to better reflect the contribution of the previous literature review studies, the keywords ‘public-private partnership’ and ‘bibliometric’ were combined to retrieve the relevant review papers from the online database of Scopus. The search was conducted on 1 April 2023, and it initially resulted in 51 documents. In order to navigate through pertinent subject areas, the list of retrieved research items was narrowed down based on the following fields, provided by Scopus: Engineering; Business, Management, and Accounting; Economics, Econometrics, and Finance; Decision Sciences; Environmental Science; and Energy. Applying this filter reduced the number of articles to 25, and it is noteworthy to highlight that all research items are written in English. It was deemed necessary to eliminate the research items that had limited compliance with the primary objective of this paper, which is the evaluation of PPP at a high abstraction level. In this regard, review studies with a specific focus pertaining to PPP, e.g., risk allocation and management, stakeholder management, sustainability, etc., were removed from the list. The same rule was also applied to disregard the articles with a particular geographical focus whose findings are limited to a specific nation or region, such as the bibliometric analysis conducted by Chen et al. [21], who have specifically focused on the market of China. The appraisal process led to the removal of 21 research items, and thus, the final list of review studies was reduced to four items. It is worthwhile to mention that to ensure a comprehensive procedure of document retrieval, the search process enabled the incorporation of terminological variations pertaining to ‘public-private partnership’, which will be thoroughly described in Section 5.

Academicians and practitioners, as explained in Section 1, have investigated PPP from several dimensions and attributed a variety of classifications to this concept. Not to mention the variations in definitions and characteristics that have hindered deriving a solid and transparent perception of this concept [4]. This divergent illustration reveals the shortage of understanding associated with the core practice of PPP in society, and it requires further attention to the rudimentary and major elements that have contributed to the structural development of this mode of partnership. In this regard, we perform a narrative review, and in order to present a holistic outlook of the PPP evolution, we initially refer to an excellent and profound analysis carried out by Beauregard [1]—discussed in the context of political economy—which is recognized as the major research work with respect to the historical framework of PPP [22]. This discussion is further extended by analyzing the credible scientific studies and early reports surrounding the practice of PPP and by considering the recent major milestones that have substantially impacted this concept, i.e., PFI, etc. Thus, we thoroughly analyze and articulate the interplay between the elements that have contributed to the evolution of PPP and the structural inherence of the major factors that have played a key role in this context. This assessment favors delivering a more transparent conceptual perception of the PPP practice.

Following the assessment of PPP development throughout history, the second phase of this study seeks to present a multi-dimensional analysis of the extant literature using bibliometric analysis. Bibliometric analysis is a quantitative method that provides researchers with analytical tools to study the bibliometric data associated with the published materials and satisfy various goals, for instance, to investigate the intellectual structure of a particular topic or to depict and identify the research trends within a field [23–25]. The underlying principle in this method is utilizing the bibliometric data, e.g., keywords, citations, publishers, etc., corresponding to the published articles to illuminate the implicit correlations between the research items pertinent to a specific topic. As a result, this method is underpinned by two major stages: data collection and quantitative examination. Given the pivotal role of data collection, Section 5 expatiates the process of systematic search, which is then accompanied by a description of the general framework, opted examinations, and utilized tool to accomplish the bibliometric analysis. In this regard, the results of each examination are presented, visualized, and meticulously interpreted throughout Section 6.

3. Former Literature Review Studies Using Bibliometric Analysis

Diversity in the conceptual mapping of PPP, along with variety in the definitions and characteristics, have hindered perceiving an integrated and solid comprehension of PPP, as discussed throughout Section 1. Although the contribution of review studies is vital to addressing such a theoretical gap, there is a shortage of effort in this regard. To better highlight this matter, and according to the scope of this study, this section aims to review the prior efforts from academia. In this regard, four review papers were collected—and as explained in Section 2—and are represented in Table 1.

Table 1. Previous literature review studies regarding PPP employing bibliometric analysis.

Author(s)	Publication Year	Sample Size	Time Interval of Study	Database
Marsilio et al. [26]	2011	323	1990–2007	SSCI
de Castro e Silva Neto et al. [27]	2016	650	1990–2014	Web of Science
Ma et al. [28]	2019	1209	2008–2018	Scopus
Narbaev et al. [29]	2020	1970	1989–2018	Scopus

With a focus on individual efforts from authors contributing to PPP, Marsilio et al. [26] utilized a few bibliometric analysis examinations, e.g., author co-citation analysis, to illustrate the intellectual structure—defined by the authors as “the manner in which the conceptual items [of a field] are organized, interrelated, and displayed”—of this field on the basis of articles published between 1990 and 2007. This study basically relies on the background and expertise of the most contributing researchers, and after identifying the most influential documents, it attempts to elaborate on the fundamental topics of PPP. The sample size in this study is 323 records, which were retrieved from the Social Science Citation Index (SSCI), which is currently a product of Clarivate Analytics, through a bottom-up and explorative approach. Along with other inferences, the authors outlined four major themes regarding PPP studies: public administration, healthcare policy and services, planning and development, and urban studies.

By incorporating more examinations, de Castro e Silva Neto et al. [27] put forward the idea of providing researchers with an overview of PPP trends in academia. Similarly to Marsilio et al. [26], the bottom-up and explorative approach is considered to retrieve the relevant documents, and this resulted in 650 records from the Web of Science (WoS) online database, expanding along the temporal interval of 1990 to 2014. In addition to the investigation of journals and nations contributing to either PPP or PFI and according to the number of publications associated with each subject, this study sheds light on 14 major research areas, i.e., contract performance, qualitative costs and benefits, contract design and risk sharing, PPP/PFI political and institutional issues, etc.

The advancement of analytical tools and more systematic search and document retrieval techniques are significant factors in improving the reliability and inclusiveness profiles of studies using bibliometric analysis. In this regard, and compared to the previously discussed review studies, Ma et al. [28] extended the sample size to 1209 research works that have been carried out within a ten-year period (between 2008 and 2018). Utilizing the Scopus online database, authors have accessed the relevant studies according to a specific set of keywords, and in this case, they have combined five terminological variations of ‘public-private partnership’. This study seeks to present a wider perspective of PPP extant literature through further quantitative elaboration of the corresponding examinations, i.e., keyword analysis, investigation of scholars and citations, and evaluation of contributing journals and countries. The findings of this study reveal that project governance and risk-oriented subjects are the most researched areas, which are followed by eight further domains, i.e., critical success factors, performance evaluation, PPP models and applications, etc., based on the number of papers published in each area of study.

Given the advantages of the systematic search, Narbaev et al. [29] combined the keywords “build operate transfer” with “public-private partnership(s)” and “private finance

initiative(s)", and retrieved 1970 records from the Scopus online database. Through an assessment of the most occurring and relevant terms, as well as the most contributing journals, corresponding to the articles published between 1989 and 2018, this study presents PPP as a multi-disciplinary subject that dominantly embraces construction management and economics, public administration and management, and transportation research disciplines. To aim at creating a knowledge map associated with PPP, the classification of research areas in this study indicates that sustainability, governance, and stakeholder management are among the emerging topics.

It is worthwhile to mention that systematic literature review (SLR) is another approach to conducting a review study (this statement does not imply dichotomizing the literature review methods) that has attracted academia in recent years. Although SLR has shown promising capabilities in the synthesis of accumulated knowledge, it does not fall within the scope of this paper from a methodological perspective. However, to shed light on the academic efforts in this regard, we combined the keyword 'public-private partnership' with 'systematic literature review' OR 'systematic review' in Scopus, which resulted in 97 records. Needless to mention, the search was conducted on 1 April 2023, and records were refined in accordance with the same filters applied earlier in this section. A preliminary assessment of this list shows that the majority of this type of review study has put emphasis on urban development and planning, water treatment, risk allocation and management, and sustainability. In fact, few studies have directed efforts toward holistic analysis of PPP, which can be found in Roehrich et al. [30], Xiong et al. [31], Zhang et al. [32], and Magalhães et al. [33].

Despite the vital contribution of literature review studies to the multi-dimensional assessment and upbuilding of the general comprehension of PPP, this concern has received limited attention from academia. According to the methodological focus and scope of this paper, only four review studies have taken advantage of bibliometric analysis, which have all been carried out within the last 12 years (between 2011 and 2020). This statistic depicts the shortage of research surrounding PPP, particularly with the aim of delivering a better understanding of this concept, even though it has been practiced and studied for many decades. 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 Akintoye et al. [4], 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. For instance, Marsilio et al. [26] echoed this issue by pointing out the inadequate conceptual classifications associated with PPP, in which the practices, e.g., infrastructure, local development, etc., and concepts, e.g., governance approach, etc., 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 to shape the grounds for better comprehension and interpretation of the results derived from the bibliometric analysis.
- A significant element to minimize bias and deliver a rigorous literature review study, regardless of the review type, is external validity [34]. This is realized through inclusive coverage of the available and relevant literature pertaining to the topic [35]. As indicated in Table 1, the number of research items incorporated into the former review studies—ranging from 323 to 1970—is limited by several factors: (1) The search strategy and document retrieval process have notable impacts on the span of the retrieved articles. For instance, despite the systematic search favoring Ma et al. [28] and Narbaev et al. [29] to expand the sample size of their study—compared to Marsilio et al. [26] and de Castro e Silva Neto et al. [27]—their studies were limited by the considered time interval and the selected keywords, respectively. (2) Another

influential element is the choices of the retrieved document types, i.e., journal papers, conference proceedings, etc., and the scientific/practical fields that distinguish the domain of studies surrounding PPP, i.e., medicine, engineering, energy, etc. The literature review papers that were studied in this section have only focused on the journal articles, and they lack transparency regarding the domains of the incorporated research items. Hence, this study seeks to address the outlined issues to better satisfy the element of external validity and to conduct a more rigorous bibliometric analysis. In this regard, the available research works are collected with no binding condition on the time span, which constitutes the studies published within the last five decades (between 1979 and 2023, April). The search process benefits from search techniques, e.g., utilization of asterisk symbol, etc., to better consider the terminological variations of the selected keyword, which is 'public-private partnership'. The collected research items are not limited to the journal papers, and several fields of PPP studies are taken into consideration, such as social sciences, engineering, business, and so forth. The outlined factors enable this study to accomplish a comprehensive bibliometric analysis using a sample size of 11,700 research items.

4. The Evolution of Public-Private Partnerships

Governments have been the major actors in urban development, both nationally and at the regional level. This agenda was magnified throughout and even before the industrialization era, when an interweaving relationship between public authorities and economic elites gradually emerged. Beginning with the provision of public services in the early 1800s, e.g., police and fire services, public health, sewers and water treatment, etc., local governments introduced taxes to finance such services, and this went hand in hand with the desirability of the city to invest in and live in, which brought political and economic elites around the same table [1]. This bilateral bond between government and business leaders was developed in two phases: the reform of government [1] and the rise of industrialization [36]. Full-time politicians initially used their powers to supplement their meager earnings. However, they were prohibited from earning from direct contributions to commercial projects after the reform of governments in the mid-1800s, and this was a considerable factor that contributed to tightening the relationship between investors and public authorities [1]. In addition, and given the significant reciprocal link between the provision of public services and the growth of the public economy (and industrialization), the delivery of infrastructure projects, e.g., canals, railroads, etc., was promoted and benefited from the collaboration between government and private businesses, as discussed by McCraw [36] regarding the political economy of the United States of America (U.S.A.) in the 19th century.

Although these milestones made substantial impacts on major partnerships between public authorities and private sectors and satisfied their mutual benefits, they also contributed to the empowerment of private business owners, which in turn fed the debate surrounding the institutional distinction between private and public sectors for decades before the beginning of the 20th century [36]. A distinction that was deemed essential to provoke the condition for establishing the contractual partnership between the public and private sectors, known as public-private partnerships [1]. Ever since, and according to the advent of considerable economic powers that were not pertinent to the government, commercial relationships between public authorities and private sectors emerged with various forms of challenges that highlighted the necessity of corresponding legislation [22]. In response to such a phenomenon, partnership between government and economic elites turned into a feasible and official approach with more legal frameworks to not only address such an adversarial relationship but, more importantly, tackle civic challenges for the public's benefit [37]. This collaboration incited more ambitious goals in the community above the constructional and operational goals, which in turn provoked the alteration of societal roles in both the government and private sectors. As exemplified by Davis [37], public authorities are urged to play a supportive role rather than being 'tax collectors',

and private business enterprises are urged to contribute to the enhancement of society rather than being 'tax payers'. It is worth mentioning that this study also highlighted the contribution of grand business leaders of the time to the partnership with the government in several critical urban projects, such as David Rockefeller and James Rouse.

As a matter of fact, the contemporary comprehension and application of PPP are due to the procedural movements throughout the last couple of centuries, specifically after the industrialization era. In a thorough study, Beauregard [1] articulates this evolution precisely within the context of U.S. political economy and highlights four historical stages for PPP development, denoted as 'Historical Chameleons'. This development commences with the emergence of political machines in the mid-1800s, which were 'strong, centralized party organizations with disciplined workers, whose loyalty [is] guaranteed by the prospect of material rewards in exchange for work in the party' [38]. Patronage and access to governmental largesse generated political and financial support for political machines, and they extensively contributed to urban growth, which ultimately expanded the scale of this entity. This period involved promising collaborations between business owners and political machines, which led to a pervasive and implicit form of PPP known as *patronage partnerships*. In the 1890s, political machines paled as opposed to local governments, with the escalation of the belief that governments are more efficient and effective means of the common good. In the meantime, and as a consequence of the industrialization expansion, investors encountered chaotic troubles such as traffic congestion, inadequate waste disposal, and so forth, which were detrimental to their businesses. Hence, real estate and industrial elites became interested in city planning and joined local governments to better satisfy the need for further urban development. This boosterism movement was in place until the 1940s, and this period was labeled as *booster partnerships*. The Second World War (WW II), however, had a disruptive effect on urban life and development. Whereas the position and investments of political and economic elites were at risk, they established redevelopment authorities, which were an instrument to purchase the blighted properties and make them available to the private sector by taking advantage of renewal legislation, funds, and the power of local government. Rehabilitation of infrastructure in this period benefited economic elites and local governments from the viewpoint of growth in private investments and tax revenues and embraced successful collaborations until the 1970s, denoted as *redevelopment partnerships*. In the early 1970s, partnerships encountered opposition from business owners whose businesses were condemned and shrank by rehabilitation/development, as well as residents whose properties were a part of such plans. Concurrently with this situation, which had led to the atrophy of redevelopment partnerships, the interest of the central government in urban renewal and financial support faded away. To remedy this adverse status, President Carter introduced the Urban Development Action Grant (UDAG) program in 1977, a breakthrough that stimulated public officials by providing financial grants for expanding and empowering public-private partnerships [22]. Not to mention that increased interest in privatization and chronic fiscal stress in society were booster elements of this program in the early 1980s. The new wave of partnerships, unlike the earlier forms of partnerships, targeted a wider range of societal problems and forms of projects, e.g., parking garages, commercial space, housing, etc. [39]. To achieve this goal, non-profit development corporations presented themselves as the partnership vehicle of choice and engendered *growth partnerships* that addressed international relationships, long-range planning, school reform, economic development, and so forth.

The current application and comprehension of partnerships between government and private investors has a solid correspondence to the latest reform of partnerships discussed above, denoted as growth partnerships. Not only have many nations incorporated this approach into their development plans throughout the recent decades, but also many organizations and public unions have contributed to enriching this type of collaboration with more legislative frameworks. A noticeable milestone in this regard is the introduction of the Private Finance Initiative (PFI) in 1992 by the United Kingdom (U.K.). The core stimulus of PFI was the promotion of public service provision, provided that private

investment contributes to the reduction of the public deficit, and according to this scheme, the government was supposed to purchase, directly or indirectly, the services supplied by the constructed infrastructure [40]. Inspired by the growth partnership, which was the latest product of the U.S. political economy, PFI's agenda was set to support various types of projects such as transport, public health, education, and so forth. Although the underlying principle of PFI is the private sector's sponsorship, it has specific ties with other fundamental elements as per the partnership between the government and the private sector. As stated by Grout [40], PFI embraces the intention of transferring risk to the private sector, and more importantly, it aims at higher value for money (VfM) for the tax payer in comparison with the traditional model of project investment. The British government defines VfM as "the optimum combination of whole-of-life costs and quality to meet the user's requirements" [41]. The engagement of this attitude with PFI demonstrates a particular turning point for partnerships between the public and private sectors. On the one hand, the evolution of PPP within the political economy of the U.S.A. revealed that this alternative was rather employed as a commercial alternative in response to public financial deficits or civic challenges. On the other hand, with experiences earned and benefits delivered through decades of applying this mode of partnership, PPP turned into a feasible and efficient option for governments by which they not only took advantage of private investment and expertise but more importantly established a long-lasting collaboration that potentially increased the VfM and improved the provision of public infrastructure and services. Concurrently with the constitution of PFI by the U.K., various nations across the globe incorporated PPP into their policies of public infrastructure provision with more concrete structures and frameworks. Kennis-centrum PPPs in the Netherlands was established in 1999 within the Ministry of Finance to support and promote the application of PPP [3]. In China, the Ministry of Foreign Trade and Economic Cooperation, the Ministry of Power, and the Ministry of Transportation were among the preliminary entities that provided documentation to support Build-Operate-Transfer (BOT) projects [42]. These initiative entities and supportive agendas were not limited to national boundaries, and many unions emerged for international support of PPP. The European PPP Expertise Centre (EPEC), the International Project Finance Association (IPFA), and the United Nations Economic Commission for Europe (UNECE) are only a few of the established international and regional organizations that favor and lubricate the PPP application [43].

Decades of experiences in constructing public infrastructure in various nations under the scheme of PPP and the development of promotional and supportive entities and unions have turned this approach into an efficient means of public service provision with high quality [8]. As a matter of fact, leveraging higher VfM as one of the major drivers throughout the recent decades has paved the way to view PPP as a beneficial and efficient commercial option rather than a financial solution for satisfying the public budgetary deficits. This attribute signifies the element of *collaboration* or *partnership* between government and private sector, which had been emphasized by Davis [37] as the prominent property of PPP, as opposed to opting for this approach as an alternative to "budget gap filler". This turned out to be a persuasive agenda for the U.K. government to make reforms and adjustments to PFI in order to enrich this framework with more terms and conditions that contribute to better delivery of public services. Hence, His Majesty's (HM) Treasury [44] of the U.K. introduced Private Finance 2 (PF2) in 2012 as an updated and revised scheme for public-private partnerships and defined it as a means "to facilitate genuine partnerships between the public and private sectors". Not to mention that prior to this milestone, PFI experienced several stages of reform and adjustments to better satisfy public and private demands, such as the 'Operational PFI Savings Programme' to enhance transparency [44]. In principle, and in order to realize the primary goal of PF2, the major incentives of this scheme were devised to address some of the PFI drawbacks manifested by the U.K. government, such as the slow and expensive procurement process, the insufficient flexibility of PFI contracts during the operational period, the insufficient transparency of the future liabilities imposed by PFI contracts, and so forth [44]. In addition,

risk allocation—which has been characterized as one of the major features of PFI—was argued to have been accomplished inefficiently as the public sector was burdened with higher levels of risk [45].

The partnership between private investors and governments has evidently experienced several reforms and adjustments over the recent decades, and as discussed above, these have not been primarily for the benefit of public financial reservoirs but rather for better provision of public services and higher VfM. Referring to the primary concern of this paper, reviewing the evolution of PPP throughout history indicates that this scheme is beyond the structural frameworks that are attributed to this concept, as discussed in Section 1, such as relational contracting, ECI, procurement models, and so forth. However, this does not imply a negation of the bilateral connection between PPP and such concepts. As a matter of fact, PPP has been employed as a framework for commercial partnership between government and business leaders that has evolved and been modified in accordance with the needs of society, and as a result, it is widely recognized as a **business model**. This section articulates the history of PPP as well as the important milestones that played a substantial role in the transition to this business approach. In this regard, Figure 1 depicts the discussed stages, milestones, and phenomena associated with the PPP's development on a timeline to convey a more vivid and concrete image of the evolution of this model.

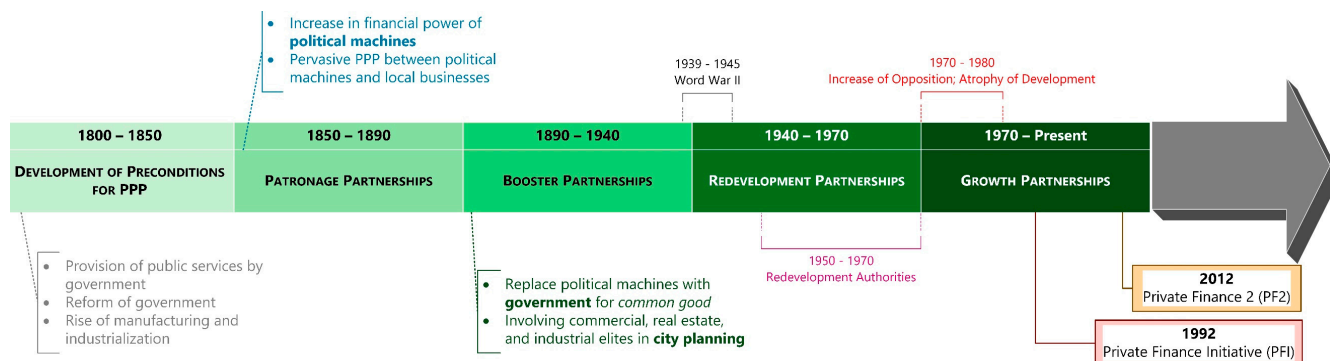


Figure 1. The timeline of PPP evolution, inspired by Beaugregard [1].

5. Bibliometric Analysis: Methodology and Search Process

The accumulation of knowledge provides academia with promising potential for scientific development, and research efforts have provided fruitful achievements through literature review studies. Bibliometric analysis is a promising approach in this context, which is evoked by research in the library and information sciences in the presence of a significant volume of bibliographic material, and thanks to the recent developments of digital tools and rich databases, it has favored many research topics [46–48]. There are numerous examinations involved in this method, and in this paper we opted for keyword co-occurrence and bibliographic coupling, which are in the category of science mapping [47]. The former provides a substantially fruitful overview of the topic by analyzing the connection between the keywords that are used together in a document. The latter relates to “a link between two items that both cite the same document” [49], and in this study the items refer to sources, which are equivalent to journals. This examination not only facilitates the identification of journals with the highest contribution to the topic but also reveals the citation relationship between journals to enable the thematic evaluation and classification of studies surrounding PPP. To aim at these goals, VOSviewer (ver. 1.6.19) software is used, which is characterized by strong analytical capabilities and in-depth visualization features [50]. In addition to the outlined examinations, and according to the discussions regarding the evolution of PPP, it is also of benefit to analyze the publication trend of the accomplished studies, which facilitates an overview of the major patterns and trends in conjunction with impactful milestones.

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 towards any particular

direction, e.g., risk sharing, sustainability, etc., the systematic search is conducted by using only one keyword, which is ‘public-private partnership’. 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. 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. Therefore, and by taking the aforementioned points into account, we use “public-private partnership *” as the search string. Not to mention that 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. The search process was performed on 1 April 2023, and initially resulted in 20,239 records, which were further reduced to 19,240 after applying the filters of ‘language’ (set to English) and ‘publication stage’ (set to Final). The next important step is narrowing down the ‘subject area’ of the studies, which leads to increasing the relevancy of the papers and, ultimately, the reliability of the analysis. Based on the categorizations provided by Scopus, the search results are confined to the following areas: Social Sciences; Engineering; Business, Management, and Accounting; Environmental Science; Economics, Econometrics, and Finance; Energy; and Decision Sciences. This ultimate filter reduces the sample size to 11,700, which is considered the final list for further examination.

6. Results of the Bibliometric Analysis

6.1. Publication Trend

The review of the evolution of PPP throughout history revealed that it was particularly promoted after the 1970s [1,22]. The publication trend (see Figure 2)—including studies published since 1979—depicts that 80.1% of the publications fall into the period of the last 13 years. According to the broad scope of this study, it is primarily interpreted within the context of the global economy. It is significant to highlight that the fourth global recession over the last 70 years occurred in 2009, and according to the sophisticated budgetary issues within governments, the value of PPP was even more elucidated for public authorities to overcome the economic difficulties [51,52]. This is particularly observable from the sharp increase in publications in 2010 (which increased to 443) compared to 2009 (which stood at 350). Another impression from this examination is the introduction of PF2 by the U.K. government in 2012, which was explained in Section 4 as an important milestone within the context of PPP development. In this regard, the number of publications experienced a drastic boost in 2012 (557 publications) compared to 2011 (438 publications), and this was the beginning of an incremental trend. Last but not least is the radical change in the pattern of publication numbers between 2017 and 2022 (2023 is disregarded in this aspect for the sake of consistency of comparison). As shown in Figure 2, 2020 stands out as the most productive year by reaching the peak of 930 publications, whereas in this period, the lowest figure corresponds to 2022 with 792 publications. This signifies a consistent increase in academia’s attention to PPP over the last six years and implies the importance of this approach on a global scale.

6.2. Keyword Co-Occurrence Analysis

One of the key advantages of bibliometric analysis is the quantitative examinations of keywords that are specified by the authors of published research works. This analysis, first and foremost, assists in identifying the dimensions that have been extensively studied by scholars and highlighting the most influential domains within the realm of PPP. Furthermore, by taking advantage of digital tools, the relationship between the most influential keywords is visualized to facilitate a thorough thematic assessment of the population of keywords and their relationships.

The initial examination in this regard is analyzing the frequency of each keyword, which determines the density of attention from academia to that particular domain. According to the sample size, the list of keywords constitutes 34,146 records, and it is dominated by the terminological variations of ‘public-private partnership’. As depicted in Table 2, the adopted search process enabled access to seven variations of PPP, which are sorted by the frequency of their occurrence and collectively account for 8337 records. This is intrinsically predictable because the entire search process was based solely on this term, and thus, it dominates the list of keywords.

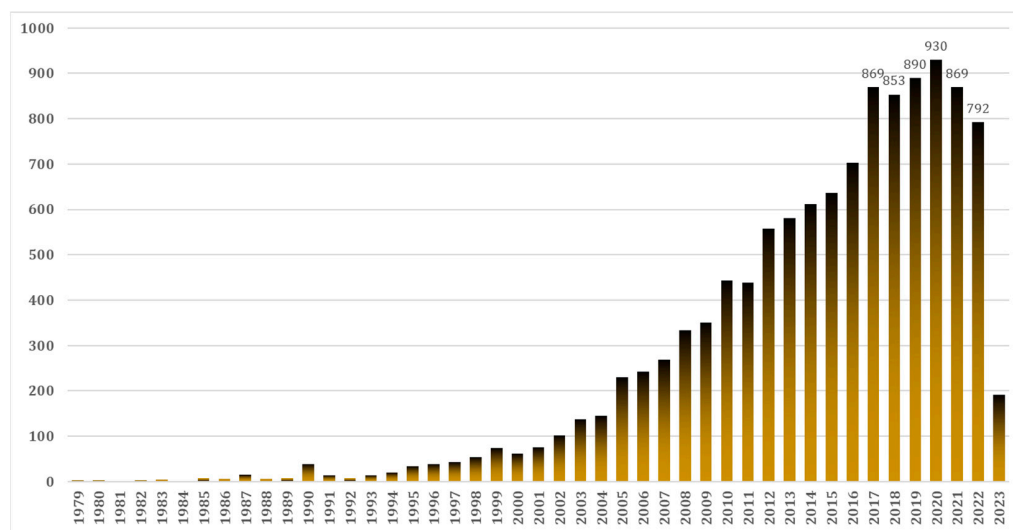


Figure 2. Publication trend of studies surrounding PPP between 1979 and 2023 (1 April 2023).

Table 2. The terminological variations of ‘Public-Private Partnership’ within the collected sample.

Nr.	Terminological Variations of PPP	Occurrences	TLS
1	Public-Private Partnership	3926	1369
2	Public Private Partnerships	2232	894
3	Public-Private Partnerships	1055	528
4	Public Private Partnership	331	178
5	Public/Private Partnerships	294	167
6	Public–Private Partnership	253	75
7	Public–Private Partnerships	246	73

With this fact accepted, the remainder of keywords are investigated regardless of this term, and the results of this part of the analysis depict that ‘human/humans’, ‘mergers and acquisitions’, ‘investments’, ‘sustainable development’, and ‘economics’ constitute the top five used keywords, respectively, with 1184, 677, 639, 572, and 503 occurrences. According to the frequency of occurrence, Table 3 represents the list of the top 10 keywords, led by the outlined terms. It is worthwhile to mention that utilizing each pair of keywords within an article generates a *link* between those keywords, and this connection has a property called *strength*, which is determined by the number of documents utilizing the same pair of terms. As a result, every distinct keyword has a property known as total link strength (TLS), which is calculated by aggregating the strength value of the links pertinent to that particular keyword. For instance, the TLS of ‘investments’ is derived by aggregating the strength value of the links between this specific term and other keywords of the sample that it is connected to, which is calculated as 3148.

Table 3. Top 10 keywords based on frequency of occurrence.

Nr.	Keyword	Occurrences	TLS
1	Human/Humans	1184	7683
2	Mergers and Acquisitions	677	3520
3	Investments	639	3148
4	Sustainable Development	572	2452
5	Economics	503	2870
6	United States	433	1854
7	Risk Assessment	413	2294
8	Decision Making	411	2059
9	Infrastructure	409	1458
10	Risk Management	390	2026

The initial contextual implication derived from the most frequently occurring keyword(s) is the benefits that PPP has delivered to society, particularly urban development, which was also discussed in Section 4 as the primary impact of this business model given its positive and innovative financial properties. According to the second and third most frequently occurring keyword(s), Table 3 signifies that organizational concerns, as well as financial and economic matters, have been constant research subjects in this realm. This is a reciprocal topic, embracing discussions regarding the economic advantages of PPP and debates associated with financial and institutional complexities to ensure higher VfM. Sustainability is considered another dimension that has received remarkable attention from academia. This is arguably significant given the fact that sustainability, particularly within the realm of PPP, maintains an interweaving link with financial issues and economic consequences. The appearance of the term ‘economics’, also signifies the importance of these two topics. Nevertheless, sustainability is not limited to economic matters and supports a wider range of concerns given the multi-dimensional impacts of PPP on society. The appearance of the United States within the list of top 10 keywords depicts the dominant contribution of this nation to the practice and conceptual development of PPP, which was articulated in Section 4. It is also noteworthy to highlight that the assessment of keywords reveals the considerable contribution of other nations and regions as well, even though they are not included in Table 3, such as the U.K., China, Europe, Australia, India, Africa, and so forth. As explained earlier, PPP is widely characterized by particular policies regarding risk sharing between government and private sector, which are specifically observable from Table 3, according to the terms ‘risk assessment’ and ‘risk management’. Although many public authorities and policymakers have considered higher VfM as the main driver of PPP, e.g., PFI [40], decisions on PPP are engaged with a plethora of complexities and uncertainties. Thereby, decision-making forms an inseparable dimension of PPP that is dense in importance. The evaluation of PPP history in Section 4 depicts that better provision of public services is among the rudimentary motivations of PPP. In this regard, Table 3 implicates that this is still a viable driver according to the presence of ‘infrastructure’ in the list of top 10 keywords. It is worthwhile to mention that infrastructure projects are not limited in type and are dichotomized according to their function [5]: *economic* and *social* infrastructures. The former contributes to ‘day-to-day’ economic activities, e.g., transport, water, sewage, electricity distribution, etc., while the latter is essential for the structure of society, e.g., schools, hospitals, libraries, prisons, etc.

The second examination is co-occurrence analysis, which investigates the relationship between keywords based on the link between each pair of terms. In this regard, a higher value of TLS indicates higher utilization of the corresponding keyword with other keywords, which in turn implies the significance of that topic and its contextual relevance to other topics. To better benefit from such quantitative data and perform more in-depth analysis, Figure 3 illustrates the correlations between keywords, where the nodes represent keywords and the lines demonstrate the link between them. In this regard, the size of nodes is determined by the frequency of occurrence associated with each keyword, and the thickness of lines is sensitive to the strength of the link between each pair of keywords. The

Group A conveys a wide range of information associated with PPP, which briefly represents the characteristics of this business model. PPP is broadly recognized for its detailed risk allocation, be it more efficient or more complicated, as well as being referred to as a commercial alternative with a prominent role for the private sector as the investor. This is dominantly observable within Group A according to the links that connect PPP with highly utilized keywords in this context, such as risk assessment, risk allocation, investment, economics, finance, and so forth. In addition, and given the financial advantages of PPP, Group A represents the practicality of PPP for developing countries. Needless to mention, Group A affirms that an intense focus from academia has been directed to infrastructure projects, which is particularly one of the major applications of PPP, as also discussed in Section 4. The other dimension of Cluster 1, demonstrated by Group B, primarily depicts sustainable development concerns in conjunction with PPP. A closer evaluation of two major keywords in this context—sustainability and sustainable development—illuminates two directions within the scope of sustainability that have been investigated by academia in the realm of PPP: economic and environmental sustainability. According to Figure 3, economic sustainability is strongly revealed through extensive connections to the keywords of this context (involved in either Group A or Group B), such as investment, commerce, economics, budget control, finance, and so forth, and the latter embraces solid links to climate change and waste management. A practical overview of Cluster 1 also indicates that transportation, urban development, and water supply are the most prominent project sectors that have extensively benefited from PPP. Cluster 2 elucidates that PPP has been investigated and practiced for the enhancement of society, and this is specifically directed towards health and education. Human, health care delivery, public health, and education are only a few of the keywords that signify this fact. It is noteworthy to highlight that even though the keyword ‘COVID-19’ is not observable in Cluster 2, it has appeared 94 times within the sample, and it is notably close to the minimum threshold of occurrences for the generation of the co-occurrence network (which is 100). As a matter of fact, even though the unfortunate pandemic of COVID-19 took place in late 2019, there has been a considerable effort from academia in a period of 3 years, which indicates the potential of PPP in response to global health issues.

6.3. Bibliographic Coupling

Bibliographic coupling serves as another quantitative examination that investigates the relationship between items—an item refers to a journal in this study—through the identification of a document that has been cited by two distinct documents from two distinct sources. In other words, any pair of documents associated with two different sources are linked to one another provided that they have both cited the same reference, and this correlation generates a link between the sources pertaining to that pair of documents. In this context, the *strength* of a link between two sources is determined by the frequency of the pairs of documents that satisfy the explained condition. Thus, the TLS in this case is calculated by aggregating the strength values of the links associated with each source. The available sample comprises 4105 distinct sources, and this list is to be narrowed down according to two significant properties for network generation: the minimum number of documents pertaining to each source and the minimum number of citations that each source has received. We set both properties to 20, which limits the sample size to 66 distinct sources. To ensure higher reliability, the sources with TLS lower than 100 were removed, which resulted in the elimination of 12 further sources.

The results are illustrated in Figure 4, encompassing three clusters. In this visualized network, the size of nodes represents the magnitude of citations received by individual sources, and the thickness of lines is determined by the strength of the link between each pair of sources. Taking the number of citations received by a journal into account, the most cited sources that are involved in the sample have played a major role in the bibliographic network of Cluster 1. Considering 54 distinct sources that are incorporated into this examination, the top three sources with the highest number of citations are in-

cluded in this cluster: 'International Journal of Project Management' (IJPM), 'Journal of Construction Engineering and Management' (JCEM), and 'Sustainability (Switzerland)', respectively with 8412, 4669, and 3108 citations. These sources, according to their citations and TLS records, act as three centers of gravity that determine the conceptual orientations of this cluster according to their links with other sources. The connections between the sources of this cluster, which are not limited to the abovementioned journals, highlight two major directions in the studies of the research community: the organizational management of PPP and sustainability. The initial direction is led by IJPM and JCEM, which are inherently multidisciplinary journals based on their aims and scopes. In this regard, and according to the prominent connections between these journals and particular sources of Cluster 1, e.g., Journal of Management in Engineering (JME), Energy Policy, Utilities Policy, etc., it is revealed that there has been a noticeable effort from academia to upbuild the knowledge surrounding PPP from a strategical and administrative standpoint. This is, in fact, a promising aspect of academic efforts to foster the commercial properties of PPP and facilitate the better establishment of this business model. Secondly, the Journal 'Sustainability (Switzerland)' has formed a cross-disciplinary network through a variety of connections with different sources. The immediate impression of this matter indicates the incremental trend of sustainability-related studies that are carried out in various directions and disciplines, particularly with respect to the strategic and policy-making studies corresponding to PPP. In addition, this journal substantiates the feature of sustainability within Cluster 1 and via solid links with other sources in this context, i.e., the Journal of Cleaner Production, Environmental Management, etc. It is worthwhile to mention that the strong link between the Journal 'Buildings' and the aforementioned journals sheds light on the significant contribution of two acknowledgeable publishers in the realm of PPP: 'The American Society of Civil Engineers (ASCE)' and 'Multidisciplinary Digital Publishing Institute (MDPI)'. The substantial contribution of 'Construction Management and Economics' (CME) and 'Engineering, Construction and Architectural Management' (ECAM), respectively, with 2857 and 1244 citations, has turned these sources into determining points of attention within Cluster 2. The bibliographic network surrounding these journals and their connections with other sources shed light on three major dimensions pertaining to the research works published by the journals of Cluster 2: economics, construction, and transportation. Finance and economy, as also described in Section 4, are the core driving factors of PPP that interact with other elements. Given PPP as a business model, the initial dimension of Cluster 2 signifies this vital and structural feature of PPP, which is observable through the connections of CME with other sources in this cluster. Furthermore, and without compromising the impact of CME, the latter direction of Cluster 2 is led by ECAM and reveals the research focus on the more practical and constructional aspects of PPP projects. Design, project lifecycle management, and architecture, just to name a few, are among the major streams of research in this context. Last but not least is the interweaving link between the outlined sources and journals, with a specific focus on the transportation sector. 'Research in Transportation Economics', 'Transport Reviews', and 'Transportation Research Record', respectively, with 748, 720, and 514 citations, are the prominent sources in this regard. The thematic concern of Cluster 3 relates to two major areas that can be addressed by PPP: urban life and societal demands. 'Habitat International', 'Public Management Review', 'Public Administration', and 'International Journal of Urban and Regional Research' are some of the most contributing journals in this regard, respectively with 1802, 1728, 1449, and 1185 citations. It is worthwhile to highlight that urban development and societal urges were studied as the major stimuli of PPP throughout Section 4, and Cluster 3 indicates the attention of scholars to these dimensions. A remarkable point to consider in this context is the connection of 'Sustainability (Switzerland)' with many of the sources of this cluster, e.g., 'Cities', 'Journal of Urban Affairs', etc., which represents the multidimensional impact of sustainability on PPP studies, particularly with regard to human life and public administration. Table 4 summarizes five of the most impactful sources in each cluster, which are sorted out according to their respective citation values.

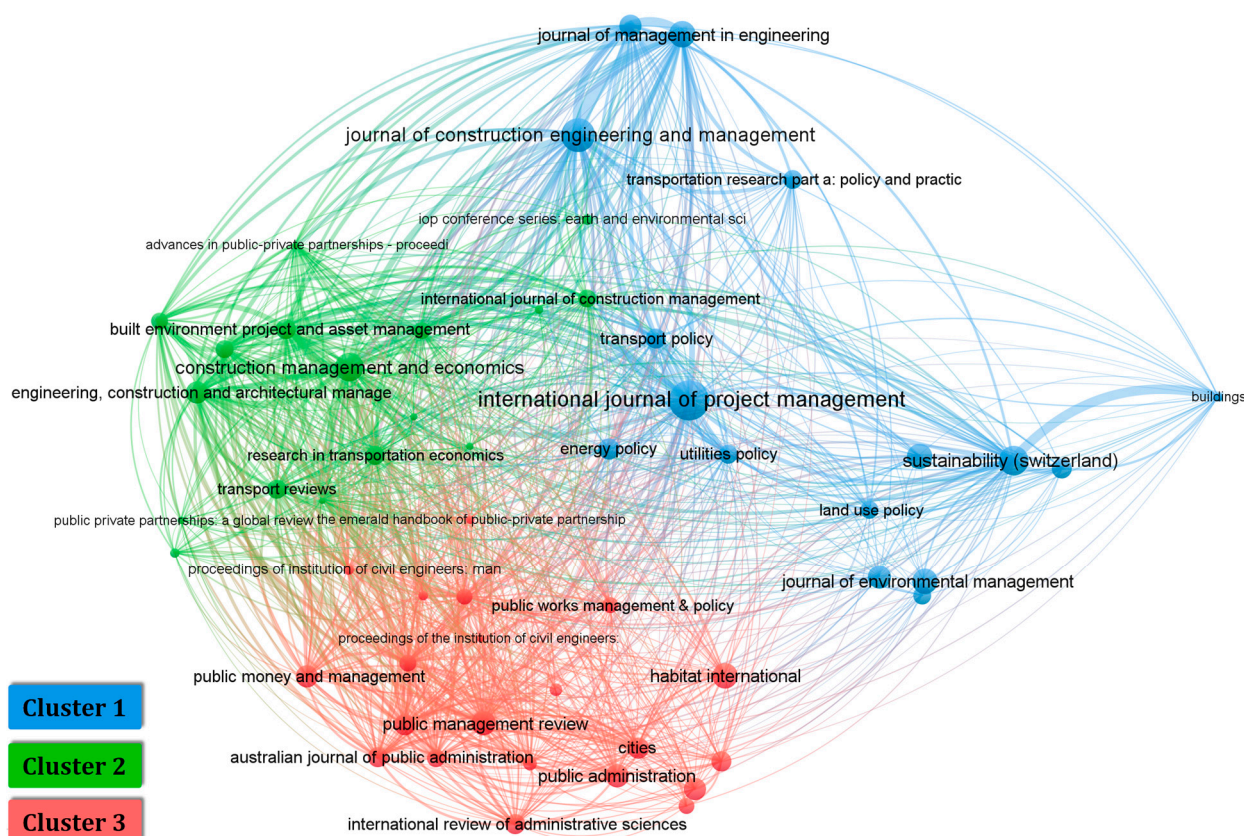


Figure 4. Network map of bibliographic coupling based on the sources (journals).

Table 4. Top five sources (journals) with the highest impact on each cluster, sorted by citation value.

Cluster	Source (Journal) Title	Nr. of Documents	Citation	TLS
Cluster 1	International Journal of Project Management	76	8412	3434
	Journal of Construction Engineering and Management	94	4669	5636
	Sustainability (Switzerland)	261	3108	2806
	Journal of Management in Engineering	71	2282	4465
	Journal of Cleaner Production	46	1935	338
Cluster 2	Construction Management and Economics	59	2857	4518
	Engineering, Construction and Architectural Management	54	1244	4870
	Built Environment Project and Asset management	63	945	4303
	Research in Transportation Economics	42	748	814
	Transport Reviews	21	720	1872
Cluster 3	Habitat International	27	1802	546
	Public Management Review	40	1728	3138
	Public Administration	30	1449	918
	International Journal of Urban and Regional Research	26	1185	440
	Public Money and Management	46	1176	1301

7. Further Discussion and Research Agenda

The expansion of urban areas, the rise of manufacturing and industrialization, and the reforms of government were among the prominent elements that shaped the ground for a novel paradigm of commercial partnerships between government and business owners, so-called PPP [1,36]. On the one hand, the public authorities had encountered societal challenges that required extra funding sources, e.g., demand for better public health, necessity of police and fire services, etc., and on the other hand, the private sector was suffering from weak infrastructure and public administration. Thus, a business partnership emerged

between the public and private sectors that was in favor of satisfying the objectives of both parties. In other words, the societal demands and commercial goals of the government and private sector were in a synergic and bilateral stream that led to the advent of a more efficient mobilization of resources in pursuit of better service delivery and infrastructure. These elements were the rudimentary drivers for establishing a partnership within the framework of PPP in the early 1800s. Although numerous studies, unions, and authorities have sought to provide an inclusive definition of PPP, they have merely presented a 'function-specific' explanation of this concept, as also emphasized by Brinkerhoff and Brinkerhoff [53]. The risk-transferring and sharing approach [54] and the long-term contract between the public and private sectors [55] are only a few instances in this context. Therefore, regardless of such functional definitions, the assessment of PPP evolution helped to recognize PPP as a business model that seeks to satisfy the mutual objectives of the public and private sectors, which are societal and commercial goals, respectively, and facilitates the atmosphere and conditions for optimal resource mobilization. This comprehension serves as an operational definition that presents PPP as a business chapeau and enables better mapping and approaching of the topics and elements that are attributed to this concept. Thus, this perception not only resonates the importance of these elements and drivers but also suggests approaching them within a commercial framework, including, but not limited to, risk sharing and private investment options [5], performance measurement, transparency concerns, and achieving higher VfM [56], contracting parties and special purpose vehicles (SPVs) [57], and so forth.

The development of PPP revealed that the incorporation of private business and funding has extensively favored governments in addressing societal challenges. To reflect the major streams of focus within the research community in the realm of PPP, an extensive list of research items, including 11,700 references, was utilized in order to conduct a thorough bibliometric analysis. This assessment, first and foremost, demonstrated the advantages of PPP in response to universal crises such as the global recession, the health pandemic, and so forth. This emanates from the practice of PPP in absorbing grand business leaders and private investments, which satisfies mutual benefits through the mobilization of resources. Further examinations, and particularly evaluation of the keywords and the most contributing journals, enabled a thematic review of academic efforts pertaining to the last five decades—from 1979 to 2023—and the results are classified and concisely discussed as follows:

- **Contributing nations and regions:** Although PPP is not a new concept, it has not been practiced and developed evenly throughout the globe. The keyword analysis revealed that nations and regions with a more impactful and larger economy have made a higher contribution to the application and conceptual development of PPP, such as the U.S.A., U.K., China, Europe, Australia, and so forth. It is worth mentioning that this does not imply ranking the most contributing countries/regions, given the fact that this assessment was not based on enumerating the PPP projects associated with each individual geographical section. For instance, according to Pu et al. [58], the number of PPP projects in China had reached a record of 14,424 by 31 December 2017, which is not comparable to many regions and nations. As a matter of fact, the number of case studies associated with each country, along with its contribution to the conceptual development of PPP, are the primary factors for a nation/region to be highlighted in this assessment.
- **Application areas and project sectors:** The most eminent applications of PPP are urban development and the delivery of public infrastructure. As also discussed earlier, PPP was incited by the pale societal situation and civic needs, and thus, improvement of habitat areas and public services were the primary drivers in this regard. This objective goes hand in hand with the development of several project sectors, and the results of bibliometric analysis revealed the most important ones, including, but not limited to, transportation, water supply, waste management, healthcare, and education. In fact,

the economic capacities and versatile characteristics of PPP enable this business model to contribute to various sectors.

- **Economic and organizational management:** Due to the incorporation of private funding and the large scale of organizations involved in a PPP project, it is majorly advised for the accomplishment of complex projects [7]. From a commercial perspective, this implies that the economic and financial aspects of PPP must be justifiable for both parties. On the other hand, and from the operational perspective, this complexity necessitates significant attention to the organizational management of a PPP project, which in turn embraces a long array of concerns, e.g., procurement procedures, contractual arrangements, project ownership, etc. [6]. In this context, the bibliometric analysis shed light on some major aspects of academia's focus that are classified as the economic and organizational management of PPP: economic and financial assessment of PPP, risk sharing, improvement of policies surrounding the application of PPP, contracting, and so forth.
- **Sustainable development:** It is also vital to highlight the interplay between sustainability and other dimensions of PPP that were discussed in this regard. The results of the bibliometric analysis demonstrated that sustainability has influenced the studies associated with PPP in two major aspects, which are economic and environmental sustainability. In this regard, sustainability puts emphasis on strategic decisions and policies regarding PPP by covering a wide range of topics such as investment, budget control, climate change, and so forth. It is also worthwhile to highlight that within the framework of sustainable development goals (SDGs), UNECE has pushed the frontiers of sustainability in conjunction with PPP and articulated this concept by prioritizing sustainable economic recovery and reconstruction, sustainable PPP and infrastructure finance, and green PPP procurement, just to name a few [59].

Future Research Agenda

Although the bibliometric analysis favored highlighting the main streams of the research works, it is also helpful in revealing the aspects that have received limited attention, and this section sheds light on these themes as recommendations for future studies.

- **Value for Money (VfM):** According to the stimuli of PPP that are broadly discussed by researchers, achieving VfM is inevitably one of the major motivations for public authorities to select this model over the traditional project delivery alternatives, which was also emphasized within the frameworks of PFI [40,41]. However, a deeper evaluation of keywords reveals that this term has been used only 85 times, which is not comparable to the prior discussed domains. Further assessment in this regard depicts that the most considerable link between VfM and other keywords in the sample is limited to 'Public-Private Partnership'. Although this is an indicator of a logical conceptual link, it signifies a shortage of academic effort in this area. This implies that a substantial amount of research is demanded from researchers regarding VfM and other dimensions of PPP.
- **Technology and Innovation:** Technological advancements have contributed to the improvement of operations and administration in various industries and organizations throughout the last couple of decades. Although manufacturing, aerospace, and medical science, just to name a few, have extensively benefited from the advantages and opportunities delivered by the recent technological improvements [60], e.g., industrial robots, collaborative robots (Cobots), 3D printing, artificial intelligence (AI), etc., there are various digital technologies that have contributed to the construction industry [61], e.g., building information modeling (BIM), geographical information systems, virtual reality (VR), augmented reality (AR), etc. Despite significant potential lying in this area, the analysis of keywords shows that limited research has addressed this direction. 'Technology', 'Technological Innovation', 'Technological Development', 'Technology Adoption', and 'Technology Transfer' are the only keywords that exist within the sample, and their frequency of occurrence ranges from 28 to 68, except for the last one,

which is 122. In addition, they have zero connection with other keywords, and the only observable link is with ‘Public-Private Partnership’, which is still weak. Hence, it is of significant benefit to investigate the potential of incorporating digital technologies into PPP, which in turn could be accomplished in several directions, such as procurement management, digitalization of PPP phases, and so forth.

- *Smart Infrastructure (SI) and Smart City (SC)*: Given the new era of urbanization developed under the impact of technological advancements, smart infrastructure (SI)—which is characterized as a bridge towards smart education, smart living, smart safety and security, smart economy, smart mobility, and smart communication—has been discussed as the prerequisite for developing smart cities (SCs) to address sustainability concerns [62]. This agenda requires particular expertise, financial mobilization, and concrete cooperation between governments and private sectors, which are potentially satisfied through PPP [63,64]. According to the importance of this topic towards meeting sustainable development goals (SDGs) as well as addressing urban life issues, there is limited research in this area in connection to PPP. In this regard, the assessment of keywords indicates limited research from academia, given only 65 occurrences for ‘smart cities’ as the only keyword appearing within the sample. Hence, it is deemed essential to put more efforts into this direction in order to explore and harness the potential of PPP with regards to developing a more sustainable society through SI and SCs.

It is noteworthy to mention that the proposed domains for future research works are not binding in terms of application given the generic scopes of this paper regarding PPP, nor are they limited to the enumerated above list according to the multidimensional structure of this business model. Moreover, and particularly given the role of technology, the provided discussion seeks to elucidate a holistic framework and trigger further elaboration on this dimension, aiming at better harnessing the potentials of digital solutions within the realm of PPP. It is also important to highlight that the outlined agenda does not neutralize the significance of current research areas, as pointed out in this study, but rather attempts to illuminate the promising directions that demand more attention from academia and are in favor of addressing several trending concerns of PPP and even society, which is one of the major beneficiaries of this approach.

8. Conclusions

The broad international application of PPP and decades of research in this regard have not only contributed to an extensive accumulation of knowledge and experience but, on the other hand, have imposed difficulties in deriving a unified comprehension of this concept. Variety in definitions provided by governments and international expert unions, different contractual arrangements, and diversity in conceptualization and classification of PPP are only a few of the additional factors that hinder conceiving a more solid perception of this model. While numerous review studies have been carried out focusing on different aspects of PPP, e.g., risk allocation, stakeholder management, contract management, project investment, etc., only a limited number of those have addressed this topic from a more holistic perspective. Hence, this study put forward to present a more transparent comprehension of PPP through the elaboration of its evolution throughout history and the analysis of the academic works surrounding this topic. To achieve that aim, we sought the answers to two research questions, which are concisely reflected below:

- Research Question 1: We conducted a narrative review to present a wide perspective of the structural development of PPP within the last couple of centuries, and particularly within the political economy environment. This assessment shaped the groundwork to recognize PPP as a business model and to illustrate a detailed timeline of PPP evolution, embracing the fundamental elements and milestones contributing to the structural development of this concept.
- Research Question 2: We employed the bibliometric analysis method and utilized the bibliometric data of studies pertaining to the last five decades, from 1979 to 2023. This

method favored in conducting profound assessments of the PPP extant literature by using three quantitative examinations, i.e., publication trend, keyword co-occurrence analysis, and bibliographic coupling, which are accompanied by the corresponding in-depth interpretations. We also proposed a research agenda, including three major directions, to provide insights on future research regarding PPP.

Reviewing the structural development of PPP throughout the last couple of centuries and particularly under the impact of the political economy environment, we elucidated four major phases for the evolution of this concept: patronage partnerships, booster partnerships, redevelopment partnerships, and growth partnerships. Studying the decisive regional and global milestones in this evolution path and identifying the financial capacities and economic impacts as the core aspects of PPP led to the recognition of this concept as a *business model* that emerged and developed in response to societal, economic, and even global urges. The publication trend—studies carried out between 1979 and 2023—primarily depicted that almost 80% of the papers were published after 2010, a trend that has been under the influence of various factors and phenomena, such as the financial advantages of PPP in response to the economic crises and the introduction of PF2 by the U.K. Further examinations of the bibliometric analysis initially demonstrated that the U.S.A., U.K., and China, just to name a few, have had the highest contribution to the conceptual development and application of PPP. Urban development and delivery of public infrastructure were identified as the most prominent applications of PPP, followed by other project sectors that have benefited from PPP, including, but not limited to, transportation, water supply, waste management, healthcare, and education. Apart from the application areas of PPP, the overall outlook of the keyword co-occurrence analysis and the bibliographic coupling illuminated two major streams within the research works: economic and organizational management and sustainable development. The former majorly emphasizes the strategic decisions and policies surrounding PPP projects and embraces a wide spectrum of concerns, which include, but are not limited to, risk allocation, economic and financial assessment of PPP, improvement of policies regarding the application of PPP, and contracting. The latter is an integration of economic and environmental sustainability. The interaction between sustainability concerns and other aspects of PPP elucidated that the research community has focused on the incorporation of sustainability into the strategic and administrative decisions pertaining to PPP. This highlights not only the significance of environmentally friendly projects but also the vital role of accomplishing a PPP project with sustainable financial decisions.

Although numerous studies have been carried out within the realm of PPP, the bibliometric analysis enabled the identification of areas that have received limited attention from academia. In this regard, this paper recommends three major directions for future research: (1) value for money (VfM); (2) technology and innovation; (3) smart infrastructure (SI) and smart city (SC). Despite the fact that the importance of VfM is well-justified as one of the major drivers and pillars of PPP, such as in PFI and PF2, the keyword analysis implicated the necessity of more research in this area. Moreover, according to the potential benefits of technology and digitalization, there is a particular essence to harnessing the advantages delivered by digital and technological solutions. In this regard, it is deemed necessary to conduct meticulous investigations on the challenges of PPP projects that can be addressed by technological and innovative solutions, which in turn lead to a more sustainable and efficient delivery of projects with PPP. Last but not least, and also following the sustainable development goals, SI and SC are two important areas that are in the early phases and demand more studies from both the organizational management of PPP and technical aspects.

This study put forward the idea of conducting a review of PPP at a high abstraction level and contributed to presenting a more transparent comprehension of this business model. Although the assessment of PPP evolution and quantitative evaluation of the extant literature surrounding this topic were fruitful in satisfying that objective, this research was under the influence of some limitations that are worth mentioning. According to the

scope of this study, assessment of the PPP's evolution was maintained at a general level and based on holistic elements. This implies that microfactors are not incorporated into this phase, and the presented timeline embraces only major milestones. The bibliometric analysis was conducted on the sole basis of the records retrieved from the Scopus online database; however, it is of significance to use other well-recognized online databases, such as WoS, and merge the results of these databases to benefit from a more extensive list of records. Moreover, limiting the list of articles with an English language filter automatically eliminates research works carried out in other languages. While this is an inevitable consideration, it implies disregarding potentially influential research that is published in other languages. Thereby, we recommend addressing the outlined limitations throughout future research in this context.

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