Making Sense of the Definition of Public-Private Partnerships

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Abstract

Purpose: Despite the widespread study and application of Public-Private Partnerships (PPPs) since the 1980s, the field lacks a universally accepted definition that captures the concept's complexity. This study aims to offer a definition and foster a more substantive and comprehensive discourse on PPPs to improve communication and understanding between academics and practitioners from diverse disciplines and legislative backgrounds.

Design/methodology/approach: Grounded in the family-resemblance concept proposed by German philosopher Ludwig Wittgenstein, this study conducts a comprehensive literature review to identify core and non-core elements frequently cited in PPP descriptions. We used these findings to develop the PPP Sunflower Model as a structured framework for defining PPPs.

Findings: Our analysis elucidates six core elements consistently present in PPP descriptions: clarity of roles and responsibilities, appropriate risk allocation and sharing, injection of expertise and resources, cooperation and teamwork, a bundle of services, and long-term contracts. Coupled with identified non-core elements, these core components comprise the PPP Sunflower Model, a structured framework for defining PPPs that accommodates their multi-faceted nature.

Originality: The PPP Sunflower Model distinguishes itself as a unique contribution to the PPP literature. It offers a rigorous theoretical framework that can elucidate the complexity of PPPs for various stakeholders. The model serves as a practical tool for evaluating the authenticity and viability of PPP projects. The study's novelty lies in its adoption of the family-resemblance concept, thereby providing a comprehensive, multi-dimensional framework that enhances the understanding of PPPs across different disciplines and legislative contexts.

Keywords

Public-Private Partnership; Family-Resemblance; Ludwig Wittgenstein; Sunflower Model

1. Introduction

Public-Private Partnerships (PPPs) have been widely adopted by governments worldwide as an alternative way of developing public infrastructure and delivering public services over the past four decades (Chan et al., 2009). Despite the increasing attention that PPPs have received from academics and practitioners since the 1980s, there is still no universally accepted definition for this complex concept.

The absence of a universally accepted definition arises from factors such as conceptual vagueness, a multiplicity of definitions, ideologically-based advocacy (both pro and con), and disparate research traditions (Brinkerhoff and Brinkerhoff, 2011). For example, one contributing factor is the existence of various types and variations of PPPs (World Bank, 2017), such as user-pays vs government-pays PPPs, conventional vs institutional PPPs, infrastructure vs service PPPs, and conventional vs co-financed PPPs. Moreover, countries

differ in their adoption of PPPs based on procurement traditions, regulatory frameworks, institutional structures, and other macro-environmental factors.

Given this complexity, there is a pressing need for a common understanding of PPPs to facilitate the development of international investments in PPP projects and improve the communication efficiency between academics and practitioners from different backgrounds. This paper aims to contribute to that need by developing an innovative and meaningful approach to defining PPP. Our ambition goes beyond merely crafting a definition; we seek to stimulate a nuanced dialogue on the multifaceted nature of what PPPs can and should represent, catering to both academic inquiry and practical application.

This paper presents a comprehensive literature review on the definition of PPPs and their elements, justifying the use of Ludwig Wittgenstein's family-resemblance concept to define PPPs. The research design method is then detailed, followed by the presentation of the results. Essential elements of the PPP definition are discussed, and the proposed definition model is demonstrated in selected cases. Finally, the paper summarises the findings and offers recommendations to the construction engineering and management community.

The new framework for defining PPPs is both innovative and practical. Designed with a focus on universal applicability, it provides a concise yet comprehensive method for understanding PPPs across a variety of types, countries, and legislative contexts. Beyond serving as a theoretical underpinning that articulates the core elements of PPPs, this framework also functions as an actionable tool that allows decision-makers to assess the authenticity of a PPP project. By establishing a coherent and consistent definition of PPPs, the framework acts as a bridge, enhancing communication and understanding between academics and practitioners. Moreover, it aims to foster a richer, more unified global discourse on PPPs, thereby contributing to the field's ongoing development.

2. Literature Review

The concept of PPPs lacks a universally accepted definition, with varying interpretations depending on the context and stakeholders involved. The World Bank (2017) describes PPPs as: “a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility and remuneration is linked to performance.” The Organisation for Economic Co-operation Development (2008) defines PPPs as “an agreement between the government and one or more private partners (which may include the operators and the financers) ... within the agreement, the private partners deliver the service so that the service delivery objectives of the government are aligned with the profit objectives of the private partners.” The European Commission (2003) states PPPs as forms of cooperation between public authorities and the world of business that aim to ensure the funding, construction, renovation, management and maintenance of infrastructure for the provision of a service. In Australia, PPPs are “a long-term contract between the public and private sectors where the government pays the private sector to deliver infrastructure and related services on behalf, or in support, of government’s broader service responsibilities” (Department of Infrastructure and Regional Development, 2008). In China, the English abbreviation is PPPs; the Chinese term is defined as long-term contractual collaborations between the government and societal capital in infrastructure and public services. The introduction of the term “societal capital” indicates that the Chinese government collaborates not only with private investors but also with state-owned enterprises that are

the leading players in the role of the “private” sector in PPP projects (Tan and Zhao, 2019). All these definition examples differ not only in the wording choices but also in the inclusion of definition elements. They vary in their emphasis on risk and management responsibilities, the types of activities that can be included, and the stakeholders involved. The World Bank (2017) and the Organisation for Economic Co-operation and Development (2008) both emphasise the importance of risk and management responsibilities being shouldered by the private party. The European Commission (2003) expands on this, highlighting the range of activities that can be included in a PPP arrangement. The Chinese definition of PPPs suggests that the Chinese government views PPPs as a means to involve a wider range of stakeholders in infrastructure and public service provision.

In previous studies explaining PPPs, their unique characteristics compared with traditional procurement methods were often mentioned, such as a long-term concession period, private sector involvement in public service, and closer collaboration between public and private sectors (Chan et al., 2009). Such characteristics may also be called characteristics, features, meanings, and elements. For instance, Linder (1999) discussed six distinctive uses of the term PPPs: management reform, problem conversion, moral regeneration, risk shifting, restructuring public service, and power sharing. Although Linder (1999) did not focus on the conceptual definition, his examination of multiple meanings of the term PPPs provides a thoughtful insight into the essential elements of PPPs. Similarly, Khanom (2010) explored the conceptual issues associated with defining PPPs, including as a way of managing and governing organisations, as an institutional arrangement for a financial relationship, as a development strategy, and also as a language game. Her review of different definitions reinforced that there is no precise agreed definition of PPPs but there are common features across the different definitions (Khanom, 2010). Brogaard and Petersen (2018) mainly looked at the concept of PPPs from the perspective of development policy and framed eight common characteristics: (1) roles, sharing of resources, risks and responsibilities, (2) participants from the public, civil society and private sectors, (3) partnership commitment, (4) organisation and governance, (5) alignment with local context, (6) common development objective, (7) partnership function and purpose, and (8) sustainable effects.

The clarification of critical features of PPPs is also commonly seen in governments’ PPP guidelines. Taking Australia for example, the PPP model in Australia has several vital features, including service focus, core services, payment for services, whole-of-life, financial discipline, output specification, value for money, public interest, contract term, contract management, risk allocation and standard commercial principles (Department of Infrastructure and Regional Development, 2008).

Essential elements of PPPs can also be addressed as critical success factors (CSFs) because CSFs represent both internal and external key areas of activity in PPP projects where favourable results are vital for the project’s success. Hence, the internal key areas can be interpreted as elements of PPPs. Literature on PPP CSFs was hence reviewed, such as Osei-Kyei and Chan (2015) that methodically reviewed studies on the CSFs for implementing PPPs from selected top-tier academic journals from 1990 to 2013. Those external CSFs, such as factors related to the regulatory framework, institutional framework, and market conditions, were excluded as they are irrelevant to defining PPPs.

Our study aims to furnish a multi-dimensional and nuanced comprehension of PPPs, moving beyond the limitations of a simplified definition. This approach is substantiated by

the above comprehensive literature review that spans an array of dimensions—encompassing the concept, definition, characteristics, features, meanings, elements, and internal CSFs of PPPs. By incorporating these diverse elements, our framework transcends the traditional emphasis on merely contractual or financial aspects, thereby capturing the multifaceted operational realities that play a pivotal role in the success or failure of PPPs. In the pursuit of this comprehensive understanding, 26 PPP elements were identified, including agreed problem resolution methods (E1), appropriate risk allocation and sharing (E2), clarity of roles and responsibilities among parties (E3), clear output specifications (E4), cooperation and teamwork (E5), competitive and transparent procurement (E6), government affordability (E7), government support and guarantees (E8), improvement in efficiency (E9), improvement in project governance (E10), improvement in project management (E11), injection of expertise and resources (E12), innovations (E13), long term contract (E14), monitoring and accountability (E15), innovative finance for both parties (E16), open and constant communication (E17), performance-based payment (E18), project economic soundness (E19), bundle of services (E20), strong commitment by both parties (E21), strong private consortium (E22), strong public agency (E23), trust (E24), value for money (E25), and win-win philosophy (E26). These identified PPP elements will be used for coding in this study.

3. Using Ludwig Wittgenstein's Family-Resemblance Concept to Define PPPs

The numerous definitions of PPPs mentioned above show the difficulty of giving a concise and comprehensive explanation of the PPPs concept. After reviewing different definitions of PPPs, Khanom (2010) reinforced that there are common features across the different definitions. However, different types of PPPs exist with varying characteristics, making it difficult to agree on which elements to include in a definition. This challenge aligns with the German philosopher Ludwig Wittgenstein's argument that complex concepts cannot be defined in a traditional way by stating necessary and sufficient conditions (Wittgenstein, 2009). Ludwig Wittgenstein proposed a “family-resemblance” concept. For example, all family members may not have any common features, but the daughter could have the “same” eyes as her father, while the son could have the “same” nose as his father. As such, the “family-resemblance” concept can embrace a few different characteristics to define a multifaceted concept in a more flexible and structured manner. In the construction sector, Nyström (2005), Yeung et al. (2007), and Yeung et al. (2012) adopted Ludwig Wittgenstein’s family-resemblance concepts to successfully define partnering, alliancing and relational contracting, respectively, all of which are complex and multi-faceted concepts. Ludwig Wittgenstein’s “family-resemblance” concept hence has the potential to be adopted to define PPPs.

4. Research Methodology

The process of conducting the study is presented in Figure 1.

Insert Figure 1 here

Step 1 of the research process is to define research questions and plan for the research. This study aims to develop an innovative and meaningful approach to defining PPPs. A comprehensive literature review is the primary method adopted in this paper, which attempted to look at how often different elements are mentioned in the descriptions of PPPs and then apply the family-resemblance approach to the frequency results. In particular, a

detailed content analysis was conducted to achieve the purpose of resembling different elements of PPPs. Content analysis is a summarising analysis of messages that follows the standards of the scientific method and is not limited to the types of variables that may be measured or the context in which the message is created or presented (Neuendorf, 2017). The method has come into wide use in different research areas, such as nursing and health (Vaismoradi et al., 2013), information technology (Kim and Kuljis, 2010), social media (de Swert, 2012), and construction (Bryde et al., 2013).

Step 2 is to select a sample for the content analysis, which is those high-quality journal articles in English. The literature was selected from the databases of Science Citation Index Expanded, Social Sciences Citation Index and Emerging Sources Citation Index at Web of Science, one of the world's most trusted citation indexes for scientific and scholarly research. The titles of the journal articles were scanned with the keywords 'Public-Private Partnership' and 'Public-Private Partnerships'. In total, 2496 articles were found. To maintain the efficiency and effectiveness of the following content analysis process, only the top 50 most cited papers were included in this study. Many journal articles discussing the topic of PPPs are not shown in the search results because they may use other terms such as Build-Operate-Transfer and Private-Finance-Initiative or because they did not put the term PPPs in the title. Nevertheless, the purpose of the literature search is not to find the whole population of PPP journal articles but to identify a reasonable sample of high-quality journal articles. The literature search process mentioned above is hence appropriate.

Step 3 is to code the content analysis results, i.e., the frequency of key elements mentioned in the description of PPPs. Human coding was adopted in this study, involving the authors as coders, with each using a standard coding form to review the description of PPPs in each selected high-quality journal article and to record their careful observations on the usage of PPP elements explicated in the coding form. The main challenge of the coding process lies in two issues: first, not all authors clearly explained their agreed definition of PPPs in their papers; second, there are complex language contextual nuances. Therefore, one of the limitations of this study is the required subjective judgment from the coders during the coding process. An agreement was achieved through a discussion among the coders. The coding form includes two parts, i.e. the article reference and a list of PPP elements. As explained in the section Literature Review, the PPP elements were identified before the coding and derived mainly from the literature. Twenty-six PPP elements were identified and adopted in the coding form. The coding results are presented in Section 5.1.

Step 4 is to resemble those frequently mentioned PPP elements in the description of PPPs in the selected sample in order to develop a PPP definition model. The family-resemblance philosophy proposed by the German philosopher Ludwig Wittgenstein was adopted to define PPPs by first identifying core elements for PPPs (acting together as a sunflower core) and a few non-core elements (acting as petals of the sunflower). Different combinations of core and non-core elements constitute different variants of the PPP Sunflower Model. The resembling results and the model are presented in Section 5.1.

Step 5 is to analyse the PPP Sunflower Model and its elements. The purpose of the analysis is twofold in this study, including explaining each core element to provide sufficient details to understand the model and then applying the model to different types of projects to demonstrate its applicability of the model. The analysis is presented in Sections 5.1 and 5.2.

5. Results and Discussions

5.1 Development of PPP Sunflower Model

The 50 selected highly-cited journal articles constitute the empirical base of the study, as presented in Table 1. Table 2 provides a summary of the information statistics for these articles. They cover a wide range of research areas (defined by Web of Science), including business economics, public administration, engineering, public environmental, occupational health, construction building technology, development studies, government law, etc. The selected articles were published in 32 different journals between 1999 and 2020, and represent the work of 122 authors affiliated with 95 organisations from 26 countries, with those featuring at least two articles highlighted in Table 2. The times cited of these articles range from 104 to 589, and the total number of citations of these articles is 9,595. All the information reinforces the appropriateness of using these highly cited articles to resemble different elements of PPPs.

Insert Tables 1 & 2 here

Using the content analysis, the frequency of the identified 26 elements of PPPs mentioned in the descriptions of PPPs in the 50 selected high-quality journal articles was recorded in Table 3. The frequency of occurrence for certain elements in PPP-related literature indicates their importance or key status within the broader context. High frequency often implies a general consensus regarding the significance of these elements. Among them, 13 essential elements are included in the proposed Sunflower Model because they have been mentioned at least five times (representing 10% of the selected paper sample). These 13 elements are appropriate risk allocation and sharing (E2), clarity of roles and responsibilities among parties (E3), injection of expertise and resources (E12), cooperation and teamwork (E5), long-term contract (E14), bundle of services (E20), value for money (E25), win-win philosophy (E26), clear output specifications (E4), innovative finance for both parties (E16), improvement in efficiency (E9), competitive and transparent procurement (E6), and innovations (E13). Among the 13 elements mentioned above, the first six are considered as core elements for PPPs, acting together as a core of a sunflower as shown in Figure 2, as they have been by far mentioned most frequently by researchers defining PPPs for at least 15 times (representing 30% of the selected paper sample). The remaining elements are key but non-core elements and act as sunflower petals.

Insert Figure 2 here

Insert Table 3 here

5.2 Core Elements of PPPs

a) Appropriate Risk Allocation and Sharing (E2)

Many researchers considered the appropriate risk allocation and sharing as a core element of the PPPs (Hodge, 2004, Sachs et al., 2007, Ke et al., 2010a, Ke et al., 2010b, Chan et al., 2011, Hwang et al., 2013). One unique feature differentiating PPPs from conventional procurement is the allocation of risk; hence, a proper mechanism must be developed to help allocate risk effectively and efficiently (Osei-Kyei and Chan, 2015). Zhang (2005a) reckoned that an appropriate risk allocation is imperative for the success of a PPP

infrastructure project. The roles and responsibilities naturally determine the extent of risk transfer, as risk should not be transferred to the private partner when it has no control to influence the risk management. A general principle is that each risk should be allocated to the party best able to manage it and at the least cost (Cooper et al., 2005). An appropriate risk allocation and sharing is not to pass all risks to the private sector but to seek a solution minimising both the total management costs of the public and private sectors (Ke et al., 2010b). It is also essential for the public partner to retain risks beyond the private sector's control.

Taking transport infrastructure PPP projects for example, effective allocation of revenue risk is critical to their success, due to their inherent complexity and diversity (Ke et al., 2010a). If revenue risk is allocated sub-optimally, it can lead to costly and vulnerable project structures that are prone to failure. The allocation of revenue risk is closely tied to the remuneration model used, which can result in various types of risk, such as demand risk, counterparty risk, or a combination of both.

b) Clarity of Roles and Responsibilities among Parties (E3)

The successful implementation of PPP projects requires a clear delineation of roles and responsibilities among contracting parties (Linder, 1999, Buse and Walt, 2000a, Buse and Walt, 2000b, Murthy et al., 2001, Zhang, 2005b, Ahmed and Ali, 2006, Engel et al., 2013, Roehrich et al., 2014). This is especially important in PPP projects, which involve the bundling of services, complex risk allocation and long-term contracts. As such, there is no one-size-fits-all approach to defining roles and responsibilities in PPP projects, and each project may require a tailored solution to meet its specific needs. Clarity in roles and responsibilities among contracting parties helps to avoid disputes and ensure smooth project implementation.

In some PPP definitions, the roles of both the public and private sectors are included. For instance, the Organisation for Economic Co-operation Development (2008) highlights that "... within the agreement, the private partners deliver the service so that the service delivery objectives of the government are aligned with the profit objectives of the private partners." The Australian government defines PPPs as "a long-term contract between the public and private sectors where the government pays the private sector to deliver infrastructure and related services on behalf, or in support, of government's broader service responsibilities" (Department of Infrastructure and Regional Development, 2008).

c) Injection of Expertise and Resources (E12)

PPP projects rely heavily on the significant involvement of the private sector, which injects expertise and resources. This involvement can be understood in two ways. First, the private sector provides the investment required for the project, which includes both debt and equity financing (Sharma et al., 2010). This is particularly important for subnational governments in developing countries, which often lack the financial resources to undertake large-scale infrastructure projects (Chan et al., 2009); Second, the private sector's involvement in a PPP project encompasses a more comprehensive concept that includes responsibilities, obligations and risks undertaken, as well as resources and skills committed to the project (Jasiukevičius and Vasiliauskaitė, 2012).

The injection of expertise and resources by the private sector is crucial for the success of PPP projects, given the projects' lifecycle integration delivery of the asset and the higher level of expertise and resources required compared to traditionally procured projects (Osei-Kyei and Chan, 2015). However, the level of private involvement may vary depending on the type of PPP project. Albalate et al. (2015) indicated that the probability of governments choosing large private involvement in single "stand-alone" projects is much higher than in network infrastructure projects.

d) Cooperation and Teamwork (E5)

In the wealth of research conducted to date to explore whether and why PPPs deliver superior performance than traditionally procured projects, one of the critical factors is the cooperation and teamwork between the public and private sectors (Abdul-Aziz and Kassim, 2011, Chou and Pramudawardhani, 2015, Osei-Kyei and Chan, 2015, Zhang, 2005a). In order to create better and more innovative services and policy outputs at lower costs in a PPP project, there must be an intensive level of cooperation between the two entities (Aziz, 2007). This requires an open dialogue between the two parties, which allows them to discuss potential solutions and work together to find the best possible outcome.

Additionally, PPPs are established with long-term contracts, which by nature are incomplete. These contracts are designed to be flexible to allow for changes in circumstances over time, and as a result, the roles and responsibilities of each party may evolve throughout the project lifecycle. This uncertainty can lead to disagreements and conflicts. To address these challenges, it is essential that the parties involved in the PPP project establish strong relationships based on trust and open communication. This allows them to adapt to changing circumstances, negotiate solutions to challenges that arise, and ultimately deliver better outcomes for all stakeholders.

e) Long-Term Contract (E14)

The long-term nature is one of the essential features of PPP projects, as highlighted in many existing PPP definitions, such as the World Bank's (2017) definition of "a long-term contract between a private party and a government entity…" and the Australian definition of "a long-term contract between the public and private sectors …" (Department of Infrastructure and Regional Development, 2008). PPPs typically have a long-term contract period, with studies showing that contract periods are often 20-30 years (Ma et al., 2019, Ke et al., 2014).

While several studies, such as Xu et al. (2017), have tried to determine the optimal concession period for PPP projects, there is still no universally agreed-upon length for a contract to be considered long-term. However, it is essential to recognise both the duration and effectiveness of the partnership when assessing the long-term nature of PPPs. Bloomfield (2006) suggested that PPP contracts should be long enough to ensure an effective risk transfer to the private sector and efficient life cycle cost management over a significant part of the asset life. The length of a PPP contract allows for the development of strong relationships and trust between the public and private parties involved.

f) Bundle of Services (E20)

In a typical PPP project, the private party is materially and integrally responsible for the construction and management of the asset rather than only being dedicated to specific and/or minor areas of responsibility, which provides an opportunity for lifecycle management efficiency improvement (Chan et al., 2009). Compared to traditional projects where the client divides services into different work packages and contracts them to different partners, value for money is achieved when the obligation for different services like design, construction, finance, operation and maintenance of an asset is bundled and entrusted to the private sector as a single PPP project (Dolla and Laishram, 2019).

It is worth noting that the bundling of services, i.e. the contract scope and the deal structure, vary significantly within sectors and even projects within the same sector (Dolla and Laishram, 2019). For example, a health PPP project may include a) the integrated delivery of hospital facilities, non-core services and clinical services; b) the provision of hospital facilities and non-core services, leaving the clinical services in the hands of the public health agency; and c) only the infrastructure provision and maintenance (Barlow et al., 2013).

5.3 Application of the PPP Sunflower Model

The PPP Sunflower Model is a highly innovative and practical tool that provides a structured approach for defining PPPs in various contexts and countries. It offers a concise and comprehensive framework that not only provides a theoretical understanding of the core elements of PPPs but also serves as a practical tool for decision-makers to assess the authenticity of a PPP project. By evaluating the compliance of a project with the six essential elements and other petals, the PPP Sunflower Model allows decision-makers to determine whether a project qualifies as a genuine PPP project. This model has significant practical implications as it offers a systematic and objective approach to assessing the authenticity of PPP projects, which can be challenging due to the vague and multi-faceted concept of family resemblance (Yeung et al., 2012).

A few examples are demonstrated in the following.

a) Design-Build-Finance (DBF)

The DBF case, I-75 Roadway Expansion (iROX) Project in the United States, is a relevant example discussed in Gurram (2020) and Forcael et al. (2011). This project bundled nine smaller projects into a single DBF contract to achieve economies of scale. The period for design and construction was three years, and the government deferred the payments for five years (Forcael et al., 2011). Although the private sector financed the development of the infrastructure, only construction risk was meaningfully associated with such financing. Operation and maintenance were not bundled into the work package and the private sector's expertise and resources in operating and maintaining the asset were not utilised. Consequently, the required level of cooperation and teamwork between the public and private sectors was naturally low.

In terms of PPP definitions, the iROX project falls short of some core elements and several petals of the PPP Sunflower Model. Although the project satisfies some elements, it fails to acknowledge the importance of the injection of expertise and resources (E12), cooperation and teamwork (E5), long-term contract (E14), and bundle of services (E20). Therefore,

according to the PPP Sunflower Model, the iROX project cannot be regarded as a PPP project.

It is worth noting, however, that the state of Florida, where the iROX project is located, considers DBF contracts as a type of PPPs (Gurram, 2020), which reinforces that PPP definitions in different countries differ not only in the wording choices but also in the inclusion of definition elements.

b) Design-Build-Operate-Maintain (DBOM)

The DBOM case, Hudson-Bergen Light Rail Transit System (HBLRT) in the United States, is found in Miller (2002). The 21st Century Rail Corporation was selected to provide the design, construction, operation and maintenance services for a period of 15 years. At first, private financing was required. However, the State Department of Treasury intervened and pursued a new financing strategy that did not include any private funding before the contract was granted because the contract price was significantly less than anticipated (Miller, 2002).

In this long-term contract, the private sector was in charge of a bundle of services and was motivated by self-interest to incorporate life cycle management for potential innovations and efficiency enhancements. According to its President and CEO, the private sector's expertise and resources, especially value engineering and extremely sound financial planning, play a vital role in achieving significant cost savings (Miller, 2002). It is important to note that due to the absence of private capital at risk, the incentives for them to properly perform the works and provide high-quality services may be limited, depending on the material transfer of risks under the contract.

Based on the analysis, we confirm that the HBLRT project included the following elements: clarity of roles and responsibilities among parties (E3), injection of expertise and resources (E12), cooperation and teamwork (E5), long-term contract (E14), bundle of services (E20), value for money (E25), competition & transparency (E6), efficiency improvement (E9), innovations (E13), and win-win philosophy (E26). It is unknown if there were clear output specifications or if construction and maintenance risks were materially passed to the private sector due to the unavailability of detailed contract conditions. According to the proposed PPP Sunflower Model, the HBLRT project would be a PPP project if the element of risk allocation was recognised.

6. Conclusions

The literature on PPPs is enormous, yet the definition of PPPs needs to be clarified and conclusive. Based on a comprehensive content analysis of selected 50 highly cited journal articles, this paper has clearly defined PPPs using an innovative Sunflower Model originally developed by the German philosopher Ludwig Wittgenstein. The principal assumption is that complex concepts can be understood as a network of overlapping similarities. Six core elements were frequently included in the descriptions, i.e. clarity of roles and responsibilities among parties, appropriate risk allocation and sharing, injection of expertise and resources, cooperation and teamwork, bundle of services, and long-term contract. Besides these core elements, there are a few other key elements, including win-win philosophy, innovative finance for both parties, value for money, clear output specifications, competitive and transparent procurement, improvement in efficiency, and innovations.

The proposed PPP Sunflower Model elevates the discourse around PPPs to a new level of clarity and utility. While its innovative design and universal applicability lay a solid theoretical foundation for academics, it also serves as an indispensable, actionable tool for decision-makers and stakeholders in diverse sectors and jurisdictions. For example, consider its practical application in settings such as the China Public Private Partnerships Center. This institution, tasked with curating the national PPP project management database, can use the PPP Sunflower Model as a stringent evaluative measure for project inclusion. The same applies to decision-makers in countries with specialised funds for PPP projects. Using the PPP Sunflower Model, they can confidently identify and select projects that meet PPP criteria, ensuring that financial resources are allocated wisely.

By introducing this framework, we not only clarify and standardise the complex concept of PPPs but also facilitate a more enriched, globally unified dialogue on the subject. This dual utility—both theoretical and practical—affirms the PPP Sunflower Model's pivotal role in advancing the ongoing development of the PPP field, while also acting as a catalyst for more coherent and effective communications between academics and practitioners.

The current research has some limitations, as the inter-relationships between core and non-core elements and within them were not examined due to time and resource constraints. It is also crucial to recognise that the frequency of occurrence for certain elements in PPP-related literature is just one aspect of determining an element's importance. The role these elements play within the larger framework of PPPs, their practical implications, and their interrelationships with other elements are also vital factors in ascertaining their significance. As a result, the PPP Sunflower Model has not been fully validated in real-world situations. However, to address this limitation and further validate the model, future research will apply it to a large number of projects from the Project Management Database of the National PPP Integrated Information Platform in China, which has over 10,000 projects. In addition, the model will be applied to projects that were previously identified as non-genuine PPP projects and removed from China's PPP database during regular reviews. The practical application of the PPP Sunflower Model to both genuine and non-genuine PPP projects will contribute to its validation. In addition, a future study can be conducted to identify defining features for various PPP models.

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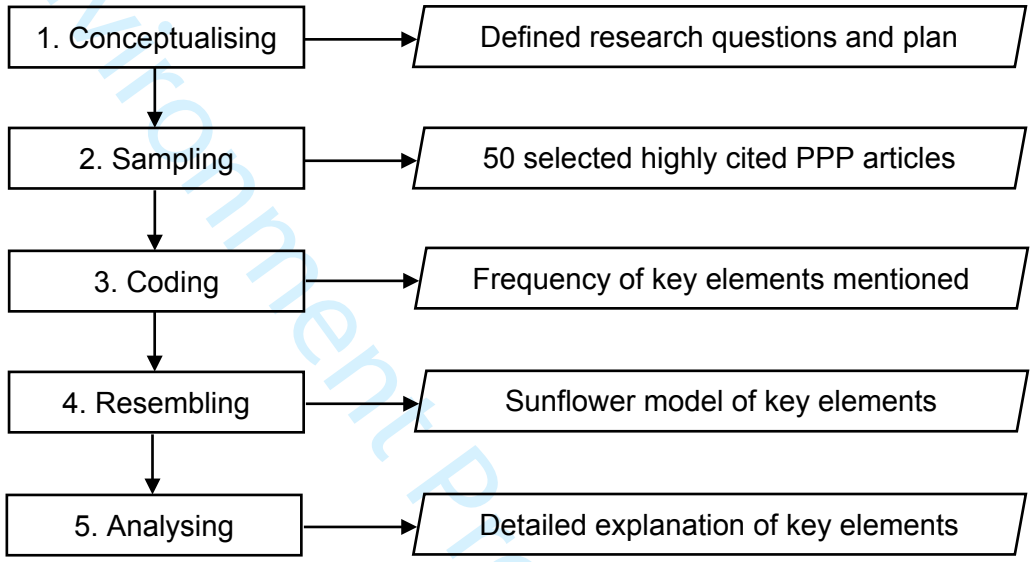

Figure 1: Research Framework of This Paper

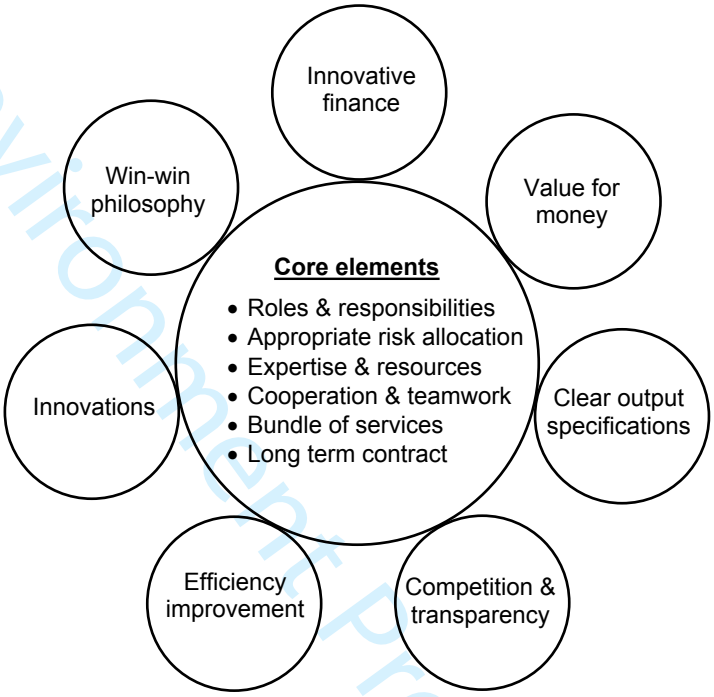

Figure 2: PPP Sunflower Model Containing the Key Elements

List of Tables

Table 1: Full List of Selected Articles Sorted by Citations

No	Journal	Authors	No	Journal	Authors
1	PAR	(Hodge and Greve, 2007)	26	IJIO	(Martimort and Pouyet, 2008)
2	EJ	(Hart, 2003)	27	IJPM	(Chou and Pramudawardhani, 2015)
3	JCEM	(Zhang, 2005a)	28	JPER	(Miraftab, 2004)
4	IJPM	(Osei-Kyei and Chan, 2015)	29	IJPM	(Cruz and Marques, 2013)
5	CMR	(Kwak et al., 2009)	30	JCEM	(Aziz, 2007)
6	IRAS	(Bovaird, 2004)	31	AJPA	(Hodge, 2004)
7	IJPM	(Ke et al., 2010b)	32	ISR	(Schaferhoff et al., 2009)
8	PAD	(Brinkerhoff and Brinkerhoff, 2011)	33	FP	(Martinez et al., 2007)
9	IJPM	(Tang et al., 2010)	34	JPET	(Iossa and Martimort, 2015)
10	PMM	(Klijn and Teisman, 2003)	35	BWHO	(Buse and Walt, 2000b)
11	SSM	(Roehrich et al., 2014)	36	ESA	(Ameyaw and Chan, 2015)
12	IJPM	(Hwang et al., 2013)	37	GEP	(Andonova, 2010)
13	PAR	(Koppenjan and Enserink, 2009)	38	IJPDLM	(Stewart et al., 2009)
14	IJPM	(Cui et al., 2018)	39	BWHO	(Widdus, 2001)
15	EE	(Shahbaz et al., 2020)	40	IJPM	(Hueskes et al., 2017)
16	JCEM	(Ke et al., 2009)	41	JIS	(Ke et al., 2010a)
17	PAR	(Forrer et al., 2010)	42	HA	(Barlow et al., 2013)
18	JME	(Chan et al., 2011)	43	PMR	(Torchia et al., 2015)
19	FP	(Narrod et al., 2009)	44	HI	(Abdul-Aziz and Kassim, 2011)
20	BWHO	(Buse and Walt, 2000a)	45	SD	(Khan et al., 2020)
21	NRDD	(Nwaka and Ridley, 2003)	46	IJPM	(Liu et al., 2016)
22	PAR	(Bloomfield, 2006)	47	JEEA	(Engel et al., 2013)
23	ABS	(Linder, 1999)	48	NCB	(Knapp et al., 2013)
24	PA	(Koppenjan, 2005)	49	PWMP	(Hodge and Greve, 2017)
25	PMR	(Wang et al., 2018)	50	IJPM	(Benitez-Avila et al., 2018)

Table 2: Statistics of Selected Articles

Research Areas*	Record Count	Publication Year	Record Count	Authors#	Record Count	Organisations#	Record Count	Countries#	Record Count	Journals#	Record Count
Business Economics	21	2020	2	Chan APC	6	Hong Kong Polytechnic University	6	USA	14	International Journal of Project Management	10
Public Administration	15	2018	3	Ke YJ	4	Tsinghua University	5	China	13	Public Administration Review	4
Engineering	6	2017	2	Wang SQ	4	George Washington University	3	England	8	Bulletin of the World Health Organization	3
Public Environmental Occupational Health	4	2016	1	Hodge GA	3	Imperial College London	3	Netherlands	5	Journal of Construction Engineering and Management	3
Construction Building Technology	3	2015	5	Buse K	2	Monash University	3	Australia	4	Food Policy	2
Development Studies	3	2014	1	Greve C	2	National University of Singapore	3	Germany	3	Public Management Review	2
Government Law	3	2013	5	Jiao ZL	2	University of London	3	Singapore	3		
		2011	3	Koppenjan JFM	2	Yale University	3	Switzerland	3		
		2010	5	Martimort D	2	Copenhagen Business School	2	Canada	2		
		2009	6	Walt G	2	Delft University of Technology	2	Denmark	2		

		2008	1	Roehrich JK	2	Harvard University	2	France	2		
		2007	3			London School of Hygiene Tropical Medicine	2	India	2		
		2006	1			Nankai University	2				
		2005	2			University of Bath	2				
		2004	3			University of Washington	2				
		2003	3								
		2001	1								
		2000	2								
		1999	1								

* Statistics with a minimum record count of 3
# Statistics with a minimum record count of 2

Table 3: Frequency of Mention for PPP Elements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	Total
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E3		√	√					√	√		√		√			√	√	√	√	√		√	√	√		√		√			√		√	√	√		√	√	√				√	√			√		√		27
E4	√					√		√											√	√									√	√					√				√						√						10
E5	√					√		√		√					√	√		√	√	√	√	√		√	√							√	√		√		√						√					√			19
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E13													√									√				√			√																√			√			6
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Dear Prof. Boeing Laishram,

Thank you for giving us the opportunity to submit a revision of our manuscript BEPAM-01-2023-0009.R1 entitled "Making Sense of the Definition of Public-Private Partnerships" to the *Built Environment Project and Asset Management*. We appreciate the time and effort that you and the reviewers have dedicated to providing your valuable feedback on our manuscript. We are grateful to the reviewers for their insightful comments. We have been able to incorporate changes to reflect most of the suggestions provided by the reviewers. We have highlighted the changes within the manuscript.

Here is a point-by-point response to the reviewers' comments and concerns. Locations in the responses are those in the change-tracked revision.

We look forward to hearing from you in due time regarding our submission and to responding to any further questions and comments you may have.

Sincerely,

The author team of this manuscript

Guest Editor's Comments

- **Comment 1**: The reviewers have given mixed review with Reviewer 2 recommending to accept the manuscript while Reviewer 3 recommending Major Revision. Though the issues raised by Reviewer 3 is important and need to be addressed however, the issues being highlighted could be addressed easily and thus it is recommended for Minor Revision. Therefore, we now invite you to respond to the reviewer(s)' comments and revise your manuscript accordingly.

Response: We appreciate the reviewers' time and effort in evaluating our manuscript, and we're encouraged by the mixed yet constructive feedback. We have revised the manuscript accordingly to comprehensively address the concerns raised, thereby enhancing the quality and impact of the work.

- **Comment 2**: Addressing the comments of the reviewers is expected to lead to additional words in the revised manuscript. In order to enable addressing the comments, the allowed word count in the revised submission is, therefore, increased from 8,800 word equivalents (including Abstract, Figs. Tables, Refs. Appendices) to 9,300 word equivalents. Note: each Fig. and each Table is counted at 280 words each. If more 'words' are needed to address all the comments fully, authors may consider to trim some of non-essential existing text.

Response: We confirm that the total word count is 9054 word equivalents.

- **Comment 3**: We also remind authors that a clear and complete Summary of Revisions done is expected to be submitted as a Supplementary “For Review” doc. This should clearly show how each and every review comment was addressed; and also exactly where (location in the revised paper) it was addressed -e.g. with changed areas in a different coloured font or with a separate track-changed file. These files should also be seen by Reviewers, hence classified as “For Review’, but author identities should not be exposed e.g., in track-changes or comments boxes, since these are for Anonymous peer-review!

Response: A summary of revisions done (i.e. this file) is submitted as a supplementary for review document. We confirm that all submission documents seen by reviewers are anonymous.

Reviewer 2's Comments

- **Comment 1**: The authors have considerably improved the manuscript by addressing the comments given. However, a few grammatical errors were found throughout. It is recommended to proofread the manuscript to avoid formatting and grammatical errors prior to publishing.

Response: We appreciated the acknowledgment of the improvements made to our manuscript and took the grammatical errors noted seriously. In response, we carefully proofread the paper to ensure that the manuscript met the highest standards of scholarly writing. All grammatical and formatting errors were corrected prior to finalising the manuscript for publication.

- **Comment 2**:
  1. Originality: Does the paper contain new and significant information adequate to justify publication?: Yes. The manuscript has significantly improved.
  2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: Literature review has been restructured and improved.
  3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed appropriate?: Yes.
  4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: Yes. The methodology section has been improved.
  5. Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: Yes. Implications are clearly elaborated.
  6. Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: To some extent.

Response: We are pleased that the improvements in the manuscript, particularly in the literature review and methodology sections, were recognised and well-received. We also appreciate the positive feedback on the clarity and impact of our results and their implications for research and practice. Regarding the comment on the quality of communication, we undertook a thorough review of the manuscript to enhance clarity and readability, making sure that the paper's language and structure were aligned with the expectations of the journal's readership.

Reviewer 3's Comments

- **Comment 1**: Appreciate the efforts of author/s in revising their paper. While it is having something valuable, the article is still underdeveloped. The reasons for such an opinion are given below. Partly, one of the causes is missing clarity on what the author/s intends to deliver, though they have grounded on a rich philosophical base that might bring good value when carefully applied.

Response: We appreciate recognising the paper's intrinsic value and solid foundation in philosophical principles. We wish to clarify that the study's comprehensive approach is intentionally designed to navigate the complex domain of PPPs. Our goal extends beyond merely offering a definition; we aim to foster a nuanced dialogue on what PPPs can and should be. To this end, the title "Making Sense of the Definition of Public-Private Partnerships" serves as a guiding theme for the paper. To address the concern about a lack of clarity in our objectives, we have carefully revised both the introduction and conclusion sections to more clearly outline the research aims and contributions to the field. Further elaborations are provided in our responses to subsequent comments.

- **Comment 2**: Each country and legislation has its way of looking at PPPs and sometimes with different terminologies. While the value is appreciated, I wonder due to poor in-conclusive work, the study has opened a pandora's box but no much use? Please strengthen your arguments on the usefulness. Is there a real need or use to have a universally accepted definition? Please further justify the benefit of the findings of this study.

Response: We acknowledge this complexity in response to the observation regarding the divergent perspectives and terminologies for PPPs across various countries and legislative frameworks. While we are not advocating for a universally mandated definition, our research aims to stimulate a more substantive and comprehensive discourse on what PPPs can and should be. To address this divergence and inherent complexity, our study contributes a structured framework intended as a foundational reference point for comprehending PPPs in multifarious contexts. We assert that this framework could enhance the efficacy of international collaborations and help synchronise disparate legislative approaches to PPPs. Moreover, our research offers actionable insights that could inform and refine the strategies of policymakers and practitioners. To underscore these points, we have amplified the discussion on the practical utility of our findings in the manuscript, focusing particularly on how they can contribute to a more unified and meaningful global conversation on PPPs.

- **Comment 3**: Since it is not a computer program, start and end can be deleted in Figure 1.

Response: As advised, we have deleted "start" and "end" in Figure 1.

- **Comment 4**: When I looked at the aspects such as how robust and repeatable this study is? How valid are the chosen elements? How reliable is the analysis of the study? Given it is content analysis. Did author/s leave out some critical aspects and include unnecessary parts? I think there are some

serious problems in the manuscript. Since the definition is the point of interest (as mentioned in the title as well), I wonder why internal CSFs have come into the picture/analysis. Also, the presence of some elements is questionable. E.g. E3 is about roles and responsibilities. How is it relevant to the definition-related framework? Isn't it the same as bundling assets, services, components, or the supply chain of the assets/services? These are only to point out. There are many such unclear and underdeveloped aspects that do not fit the purpose/goal of the paper. Similarly, all improvement-related elements do not fit into definition. It is all the more confusing and a point of concern as to why authors have not restricted only the elements/characteristics that define PPPs. E.g. Is there any specific PPP or non-PPP model that does not have a win-win philosophy? How is it relevant to developing a framework to define PPP?

Response: In response to the comment concerning the inclusion of various elements, our research is underpinned by an intent to deepen the discourse on what PPPs can and should entail. Our study seeks to offer a multi-dimensional and nuanced understanding of PPPs beyond merely providing a simplified definition. Hence, this justification is rooted in an extensive literature review covering various dimensions, including the concept, definition, characteristics, features, meanings, elements, and internal CSFs of PPPs. The inclusion of elements such as internal CSFs and improvement-related components is deliberate. This approach transcends the conventional focus on contractual or financial aspects to encapsulate the operational realities that significantly impact the success or failure of PPPs.

Specifically, the integration of internal CSFs into our framework aligns with their crucial role in influencing PPP outcomes. To illustrate, Australia's PPP model incorporates several key defining features like whole-of-life management, clear output specifications, value for money, and appropriate risk allocation, which are universally recognised as CSFs. These features are not just peripheral considerations; they are integral to any comprehensive understanding of what constitutes a PPP.

The incorporation of improvement-related elements is also purposeful. Components such as "improvement in efficiency" (E9) and "improvement in project governance" (E10) spotlight the advantages of PPPs over traditional procurement methods. This aligns with the findings of prior research, like that of Brogaard and Petersen (2018), which highlighted similar characteristics in their exploration of the concept of PPPs.

We've fortified these arguments in the revised manuscript (see the last paragraph of the Literature Review section), clarifying our rationale for the selection of these elements.

- **Comment 5**: Also, because they are highly repeated or have a higher frequency, can we say those are the key elements? Can we map with the various names of PPP models? e.g. DBFOM, BOO etc to those elements? Will the findings make real sense once such an understanding is presented? Since the main claim is "a concise and innovative framework for defining PPPs in a structured manner," I think the authors have yet to deliver such a framework. Part of the problem is the authors have attempted to brew

multiple things rather than sticking to the hallmarks/characteristics of the PPP model.

Response: The frequency of occurrence for certain elements in PPP-related literature and guidelines can indicate their importance or key status within the broader context. High frequency often implies a general consensus among scholars and practitioners regarding the significance of these elements. However, it's crucial to recognise that frequency is just one aspect of determining an element's importance. The role these elements play within the larger framework of PPPs, their practical implications, and their interrelationships with other elements are also vital factors in ascertaining their significance. We have added the explanation in section 5.1 and acknowledged this complexity by including it in the limitations section of our manuscript.

As for the suggestion to map specific elements to distinct PPP models like DBFOM or BOO, we appreciate the potential value such mapping could offer. Nonetheless, our research aims for a broader, more overarching understanding of PPPs that transcends specific models. Our goal is to encapsulate the nuanced elements that have universal applicability across various PPP models, rather than confining the study to the intricacies of particular models. This approach ensures that the findings retain broader relevance and applicability. We also acknowledged this as one of the future studies.

For further clarification on the inclusion of specific elements in our study, please refer to our previous response to Comment 4, which provides an in-depth justification for our methodological choices.

- **Comment 6**: Additional Questions:
  1. Originality: Does the paper contain new and significant information adequate to justify publication?: Yes
  2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: Good
  3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed appropriate?: Sound
  6. Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: Good.

Response: We are pleased to note the positive comments regarding the originality, relationship to literature, methodology, and quality of communication in our paper. Your feedback affirms the rigor and significance of our research.

- **Comment 7**: 4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: Doubtful in the present form

Response: Please refer to the responses to Comments 4 and 5.

- **Comment 8**: 5. Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: not clear

Response: Please refer to the responses to Comments 1 and 2.

Making Sense of the Definition of Public-Private Partnerships

Abstract

Purpose: Despite the widespread study and application of Public-Private Partnerships (PPPs) since the 1980s, the field lacks a universally accepted definition that captures the concept's complexity. This study aims to offer a definition and foster a more substantive and comprehensive discourse on PPPs. Our purpose is to improve communication and understanding between academics and practitioners from diverse disciplines and legislative backgrounds. ~~Public-Private Partnerships (PPPs) have been extensively studied by academics and used by practitioners since the 1980s, but a universally accepted definition for this complex concept is still lacking. To bridge this gap, we propose a novel and innovative framework to define PPPs that can improve communication between academics and practitioners from different backgrounds.~~

Design/methodology/approach: Grounded in the family-resemblance concept proposed by German philosopher Ludwig Wittgenstein, this study conducts a comprehensive literature review to identify core and non-core elements frequently cited in PPP descriptions. We used these findings to develop the PPP Sunflower Model as a structured framework for defining PPPs. ~~To develop our framework, we adopted the family-resemblance concept proposed by the German philosopher Ludwig Wittgenstein. We conducted a comprehensive literature review to identify the core elements that are frequently mentioned in the descriptions of PPPs and used the family-resemblance approach to develop a PPP Sunflower Model.~~

Findings: Our analysis elucidates six core elements consistently present in PPP descriptions: clarity of roles and responsibilities, appropriate risk allocation and sharing, injection of expertise and resources, cooperation and teamwork, a bundle of services, and long-term contracts. Coupled with identified non-core elements, these core components comprise the PPP Sunflower Model, a structured framework for defining PPPs that accommodates their multi-faceted nature. ~~Our analysis revealed six core elements that are consistently present in the descriptions of PPPs, including clarity of roles and responsibilities, appropriate risk allocation and sharing, injection of expertise and resources, cooperation and teamwork, bundle of services, and long-term contracts. Additionally, we identified a few non-core elements. Combining these core and non-core elements, we proposed the PPP Sunflower Model, a concise and innovative framework for defining PPPs in a structured manner.~~

Originality: The PPP Sunflower Model distinguishes itself as a unique contribution to the PPP literature. It offers a rigorous theoretical framework that can elucidate the complexity of PPPs for various stakeholders. The model serves as a practical tool for evaluating the authenticity and viability of PPP projects. The study's novelty lies in its adoption of the family-resemblance concept, thereby providing a comprehensive, multi-dimensional framework that enhances the understanding of PPPs across different disciplines and legislative contexts. ~~The PPP Sunflower Model is a unique contribution to the field of PPPs. It can provide a rigorous theoretical framework for explaining PPPs to interested parties and serve as an effective instrument for relevant decision-makers to evaluate the authenticity of a PPP project. The novelty of our work lies in the adoption of the family-resemblance concept and the development of a comprehensive framework that can enhance the understanding of PPPs across different disciplines and backgrounds.~~

Keywords

Public-Private Partnership; Family-Resemblance; Ludwig Wittgenstein; Sunflower Model

1. Introduction

Public-Private Partnerships (PPPs) have been widely adopted by governments ~~around the world~~worldwide as an alternative way of developing public infrastructure and delivering public services over the past four decades (Chan et al., 2009). Despite the increasing attention that PPPs have received from academics and practitioners since the 1980s, there is still no universally accepted definition for this complex concept.

The absence of ~~reasons for the lack of~~ a universally accepted definition ~~include~~ arises from factors such as conceptual vagueness, a multiplicity of definitions, ideologically-based advocacy (both pro and con), and disparate research traditions (Brinkerhoff and Brinkerhoff, 2011). For example, one ~~of the reasons~~ contributing factor is the existence of various types and variations of PPPs (World Bank, 2017), such as user-pays vs government-pays PPPs, conventional vs institutional PPPs, infrastructure vs service PPPs, and conventional vs co-financed PPPs. Moreover, countries differ in their adoption of PPPs based on procurement traditions, regulatory frameworks, institutional structures, and other macro-environmental factors.~~in the forms of PPPs depending on their procurement tradition, regulatory framework, institutional framework and many other macro environment factors.~~

Given this complexity, there is a pressing ~~Therefore, there is a~~ need for a common understanding of PPPs to facilitate the development of international investments in PPP projects and improve the communication efficiency between academics and practitioners from different backgrounds. This paper aims to contribute to that need by developing ~~develop~~ an innovative and meaningful approach to defining PPP~~s~~. Our ambition goes beyond merely crafting a definition; we seek to stimulate a nuanced dialogue on the multifaceted nature of what PPPs can and should represent, catering to both academic inquiry and practical application.

This paper presents a comprehensive literature review on the definition of PPPs and their elements~~of the PPPs definition and its elements~~, justifying the use of Ludwig Wittgenstein's family-resemblance concept to define PPPs. The research design method is then ~~explained~~detailed, followed by the presentation of the results. Essential elements of the PPP definition ~~The essential elements of the PPPs definition~~ are discussed, and the proposed definition model is demonstrated in selected cases. Finally, the paper summarises the findings and offers recommendations to the construction engineering and management community.

The new framework for defining PPPs is both innovative and practical. Designed with a focus on universal applicability, it provides a concise yet comprehensive method for understanding PPPs across a variety of types, countries, and legislative contexts. Beyond serving as a theoretical underpinning that articulates the core elements of PPPs, this framework also functions as an actionable tool that allows decision-makers to assess the authenticity of a PPP project. By establishing a coherent and consistent definition of PPPs, the framework acts as a bridge, enhancing communication and understanding between academics and practitioners. Moreover, it aims to foster a richer, more unified global

discourse on PPPs, thereby contributing to the field's ongoing development.~~It offers a concise and structured way of defining PPPs that can be applied to various types of PPPs across different countries and contexts. This framework not only provides a theoretical basis for understanding the core elements of PPPs but also offers a practical tool for decision-makers to evaluate whether a project is a genuine PPP project. By providing a clear and consistent definition of PPPs, this framework can help bridge the communication gap between academics and practitioners and contribute to the development of the PPP field.~~

2. Literature Review

The concept of PPPs lacks a universally accepted definition, with varying interpretations depending on the context and stakeholders involved. The World Bank (2017) describes PPPs as: “a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility and remuneration is linked to performance.” The Organisation for Economic Co-operation Development (2008) defines PPPs as “an agreement between the government and one or more private partners (which may include the operators and the financers) ... within the agreement, the private partners deliver the service so that the service delivery objectives of the government are aligned with the profit objectives of the private partners.” The European Commission (2003) states PPPs as forms of cooperation between public authorities and the world of business that aim to ensure the funding, construction, renovation, management and maintenance of infrastructure for the provision of a service. In Australia, PPPs are “a long-term contract between the public and private sectors where the government pays the private sector to deliver infrastructure and related services on behalf, or in support, of government’s broader service responsibilities” (Department of Infrastructure and Regional Development, 2008). In China, ~~when~~ the English abbreviation is PPPs~~, the~~; the Chinese term ~~PPPs~~ is defined as long-term contractual collaborations between the government and societal capital in ~~the areas of~~ infrastructure and public services. The introduction of the term “societal capital” indicates that the Chinese government collaborates not only with private investors but also with state-owned enterprises that are the leading players in the role of the “private” sector in PPP projects (Tan and Zhao, 2019). All these definition examples differ not only in the wording choices but also in the inclusion of definition elements. They vary in their emphasis on risk and management responsibilities, the types of activities that can be included, and the stakeholders involved. The World Bank (2017) and the Organisation for Economic Co-operation and Development (2008) both emphasise the importance of risk and management responsibilities being shouldered by the private party. The European Commission (2003) expands on this, highlighting the range of activities that can be included in a PPP arrangement. The Chinese definition of PPPs suggests that the Chinese government views PPPs as a means to involve a wider range of stakeholders in infrastructure and public service provision.

In previous studies explaining PPPs, their unique characteristics compared with traditional procurement methods were often mentioned, such as a long-term concession period, private sector involvement in public service, and closer collaboration between public and private sectors (Chan et al., 2009). Such characteristics may also be called ~~as~~ characteristics, features, meanings, and elements. For instance, Linder (1999) discussed six distinctive uses of the term PPPs~~, including management~~: management reform, problem conversion, moral regeneration, risk shifting, restructuring public service, and power

sharing. Although Linder (1999) did not focus on the conceptual definition, his examination of multiple meanings of the term PPPs provides a thoughtful insight into the essential elements of PPPs. Similarly, Khanom (2010) explored the conceptual issues associated with defining PPPs, including as a way of managing and governing organisations, as an institutional arrangement for a financial relationship, as a development strategy, and also as a language game. Her review of different definitions reinforced that there is no precise agreed definition of PPPs but there are common features across the different definitions (Khanom, 2010). Brogaard and Petersen (2018) mainly looked at the concept of PPPs from the perspective of development policy and framed eight common characteristics: (1) roles, sharing of resources, risks and responsibilities, (2) participants from the public, civil society and private sectors, (3) partnership commitment, (4) organisation and governance, (5) alignment with local context, (6) common development objective, (7) partnership function and purpose, and (8) sustainable effects.

The clarification of critical features of PPPs is also commonly seen in governments' PPP guidelines. Taking Australia for example, the PPP model in Australia has several vital features, including service focus, core services, payment for services, whole-of-life, financial discipline, output specification, value for money, public interest, contract term, contract management, risk allocation and standard commercial principles (Department of Infrastructure and Regional Development, 2008).

Essential elements of PPPs can also be addressed as critical success factors (CSFs) because CSFs represent both internal and external key areas of activity in PPP projects where favourable results are vital for the project's success. Hence, the internal key areas can be interpreted as elements of PPPs. Literature on ~~the topic of~~ PPP CSFs was hence reviewed, such as Osei-Kyei and Chan (2015) that methodically reviewed studies on the CSFs for implementing PPPs from selected top-tier academic journals from 1990 to 2013. Those external CSFs, such as factors related to the regulatory framework, institutional framework, and market conditions, were excluded as they are ~~not relevant~~irrelevant to defining PPPs.

Our study aims to furnish a multi-dimensional and nuanced comprehension of PPPs, moving beyond the limitations of a simplified definition. This approach is substantiated by the above comprehensive literature review that spans an array of dimensions—encompassing the concept, definition, characteristics, features, meanings, elements, and internal CSFs of PPPs. By incorporating these diverse elements, our framework transcends the traditional emphasis on merely contractual or financial aspects, thereby capturing the multifaceted operational realities that play a pivotal role in the success or failure of PPPs. In the pursuit of this comprehensive understanding, ~~Our study seeks to offer a multi-dimensional and nuanced understanding of PPPs beyond merely providing a simplified definition. Hence, this justification is rooted in the above extensive literature review covering various dimensions, including the concept, definition, characteristics, features, meanings, elements, and internal CSFs of PPPs. Such inclusion of elements transcends the conventional focus on contractual or financial aspects to encapsulate the operational realities that significantly impact the success or failure of PPPs. Base on the above literature review on the concept, definition, characteristics, features, meanings, elements, and internal CSFs, 26~~26 PPP elements were identified, including agreed problem resolution methods (E1), appropriate risk allocation and sharing (E2), clarity of roles and responsibilities among parties (E3), clear output specifications (E4), cooperation and teamwork (E5), competitive and transparent procurement (E6), government affordability

(E7), government support and guarantees (E8), improvement in efficiency (E9), improvement in project governance (E10), improvement in project management (E11), injection of expertise and resources (E12), innovations (E13), long term contract (E14), monitoring and accountability (E15), innovative finance for both parties (E16), open and constant communication (E17), performance-based payment (E18), project economic soundness (E19), bundle of services (E20), strong commitment by both parties (E21), strong private consortium (E22), strong public agency (E23), trust (E24), value for money (E25), and win-win philosophy (E26). These identified PPP elements will be used for coding in this study.

3. Using Ludwig Wittgenstein's Family-Resemblance Concept to Define PPPs

The numerous definitions of PPPs mentioned above show the difficulty of giving a concise and comprehensive explanation of the PPPs concept. After reviewing different definitions of PPPs, Khanom (2010) reinforced that there are common features across the different definitions. However, different types of PPPs exist with varying characteristics, making it difficult to agree on which elements to include in a definition. This challenge aligns with the German philosopher Ludwig Wittgenstein's argument that complex concepts cannot be defined in a traditional way by stating necessary and sufficient conditions (Wittgenstein, 2009). Ludwig Wittgenstein proposed a “family-resemblance” concept. For example, all family members may not have any common features, but the daughter could have the “same” eyes as her father, while the son could have the “same” nose as his father. As such, the “family-resemblance” concept can embrace a few different characteristics to define a multifaceted concept in a more flexible and structured manner. In the construction sector, Nyström (2005), Yeung et al. (2007), and Yeung et al. (2012) adopted Ludwig Wittgenstein’s family-resemblance concepts to successfully define partnering, alliancing and relational contracting, respectively, all of which are complex and multi-faceted concepts. Ludwig Wittgenstein’s “family-resemblance” concept hence has the potential to be adopted to define PPPs.

4. Research Methodology

The process of conducting the study is presented in Figure 1.

Insert Figure 1 here

Step 1 of the research process is to define research questions and plan for the research. This study aims to develop an innovative and meaningful approach to defining PPPs. A comprehensive literature review is the primary method adopted in this paper, which attempted to look at how often different elements are mentioned in the descriptions of PPPs and then apply the family-resemblance approach to the frequency results. In particular, a detailed content analysis was conducted to achieve the purpose of resembling different elements of PPPs. Content analysis is a summarising analysis of messages that follows the standards of the scientific method and is not limited to the types of variables that may be measured or the context in which the message is created or presented (Neuendorf, 2017). The method has come into wide use in different research areas, such as nursing and health (Vaismoradi et al., 2013), information technology (Kim and Kuljis, 2010), social media (de Swert, 2012), and construction (Bryde et al., 2013).

Step 2 is to select a sample for the content analysis, which is those high-quality journal articles in English. The literature was selected from the databases of Science Citation Index Expanded, Social Sciences Citation Index and Emerging Sources Citation Index at Web of Science, one of the world's most trusted citation indexes for scientific and scholarly research. The titles of the journal articles were scanned with the keywords 'Public-Private Partnership' and 'Public-Private Partnerships'. In total, 2496 articles were found. To maintain the efficiency and effectiveness of the following content analysis process, only the top 50 most cited ~~paper~~papers were included in this study. Many journal articles discussing the topic of PPPs are not shown in the search results because they may use other terms such as Build-Operate-Transfer and Private-Finance-Initiative or because they did not put the term PPPs in the title. Nevertheless, the purpose of the literature search is not to find the whole population of PPP journal articles but to identify a reasonable sample of high-quality journal articles. The literature search process ~~above-mentioned~~mentioned above is hence appropriate.

Step 3 is to code the ~~results of the content analysis, i.e.~~content analysis results, i.e., the frequency of key elements mentioned in the description of PPPs. Human coding was adopted in this study, involving the authors as coders, with each using a standard coding form to review the description of PPPs in each selected high-quality journal article and to record their careful observations on the usage of PPP elements explicated in the coding form. The main challenge of the coding process lies in two issues: first, not all authors clearly explained their agreed definition of PPPs in their papers; second, there are complex language contextual nuances. Therefore, one of the limitations of this study is the required subjective judgment from the coders during the coding process. An agreement was achieved through a discussion among the coders. The coding form includes two parts, i.e. the article reference and a list of PPP elements. As explained in the section Literature Review, the PPP elements were identified before the coding and derived mainly from the literature. Twenty-six PPP elements were identified and adopted in the coding form. The coding results are presented in Section 5.1.

Step 4 is to resemble those frequently mentioned PPP elements in the description of PPPs in the selected sample in order to develop a PPP definition model. The family-resemblance philosophy proposed by the German philosopher Ludwig Wittgenstein was adopted to define PPPs by first identifying core elements for PPPs (acting together as a sunflower core) and a few non-core elements (acting as petals of the sunflower). Different combinations of core and non-core elements constitute different variants of the PPP Sunflower Model. The resembling results and the model are presented in Section 5.1.

Step 5 is to analyse the PPP Sunflower Model and its elements. The purpose of the analysis is twofold in this study, including explaining each core element to provide sufficient details to understand the model and then applying the model to different types of projects to demonstrate its applicability of the model. The analysis is presented in Sections 5.1 and 5.2.

5. Results and Discussions

5.1 Development of PPP Sunflower Model

The 50 selected highly-cited journal articles constitute the empirical base of the study, as presented in Table 1. Table 2 provides a summary of the information statistics for these

articles. They cover a wide range of research areas (defined by Web of Science), including business economics, public administration, engineering, public environmental, occupational health, construction building technology, development studies, government law, etc. The selected articles were published in 32 different journals between 1999 and 2020, and represent the work of 122 authors affiliated with 95 organisations from 26 countries, with those featuring at least two articles highlighted in Table 2. The times cited of these articles range from 104 to 589, and the total number of citations of these articles is 9,595. All the information reinforces the appropriateness of using these highly cited articles to resemble different elements of PPPs.

Insert Tables 1 & 2 here

Using the content analysis, the frequency of the identified 26 elements of PPPs mentioned in the descriptions of PPPs in the 50 selected high-quality journal articles was recorded in Table 3. The frequency of occurrence for certain elements in PPP-related literature indicates their importance or key status within the broader context. High frequency often implies a general consensus regarding the significance of these elements. Among them, 13 essential elements are included in the proposed Sunflower Model because they have been mentioned at least five times (representing 10% of the selected paper sample). These 13 elements are appropriate risk allocation and sharing (E2), clarity of roles and responsibilities among parties (E3), injection of expertise and resources (E12), cooperation and teamwork (E5), long-term contract (E14), bundle of services (E20), value for money (E25), win-win philosophy (E26), clear output specifications (E4), innovative finance for both parties (E16), improvement in efficiency (E9), competitive and transparent procurement (E6), and innovations (E13). Among the 13 elements mentioned above, the first six are considered as core elements for PPPs, acting together as a core of a sunflower as shown in Figure 2, as they have been by far mentioned most frequently by researchers defining PPPs for at least 15 times (representing 30% of the selected paper sample). The remaining elements are key but non-core elements and act as sunflower petals.

Insert Figure 2 here

Insert Table 3 here

5.2 Core Elements of PPPs

a) Appropriate Risk Allocation and Sharing (E2)

Many researchers considered the appropriate risk allocation and sharing as a core element of the PPPs (Hodge, 2004, Sachs et al., 2007, Ke et al., 2010a, Ke et al., 2010b, Chan et al., 2011, Hwang et al., 2013). One unique feature differentiating PPPs from conventional procurement is the allocation of risk; hence, a proper mechanism must be developed to help allocate risk effectively and efficiently (Osei-Kyei and Chan, 2015). Zhang (2005a) reckoned that an appropriate risk allocation is imperative for the success of a PPP infrastructure project. The roles and responsibilities naturally determine the extent of risk transfer, as risk should not be transferred to the private partner when it has no control to influence the risk management. A general principle is that each risk should be allocated to the party best able to manage it and at the least cost (Cooper et al., 2005). An appropriate risk allocation and sharing is not to pass all risks to the private sector but to seek a solution minimising both the total management costs of the public and private sectors (Ke et al.,

2010b). It is also essential for the public partner to retain risks beyond the private sector's control.

Taking transport infrastructure PPP projects for example, effective allocation of revenue risk is critical to their success, due to their inherent complexity and diversity (Ke et al., 2010a). If revenue risk is allocated sub-optimally, it can lead to costly and vulnerable project structures that are prone to failure. The allocation of revenue risk is closely tied to the remuneration model used, which can result in various types of risk, such as demand risk, counterparty risk, or a combination of both.

b) Clarity of Roles and Responsibilities among Parties (E3)

The successful implementation of PPP projects requires a clear delineation of roles and responsibilities among contracting parties (Linder, 1999, Buse and Walt, 2000a, Buse and Walt, 2000b, Murthy et al., 2001, Zhang, 2005b, Ahmed and Ali, 2006, Engel et al., 2013, Roehrich et al., 2014). This is especially important in PPP projects, which involve the bundling of services, complex risk allocation and long-term contracts. As such, there is no one-size-fits-all approach to defining roles and responsibilities in PPP projects, and each project may require a tailored solution to meet its specific needs. Clarity in roles and responsibilities among contracting parties helps to avoid disputes and ensure smooth project implementation.

In some PPP definitions, the roles of both the public and private sectors are included. For instance, the Organisation for Economic Co-operation Development (2008) highlights that "... within the agreement, the private partners deliver the service so that the service delivery objectives of the government are aligned with the profit objectives of the private partners." The Australian government defines PPPs ~~are~~as "a long-term contract between the public and private sectors where the government pays the private sector to deliver infrastructure and related services on behalf, or in support, of government's broader service responsibilities" (Department of Infrastructure and Regional Development, 2008).

c) Injection of Expertise and Resources (E12)

PPP projects rely heavily on the significant involvement of the private sector, which injects expertise and resources. This involvement can be understood in two ways. First, the private sector provides the investment required for the project, which includes both debt and equity financing (Sharma et al., 2010). This is particularly important for subnational governments in developing countries, which often lack the financial resources to undertake large-scale infrastructure projects (Chan et al., 2009); Second, the private sector's involvement in a PPP project encompasses a more comprehensive concept that includes responsibilities, obligations and risks undertaken, as well as resources and skills committed to the project (Jasiukevičius and Vasiliauskaitė, 2012).

The injection of expertise and resources by the private sector is crucial for the success of PPP projects, given the projects' lifecycle integration delivery of the asset and the higher level of expertise and resources required compared to traditionally procured projects (Osei-Kyei and Chan, 2015). However, the level of private involvement may vary depending on the type of PPP project. Albalate et al. (2015) indicated that the probability of governments choosing large private involvement in single "stand-alone" projects is much higher than in network infrastructure projects.

d) Cooperation and Teamwork (E5)

In the wealth of research conducted to date to explore whether and why PPPs deliver superior performance than traditionally procured projects, one of the critical factors is the cooperation and teamwork between the public and private sectors (Abdul-Aziz and Kassim, 2011, Chou and Pramudawardhani, 2015, Osei-Kyei and Chan, 2015, Zhang, 2005a). In order to create better and more innovative services and policy outputs at lower costs in a PPP project, there must be an intensive level of cooperation between the two entities (Aziz, 2007). This requires an open dialogue between the two parties, which allows them to discuss potential solutions and work together to find the best possible outcome.

Additionally, PPPs are established with long-term contracts, which by nature are incomplete. These contracts are designed to be flexible to allow for changes in circumstances over time, and as a result, the roles and responsibilities of each party may evolve throughout the project lifecycle. This uncertainty can lead to disagreements and conflicts. To address these challenges, it is essential that the parties involved in the PPP project establish strong relationships based on trust and open communication. This allows them to adapt to changing circumstances, negotiate solutions to challenges that arise, and ultimately deliver better outcomes for all stakeholders.

e) Long-Term Contract (E14)

The long-term nature is one of the essential features of PPP projects, as highlighted in many existing PPP definitions, such as the World Bank's (2017)~~'s~~ definition of "a long-term contract between a private party and a government entity…" and the Australian definition of "a long-term contract between the public and private sectors …" (Department of Infrastructure and Regional Development, 2008). PPPs typically have a long-term contract period, with studies showing that contract periods are often 20-30 years (Ma et al., 2019, Ke et al., 2014).

While several studies, such as Xu et al. (2017), have tried to determine the optimal concession period for PPP projects, there is still no universally agreed-upon length for a contract to be considered long-term. However, it is essential to recognise both the duration and effectiveness of the partnership when assessing the long-term nature of PPPs. Bloomfield (2006) suggested that PPP contracts should be long enough to ensure an effective risk transfer to the private sector and efficient life cycle cost management over a significant part of the asset life. The length of a PPP contract allows for the development of strong relationships and trust between the public and private parties involved.

f) Bundle of Services (E20)

In a typical PPP project, the private party is materially and integrally responsible for the construction and management of the asset rather than only being dedicated to specific and/or minor areas of responsibility, which provides an opportunity for lifecycle management efficiency improvement (Chan et al., 2009). Compared to traditional projects where the client divides services into different work packages and contracts them to different partners, value for money is achieved when the obligation for different services like design, construction, finance, operation and maintenance of an asset is bundled and entrusted to the private sector as a single PPP project (Dolla and Laishram, 2019).

It is worth noting that the bundling of services, i.e. the contract scope and the deal structure, vary significantly within sectors and even projects within the same sector (Dolla and Laishram, 2019). For example, a health PPP project may include a) the integrated delivery of hospital facilities, non-core services and clinical services; b) the provision of hospital facilities and non-core services, leaving the clinical services in the hands of the public health agency; and c) only the infrastructure provision and maintenance (Barlow et al., 2013).

5.3 Application of the PPP Sunflower Model

The PPP Sunflower Model is a highly innovative and practical tool that provides a structured approach for defining PPPs in various contexts and countries. It offers a concise and comprehensive framework that not only provides a theoretical understanding of the core elements of PPPs but also serves as a practical tool for decision-makers to assess the authenticity of a PPP project. By evaluating the compliance of a project with the six essential elements and other petals, the PPP Sunflower Model allows decision-makers to determine whether a project qualifies as a genuine PPP project. This model has significant practical implications as it offers a systematic and objective approach to assessing the authenticity of PPP projects, which can be challenging due to the vague and multi-faceted concept of family resemblance (Yeung et al., 2012).

A few examples are demonstrated in the following.

a) Design-Build-Finance (DBF)

The DBF case, I-75 Roadway Expansion (iROX) Project in the United States, is a relevant example discussed in Gurram (2020) and Forcael et al. (2011). This project bundled nine smaller projects into a single DBF contract to achieve economies of scale. The period for design and construction was three years, and the government deferred the payments for five years (Forcael et al., 2011). Although the private sector financed the development of the infrastructure, only construction risk was meaningfully associated with such financing. Operation and maintenance were not bundled into the work package and the private sector's expertise and resources in operating and maintaining the asset were not utilised. Consequently, the required level of cooperation and teamwork between the public and private sectors was naturally low.

In terms of PPP definitions, the iROX project falls short of some core elements and several petals of the PPP Sunflower Model. Although the project satisfies some elements, it fails to acknowledge the importance of the injection of expertise and resources (E12), cooperation and teamwork (E5), long-term contract (E14), and bundle of services (E20). Therefore, according to the PPP Sunflower Model, the iROX project cannot be regarded as a PPP project.

It is worth noting, however, that the state of Florida, where the iROX project is located, considers DBF contracts as a type of PPPs (Gurram, 2020), which reinforces that PPP definitions in different countries differ not only in the wording choices but also in the inclusion of definition elements.

b) Design-Build-Operate-Maintain (DBOM)

The DBOM case, Hudson-Bergen Light Rail Transit System (HBLRT) in the United States, is found in Miller (2002). The 21st Century Rail Corporation was selected to provide the design, construction, operation and maintenance services for a period of 15 years. At first, private financing was required. However, the State Department of Treasury intervened and pursued a new financing strategy that did not include any private funding before the contract was granted because the contract price was significantly less than anticipated (Miller, 2002).

In this long-term contract, the private sector was in charge of a bundle of services and was motivated by self-interest to incorporate life cycle management for potential innovations and efficiency enhancements. According to its President and CEO, the private sector's expertise and resources, especially value engineering and extremely sound financial planning, play a vital role in achieving significant cost savings (Miller, 2002). It is important to note that due to the absence of private capital at risk, the incentives for them to properly perform the works and provide high-quality services may be limited, depending on the material transfer of risks under the contract.

Based on the analysis, we confirm that the HBLRT project included the following elements: clarity of roles and responsibilities among parties (E3), injection of expertise and resources (E12), cooperation and teamwork (E5), long-term contract (E14), bundle of services (E20), value for money (E25), competition & transparency (E6), efficiency improvement (E9), innovations (E13), and win-win philosophy (E26). It is unknown if there were clear output specifications or if construction and maintenance risks were materially passed to the private sector due to the unavailability of detailed contract conditions. According to the proposed PPP Sunflower Model, the HBLRT project would be a PPP project if the element of risk allocation was recognised.

6. Conclusions

The literature on PPPs is enormous, yet the definition of PPPs needs to be clarified and conclusive. Based on a comprehensive content analysis of selected 50 highly cited journal articles, this paper has clearly defined PPPs using an innovative Sunflower Model originally developed by the German philosopher Ludwig Wittgenstein. The principal assumption is that complex concepts can be understood as a network of overlapping similarities. Six core elements were frequently included in the descriptions, i.e. clarity of roles and responsibilities among parties, appropriate risk allocation and sharing, injection of expertise and resources, cooperation and teamwork, bundle of services, and long-term contract. Besides these core elements, there are a few other key elements, including win-win philosophy, innovative finance for both parties, value for money, clear output specifications, competitive and transparent procurement, improvement in efficiency, and innovations.

The proposed PPP Sunflower Model elevates the discourse around PPPs to a new level of clarity and utility. While its innovative design and universal applicability lay a solid theoretical foundation for academics, it also serves as an indispensable, actionable tool for decision-makers and stakeholders in diverse sectors and jurisdictions. For example, consider its practical application in settings such as the China Public Private Partnerships Center. This institution, tasked with curating the national PPP project management database, can use the PPP Sunflower Model as a stringent evaluative measure for project inclusion. The same applies to decision-makers in countries with specialised funds for PPP

projects. Using the PPP Sunflower Model, they can confidently identify and select projects that meet PPP criteria, ensuring that financial resources are allocated wisely.

By introducing this framework, we not only clarify and standardise the complex concept of PPPs but also facilitate a more enriched, globally unified dialogue on the subject. This dual utility—both theoretical and practical—affirms the PPP Sunflower Model's pivotal role in advancing the ongoing development of the PPP field, while also acting as a catalyst for more coherent and effective communications between academics and practitioners.~~This study advances knowledge by establishing a clear, cutting-edge framework for defining the complex concept of PPPs in a methodical way. Researchers can move on to look into specific study problems pertaining to maximising value for money. It can also act as a rigorous theoretical framework to explain PPPs to those who are interested. The PPP Sunflower Model can be used in a variety of situations. For example, one of the duties of the China Public Private Partnerships Center, which manages the national PPP project management database, is to decide if a project proposed by local governments qualifies as a PPP project and should be included in the database. Another example is that many countries have created funds to aid in financing their PPP projects. For decision-makers, selecting a genuine PPP project is crucial. They can use the proposed PPP Sunflower Model as an effective instrument.~~

The current research has some limitations, as the inter-relationships between core and non-core elements~~, as well as within them,~~ and within them were not examined due to time and resource constraints. It is also crucial to recognise that the frequency of occurrence for certain elements in PPP-related literature is just one aspect of determining an element's importance. The role these elements play within the larger framework of PPPs, their practical implications, and their interrelationships with other elements are also vital factors in ascertaining their significance. As a result, the PPP Sunflower Model has not been fully validated in real-world situations. However, to address this limitation and further validate the model, future research will apply it to a large number of projects from the Project Management Database of the National PPP Integrated Information Platform in China, which has over 10,000 projects. In addition, the model will be applied to projects that were previously identified as non-genuine PPP projects and removed from China's PPP database during regular reviews. The practical application of the PPP Sunflower Model to both genuine and non-genuine PPP projects will contribute to its validation. In addition, a future study can be conducted to identify defining features for various PPP models.

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