Project-focused literature on public-private partnership (PPP) in developing countries: a critical review

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Abstract

Set within the context of developing countries, we conduct a state of the art systematic review of project-focused, public-private partnership literature published between 1997 and 2021. The outcome of this review provides critical insight into trends in publication volume over time, types of projects addressed, chosen research methods, major research themes identified and their variances, but also identifies the critical challenges facing PPP projects in developing countries. More specifically, we find that for PPP projects in developing countries, the three most commonly reported challenges were *'Appropriate risk allocation and risk-sharing'*, *'Political support'*, and *'The private sector's financial strength'*. We also find that in developing countries, factors such as '*Compatibility and complementary skills among key parties'*, *'Competitive procurement process*', *'Democracy'*, *'Efficient approval processes'*, *'Favourable legal framework'*, and *'Transparent and efficient procurement'* are contingent problems associated with the use of PPP in construction project delivery. The main contribution of this study resides in the detailed identification, evaluation and classification of the literature. This taxonomy provides a detailed overview and evaluation of existing literature; providing for more comprehensive appreciation of PPP.

Keywords: Public-Private Partnership; Project Management; Construction Projects; Challenges; Systematic Literature Review.

1.0 Introduction

1.1 Background

The notion of a public-private partnerships approach (henceforth '*PPP*') has caught the attention of many interested in the funding of public sector infrastructure projects (Kim and Kwa 2020; Le et al. 2020; Nguyen et al. 2020; Vassallo et al. 2020). Scholars in various disciplines have been increasingly attracted to explore the PPP concept. This has included scholars in the field of operations management (Fandel et al. 2012; Roehrich and Lewis 2014; Liu et al. 2018; Aben et al. 2021). A Public-private partnership (PPP) is considered a method of procurement that emphasises close guarantees the provision of services (Lee and Schaufelberger 2014) and an increase in standards of living (Chou et al. 2016) thanks to the cooperation between the public sector (i.e. government) and organisations and businesses in the private sector (Liu et al. 2015). This joining of forces is essential for nations that, economically speaking, wish to produce and distribute greater output (Demirel et al. 2019; Nguyen et al. 2020), since this partnership provides the public and private sectors with a solution to overcome a number of obstacles, including financial issues, as well as inexperience and/or lack of expertise and knowledge (Aladağ and Işik 2020). PPP can stimulate innovation in providing public services, sharing risks with private entities and increasing project delivery efficiency (Verweij et al. 2020). Despite the clear advantages of PPP, many problems have been reported in the literature. These problems include (i) poor-risk allocation and risk-sharing (Wang et al. 2020), (ii) inadequate length of the concession period (Le et al. 2020), and (v) poor communication among stakeholders (Kwofie et al. 2019). These problems have led to PPP project failure. These problems have been more pronounced in developing rather than developed countries (Lee and Schaufelberger 2014; Robert et al. 2014).

Underpinning a majority of the literature on PPP project failure is that its challenges can be traced to low levels of political and economic stability in the host country (Aladağ and Işik 2020; Kim and Kwa 2020). This comes about because construction projects procured using PPP (henceforth 'PPP construction projects') are very sensitive to host country political and economic stability (Liu and Wilkinson 2015; Dewulf and Garvin 2020).

The last three decades have seen literature reviews being undertaken in a wide range of diverse topics within PPP literature (see for example, Ke et al. 2009; Roehrich et al. 2014; Osei-Kyei and Chan 2015; Zhang et al. 2016; Bao et al. 2018; Cui et al. 2018; Ma et al. 2019; Jayasena et al. 2021; Wang and Ma 2021; Le et al. 2022). More specifically, some scholars summarised the evolution of topics in PPP, exploring the gaps and with proposals for possible future studies for PPP research (Cui et al. 2018; Narbaev et al. 2020; Zhang et al. 2020). Other scholars compared and contrasted the direction of PPP research (Tang et al. 2010); or proposed possible future studies from the perspective of the PPP project's life cycle (Bao et al. 2018). Literature reviews are important in academic discourse as they represent viable means of reinforcing research problems (Tranfield et al. 2003; Rowe 2014). In particular, because they are exploratory in nature, literature reviews allow for the reorganisation of knowledge by facilitating the identification of gaps in knowledge and avenues for the undertaking of further studies (Fink 2010). However, despite the burgeoning of these literatures, sufficient attention has not been paid by scholars to project-focused developing country context PPP literature. Neither has any associated systematic review of PPP literature been undertaken from this perspective. This is despite such systematic review of literature being important as it will provide more detailed insight into state-of-the-art PPP research. In the process, it will also facilitate clearer appreciation of (i) the research trend of PPP topics shaping project-focused PPP literature (ii) major research PPP themes (and the nature of their variances) shaping project-focused PPP literature and (iii) the more salient challenges facing PPP projects in the context of developing countries.

1.2 Aim and research question

The advantages of the Public-Private Partnership (PPP) should be particularly salient in developing countries, especially where there is political and economic instability. Research is yet to fully consider this issue. Therefore, the aim of this study is to undertake a state of the art systematic review of *project*-focused literature on PPP set within the construction industry of developing countries. By synthesising the totality of the evidence from the literature, the outcome of this review not only provides critical insight into (i) trends in publication volume over time, (ii) types of projects addressed, (iii) chosen research methods, (iv) major research themes identified and their variances, but also (v) identifies the critical challenges facing PPP projects in developing countries. To meet these objectives, our study advances three research questions in a manner similar to that

adopted in earlier studies by Ke et al. (2009), Narbaev et al. (2020) and Wang and Ma (2021). Thus, we present our three research questions as:

> ***RQ1****: What has been the research trend of PPP topics (publication volume over time, types of projects addressed and research methods) shaping project-focused PPP literature during the period of 1997–2021?*
> ***RQ2****: What are the major research PPP themes (and the nature of their variances) shaping project-focused PPP literature during the period of 1997–2021?*
> ***RQ3****: What are the more salient challenges facing PPP projects in the context of developing countries?*

Drawing from Petro et al. (2019), by reference to '*project-focused PPP literature'*, we imply PPP literature situated firmly within project and engineering management scholarship. To address the research questions, we draw upon the outcome of a systematic review of 160 PPP project management/related journal articles published between 1997 to 2021. Using mixed methods, involving qualitative coding, classification and cross-tabulation, 24 challenges that emerge from the literature are identified. To identify the more salient challenges facing PPP projects in developing countries, a cross-tabulation between the identified challenges and the developmental stage will be employed. The salient challenges in developing countries and the implications for practice are also discussed. The outcome from our study can assist the public and private sectors understand the impact of political and economic stability on the success of PPP construction projects. It is intended that the outcomes of this study will contribute to the body of knowledge related to PPP construction projects. It will also provide greater understanding of the impact of political and economic stability on the success of PPP construction projects.

The rest of this paper is organised as follows. Following this introduction, in section 2, we provide an overview of the background to PPP. Section 3 articulates on systematic literature reviews. Section 4 provides an overview of the body of PPP construction research literature based on the reviewed articles. In section 5, each theme and its sub-themes identified from qualitatively coding the content of the articles reviewed are described. Section 6 examines how the themes and sub-themes vary across the developmental status (i.e., developed or developing) of the country where the PPP research was conducted in order to identify the key challenges facing PPP

construction projects that may be most prevalent in developing countries. Finally, the findings are discussed, and conclusions are presented in sections 7 and 8.

2.0 Public-private partnership (PPP)

2.1 What it is

PPP is a procurement approach between the public (i.e., government) and the private sector (Liu et al. 2015). The government identifies the project requirements and then establishes the concession period that is awarded to the cooperating partner from the private sector (Algarni et al. 2007). The private sector entity in this relationship becomes the concessionaire, and could if so wished enter into contracts with a number of other participants such as (i) the public client; (ii) main contractor(s); (iii) investors and lenders; (iv) insurers; (v) main designer(s); (vi) material/equipment suppliers; (vii) operator/maintainer; viii) intermediate and end product/ service purchasers; and ix) non-governmental organizations (NGO) (Zhang et al. 2016). The aim of this relationship between the public sector and the private sector is to provide public infrastructure services (Lee and Schaufelberger 2014).

As we will show, prior studies on PPP in can be broadly categorised under studies that have undertaken a review of (i) its benefits (ii) critical challenges (iii) issues in tendering (iv) developed and developing country context and (v) other uncategorized studies.

2.2 Benefits of PPP

PPPs have become widely accepted and popular in public sector management (Khanom 2010), especially in the construction industry, for the great advantages they offer (Tang et al. 2010). Most importantly, this method of procurement has demonstrated several benefits: (i) it has enhanced technology transfer to local enterprises (Li et al. 2005b), (ii) it has offered benefits to local economic development by reducing public sector administration costs and (iii) it has facilitated creative and innovative approaches to implementing projects (Robert et al. 2014). Additionally, it has: (iv) reduced the total project cost (Bing et al. 2005), (v) improved public infrastructure management and maintenance (Li et al. 2005b), (vi) allowed for shared risk (Askar and Gab-Allah 2002) and vii) saved the state budget from spending its funds on the increasing demands for utilities and public services (Ismail 2013). In developing countries the advantages of the PPP procurement approach should be particularly salient where structural problems such as meagre public-sector finances, lack

of experience, knowledge and expertise are more prominent (Robert et al. 2014; Yang et al. 2016; Le et al. 2020). PPPs can also help redirect state budgets to necessary expenditures such as the increasing demand for utilities and public services (Ismail 2013). Indeed, there appears to be a study reports a predominance of research into PPP construction projects in the developing world. Public sector enthusiasm for PPP can be demonstrated in the amount of its investment in PPP projects.

In the UK, the expenditure on PPP reached almost $13.4 billion between 1992 and 1999 (Li et al. 2005a). In 2002, the expenditure of the UK government on PPP, was estimated to be 11% of its total expenditure (Li et al. 2005a; Cheung et al. 2012). In Australia, the National PPP Forum in 2004, 'estimated that over $9 billion in PPP projects had already been contracted' (Raisbeck et al. 2010). In Saudi Arabia, the plans for the '2030 KSA Vision' suggest the intention of spending over $1.2 trillion on PPP projects (Biygautane et al. 2016; Government of Saudi Arabia 2016; JLL 2017). In fact, the National Center for Privatization and PPP, as well as the Saudi Partner Program in 2021, estimated that around $1.3 trillion in PPP projects will be contracted by 2030 (National Center For Privatization 2021; The official Saudi Press Agency 2021). Enthusiasm for PPP has not only come from the government side. It has also come from the investors' side for a number of reasons which includes (ii) it gives them the opportunity to take advantage of government guarantees; (ii) tax breaks; and (iii) reduction the fees and long-term investment returns (Robert et al. 2014).

2.3 Prior relevant PPP reviews

Broadly speaking, there are a number of studies that have undertaken a review of project-focused PPP literature.

In Ke et al. (2009), a critical bibliometric review and analysis of PPP literature (170 publications) between 1998 and 2003 was undertaken. The focus being to review in a methodical manner, (i) volume of PPP publications (ii) specific author contributions, and (iii) research focus. The outcome of their study suggested that interest in three topics of PPP (risk, procurement and financing) had grown over the years to include research topics covering seven key themes which included (i) procurement (ii) economic viability (iii) investment environment (iv) financial package (v) governance (vi) integration research and (vii) risk management. A similar study was also undertaken by Ma et al. (2019), the focus however being to review (i) scholars, (ii) journal articles, (iii) institutions (iv) countries and (v) future research directions. In Kwak et al. (2009), the focus was on analysing prior studies with a view of facilitating an understanding of contractual arrangements

employed in PPP infrastructure development across various disciplines. The outcome of their study was the identification of five PPP research themes, namely (i) success factors and barriers (ii) government roles (iii) concessionaire selection (iv) PPP risks and (v) PPP finance.

With the intention providing the necessary insight needed to enrich PPP research and practice, Tang et al. (2010) undertook a review of studies on PPP construction projects based on a categorization of PPP research into *either* empirical (with research themes focused on finance, relationships and risks) or non-empirical research (with research themes focused on concession periods, finance, project success factors and risks). The outcome of their study included recommendations for PPP research to focus on six core research areas, namely (i) concession periods (ii) contractual agreements (iii) developing PPP models (iv) finance (v) risk and (vi) strategies in choosing the right type of PPP. Contextualised within Tang et al's. (2010) notion of empirical PPP research (focused on risk), Xu et al. (2010) developed a 17- factor PPP risk assessment model. Marsilio et al. (2011) undertook a bibliometric analysis of PPP literature (non project-focused) published between 1990 and 2010 in the process, identifying four major research clusters, namely (i) governmental and intergovernmental organizations (ii) public administration and public policy (iii) transaction cost and contracts and (iv) strategy and alliances. In a similar vein, Neto et al. (2016) also employed bibliometric methods to examine 575 PPP publications finding that traditionally, the focus of PPP research has been on a narrow set of topics, namely (i) contract design and risk sharing (ii) contract performance (iii) costs and benefits, (iv) political and institutional issues and (v) value for money tests.

In Osei-Kyei and Chan (2015), a critical review of PPP critical success factor literature between 1990 and 2013 was undertaking, the focus being to review in a methodical manner, PPP implementation literature. Among the various findings were that the country of focus of majority of PPP risk literature has been Australia, China, Hong Kong and the United Kingdom. Noting China's global presence in the PPP market, Zhang et al. (2016) extended Osei-Kyei and Chan's (2015) earlier study by undertaking a critical review on PPP research as published in both Chinese journals and international journals set within the Chinese context. With a focus on research methods, research topics and research findings, they found for example, that similarities existed more in terms of the focus of research topics between Chinese and international journals, than between the research methods adopted in the journals. Chen et al. (2016) focused their study on the analysis of 95

empirical studies on PPP finding the existence of five research clusters, namely (i) performance (ii) contract (iii) risk (iv) value for money and (v) institutional factors.

The study by Song et al. (2016) focused on reviewing emerging trends in global PPP research noting the transition of PPP research away from topics such as concession pricing and concession periods (see Tang et al. 2010), towards topics such as risk allocation and contract management. Under the premise that an understanding of PPP research will be enhanced by focusing on variations that exist within different PPP phases, Bao et al.'s (2018) study focused on a reviewing PPP literature from the perspective of the project lifecycle. Cui et al. (2018) on the other hand found the existence of five major research themes in PPP infrastructure project research focused on (i) financial package and PPP application (ii) economic viability and value for money (VFM) (iii) risk management and success factors (iv) procurement and contract management (v) performance management and (vi) governance and regulation. Ma et al. (2019) undertook a review of literature published between 2008 and 2018 finding thirteen key research themes to be dominant in PPP research. Studies by Narbaev et al. (2020) found PPP research to be multi-disciplinary in nature. Furthermore, they identified four key research domains for existing PPP research (partnership, public welfare, worldwide diffusion and PPP project) and three areas where PPP research is likely to focus upon (Stakeholders and sustainable partnership in PPP, Improved PPP project performance, Government support and regulatory framework for PPP).

The focus of the study by Zhang et al. (2020) was to analyse PPP research 2009 to 2019. The outcome of their study was the development of a seven stream classification of existing PPP research. Similar to Song et al. (2016), they also sought to identify emerging trends in global PPP research noting a transition from research topics such as (i) PPP promotion (ii) risk management processes (iii) finance (iv) contract management (v) legal and procurement and (v) governance and performance to five emerging research directions, namely (i) area development PPP (ADP) for regional social sustainability (ii) quantitative risk assessment and risk allocation (iii) compensation mechanisms (iv) regulatory and (v) stakeholder satisfaction management.

The summation of these literatures points to major challenges in different facets of PPP including (i) in its arrangements (Aladağ and Işik 2017; Kim and Kwa 2020). The literature has reported several problems in the implementation of PPP construction projects; these include such as inappropriate risk allocation and risk-sharing (Dewulf and Garvin 2020; Wang et al. 2020), poor concession period (Le et al. 2020), the private sector's lack of financial strength (Budayan 2019),

lack of public support (Cheah and Liu 2006), and inability to maintain open and constant communication among stakeholders (Kwofie et al. 2019). Other identified problems are unrealistic feasibility studies (Jeong et al. 2016), selection of inappropriate partners (Aladağ and Işik 2020), and poor relationship between the project partners (Ren et al. 2019).

2.4 Developing country context

In addition to studies that have undertaken a review of project-focused literature on critical challenges facing PPP projects, other studies have sought to undertake a review of project-focused literature on PPP focused primarily on the developing country context. Generally, literature specific to PPP from developing countries has remained comparatively low, when compared to the literature emerging from developed countries. They may be a number of reasons for this, including that PPP use is not matured in developing countries. These studies include that of Biygautane et al. (2016), Babatunde et al. (2017), Brogaard and Petersen (2018), Kwofie et al. (2019), Osei-Kyei et al. (2019), Eyiah-Botwe et al. (2020), Bolomope et al. (2021), Wang and Ma (2021), and Hai et al. (2022).

For example, Biygautane et al. (2016) focused their study on exploring the prospect of PPP in three gulf countries (Kuwait, Saudi Arabia, and Qatar). They identify various challenges constraining the effective implementation of PPP within the gulf region. Babatunde et al. (2017) on the other hand identified 4 principal factors (which can be construed as risk factors), causing delays in PPP projects in Nigeria as (i) political interference (ii) resource constraints (iii) weak institutions and (iv) legal delays. In Osei-Kyei et al. (2019), conflict prevention measures for PPP was examined within Ghana. Their study found the existence of four key conflict prevention measures for PPP, namely (i) stakeholder consultation (ii) goal clarity (iii) role clarity and (iv) transparent procedures for dispute resolution. Kwofie et al. (2019) focused their study on generating an understanding of communication performance challenges unique to PPP projects in Ghana and South Africa. The insight developed from their study serves a useful purpose in that it can be employed to draw up effective communication plans for PPP project delivery. Other PPP project studies undertaken within the context of developing countries includes Eyiah-Botwe et al. (2020) which focused on evaluating the main factors impacting upon effective stakeholder management; Bolomope et al. (2021) who focused on examining challenges associated with the local financing of PPP infrastructure projects in Nigeria and Hai et al. (2022) who examined the critical success factors

impacting upon PPP infrastructure projects in Vietnam. Among key CSF's identified included procurement, risk management and project information.

In sum, problems may be more pronounced in developing countries due to unstable political and economic conditions (Dansoh and Ofori-Kuragu 2014; Bertelli 2019). Such instability is likely to lead to authorisation and approval delays (Song et al., 2013) and unanticipated regulatory changes (Lee and Schaufelberger 2014). These are likely to be as a result of poor decision-making processes which are more likely to be manifest in such countries (Bing et al. 2005). Our proposition is that a developing/developed dichotomy exists as relates to PPP project success, which research has yet to address. While the benefits of PPP construction projects are more pronounced in developing countries, the prevalence of political and economic instability in such countries are less conducive for PPP project success.

2.5 Other studies

Drawing from Bao et al. (2018), they were studies that could not necessarily be appropriately classified into either studies (i) examining the challenges facing PPP projects and/or (ii) studies focused on specific developing country context. Example of such studies are those focused on the role of PPP as a tool for national/sustainable development (see Brogaard and Petersen 2018; Wang and Ma 2021). Driven by a recognition that numerous PPP initiatives will be handed back to host governments at the end of their concession period, Yuan et al. (2015) opined that problems associated with the subsequent management of PPP projects was a key driver why Residual value risk (RVR) should be of interest to PPP practitioners. Here, Residual value risk (RVR) is defined as "…*the risk that on expiry or earlier termination of the service contract, the asset (tangible or intangible) is not in accordance with the value originally estimated by the government at which point the private party agreed to transfer it to the government*" (p. 04014041). Examples of other PPP-related literatures are those focused on tendering (see Carbonara et al. 2016; Liu et al. 2016; Reeves et al. 2017; Simon et al. 2020), PPP risk exposure (see Chan et al. 2018; Jin et al. 2021) and revenue uncertainty (see Liu et al. 2020; Pellegrino 2021) and guarantees provisions (see for example, Carbonara et al. 2015; Wang et al. 2018, 2019). Thus for example, as relates to tendering, Carbonara et al. (2016) developed a PPP decision model that is able to minimize public sector transaction costs. One of the major advantages of such a model being its ability to support public sector entities in PPP tendering-related decision-making while in Liu et al. (2016), a total of 14 key factors impacting

upon PPP tendering effectiveness were identified (a study later extended by Simon et al. 2020). Noting that unduly long tendering served to deter bidders, Reeves et al. (2017) sought to examine factors impacting upon tender duration of PPP contracts finding major variations across different sectors (for example, between PPP housing projects and those commissioned within the healthcare sector).

3.0 Systematic reviews of literature

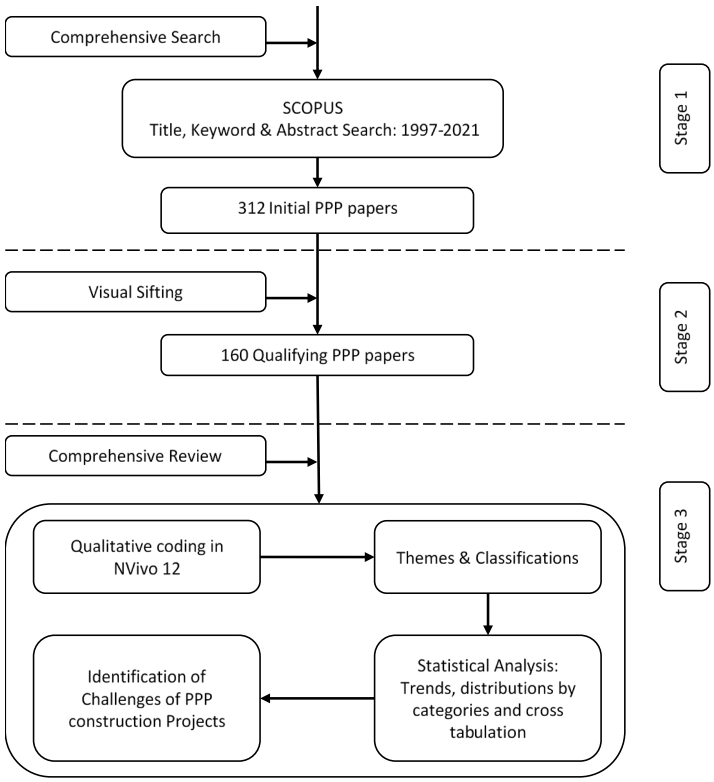
The purpose of a literature review is to conduct inquiry which is creative and in the process, create a platform for scholars to engage in dialogue likely to facilitate the appreciation of existing theory (Rowley and Slack 2004; Montuori 2005). Literature reviews have been defined as "…*a systematic, explicit and reproducible method[s] for identifying, evaluating and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners*" (Fink 2010, p. 3). In general, the objectives of any literature review can be summarised as (i) the summarisation of prior research (ii) detailed examination of this prior research (iii) elucidation of the outcome of the prior research and (iv) provision interpretations on alternate views of this prior research (Schwarz et al. 2006).

Most recently, systematic reviews have become very popular. Systematic reviews have been variously defined for example as "…*a form of secondary study that uses a well defined methodology to identify, analyse and interpret all available evidence related to a specific research question in a way that is unbiased and (to a degree) repeatable*" (Rowe 2014, p. 246), or "…*an approach to reviewing the literature that adopts explicit procedures…*", which can be "…seen as a cornerstone of evidence-based approaches" (Bell et al. 2018, p. 104). Tranfield et al. (2003, p. 209) defined a systematic review as "…*a replicable, scientific and transparent process, in other words a detailed technology, that aims to minimise bias through exhaustive literature searches of published studies and by providing an audit trail of the reviewer's decisions, procedures and conclusions*".

The popularity of systematic reviews is now well recognised in a range of scholarly fields and disciplines including project management (Geraldi et al. 2011; Petro et al. 2019; Williams et al. 2019; Condé and Martens 2020; Testorelli et al. 2020; Cantarelli and Genovese 2021; Dallasega et al. 2021) and operations management (Lightfoot et al. 2013; Thomé et al. 2016; Glas et al. 2018; Bagni et al. 2021; Zhou et al. 2021). Systematic reviews entails undertaking two distinct procedures (Easterby-Smith et al. 2012, p. 108). The first involves undertaking a definition of not only review protocols, but also conducting a mapping exercise. This mapping exercise will entail seeking to access, retrieve

and then judge both the quality and significance of relevant studies. The second procedure then entails recording the outcomes of the first process and in doing so, identifying current research gaps'. Based on Tranfield et al. (2003) and Easterby-Smith et al. (2012), an applicable framework for the undertaking of systematic reviews will entail (i) comprehensive search, (ii) visual sifting and (iii) comprehensive review. We show this framework as applied to our study in Figure 1.

Figure 1: The stages of the search process of PPP publications



3.1 First stage

In stage one, a comprehensive search was conducted using the title, abstract and keyword in the SCOPUS database engine. We chose this database (SCOPUS) because; (i) it is one of the largest abstract and citation database engines of scientific journals (Osei-Kyei and Chan 2015), (ii) SCOPUS performs better in terms of accuracy and coverage than other engines such as Web of Science, PubMed, and Google Scholar (Falagas et al. 2008) and, as a result, (iii) it is widely adopted in similar systematic reviews conducted within construction management (Bao et al. 2018; Narbaev et al. 2020) and operations management (Mahdavi et al. 2013; Geraldi et al. 2011; Akmal et al. 2018; Dallasega et al. 2021).

As not all definitions of PPP are agreed upon (Liu et al. 2015a; Zhang et al. 2020), the search code included all the main PPP definitions: Public-Private Partnership (PPP), Private Finance Initiative (PFI), and Build-Operate-Transfer (BOT). In PFI, financing rests mainly with the private sector. PFI was first launched in the United Kingdom (UK) in the 1980s, it has been used in, among others, Australia, the United States and New Zealand (Raisbeck et al. 2010). BOT is mainly used in infrastructure projects as a delivery/financing system by the private sector (Algarni et al. 2007). The government allocates the private sector a specific concession period during which it collects revenues by operating and maintaining the infrastructure (Zhu et al. 2016; Le et al. 2020). We employed '*Construction'* or '*Infrastructure'* in the search string as a means of ensuring that our search not was not limited to literature focused on building-related construction. More specifically, the IPA (2021) notes that "*Infrastructure and Construction projects include improving and maintaining [] energy, environment, transport, telecommunications, sewage and water systems; and constructing new public buildings*" (p.4).

Scholars such as Reijniers (1994) have opined that 'projectivity', in order words, the ability to efficiently and effectively manage projects is an essential element of success in PPP projects. Reflective of this, similar to Ma et al. (2019), we included '*Project Management'* as a search string. Furthermore, including '*Project Management'* as a search string acknowledges that since the project implementation phase (consisting of actual construction, management and operation - Hueskes et al. 2017) of most PPP projects will occur over a duration of between approximately 20 and 30 years, project management implying "…*the process of controlling the achievement of the project objectives*" (Munns and Bjeirmi 1996; p. 81), is essential to PPP project success. These processes often entail guideline and standards integration (Kerzner and Kerzner 2017), stakeholder management (Jacobson and Choi 2008) and performance monitoring (Osei-Kyei et al. 2017).

Beyond definitions, the search was limited to '*Articles'*, and '*Journals'*, and '*English language'*. This led to the generation of the following search code:

(TITLE-ABS-KEY ('Public-private partnership' OR 'PPP*' OR 'PFI' OR 'PPP type*' OR 'BOT' OR 'Build/Operate/Transfer' OR 'Build-Operate-Transfer') AND TITLE-ABS-KEY ('project management*') AND TITLE-ABS-KEY ('Construction*' OR 'Infrastructure*')) AND (LIMIT-TO (DOCTYPE, 'ar')) AND (LIMIT-TO (LANGUAGE, 'English')) AND (LIMIT-TO (SRCTYPE, 'j'))*

The earliest published article that met the search criteria was published in 1997. The search produced 312 PPP articles published between 1997 to 2021, inclusive.

3.2 Second stage

Stage two was a visual sifting to exclude irrelevant articles which, while meeting the search criteria, did not actually qualify, for example, because of alternative meanings of PPP such as '*Purchasing Power Parity*', '*Power Projection Platform'*, '*Projects, Plans and Policy'*, and '*Payment Protection Plan*', etc. As a result, the final number of qualifying PPP construction projects articles was 160. Table 1 shows the list of journals of the selected papers with the number of articles per journal.

Table 1: List/frequency of qualifying articles

Row Labels	Count of Source Title
International Journal of Project Management	26
Journal of Construction Engineering and Management	26
Construction Management and Economics	20
Journal of Management in Engineering	11
Engineering, Construction and Architectural Management	8
Journal of Infrastructure Systems	5
Built Environment Project and Asset Management	4
Project Management Journal	3
Sustainability	3
Transportation Research Part A: Policy and Practice	2
Journal of Urban Planning and Development	2
Public Works Management & Policy	2
International Journal of Construction Management	2
Transport Reviews	2
IEEE Transactions on Engineering Management	2
Journal of Property Investment and Finance	2
Journal of Financial Management of Property and Construction	2
Transportation Planning and Technology	1
Public Administration and Development	1
Expert Systems with Applications	1
International Journal of Management	1
Asian Journal of Political Science	1
Advances in Transportation Studies	1
Industrial Management and Data Systems	1
International Journal of Public Sector Management	1
Proceedings of the Institution of Civil Engineers: Water Management	1
International Journal of Strategic Property Management	1
GeoJournal	1

International Journal of Urban Sciences	1
Transport Policy	1
International Journal on Advanced Science, Engineering and Information Technology	1
Transportation Research Part B: Methodological	1
Journal of Building Engineering	1
Institution of Civil Engineers-Management, Procurement and Law	1
Journal of Civil Engineering and Management	1
KSCE Journal of Civil Engineering	1
Journal of Computing in Civil Engineering	1
Facilities	1
Advances in Civil Engineering	1
Public Policy and Administration	1
Architectural Engineering and Design Management	1
Structure and Infrastructure Engineering	1
Ecological economics	1
Transport	1
Benchmarking: An International Journal	1
Asia-Pacific Journal of Business Administration	1
Journal of Professional Issues in Engineering Education and Practice	1
International Journal of Energy Sector Management	1
Environment and Planning C: Government and Policy	1
Transportmetrica A: Transport Science	1
Journal of Public Administration Research and Theory	1
Complexity	1
Journal of Shanghai Jiaotong University (Science)	1
International Journal of Hydrogen Energy	1
Journal of the Chinese Institute of Engineers, Transactions of the Chinese Institute of Engineers, Series A/Chung-kuo Kung Ch'eng Hsuch K'an	1
Total	**160**

3.3 Third stage

In stage three, a comprehensive review of the qualifying articles was conducted. Mixed methods (i.e., qualitative and quantitative) were employed. NVivo 12 software was used as follows. First, all data was exported to the software. Second, using the search keywords as preliminary codes, the main themes and sub-themes were identified. The main author conducted the qualitative coding, while the co-authors independently validated the codes. Since some articles may cover more than one research area, each article was classified under the best-fit theme.

Each of the research articles was categorised according to (i) the main research methods applied, (ii) types of projects the researchers addressed, and (iii) whether the research was

conducted in a developing country, a developed country, or both. For this classification, we relied upon United Nations (2020).

The United Nations classification was chosen because it distinguished by using the data that the World Economic Situation and Prospects (WESP) employs to delineate trends in various dimensions of the world economy. It is based on the information that it has been collected from six United Nations regional commissions: (i) the United Nations Conference on Trade and Development (UNCTAD); (ii) Statistics Division and the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (UN/DESA); (iii) the United Nations World Tourism Organisation (UNWTO); (iv) the Organisation for Economic Cooperation and Development (OECD); (v) the International Monetary Fund (IMF); and (vi) the World Bank (United Nations 2020).

Finally, statistical analysis was conducted to identify the patterns over time, project types, research methods, themes and sub-themes, and between developed and developing countries. After that, tabulation analysis was performed for the country's development stage where the research was conducted against the classification of each article by the themes/sub-themes uncovered from the qualitative coding of the research articles. From the cross-tabulation, the variance of themes and sub-themes were examined across different country types and identify challenges facing PPP projects in developing countries as those issues that were predominantly or only reported from research conducted in developing countries. Any sub-theme that does not have challenges were removed.

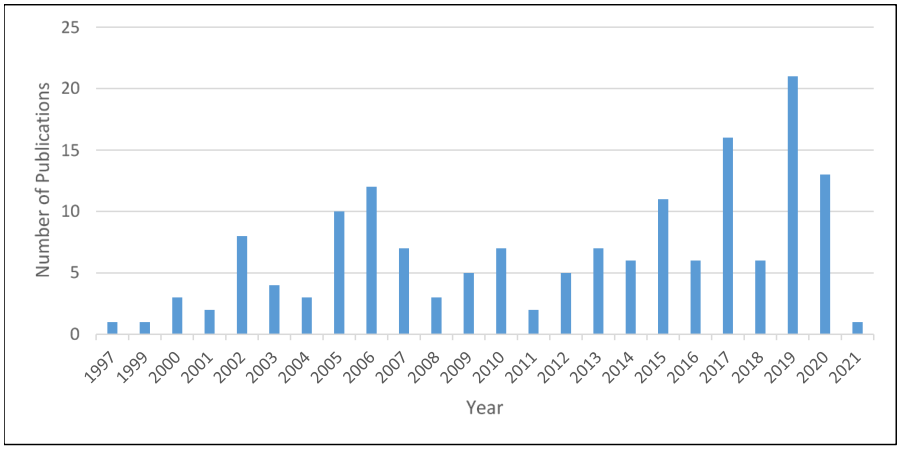
4.0 Overview of PPP construction projects literature

To obtain an overview of PPP construction projects literature, three elements were examined: (i) trends in publication volume over time, (ii) the types of projects the research addressed, and (iii) the research methods researchers chose. For brevity, this overview was kept at a high level and do not list all the relevant articles in each classification.

4.1 Trends over time

Figure 2 depicts the number of publications of PPP projects construction articles each year from 1997 to 2021.

Figure 2: PPP construction projects publications (1997 to 2021)



The pattern indicates two peaks; the first before the financial crisis of 2007-2008 (the subprime lending crisis), and the second in 2019 (the start of the Covid pandemic). The data suggest greater interest in PPP construction research following the financial crisis with around two more publications a year than previously. This interest is justifiable as both the subprime lending crisis and the Covid pandemic meant that the public sector had to divert substantial financial resources to urgent social programmes, meaning that available resources for infrastructure was servery limited. Facing these constraint, the in order to shore up infrastructure investment commitments, the public sector had to turn to the private sector to secure alternative funding sources required to meet gaps funding gaps.

4.2 Types of PPP construction projects

Almost 36% of the 160 articles did not specify the type of PPP construction project in their articles. From the remaining nearly 64% articles, three main types of PPP construction projects were identified: (i) transportation projects, (ii) utility infrastructure, and (iii) social service projects.

The most common type was transportation projects, which accounted for nearly 38% of studies. Many of the studies addressed road construction projects in many different locations (Demirel et al. 2019; Verweij et al. 2020; Kim and Le 2021). There was research on harbour tunnel construction projects in Hong Kong and Thailand (Tam 1999; Zhang et al. 2016); subway construction projects in the United Kingdom (Glaister et al. 2000) and China (Wu et al. 2016); tunnel construction projects in Hong Kong (Zhang et al. 2002); bridge construction projects in both

developed and developing countries (Kivilä et al. 2017). Other research foci were rail construction projects in Taiwan (Huang and Chou 2006; Ng and Loosemore 2007), and airport construction projects in developing countries (Aladağ and Işik 2017; Biygautane et al. 2019).

The second most common type was infrastructure projects for the provision of public utilities, addressed by almost 10% of the studies. Studies included power plant projects in several countries (Bashtannyk et al. 2020); water treatment projects in the United Kingdom (Grimsey and Lewis 2002), China (Liu and Cheah 2009) and Kuwait (Al-Azemi et al. 2014); as well as oil and gas pipeline projects in developing countries (Boudet et al. 2011).

The remainder of the studies – i.e., nearly 5% addressed various types of construction project for public social services provision. Social service projects included prison construction projects in several countries (Liu and Wilkinson 2015); theme park construction in Hong Kong (Shen et al. 2006); stadium construction in Australia (Jefferies 2006); hospital construction in several countries (Leiringer 2006); social housing construction in the United Kingdom (Wang et al. 2014); Tanzanian (Kavishe et al. 2019), and school construction in Canada (Roberts and Siemiatycki 2015).

4.3 Research methods chosen by researchers

The review suggests that many of the PPP construction researchers favour qualitative over quantitative approaches. More specifically, the review suggests that researchers tended to apply one or more of five main methods, which, in descending order of popularity, were case study, survey questionnaire, literature review, interviews, and comparative analysis (see Ke et al. 2009; Osei-Kyei and Chan 2015; Ma et al. 2019).

The case study method was the most popular, appearing in approximately 46% of studies. This is in line with earlier studies. For example, Ke et al. (2009) identified case studies (alongside with literature reviews, interviews and questionnaire surveys) as the most popular research methods in PPP research. This position was reiterated by Osei-Kyei and Chan (2015) who identified 41% of PPP studies as being conducted in the form of case studies. Ma et al. (2019), identified 29% of PPP studies being conducted using case studies. According to Osei-Kyei and Chan (2015), case studies remained particularly popular in PPP research because it is an approach that "…*provides for in depth information about the phenomenon under study*" (p. 1343).

Many more of the case studies were in developing countries (21%) than in developed ones (15%). Most cases studies focused on actual projects. Actual cases covered the whole spectrum of

project types, including utilities (He et al. 2020), transportation (Le et al. 2020), and social services projects (Leiringer 2006; Kavishe et al. 2019). There was also a small number of hypothetical case studies, all of which, notably, addressed hypothetical transportation projects (Jeerangsuwan et al. 2014; Zhu et al. 2016; Li et al. 2017).

Closely 26% of studies adopted the survey questionnaires method. Quantitative studies of survey questionnaire data tended to be small-scale, soliciting expert opinion rather than the general populace, with typically small datasets ranging from N = 45 (Osei-Kyei et al. 2017) to N = 310 (Osei-Kyei et al. 2017).

Nearly 24% of studies adopted the literature review method. Reviews could be classified as narrative or comprehensive. Narrative reviews used the literature as a dataset to identify knowledge gaps, build or support theoretical arguments and identify areas where the field could be advanced. However, the reviews were not comprehensive in that they included only literature that was relevant to the research questions rather than the whole body of the literature. Examples of narrative reviews included identifying concessionaire-selection priorities in (Zhang,2004, 2009); identifying success factors (Dulaimi et al. 2010; Ismail 2013) and factors that influence the attractiveness of PPP/PFI procurement (Li et al. 2005b). Comprehensive literature reviews, on the other hand, systematically analysed the whole body of the literature for specific purposes. Systematic reviews addressed issues such as the drivers of PPP in the public sector (Chan et al. 2009), success factors (Chan et al. 2010a, 2010b), elements of risk (Liu and Wilkinson 2015; Aladağ and Işik 2017), rule sets for disputes and resolutions (Chou et al. 2016) and challenges in achieving best VFM (Ren et al. 2019).

The other popular methods were interviews and comparative studies, which, respectively, appeared in 24% and 17% of studies.

Researchers applied both in-depth and semi-structured interviews (Mazher et al. 2018) to obtain the detailed views of a range of participants in PPP construction projects including clients (Wang et al. 2014), project managers (Kivilä et al. 2017), and senior managers (Dulaimi et al. 2010).

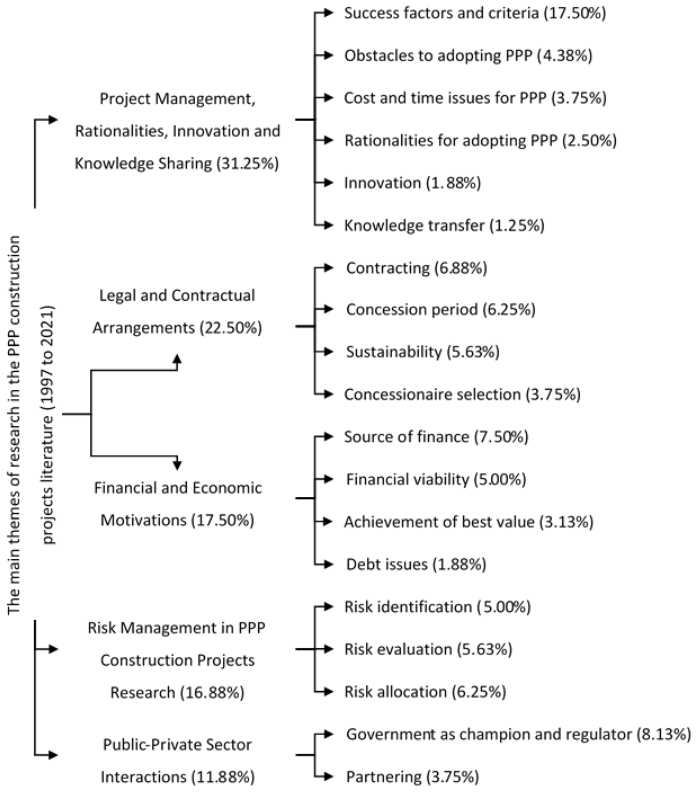
Comparative studies compared and/or contrasted aspects to highlight similarities or differences between PPP construction projects. They examined a variety of issues in different countries such as partner selection criteria (Palaneeswaran and Kumaraswamy 2000), concessionaire's financial capability (Glaister et al. 2000; Zhang 2005a), the role of government in

PPP construction projects (Chen and Messner 2005), and the effects of concession period structures on BOT road contracts (Zhang et al. 2018).

5.0 Key themes from PPP construction projects research

Based on the qualitative coding of the research articles with NVivo 12, five main themes were identified in the PPP construction projects literature between 1997 to 2021. Figure 3 shows these five main themes, their sub-themes and the percentage of studies where each theme/sub-theme occurs. The diagram shows the '*Project Management, Rationalities, Innovation and Knowledge Sharing'* for the largest number of studies (31.25%). The second-largest theme is the '*Legal and Contractual Arrangements theme'* (22.50%). The three other themes were also similar in their frequency of appearance in the studies: '*Financial and Economic Motivations'* (17.50%), '*Risk management'* (16.88%) and '*Public-Private Sector Interactions*' (11.88%). Each theme and its sub-themes were described and discussed in the following sections. For the interested reader, the details are provided in Appendix A, which lists all the studies within each classification.

Figure 3: Themes and sub-themes of the PPP construction projects literature (1997 to 2021)



5.1 Project Management, Rationalities, Innovation and Knowledge Sharing

Research within the *Project Management, Rationalities, Innovation and Knowledge Sharing* theme considered better-managing PPP construction projects and the contributions herein of rationalities for PPP, innovation and knowledge sharing. Six sub-themes were identified within this theme: '*Success factors and criteria*', '*Obstacles to adopting PPP*', '*Cost and time issues of PPP*', '*Rationalities for adopting PPP*', '*Innovation*', and '*Knowledge transfer*'.

5.1.1 Success factors and criteria

In the literature, several types of studies related to the success of PPP construction projects have been identified. The first type of success studies focused on listing and ranking the critical success factors (CSFs) based on their importance by using three main perspectives: (i) a country perspective (Hsueh and Chang 2017; Nguyen et al. 2020), (ii) a PPP construction project perspective (Liu and Wilkinson, 2015), and (iii) a project's life cycle perspective (Liu et al. 2015b; Osei-Kyei et al. 2017).

The second type of success studies focused on measuring the success of PPP construction projects based on the key stakeholders' goals. In this regard, researchers identified the key success criteria for PPP construction projects: (i) in the UK (Dixon et al. 2005), (ii) cross countries (Osei-Kyei et al. 2017), (iii) the key performance indicators (Yuan et al. 2009, 2012; Mladenovic et al. 2013), (iv) the success of PPP transport projects from four different EU countries (Liyanage and Villalba-Romero 2015), (v) the success criteria for PPP construction projects in Ghana (Osei-Kyei and Chan 2017a), and (vi) developed a model to quantify the success of PPP projects in developing countries (Osei-Kyei and Chan 2017b).

The third type of success studies focused on analysing the relationship between the first and the second type of success studies (i.e. CSFs and project success criteria). For example, Ng et al. (2010) evaluated the relationship between initial feasibility with the overall stakeholders' satisfaction in Hong Kong PPP construction projects. Ahmadabadi and Heravi (2019a) estimated the effects of CSFs during the procurement phase of PPP construction projects on the success of PPP highway projects in Iran. Osei-Kyei and Chan (2019) developed a conceptual model for PPP projects'

success in order to examine the relationship between CSFs and success criteria for PPP projects in Ghana.

It is noteworthy that researchers that studied CSFs for PPP construction projects in different countries, such as China, Hong Kong, Taiwan, and Malaysia (Chan et al. 2010a; Cheung et al. 2012; Ismail 2013; Hsueh and Chang 2017), reported different results. This outcome suggests CSFs may be context-specific in each country. Moreover, there is no unified global formula for PPP construction projects success (Kim and Kwa 2020). For example, Dulaimi et al. (2010) identified 7 CSFs while Salman et al. (2007) identified 21 CSFs for the feasibility stage. Also, Li et al. (2005a) identified 18 CSFS for PPP construction projects in the UK; while Cheung et al. (2012) identified 15 CSFs for construction projects in China and Hong Kong. This variety possibly arises from CSFs being based on a country's or project's characteristics, which differ from one another. Furthermore, it is notable that only a few of the CSFs can influence PPP projects' success as a result of the relationship between CSFs and project success criteria studies (Ahmadabadi and Heravi 2019a; Osei-Kyei and Chan 2019).

5.1.2 Obstacles to adopting PPP

The research investigated the potential obstacles to adopting PPP construction projects in different countries. For example, the potential obstacles are examined Southeast Asian region (Tam 1999), China and Hong Kong (Chan et al. 2010b), Jordan (Mistarihi et al. 2013), Greece (Ojiako et al. 2015) and in Nigeria (Adama 2018). Other countries of interest include Ghana and South Africa (Kwofie et al. 2019), and Vietnam (Kim and Le 2021). Findings suggest the key obstacles are a lack of: (i) compatibility/ complementary skills among the key parties, (ii) effective negotiation between the project partners, iii) trust, iv) effective open communication between stakeholders, (v) social and political stability/support, vi) appropriate risk allocation and risk-sharing, (vii) equality between partners, (viii) the time required to make decisions and solve problems, (ix) suitable project management.).

5.1.3 Cost and time issues for PPP

Strongly linked to CSFs and the characteristics of PPP contracts (Liu et al. 2015c), many researchers explored efficiency with respect to time and cost. For example Hampton et al. (2012); Rajan et al. (2014) compared PPP with traditional procurement, with conflicting results. On the other hand,

Raisbeck et al. (2010) and Hampton et al. (2012) found the PPP approach more efficient in Australia and Scotland, while Rajan et al. (2014) reported that traditional procurement was more efficient with respect to cost in India as compared to PPP procurement. Yang et al. (2010) identified debt issues, improper contract planning, and political uncertainty as the most significant causes of delay in BOT projects in Taiwan. Little (2011) found that the mega PPP projects are often associated with huge time overruns and large cost overruns. Recently, Budayan (2019) analysed the perception of public and private sectors on causes of delay in BOT projects in Turkey. Through an analytic hierarchical process, he identified that political and governmental issues are the key factors that cause a delay in BOT projects in Turkey, especially in the implementation phase.

5.1.4 Rationalities for adopting PPP

The research examined the reasons for adopting PPP construction projects in different markets. Li et al. (2005b) found some of the reasons for adopting PFI procurement in the UK construction industry were reducing transaction costs, helping the public sector handle regulatory and financial constraints, technological innovation, and societal benefit. Chan et al. (2009) compared China and Hong Kong, where respondents rated efficiency- and economy-related drivers, respectively, higher and lower than in China. Cheung et al. (2009) found that the main reasons for adopting PPP in the UK were financial, while improvement of public project performance was the most cited reason in Hong Kong and Australia. Robert et al. (2014) reported that the top reasons for adopting PPP in Ghana were to reduce public sector administrative costs and budgetary constraints, sharing risk, innovation enhancement, and local economic development.

5.1.5 Innovation

By sharing the risks and responsibilities with the private sector, the public sector hopes that PPP will bring innovations to infrastructure development. Leiringer (2006) identified the factors that may contribute to innovation such as: (i) design freedom, (ii) risk transfer, (iii) collaborative working, and i(v) long-term commitment in the design and construction phases of the PPP social service projects in developed markets. He argues that most of the PPP construction project funders are unwilling to carry the additional risks of innovation. Weisheng et al. (2013) compared the PPP approach and the agent-construction system to explain procurement innovation in China, and found that the latter has more popularity. Recently Verweij et al. (2020) explored the role of the public partner in

innovation in the PPP Dutch transport infrastructure and concluded that innovation is likely to be achieved if three conditions are met: (i) the procurement of the partnership contract is completed, (ii) there is a strong and good private consortium, and (iii) appropriate project management by the public partner such as: a) technical management, (b) stakeholder management and c) contract management.

5.1.6 Knowledge transfer

Kumaraswamy and Morris (2002) highlighted the importance of knowledge sharing in PPP construction projects and its impact on BOT project success in Hong Kong. Aerts et al. (2017) explained knowledge transfer between public-sector organisations in Belgium's transportation sector.

5.2 Legal and Contractual Arrangements

It is important to have a procurement system to encourage private sector participation and guarantee the rights of all parties (Weisheng et al. 2013). Each procurement system has some advantages and disadvantages. With the PPP approach, issues can become more complex than other approaches (Verweij 2015). Research in this theme examined the characteristics of a successful procurement system and attempted to draw lessons from less successful systems (Wang and Tiong 2000). Four sub-themes were identified within this category; '*Contracting'*, '*Concession period*', '*Sustainability'*, and '*Concessionaire selection'*.

5.2.1 Contracting

Studies focused on the issue of contracting have examined contractual aspects in PPP construction projects. Chou et al. (2016) investigated successful negotiations in contracting. Umar et al. (2019) compared types of PPP contracts and suggested some protocols for improving the contract management: i) proper legal foundation, ii) project management and iii) stakeholder management; as well as fitting the procurement process. Both Merrifield et al. (2002) and Boudet et al. (2011) highlighted difficulties in contractual situations that might arise due to political decisions and a lack of democratic processes in developing countries. Cruz et al. (2015) studied alternative contractual arrangements such as the hybrid model, which they suggest could help reduce the operating costs in the light rail systems they examined in Portugal and Spain. Demirel et al. (2017) discussed the

potential changes and the subsequent requirement of flexibility in the Netherlands PPP transportation contracts. They highlighted the importance of smart PPP contracts based on proactively anticipating potential change. Demirel et al. (2019) investigated the PPP transportation project in the Netherlands via the changes in the realisation phase. They state that the PPP project needs additional social mechanisms between the key partners to deal with the changes in PPP projects. Lozano and Sánchez-Silva (2019) presented a model to define the contractual parameters that maximise the effectiveness in maintenance policies of PPPs. Their outcomes show the importance of flexibility in decision making when facing various sources of uncertainty whilst trying to make maintenance decisions.

5.2.2 Concession period

Concession period research examined the effect of different concession periods. Several researchers tried to identify the optimal lifespan in BOT projects to maximise benefits to both the public and private sectors. Studies included bridge construction projects (Emamian et al. 2017) and road construction projects (Zhu et al. 2016). The optimal lifespan for BOT projects can be based on: (i) cash flow (Hanaoka and Palapus 2012), (ii) estimation of the economic and social development (Zhang et al. 2016), (iii) negotiation between the projects' parties (Zhu et al. 2016), and iv) total investment cost (Emamian et al. 2017). Regarding the effects of a single-period concession structure as compared with a two-period concession structure, Ye and Tiong (2003) analysed the effects based on time overruns, and suggested the two-period structure would be better at reducing the risk of overruns. Zhang et al. (2018) examined two concession period structures based on toll prices, road quality and the concession period, and found that the optimal concession period is independent of concession period structures. Shen et al. (2007) introduced a new concession model, Build-Operate-Transfer-Bargaining (BOTB), for negotiating the concession period, which accounts for the risk attitudes of both the investor and the host government. They found that attitudes to risk could significantly influence the concession period. Wang et al. (2018) proposed a model to demonstrate how to design an optimal contract with government support. They found that the private sector does not always prefer the longest concession period; this preference is because the concession period that is less than the lifetime of the infrastructure may be more profitable for the private sector. However, this orientation countered the government's view that

preferred either the longest concession period or zero of the lifetime of the infrastructure, based on the government's inefficiency cost and construction cost.

5.2.3 Sustainability

Sustainability has recently been acknowledged as a fundamental issue in infrastructure projects (Li et al., 2019). Researchers in this filed examined how sustainability ethos, or lack thereof in PPP construction projects, may influence the environment, economy, and society. Wang et al. (2014) studied the relationship between whole life project management and sustainability in social services projects. Kivilä et al. (2017) argued that innovation in PPP promoted social and economic sustainability in transportation projects in Finland. Similarly, Firouzi and Vahdatmanesh (2019) argued that the material price for BOT highway projects promotes social and economic sustainability. However, Hueskes et al. (2017) believed that social sustainability considerations played only a limited role in PPP construction projects in Belgium. Lehtonen (2019) believed that ecological economics has paid little attention to the assessment and evaluation of PPP projects, despite their problematic relationship with sustainability. Biygautane et al. (2019) highlighted the value of understanding how organisational, social and political factors influence the success of PPP projects. (He et al. 2020) identified the factors that affect the sustainability of PPP water treatment projects and then laid a foundation for the evaluation of project sustainability. Recently Cheng et al. (2021) investigated the link between the PPP contract functions and the performance of PPP construction project sustainability. They stated that the PPP contract functions are positively associated with the performance of PPP construction project sustainability.

5.2.4 Concessionaire selection

Concessionaire selection research attempted to develop criteria for selecting the private sector partner for BOT construction projects. Researchers found that a successful selection of the concessionaire can be based on several issues, such as: (i) the quality of financial assessment and technical assessment (Zhang 2004), (ii) operation and transport planning assessment and consortium ability (Zhang 2009), and (iii) safety, health and environmental factors, and managerial issues (Zhang 2005b). Aladağ and Işik (2020) confirmed that improper partner selection and incompetent contractor selection were considered significant risks to PPP transportation projects' success.

5.3 Financial and Economic Motivations

Eighteen per cent of studies addressed the Financial and Economic Motivations in PPP construction projects. Usually, PPP construction projects require large capital investment, and investors require a reasonable return on their investments. This can be achieved by applying a concession period during which investors can sell the services or products of the project. Even so, financing PPP construction projects is complicated by many internal and external factors (Verweij 2015). This theme could be split into four sub-themes; '*Source of finance'*, '*Financial viability'*, '*Achieving best value*', and '*Debt issues'*.

5.3.1 Sources of finance

Sources of finance research addressed the various financing mechanisms of PPP construction projects. Abdel-Aziz (2007) highlighted the importance of the competitive financial proposals in Design-Build-Finance-Operate (DBFO) transportation projects in the UK, Colombia and Canada. Glaister et al. (2000) analysed the alternative funding mechanisms including bond financing by drawing comparisons between the London Underground's Crossrail PPP with the Channel Tunnel Rail Link Project. Bakatjan et al. (2003) developed a model to determine the capacity for debt finance on the basis of taxes on the returns on utility projects. Kokkaew and Chiara (2013) presented a model of government revenue guarantees in highway BOT projects; and explored how to cope with uncertainty in government revenue relating to transportation projects in the US. Chiara and Kokkaew (2013) presented a new type of revenue risk-hedging contract. They proposed the flexible revenue insurance contract that can be as an alternative to the conventional government guarantees. Li et al. (2017) incorporated a credit default swap in PPP projects and evaluated it by using a risk-neutral valuation method.

Attarzadeh et al. (2017) proposed a model to evaluate early funding options under uncertainty in BOT projects Iran, and González-Ruiz et al. (2017) argued that public support can increase the likelihood of private investor participation. In contrast, Bashtannyk et al. (2020) indicated that if the private sector in Ukraine is provided with the necessary capital, private investors will not be interested in infrastructure development. Bae et al. (2019) analysed the alternative solutions that reduce government financial exposure when maintaining the private sector's net present value by using the Incheon airport highway in South Korea as a case study. Bai and Zhang (2020) compared

four models for financing and operating hydrogen refuelling stations and concluded that project risks, financing difficulties, and financing costs are the crucial factors for investors to satisfactorily resolve when financing hydrogen-refuelling stations. Vassallo et al. (2020) analysed the PPP highway program performance over time in Santiago. They stated the importance of (i) promoting integration with public transportation, (ii) avoiding separation among neighbourhoods, and (iii) adopting regulatory measures to prevent congestion in the future.

5.3.2 Financial viability

It is essential to know the financial viability of the private sector bidder before awarding them the contract. In a first of its kind, Ho and Liu (2002) used an option pricing-based model to evaluate the financial viability of a privatised construction BOT project in Canada, in order to determine the risk of bankruptcy. Huang and Chou (2006) developed a pricing method between the minimum revenue guarantee and the option to terminate the contract in the preconstruction phase. Subprasom and Chen (2007) developed a model of pricing and capacity in BOT projects in China. Garvin and Cheah (2004) studied valuation techniques for infrastructure investment decisions for construction BOT projects in the US. Jeerangsuwan et al. (2014) used a hypothetical case study to evaluate the financial viability of PPP toll road projects. Jeong et al. (2016) evaluated the financial viability of BOT projects in South Korea via a case study. Sun et al. (2019) developed a model for financial viability based on the equity and debt of the BOT highway projects. Their results indicated that the optimal equity ratio would increase when the government provides a revenue-sharing scheme and a minimum traffic volume guarantee. Closely related to financial viability, Zhang (2005a) studied the importance of concessionaire's financial capability in BOT construction projects.

5.3.3 Achieving best value

Researchers have explored the challenges PPP projects faced in achieving best value in the UK (Akintoye et al. 2003) and across countries (Zhang 2006a). Both argued the biggest challenge to achieving best value was finding an acceptable tariff level, but neither provided guidance on what was an 'acceptable level'. Moreover, Park et al. (2018) added that the political and economic issues were the biggest challenges in delivering the best value for many PPP construction projects in Korea. This outcome has been supported by (Bertelli 2019) who researched 4,300 agreements for PPP construction projects in 83 developing economies. Furthermore, Ren et al. (2019) argue that the

main challenge to achieve the best value is sharing information between the key partners. Therefore, they developed schema to formalise the data exchange needed to support information extraction and performance measurement.

5.3.4 Debt issues

Research suggests that the levels of debt may affect the behaviour of managers in PPP projects. Devapriya (2006) and Marco and Mangano (2017) investigated the nature of debt under the PPP energy sectors worldwide. Devapriya (2006) suggested that managerial effectiveness may be lower when there is reserve financing, while other factors such as: (i) construction duration, (ii) a country's stability index and (iii) the average size of partners may increase managerial effectiveness (Marco and Mangano 2017). Regarding multi-sourced debt financing strategy is used for financing capital investments, Yuning and Xiaohua (2019) suggested that developing a financial model can help investors in China to choose the optimal capital structure for investment.

5.4 Risk Management in PPP Construction Projects Research

On the one hand, risk sharing is a potential motivation for PPP (Bing et al. 2005). Conversely, PPP may create additional risks due to the complexity of organisations, government involvement, financing, and technical expertise of the project (Grimsey and Lewis 2002). Therefore, understating risk in PPP construction projects is a key research area. Three sub-themes were identified within this category: '*Risk identification'*, '*Risk evaluation'* and '*Risk allocation'*.

5.4.1 Risk identification

Risk identification authors identified and compared critical risk factors for construction PPP projects (Le et al. 2020; Wang et al. 2020). The key risks identified were: (i) government-related delays in public sector support, (ii) immature legal systems in the host government, and (iii) political risk, which were the main causes of failure in construction BOT construction projects. Wang et al. (2020) stated that the critical risk factors of PPP projects could be divided into two types. The first type involves risk factors that have independent and robust influence such as: (i) state stability, (ii) delay in government approval, (iii) imperfect legal and regulatory systems, and (iv) government credit. The second type covers risk factors that are highly exposed and easily changed (e.g. insufficient

revenue in the market, completion risks, and fee change). Therefore, professional experts should fully analyse the risk elements at both macro and micro levels.

5.4.2 Risk evaluation

Grimsey and Lewis (2002) used Monte Carlo simulation to create a framework for evaluating the risks on the wastewater treatment in Scotland. Zayed and Chang (2002) developed a prototype for risk evaluation for BOT projects, which can also rank risks. Dey and Ogunlana (2004) developed a model for selecting the risk management process for BOT projects. They concluded that political risk factors are most important, especially in developing countries. Mazher et al. (2018) state that effective risk allocation can be achieved via sufficient risk assessment. Moreover, Tepeli et al. (2021) developed a formalised and systematic multi-dimensional modelling of the risk management process to assess the project risks during the PPP project life-cycle. Ahmadabadi and Heravi (2019b) developed a risk evaluation framework by focusing on risk interaction and stakeholders' expectations in an Iranian PPP transportation project. An important finding from several risk evaluation studies of BOT construction projects is that the country context is the most important risk, especially in developing countries (Mazher et al. 2018; Ahmadabadi and Heravi 2019b).

5.4.3 Risk allocation

Risk allocation is an important strand addressed in PPP construction project research. Carpintero and Petersen (2015) studied the impact of risk allocation in a BOT transportation project in Spain and concluded that PPP construction projects were more likely to fail if the risk was not properly allocated from the outset. This view has been supported by Kim and Kwa (2020) who analysed six failed PPP cases in Singapore. They concluded that poor risk allocation and risk sharing between the key partners are the most significant factors for PPP construction projects' failures. Bing et al. (2005) studied the impact of the risk allocation on the negotiations and contract transactions for construction projects in the UK, while studies by Abednego and Ogunlana (2006) and Shen et al. (2006); all discussed how to allocate risk among partners, taking into account types of risk and partners' characteristics. For example, the public sector can more effectively manage 'legal and policy' and 'allocation of site acquisition' risks, while the private sector is better equipped to handle 'design and construction' and 'operational' risks. Similarly, Ng and Loosemore (2007) explored factors to consider when allocating risk between public and private sector partners. Roumboutsos

and Pantelias (2015) examined the preferred risk allocation in PPP construction projects in several countries. Ke et al. (2010) concluded that private investors have to become more active in managing the micro level risks. While Roumboutsos and Pantelias (2015) found that theory and practice were divergent, which led to low-level structuring and exposing projects to potential failure. Dewulf and Garvin (2020) studied the risk allocation impacts on the PPP construction projects over time, taking into account the project-changing environment. They found that changes in the political aspect and economic market have a major impact on PPP construction projects. For example: (i) the impact of the political landscape on investment and economic development and (ii) the influence of financial crises on projects' cash flows. Therefore, adaptation to changing conditions is a crucial requirement for PPP success.

5.5 Public-Private Sector Interactions

The final research theme addressed why and how the public and private sectors engage and cooperate in PPP construction projects. Research suggests that a springboard for PPP is governments encouraging the private sector to engage with the public sector to provide public services and to raise living standards (González-Ruiz et al. 2017). Usually, the project starts via the public sector then the private sector will take part up to a certain stage to achieve the project objectives. Thus, the PPP project can be considered as government action. Naturally, the private sector will also ask for financial guarantees from the government to alleviate its risk concerns (Robert et al. 2014). Therefore, it will be more appropriate to have a clear regulation for PPP projects to achieve the host government goals, which is one of the government responsibilities (The World Bank 2017). Anyway, to achieve success in PPP projects, the host government should consider several factors such as government relationships (Edkins and Smyth 2006), initiatives and guarantees (Brandao and Saraiva 2008), and favourable legal framework (Zhang et al. 2015). The 12.58% of articles within the Public-Private Sector Interactions theme could be split into two sub-themes: government as champion and regulator, and partnering.

5.5.1 Government as champion and regulator

Research in this sub-theme examined the dual role of the public sector to encourage and maintain PPP construction projects. Scholars including Yang et al. (2016) and Kavishe et al. (2019) identified the main issues that governments should consider to effectively support PPP construction projects

in developing countries. These were (i) the win-win principle (Ho 2006); (ii) political stability and (iii) a competitive procurement process (Yang et al. 2016); (iv) government guarantees (Cheah and Liu 2006), (iv) favourable legal framework, v) state credibility and vi) developing the domestic capital market (Kavishe et al. 2019). Wang and Tiong (2000) addressed the initiatives and guarantees that governments can provide to support the implementation of transportation and utility infrastructure projects in developing countries. These issues include: (i) the granting of exclusive concessions, and (ii) a range of guarantees such as: (a) power purchase, (b) fuel supply, (c) force majeure (including changes in the law), (d) foreign exchange regulations, (e) compensation under government's default and political risks, (f) tax incentives and (g) lenders' right.

Studies also examined how governments may facilitate PPP through: (i) public support, (ii) efficient approval processes (Sinha and Jha 2021), (iii) transparent and efficient procurement (Chen and Messner 2005), (iv) offering a favorable legal framework in China (Zhang et al. 2015), (v) clarifying the role of project partners in China (Wu et al. 2016) and (vi) political stability and support in the US (Algarni et al. 2007). Meanwhile, Brandao and Saraiva (2008) presented a real options model to assess the value of the minimum traffic guarantee; their model also allows the government to analyse the costs and benefits of each level of support. Wang et al. (2020) proposed a conceptual model to demonstrate ways for the public sector to improve efficiency through integrated governance of PPP projects in order to achieve sustainability. The findings illustrated the policy strategies for the public sector on how to regulate the PPP market further and address the gaps. These initiatives included: (i) providing measurement tools, (ii) further standardising instruction and regulations for the PPP infrastructure projects.

5.5.2 Partnering

Partnering studies examined relationships between partners in PPP construction projects. A number of studies i.e. (Edkins and Smyth 2006; Roberts and Siemiatycki 2015) explored the impact and importance of effective relationships on how PPP projects performed. Researchers found that the effective relationships between the project's parties can help to improve the performance of the PPP project (Roberts and Siemiatycki 2015). That relationships between partners in PPP construction projects can be measured by the level of trust as an indicator of robustness (Edkins and Smyth 2006). Regarding the sustainability of partnerships, Kumaraswamy et al. (2007) modelled the effect of the strength of the relationship, Koops et al. (2017) examined the influences on

relationships. South et al. (2018) concluded that it would be challenging to study the stakeholders' relationships longitudinally in PPP projects due to the stakeholders' change during the concession period.

6.0 Variance in PPP research themes

Once the themes and sub-themes emerging from the reviewed articles were identified, further analysis of the distribution of the research across the developmental stage of the country in question was conducted. The purpose of the analysis was to compare research findings from developing and developed countries and, subsequently, identify challenges that PPP construction projects face in developing countries. Table 2 is a cross-tabulation of the development stage of countries against the classification of each article by themes/sub-themes.

Table 2: Research themes by country developmental stage

Main themes	**Sub-themes**	**Countries context**			**Sub Total**	**Total**
		Developed	**Developing**	**Both**		
Project Management, Rationalities, Innovation and Knowledge Sharing	Success factors and criteria	4	13	11	28	**50**
	Obstacles to adopting PPP	-	6	-	7	
	Cost and time issues for PPP	2	3	1	6	
	Rationalities for adopting PPP	1	2	1	4	
	Innovation	2	1	-	3	
	Knowledge transfer	1	1	-	2	
Legal and Contractual Arrangements	Contracting	3	4	3	11	**36**
	Concession period	-	5	5	10	
	Sustainability	3	2	4	9	
	Concessionaire selection	1	2	3	6	
Financial and Economic Motivations	Source of finance	4	7	1	12	**28**
	Financial viability	2	3	3	8	
	Achievement of best value	1	2	2	5	
	Debt issues	-	2	1	3	
Risk management	Risk identification	-	5	3	8	**27**

	Risk evaluation	2	5	2	9	
	Risk allocation	3	4	3	10	
Public-Private Sector Interactions	Government as champion and regulator	1	11	1	13	**19**
	Partnering	4	1	1	6	
Total		**36**	**79**	**45**	**160**	**160**

Findings suggest that the PPP procurement approach attracts more research in the developing world. By using the United Nations (2015) classification, almost half i.e., 79 studies (49%) of all the studies were conducted in developing countries, nearly twice as many as those in developed countries i.e., 36 studies (23%) and more to the number in both developed and developing countries i.e., 45 studies (28%). This supports the notion that PPP's strengths should particularly help the public sector in the developing world.

Next, more granular analysis was conducted by identifying, for each sub-theme, challenges facing PPP construction projects and then delineating challenges specific to developing countries. Any sub-theme that does not have challenges related to developing countries were removed. The key findings are as follows. *First*, altogether, 24 challenges facing PPP construction projects were identified; 18 common challenges between developed and developing countries, and six challenges exclusive to developing countries. *Second*, the top three challenges are *'Appropriate risk allocation and risk-sharing*', *'Political support'*, and *'The private sector's financial strength'* which, respectively, appeared in 21, 15, and 11 studies. *Third*, the top themes reporting challenges are *'Public-Private Sector Interactions*' which presented 12 challenges, then *'Project Management, Rationalities, Innovation and Knowledge Sharing*', *'Financial and Economic Motivations'* which parallel presented 11 challenges, then *'Legal and Contractual Arrangements'*, and *'Risk Management in PPP Construction Projects Research*' which, respectively, presented eight, and seven challenges. *Fourth*, the top three sub-themes reporting challenges are *'Government as champion and regulator'*, which presented 11 challenges, then *'Obstacles to adopting PPP'* which presented 8 challenges, then *'Source of finance'* which presented 7 challenges. In other words, most of the 24 identified challenges fell in these sub-themes. Therefore, these three appear to be the most challenging areas for PPP construction projects.

The challenges that were exclusive to studies conducted in developing countries were *'Compatibility and complementary skills among key parties'*, *'Competitive procurement process'*, *'Democracy'*, *'Efficient approval processes'*, *'Favourable legal framework'*, and *'Transparent and efficient procurement*'. Thus, based on the issues the researchers examined, these are the most likely challenges to PPP construction projects in the developing world. Table 3 lists the identified challenges. It is important to stress once again that these challenges are limited only to the issues the research examined and that there could be other challenges that the researchers overlooked or did not report.

Table 3: Challenges facing PPP construction projects from the literature

Main themes of PPP			**Project Management, Rationalities, Innovation and Knowledge Sharing**				**Legal and Contractual Arrangements**				**Financial and Economic Motivations**				**Risk Management in PPP Construction Projects Research**			**Public-Private Sector Interactions**		
Sub-themes			Cost and time issues for PPP	Obstacles to adopting PPP	Innovation	Knowledge transfer	Contracting	Concession period	Sustainability	Concessionaire selection	Source of finance	Financial viability	Achievement of best value	Debt issues	Risk identification	Risk evaluation	Risk allocation	Government as champion and regulator	Partnering	Total of frequency
Issues and challenges	1	Appropriate risk allocation and risk-sharing		1	1						1				7	1	10			21
	2	Political support	2	4				1					2		1			5		15
	3	The private sector's financial strength	2	1							4	2		2						11
	4	Available financial market		1					3		1			1			1	2		9
	5	Concession period						9												9
	6	Achieving the best VFM									1		3				2	1	1	8
	7	Government guarantees									3				1			4		8
	8	Negotiation between the project partners		2			6													8
	9	Relationship between the project partners														8				8
	10	Risk evaluation			1								1						5	7
	11	compatibility/complementary skills among the key parties		3					1									2		6

	12	Favourable legal framework		1													1	4		6
	13	Realistic feasibility study					1				1	3		1						6
	14	Selecting the proper partner								6										6
	15	Trust and effective open communication and willingness to compromise	1	2	1							2								6
	16	Clear roles and responsibilities among the project partners																1	2	3
	17	competitive procurement process																3		3
	18	Innovation in delivering public services	1		2															3
	19	public support									1							2		3
	20	Acceptable level of the tariff											2							2
	21	Democracy					2													2
	22	Efficient approval processes																2		2
	23	Knowledge transfer				2														2
	24	Transparent and efficient procurement																1		1
Total of frequency within the sub-theme			4	8	4	**1**	**3**	**2**	**2**	**1**	**7**	**3**	**4**	**3**	**3**	**2**	**4**	**11**	**3**	
Total of frequency within the main theme			**11**				**8**				**11**				**7**			**12**		

7.0 Discussion

By systematically reviewing the literature, 24 challenges were identified to conducting PPP construction projects reported. From those challenges, 18 common challenges between developed and developing countries, and six challenges exclusive to developing countries. While some of these challenges have been highlighted previously (see for example, Edkins and Smyth 2006; Shen et al. 2007; Jeong et al. 2016; Verweij et al. 2020), these studies have tended to examine each challenge discretely. By synthesising the evidence on the challenges that PPP construction projects face and analysing the totality of the evidence from the literature, the field is advanced.

The analysis in this research has revealed the following. First, the three most commonly reported challenges were *'Appropriate risk allocation and risk-sharing'*, *'Political support'*, and *'The private sector's financial strength'*. Therefore, these appear to be the key challenges for PPP construction projects. Second, although there is an upward trend in applying PPP construction projects in developing countries, there are some contingent problems of PPP application. These are (shortage of) '*Compatibility and complementary skills among key parties'*, *'Competitive procurement process*', *'Democracy'*, *'Efficient approval processes'*, *'Favourable legal framework'*, and *'Transparent and efficient procurement'*. The reasons behind each of these factors might be more

salient in developing than in developed countries due to political and/or economic instability are discussed below.

A lack of '*Compatibility and complementary skills among key parties'* in developing countries in the inexperience of local commissioning authorities with PPP projects is observed. Such inexperience can lead to the offer of unrealistic guarantees for proposed projects, which might be against the public interests or the government's long-term goals. Hence, there is a higher risk of delay, contractual breach, or debt cancellation particularly if (i) the central governments are unable or unwilling to commit or (ii) individuals with ultimate responsibility are changed (Mistarihi et al. 2013). There is also the potential for financiers to exploit local authorities' lack of or limited experience and knowledge of PPP for profiteering (Chan et al., 2010b). Such exploitation is less likely in more developed countries with greater knowledge and experience of PPP (Li et al. 2005a). A lack of '*Compatibility and complementary skills among key parties'* also impinges on competitive procurement processes. In developing countries, there may often be misspecification of tendering cost due to insufficient knowledge, skill or experience (Kumaraswamy and Zhang 2001). As such, tendering processes may be inefficient, so that local authorities struggle to select the most suitable PPP projects developers to achieve the optimal efficiencies (Kumaraswamy and Zhang 2001; Yang et al. 2016). While the relationship between democracy and development is complicated, developed countries tend to have more established and stronger democratic institutions than developing countries (Doorenspleet 2019). The extent of democracy in a country influences political stability, which affects PPP construction projects. Research suggests that lack of democratic accountability is a recipe for dispute (Boudet et el. 2011). For example, Boudet et at. (2011) presented accounts of legal conflict emerging in both large and small PPP projects when undemocratic regimes in different countries disregarded some governance elements. Like procurement, approval processes may also be more inefficient in developing countries than in developed ones. Researchers suggest several reasons for inefficiencies, including inconsistencies in the policies adopted by different agencies and issuing approvals in sequential rather than parallel order (Chen and Messner 2005).

Lack of political stability may also reduce the extent of a conducive legal framework comprising a system of contracts, agreements, policies and regulations, which, in turn, can discourage private enterprises' participation in PPP construction projects (Zhang et al. 2015). For example, researchers noted that some developing countries lack of such a framework contributed

to failure to complete or deliver some PPP construction projects (Zhang et al. 2015). Kumaraswamy and Zhang (2001) and Bildfell (2018) suggested that a critical factor arising from the absence of such legal frameworks is corruption, which, as mentioned above, may impair efficient procurement. In contrast, some developed countries such as the UK, Australia and Canada have established the legal frameworks to stimulate PPP procurement approaches (Cheung et al. 2012). Additionally, public procurement is highly susceptible to corruption in developing countries (Bildfell 2018). A cause and a consequence of corruption is lack of transparency. Transparency requires effective communication among all parties and helps to establish a clear basis for making decisions, lowering transaction costs and shortening negotiations to complete the deal (Chan et al. 2010a). For example, there were tangible improvements when China adopted a more transparent, international competitive bidding process (Chen and Messner 2005).

By qualitatively coding the content of 160 PPP construction projects articles, five themes were identified from the PPP construction projects research, which was split into 19 sub-themes afterwards. The themes and sub-themes vis-à-vis the classifications of research articles provide a useful framework for discussing the key findings from the literature, thus identifying where and how the literature may be advanced by future research.

The first theme was '*Project Management, Rationalities, Innovation and Knowledge Sharing*' (see Appendix A). Within this theme, one of the most well developed areas was research examining '*Success factors and criteria*' in PPP construction projects. An important finding was that '*Success factors and criteria*' might be dependent upon the context of the country (Hsueh and Chang 2017; Osei-Kyei and Chan 2017a); for example, the political and economic systems. Like '*Success factors and criteria*', the '*Rationalities for adopting PPP*' in construction projects may also differ across countries due to the differences in the context (Robert et al. 2014). Studies also found that '*Knowledge transfer*' between the public and private sectors is needed to increase the success of PPP projects, and can be considered an important mechanism for improving the practice and implementation of PPP construction projects (Aerts et al. 2017). Fundamentally, it was noted that there is no unified global formula for PPP construction projects success (Kim and Kwa 2020). It was also recognised that there is a lack of studies into CSFs for the PPP project procurement phase and the project detailed preparation phase in the PPP project's life cycle (Liu et al. 2015b; Osei-Kyei et al. 2017). Another issue related to the '*Success factors and criteria*' is the lack of studies that examine the external influences on the success of the project, such as the political and economic

stability. Similarly, research into '*Obstacles to adopting PPP*' remains ambiguous regarding the sensitivity of those obstacles to a specific context (Kim and Le 2021). Although *'Innovation'* is one of the main concepts of the PPP approach (Leiringer 2006), it is notable that studies are lacking on how to encourage the private sector to engage in '*Innovation'*, as well as the impact of innovation in PPP, particularly with regard to delivering public services (Verweij et al. 2020). Findings regarding '*Cost and time issues for PPP'* projects were unclear (Rajan et al. 2014), which suggests a need for more research to understand the nuances of how PPP may exacerbate or mitigate time delays or financial overspending.

Research on the largest theme, '*Legal and Contractual Arrangements'* (see Appendix B), confirmed the importance of '*Contracting'* arrangements (Demirel et al. 2019; Lozano and Sánchez-Silva 2019), the need to carefully design the '*Concession period'* (Zhang et al. 2018) and, particularly, ''*Concessionaire selection*' in PPP construction projects (Aladağ and Işik 2020). Overall, the '*Legal and Contractual Arrangements'* literature is quite strong, with a growing body of literature on how best to effect '*Concessionaire selection*' in PPP construction projects. Nevertheless, although the evidence from some of the literatures (see Kivilä et al. 2017) hints at the potential gains of embedding '*Sustainability'* in PPP construction projects, there is very little research within this sub-theme, which indicates the need for greater research in the role that '*Sustainability'* considerations can or should play in PPP construction projects.

Studies in the third theme, i.e., '*Financial and Economic Motivations'* (see Appendix C), emphasised the importance of robust financial forecasting, exploring different financing mechanisms, and the role of public support and government guarantees may play in securing private sector finance (Bai and Zhang 2020). There is a strong body of literature on how to examine the '*Financial viability'* of private partners and '*Sources of finance'* in PPP construction projects and a characteristic of the studies in this theme is the multidisciplinary of the approaches used to examine '*Financial viability*' (Sun et al. 2019). A much smaller number of studies examined the notion of '*Achieving best value'* in PPP construction projects (for example, Ren et al. 2019), suggesting the need for more research given the growing importance of the concept of value in projects. Similarly, given the indications that level of debt may impact managerial effectiveness (Yuning and Xiaohua 2019), more research within the sub-theme of *'Debt issues'* in PPP construction projects would be helpful to affirm the findings and provide more clarification on the mechanisms behind how debt levels may drive behaviour.

The fourth theme comprised research on '*Risk Management'* (see Appendix D), with sub-themes of' *'Risk identification'*, '*Risk evaluation'* and '*Risk allocation'*. Although research on '*Risk identification'* is well developed, most of the research addressed BOT projects in East Asia and Pacific regions (Le et al. 2020; Wang et al. 2020). As such, *'Risk identification'* research may be extended by examining the extent to which findings extend to other types of PPP or regions. Given the finding from several studies of the potential impact of the context of the country on risk (Mazher et al., 2018; Ahmadabadi and Heravi, 2019b), it would seem reasonable to suggest that *'Risk evaluation'* research may be further advanced by more extensive study of the importance of context of a country– e.g., political or economic regulatory. In contrast, the '*Risk allocation'* research is quite well developed (Abednego and Ogunlana 2006;), without any noticeable weaknesses.

Finally, the last theme focused on research on '*Public-Private Sector Interactions*' (see Appendix E), which examined elements of '*Partnering'* and the '*Government as champion and regulator'* in PPP construction projects. Research underscored the importance and influence of relationships and sustaining relationships among the project partners (Roberts and Siemiatycki, 2015) and that it is the government's role to provide systems to encourage the private sector to participate and cooperate in PPP construction projects (Kavishe et al. 2019; Wang et al. 2020). Overall, research in this theme is quite well developed.

8.0 Conclusions

The study makes several significant contributions to PPP practice and theory with the main practical contributions being the list of challenges that PPP construction projects practitioners should expect, which is the result of political and economic stability. Specifically, for any project, practitioners should pay attention to the management of '*Appropriate risk allocation and risk-sharing*', *'Political support'*, and '*The private sector's financial strength'*. For PPP projects in developing countries, the key challenges that were identified found to be more salient requiring practitioners to pay additional attention to were '*Compatibility and complementary skills among key parties'*, *'Competitive procurement process'*, *'Democracy', 'Efficient approval processes'*, *'Favourable legal framework'*, and '*Transparent and efficient procurement'*. As such, practitioners can derive a number of benefits from this study, noting the knowledge generated from primary reviews in PPP undertaken within the construction industry.

In terms of theoretical contributions, our study makes three distinct contributions to the literature published on PPP over the last few years.

First, is the detailed identification, synthesis, evaluation and classification of the existing literature via qualitative coding, classification and cross-tabulation. The emergent taxonomy allowed for a detailed evaluation of literature published between 1997 to 2021, providing a expanded view of what PPP entails and the challenges it faces in the context of developing countries, providing a more detailed understanding of its risk factors. Thus, our study extends current research on PPP in construction such as that of Ke et al. (2009) which reviewed PPP literature published between 1998 and 2008, Osei-Kyei and Chan (2015) which reviewed PPP literature published on critical success factors between 1990 and 2013, Bao et al. (2018) who reviewed similar literature published between 1996 and 2016, Ma et al. (2019) who focused on such literature published between 2008 and 2018 and Narbaev et al. (2020) who reviewed and engaged in a clustering of PPP literature published between 1989 and 2018.

The second theoretical contribution of our study is that the systematic review of the literature we undertook revealed insights into the state, nature and health of the PPP construction projects literature. For example, for the period we covered (between 1997 and 2021), we found that the rate of PPP construction projects research published in journals roughly doubled, indicating higher research activity. This is similar to findings made earlier by both Ke et al. (2009) and Ma et al. (2019). As anticipated, given the expected greater benefit of the PPP approach in the developing world context, there was a preponderance of research conducted in developing countries. The main types of projects examined were transportation projects, utility infrastructure, and social service projects by using qualitative approaches. Even when researchers conducted quantitative studies, they did not achieve large sample sizes. This suggests that the PPP construction literature currently lacks empirically-based studies which, for example, test theories based on large samples and are, consequently, statistically powerful.

The third theoretical contribution of our study is that building on previous literature on challenges associated with PPP projects, the three key factors which emerged from our study ('*Appropriate risk allocation and risk-sharing*', *'Political support'*, and '*The private sector's financial strength'*), together can be construed as risk factors to be taken into consideration by the public sector seeking to better regulate and manage PPP projects in different developing country context. However, we posit that these three risk factors will be best put to use when cumulatively considered

alongside other factors identified in these other reviewed works on PPP published over the last few years. These studies include that of Osei-Kyei and Chan (2015), Yuan et al. (2015), Bao et al. (2018), Cui et al. (2018), and Ma et al. (2019). Thus, taking these various studies into consideration, we opine that our study provides one of the numerous different perspectives of PPP risk factors. Our study also contributes to the literature by specifically extending prior studies. For example, in response to Ma et al.'s (2019) call for comparative studies to explore differences in PPP practice between developing and developed countries, we were able to identify a number of PPP challenges exclusive to developing countries. Our study can serve to inspire other scholars to further conduct reviews of contemporary project-focused literature on PPP in developing countries. In the process, providing academic guidelines that are characterised by a wide coverage of the topic. The outcome of such studies enabling for more detailed appreciation and integrative lens of the PPP concept and its future research direction.

Although undoubtedly making a contribution to our understanding of Public-private partnership (PPP) literature, our study does have some limitations which open theoretical and empirical avenues for further studies. The first limitation has to do with our selected keywords. Here, we acknowledge that while there are other types of PPP which include BOO (Build-Own-Operate), BOT (Build Operate Transfer) BOOT (Build-Own-Operate-Transfer), and PFI (Private Finance Initiative). In our study, these iterations of PPP were not employed as keywords in our search string as had been the case in other studies such as Cui et al. (2018), Ma et al. (2019) and Wang and Ma (2021). This led to these prior studies returning large selection of papers. Thus, for example, Cui et al. (2018) returned 4911 papers while Ma et al. (2019) returned 1209 papers. The second limitation has to do with the addition of '*Project Management*', '*Construction*' and '*Infrastructure'* to what could be construed as an already restricted set of keywords. The implication being that our search returned a limited number of papers (312) as some relevant papers may have been excluded from our search. However, despite this limitation, we opine that the the 312 returned papers is reflective of the general nature of PPP in developing countries. However, for future studies, it may be beneficial not only for the various PPP iterations to be included as keywords as in other studies, but also for the '*Project Management*', '*Construction*' and '*Infrastructure*' keywords to be removed. As an alternative, the approach adopted by Ma et al. (2019) could be adopted. This involves undertaking a less restrictive search to be followed by a manual exclusion of papers construed as not within the project management domain. The third limitation of this study

is that published research was used as a dataset to identify the challenges facing conducting PPP construction projects. Therefore, the findings were likely limited by selection bias regarding the issues researchers choose to study or which are popular in the literature, and by publication/reporting bias whereby, for example, non-significant findings are not published or reported. One way to address this limitation would be by extending the literature coverage. Future research could also conduct empirical research to confirm the relative importance of the identified challenges, and how that varies across different countries. The final (fourth) limitation of our study is the lack of country specificity in our analysis. Future studies in this area could enlarge how variance in PPP research themes are understood in the developing country context, thus creating more theoretical value. For example, additional analysis could provide more insigtht into specific developing context related to political and economic stability.

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Appendix A: Details of studies on PPP construction projects 1997 to 2021

Appendix A: Project Management, Rationalities, Innovation and Knowledge Sharing theme in the PPP construction projects literature (1997 to 2021)

Sub-themes	Countries context			Sub Total	Theme Total
	Developed	**Developing**	**Both**		
Success factors and criteria studies	N = 4: (Dixon, Pottinger and Jordan, 2005); (Li *et al.*, 2005a); (Jefferies, 2006); (Liu and Wilkinson, 2015).	N = 13: (Askar and Gab-Allah, 2002); (Chan *et al.*, 2010a); (Dulaimi *et al.*, 2010); (Ng, Wong and Wong, 2010); (Cheung *et al.*, 2012); (Ismail, 2013); (Tang and Shen, 2013); (Hsueh and Chang, 2017); (Osei-Kyei and Chan, 2017b); (Osei-Kyei and Chan, 2017a); (Ahmadabadi and Heravi, 2019b); (Osei-Kyei and Chan, 2019); (Nguyen, Likhitruangsilp and Onishi, 2020).	N = 11: (Zhang, 2005c); (Salman, Skibniewski and Basha, 2007); (Jacobson and Choi, 2008); (Yuan *et al.*, 2009); (Yuan *et al.*, 2012); (Mladenovic *et al.*, 2013); (Chou and Pramudawardhani, 2015); (Liu, Love, Smith, Regan and Davis, 2015); (Liyanage and Villalba-Romero, 2015); (Osei-Kyei, Chan and Ameyaw, 2017); (Osei-Kyei *et al.*, 2017).	28	50
Cost and time issues	N = 2: (Hampton, Baldwin and Holt, 2012); (Raisbeck, Duffield and Xu, 2010).	N = 3: (Budayan, 2019); (Rajan, Gopinath and Behera, 2014); (Yang, Yang and Kao, 2010).	N = 1: (Little, 2011).	6	
Obstacles to adopting PPP	-	N = 6: (Tam, 1999); (Chan *et al.*, 2010b);	N = 1: (Ojiako *et al.*, 2015).	7	

		(Mistarihi, Hutchings and Shacklock, 2013); (Adama, 2018); (Kwofie, Aigbavboa and Thwala, 2019); (Kim and Le, 2021).			
Rationalities for adopting PPP	N = 1: (Li *et al.*, 2005b).	N = 2: (Chan *et al.*, 2009); (Robert, Dansoh and Ofori-Kuragu, 2014).	N = 1: (Cheung, Chan and Kajewski, 2009).	4	
Innovation	N = 2: (Leiringer, 2006); (Verweij, Loomans and Leendertse, 2020).	N = 1: (Weisheng *et al.*, 2013).	-	3	
Knowledge transfer	N = 1: (Aerts, Dooms and Haezendonck, 2017).	N = 1: (Kumaraswamy and Morris, 2002).	-	2	

Appendix B: Legal and Contractual Arrangements theme in the PPP construction projects literature (1997 to 2021)

Sub-themes	Countries context			Sub Total	Theme Total
	Developed	**Developing**	**Both**		
Contracting	N = 4: (Zhang and Kumaraswamy, 2001); (Cruz, Marques and Pereira, 2015); (Demirel *et al.*, 2017); (Demirel *et al.*, 2019).	N = 4: (Merrifield, Manchidi and Allen, 2002); (Liu and Cheah, 2009); (Boudet, Jayasundera and Davis, 2011); (Chou *et al.*, 2016).	N = 3: (Ngee, Tiong and Alum, 1997); (Lozano and Sánchez-Silva, 2019); (Umar, Zawawi and Abdul-Aziz, 2019).	11	36
Concession period	-	N = 5: (Ye and Tiong, 2003); (Hanaoka and Palapus, 2012); (Bao *et al.*, 2015); (X. Zhang *et al.*, 2016); (Emamian, Naini and Shahanaghi, 2017).	N = 5: (Shen, Li and Li, 2002); (Shen *et al.*, 2007); (Zhu, Xu and Hu, 2016); (Zhang, Feng and Zhang, 2018); (Wang *et al.*, 2018).	10	
Sustainability	N = 3: (Wang, Wei and Sun, 2014); (Hueskes, Verhoest and Block, 2017); (Kivilä, Martinsuo and Vuorinen, 2017).	N = 2: (Biygautane, Neesham and Al-Yahya, 2019); (Cheng, Liu and Xu, 2021).	N = 4: (Firouzi and Vahdatmanesh, 2019); (Lehtonen, 2019); (Li *et al.*, 2019); (He *et al.*, 2020).	9	
Concessionaire selection	N = 1: (Zhang, 2004).	N = 2: (Palaneeswaran and Kumaraswamy, 2000); (Zhang *et al.*, 2002).	N = 3: (Zhang, 2009); (Zhang, 2005b); (Aladağ and Işik, 2020).	6	

Appendix C: Financial and Economic Motivations theme in the PPP construction projects literature (1997 to 2021)

Sub-themes	Countries context			Sub Total	Theme Total
	Developed	**Developing**	**Both**		
Source of finance	N = 4: (Glaister, Scanlon and Travers, 2000); (Abdel-Aziz, 2007); (Chiara and Kokkaew, 2013); (Li, Abraham and Cai, 2017).	N = 7: (Bakatjan, Arikan and Tiong, 2003); (Attarzadeh *et al.*, 2017); (González-Ruiz *et al.*, 2017); (Bae, Damnjanoic and Kang, 2019); (Bai and Zhang, 2020); (Bashtannyk *et al.*, 2020); (Vassallo *et al.*, 2020).	N = 1: (Kokkaew and Chiara, 2013).	12	28
Financial viability	N = 2: (Ho and Liu, 2002); (Garvin and Cheah, 2004).	N = 3: (Huang and Chou, 2006); (Subprasom and Chen, 2007); (Jeong *et al.*, 2016).	N = 3: (Zhang, 2005a); (Jeerangsuwan *et al.*, 2014); (Sun, Jia and Wang, 2019).	8	
Achievement of best value	N = 1: (Akintoye *et al.*, 2003).	N = 2: (Park, Lee and Kim, 2018); (Bertelli, 2019).	N = 2: (Zhang, 2006a); (Ren *et al.*, 2019).	5	
Debt issues	-	N = 2: (Devapriya, 2006); (Yuning and Xiaohua, 2019).	N = 1: (Marco and Mangano, 2017).	3	

Appendix D: Risk Management theme in the PPP construction projects literature (1997 to 2021)

Sub-themes	Countries context			Sub Total	Theme Total
	Developed	**Developing**	**Both**		
Risk identification	-	N = 5: (Zeng *et al.*, 2008); (Cheung and Chan, 2012); (Lee and Schaufelberger, 2014); (Aladağ and Işik, 2017); (Le *et al.*, 2020).	N = 3: (Xenidis and Angelides, 2005); (Schaufelberger and Wipadapisut, 2003); (Wang *et al.*, 2020).	8	27
Risk evaluation	N = 2: (Grimsey and Lewis, 2002); (Tepeli, Taillandier and Breysse, 2021).	N = 5: (Wibowo and Kochendörfer, 2005); (Thomas, Kalidindi and Ganesh, 2006); (Al-Azemi, Bhamra and Salman, 2014); (Mazher *et al.*, 2018); (Ahmadabadi and Heravi, 2019a).	N = 2: (Zayed and Chang, 2002); (Dey and Ogunlana, 2004).	9	
Risk allocation	N = 3: (Bing *et al.*, 2005); (Ng and Loosemore, 2007); (Carpintero and Petersen, 2015).	N = 4: (Abednego and Ogunlana, 2006); (Shen, Platten and Deng, 2006); (Almarri, Alzahrani and Boussabaine, 2019); (Kim and Kwa, 2020).	N = 3: (Ke, Wang and Chan, 2010); (Roumboutsos and Pantelias, 2015); (Dewulf and Garvin, 2020).	10	

Appendix E: Public-Private Sector Interactions theme in the PPP construction projects literature (1997 to 2021)

Sub-themes	Countries context			Sub Total	Theme Total
	Developed	**Developing**	**Both**		
Government as champion and regulator	N = 1: (Algarni, Arditi and Polat, 2007).	N = 11: (Wang and Tiong, 2000); (Kumaraswamy and Zhang, 2001); (Chen and Messner, 2005); (Cheah and Liu, 2006); (Brandao and Saraiva, 2008); (Zhang *et al.*, 2015); (Wu *et al.*, 2016); (Yang *et al.*, 2016); (Kavishe, Chileshe and Jefferson, 2019); (Sinha and Jha, 2019); (Wang, Ma and Liu, 2020).	N = 1: (Ho, 2006).	13	19
Partnering	N = 4: (Clifton and Duffield, 2006); (Edkins and Smyth, 2006); (Roberts and Siemiatycki, 2015); (South, Eriksson and Levitt, 2018).	N = 1: (Kumaraswamy *et al.*, 2007).	N = 1: (Koops *et al.*, 2017).	6	