

Challenges in public private partnerships in construction industry

A review and further research directions

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Received 16 February 2018
Revised 19 August 2018
7 December 2018
30 January 2019
Accepted 30 January 2019

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Abstract

Purpose – Public private partnerships (PPPs) face challenges in implementation and operation, and need efforts to improve their performance. The purpose of this paper is to review the PPP literature quantitatively and qualitatively, in order to establish challenge themes and set research directions.

Design/methodology/approach – More than 4,000 papers published between 2008 and 2017 were retrieved. From this collection, papers from five major international journals were selected to explore extant PPP research findings under six main PPP challenges including: challenges related to financial management, concession period and price determination, operational phase, risk management, PPP project procurement and stakeholder management (SM). Initially, the papers were categorised quantitatively into the identified challenges and subsequently the articles were qualitatively analysed and discussed.

Findings – Poor SM, the complexity of risk management models, project delivery time and cost overruns, inadequate consideration of whole life-cycle aspects and over-reliance on a Public Sector Comparator for evaluating PPPs are found to be the most commonly encountered issues. These all warrant more extensive attention and innovative solutions.

Practical implications – PPP projects have faced many challenges in practice and also existing research findings have limited application in practice. Challenges highlighted in this research can be a focus area in practice to improve the performance of PPPs.

Originality/value – No previous reviews have explored the challenges relating to PPP projects and how they can then addressed by further studies in the field. This review is intended to address that gap, and should help to shed light on further research directions to address the emerging challenges in PPP procurement.

Keywords Performance, Challenges, Construction, Review, Stakeholder management, Public private partnerships

Paper type Literature review

1. Introduction

Public private partnerships (PPPs) are a popular form of project delivery for the procurement of capital-intensive economic and social infrastructure in the public sector. PPPs combine the efforts of the public and private sectors to create public infrastructure assets and provide public services which were formerly delivered by the public sector alone. A PPP operates through an agreement between a public agency and a private consortium via a special purpose vehicle (SPV). The SPV is the legally established entity responsible for delivery (Papajohn *et al.*, 2010). The private and public partners therefore have to cooperate with each other to achieve the objectives established for the SPV.



For the public partner, achieving value for money (VfM) in the assets and services delivered and exploiting the capacity and efficiency of the private sector are the primary objectives of using PPPs (Grimsey and Lewis, 2002). The private partner(s) seek a return on investment commensurate with the level of risk involved. Raisbeck *et al.* (2010) conducted a study to compare PPPs with the traditional procurement route. Their results revealed that PPPs provide superior performance in terms of both cost and time in the project delivery phase. However, despite the worldwide uptake of PPP procurement, implementation issues have led to PPP project failure in several instances (Johnston, 2010; Soomro and Zhang, 2013), particularly in the delivery and operational phases. Issues associated with failure (or at least lack of complete success) include underbidding by the private sector partners, over-optimistic demand forecasts (by public partners, particularly for toll-road projects), inadequate risk allocation by the public partner, higher costs of private capital, a lack of transparency, a lack of citizen's trust, inappropriate stakeholder management (SM), politically disruptive behaviour and conflicts of interest.

Previous reviews of PPP research have also exposed gaps in the knowledge about PPPs. Al-Sharif and Kaka (2004) found that the published research studies did not critically analyse the levels of importance of the complex requirements of contract management and SM. They found that risk management, procurement and financial management were the most popular research themes among researchers. Ke *et al.* (2009) found that risk management and governance issues are also frequent research interests but that the research rarely delivers practical solutions. Tang *et al.* (2010) reviewed PPP studies published in six journals in the construction management field, from 1999 up to 2007 and proposed further research directions in the fields of risk management, financial management, contractual agreements, development of PPP models, the concession design phase and PPP type selection for improving PPP project success. Zhang *et al.* (2016) reviewed the studies in Chinese and international journals. Their findings are valuable for Chinese researchers to embark future research on PPPs. Also they summarise the findings in Chinese papers which help the western researchers to better understand the research status of PPPs in the context of China. Neto *et al.* (2016) undertook a bibliometric analysis of the studies undertaken in PPP-related fields. They suggested than the importance of further researching the areas such as contract termination and renegotiation of PPPs.

However, no previous reviews have explored the challenges relating to PPP projects and how they can then be addressed by further studies in the field. This review is intended to address that gap, and should help to shed light on further research directions that should address the emerging issues and challenges in PPP procurement. The review is based upon the following objectives:

- to explore the nature of the issues and challenges in PPP projects;
- to provide insights and direction for future PPP research; and
- to point to areas where management of PPPs can be improved in practice.

The study uses literature review. Following the introduction, the research method is explained. Analysis and reflective criticism of the relevant literature is then presented, followed by the identification and discussion of the major PPP issues and challenges that emerge. In the concluding section, these are expressed as topics for further research and recommendations for PPP practice.

2. Research method

Ke *et al.* (2009) carried out a two-stage literature review to identify the journals which published most PPP-related topics from 1998 to 2008. The same approach was adopted for the current review, but with a different time span. Initially, a comprehensive keyword search

was carried out under the “title/abstract/keyword” field in the Scopus search engine using “public private partnership”, “private finance initiative”, “build operate transfer”, “build-operate-own”, “public-private partnerships”, “build/operate/transfer”, “build-operate-transfer”, “PPP/PFI”, and “PFI/ PPP” as keywords. Papers with these specific terms in the title, abstract or the keywords were then considered for selection. A closer review of the content of the papers was not undertaken at this stage.

A total of 4,242 papers were retrieved initially, and Figure 1 shows the distribution of these papers from 1990 to 2017. As the figure shows, 73 per cent of all retrieved papers were published between 2008 and 2017. We argue that the more recent period is likely to contain more mature treatment of the topic area. The start of this period also appears to show a rapid increase beginning after a short plateau between 2005 and 2007. Therefore, it is reasonable to limit the temporal frame for the review to papers published between 2008 and 2017.

Next, analysis was carried out to identify the journals most frequently associated with PPP-related articles from 2008 to 2017. This confirmed that *The Journal of Construction Engineering and Management*, *The International Journal of Project Management*, *The Construction Management and Economics* journal and *The Journal of Management in Engineering* have each published more than 30 papers related to PPPs between 2008 and 2017. The selected journals were then compared with Chau’s (1997) ranked list and the *Engineering, Construction and Architectural Management* journal was added.

In the second stage of the review process, a specific and more comprehensive search of all five target journals was carried out. The content of the selectively identified papers was examined to reveal any changes in research issues and techniques. For this purpose, 181 papers were selected as being relevant to the construction management field and were thus considered for this review. Table I indicates the number of relevant PPP-related articles for each of the five selected journals. Quantitative statistics were employed initially to determine the number of publications in journals and years.

Finally, the content of the selected papers subjected to thematic analysis which identified themes comprising six identifiable challenges in PPP projects. These challenges related to economics and finance, PPP project success, contract management, risk management, procurement, SM and review are shown in Table II. Thematic analysis is a systematic process of combining a complex set of qualitative data into different themes to understand and interpret people’s opinions more effectively (Boyatzis, 1998). The themes may be based

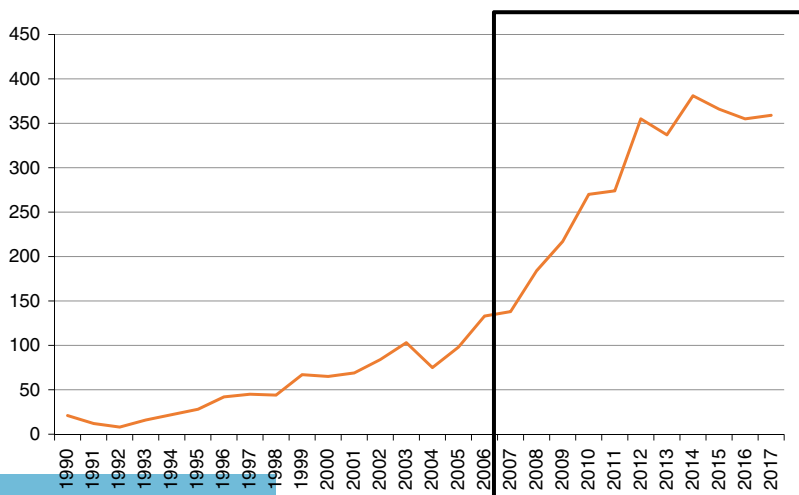


Figure 1.
Distribution of papers
related to PPPs from
1999 to 2017

on theory (deductive), on the data (inductive) or based on prior research-driven approaches (Boyatzis, 1998). For the present study, a theory-driven approach was adopted as other reviews have previously identified PPP challenges and issues. The selected 181 papers were read through carefully to explore the challenges addressed by a specific study.

The findings of the thematic analysis thus permit the emerging themes/challenges to be discussed in greater depth.

3. Discussion

Infrastructure privatisation has created many issues in terms of social, political, economic, legal and environmental contexts in the international market. According to Johnston (2010), there are a number of fundamental pitfalls that need to be addressed in Australian PPPs in sustaining the public interest. These include underbidding, over-optimistic forecasts, inadequate risk allocation, higher cost of private capital, a lack of transparency, a lack of citizen's trust, inappropriate relationship management, political behaviour and conflicts of interest. Siddiquee (2011) pointed out that toll road PPPs in Australia have failed due to

| Journal title | No. |
|---|-----|
| <i>International Journal of Project Management</i> | 54 |
| <i>Journal of Construction Engineering and Management</i> | 47 |
| <i>Journal of Management in Engineering</i> | 42 |
| <i>Construction Management and Economics</i> | 30 |
| <i>Engineering, Construction and Architectural Management</i> | 8 |
| Total | 181 |

Table I.
Number of articles
related to PPPs
published in
each journal

| Research category | Authors | Research sub categories | No. |
|---|---|---|-----|
| Challenges related to PPP project procurement | Cruz and Marques (2013), Regan <i>et al.</i> (2011), Pollock <i>et al.</i> (2002) | Suitability of PPPs, competitive procurement, PPP bidding and concessionaire selection | 20 |
| Challenges related to concession period and price determination | Johnston (2010) | Concession period and price design | 12 |
| Challenges related to risk management | Johnston (2010), Grimsey and Lewis (2002), Siddiquee (2011) | Risk factors and risk management models | 25 |
| Challenges related to financial management | Sharma <i>et al.</i> (2010), Bonnafous (2012), Laishram and Kalidindi (2009), Chiang <i>et al.</i> (2009), De Marco <i>et al.</i> (2012), Soomro and Zhang (2013) | Financial risk management, financial management models, financial viability and macroeconomic condition | 43 |
| Challenges related to stakeholder management | El-Gohary <i>et al.</i> (2006), Smyth and Edkins (2007), De Schepper <i>et al.</i> (2014) | Success factors, social network, relationships and public value | 10 |
| Challenges related to managing operational phase | Siddiquee (2011), Regan <i>et al.</i> (2011) | | 13 |
| Others | | Sustainability, knowledge management, success factors, recommendations to project success, failure drivers/challenges, asset management and conflict management | 58 |
| Review | | | 6 |
| Total | | | 181 |

Table II.
Number of articles
published in relation
to the common
challenges of
PPP research

inaccurate projections of revenue growth, patronage decrease and consumer avoidance behaviour during the concession period. Ball (2011) claimed out that some transportation PPPs in the state of Victoria have left the private sector with painful losses. Kumaraswamy and Zhang (2001) presented the accounts of projects which have ultimately failed in terms of cost overruns, unrealistic prices and income projections, and legal disputes between the private and public partners. Although these privately managed assets are meant to provide VfM for all public stakeholders, the potential value has not been achieved for many reasons.

3.1 Challenges related to concession period and price determination

According to Ng *et al.* (2007), formulating a suitable concession period is one of the most important factors for the successful delivery of a PPP project. It protected by an assured minimum “revenue stream”, the concessionaire is entitled to raise the toll/tariff that actual profit falls short of the anticipated return. For the private partner, the longer the concession period, the better will be the return on investment. From the public partner’s perspective, granting an excessively long concession period could be disadvantageous. Public interest might wane and be reflected in political disfavour. At the termination of the concession, the worth of the public asset might be severely eroded, or negotiating a new concession more difficult.

Yu and Lam (2013) identified seven factors affecting the concession period length: the toll fee, traffic flow, cost, inflation rate, interest rate, expected return rate and capital investment. Of these, only the last is known with any certainty. Researchers have used several approaches to optimise the concession period by considering the above identified factors. Carbonara *et al.* (2014) summarised concession period determination methodologies using least-present-value of revenue, a fuzzy logic approach and simulation models. However, none of these can reliably support government decision making about a concession period that will satisfy the interests of both parties by taking into account unforeseen risks and uncertainties and that allows a fair risk sharing between parties. Carbonara *et al.* (2014) therefore developed a method considering the win-win principle, the time by which the concession must end and the effect of uncertainty.

All the concession period models have used case studies to validate the estimated optimum concession period. However, the typically long-term nature of PPPs, often greater than 30 years, exacerbates problem of forecasting the demand over the long term and increases the associated uncertainty. Viegas (2010) questioned the private partner’s need for full amortisation in PPP contracts in relation to transport infrastructure through this long time period. Instead, he proposed that the concession system should be designed for successive cycles, each with a revision of the objectives, policies, technological standards and demand forecasts. However, to date no attempt has been add to model and test this proposition. Case studies could be used as a “reverse engineering” approach to address the problem. Survey research or Delphi-based focus group study could be undertaken to explore the factors affecting the concept of successive cycles in concession period determination.

Another way of dealing with the PPP concession period challenge might be through the introduction of flexible contracts into PPP projects. Demirel *et al.* (2017) found that timely and accurate recognition of potential changes, combined with the availability of flexible coping mechanisms, could provide the project stakeholders in the pre-contract phase of projects with a better understanding of the challenges they face in realizing their aims. This could help to deal with the uncertainty associated with PPP projects, especially with the concession period. With some projects now reaching the concession termination stage, and many more well into their operational stage, case study research could usefully explore the factors affecting the concession period.

Design and agreement for the concession price is essential for the financial viability of economic infrastructure projects because the private partner normally bears the

market (demand) risk and revenues are usually derived from third-party users. Xu *et al.* (2012) summarised concession price determination methodologies and found that fuzzy simulations, genetic algorithms and multi-linear regression models are the most commonly used methods. They also proposed a system dynamics-based concession pricing model. Wu and Zhang (2013) proposed a dynamic optimisation model for determining toll-pricing strategies with the aim of improving mobility, securing the public interest and attracting more investment from the private sector. However, few other studies have considered these ancillary factors in determining the concession price, and the modelling must be made more robust to improve reliability and mitigate uncertainty.

3.2 Challenges related to risk management

Several researchers have sought to identify the risk factors associated with PPPs in project/country-specific instances, and have generally categorised them in terms of being equally shared by both parties or mostly allocated either to the public or private partners. Table III presents a summary of these studies.

Based on the findings, one of the main concerns lies in the disagreement between PPP regulators (public partner) and operators (private partner) about the preferred risk allocation. Interestingly, Wibowo and Mohamed (2010) could not find strong evidence to support a popular assumption that the public partner is always seeking to transfer as many project risks as possible, while the private partner is expected to accept as few project risks as possible. However, their study confirmed a clear disagreement between the two contracting parties with the issue of precisely what PPP risks are taken on by each partner. Case study research is needed to explore these specific issues, as it appears that many PPP projects have faced sustainability issues due to the inappropriate allocation of risks (Johnston, 2010). On the other hand, a few researchers have used case studies to explore risk management in PPPs. Marques and Berg (2011) and Rebeiz (2011) have each undertaken in-depth case studies to investigate PPP risk factors and their management. Extending this research, and creating a PPP risk framework or check list suitable for each PPP partner would be a good starting contribution in this area.

| Authors | Country and project type | Which stakeholders' views were compared in terms of the preferred risk allocation? | Summary of the findings |
|---------------------------------------|---|--|---|
| Rouboutsos and Anagnostopoulos (2008) | Greece; not specific to a project type | Construction companies vs public sector (ministries) vs financing institutions | Found that the majority of risks identified, in agreement as to preferred risk allocation |
| Ke <i>et al.</i> (2010) | China; not specific to a project type | PPP experts vs non-experts | No significant disagreement on the rankings of the probability and consequence of risks identified between respondents |
| Wibowo and Mohamed (2010) | Indonesia; water supply projects | Regulators vs operators | Highlight a clear disagreement when dealing with the issue of who assumes what risk? Especially for critical risk factors |
| Chan <i>et al.</i> (2010) | China; not specific to a project type | Private vs public sectors and academics vs industrial practitioners | Both the public and private sectors are in general agreement with a majority of the risks |
| Hwang <i>et al.</i> (2013) | Singapore; not specific to a project type | Only from contractors' view point | |

Table III.
Summary of studies
on risk identification
and allocation

Efforts have also been made to develop models to predict the measurable components of risk factors, which help to comprehensively consider the allocation of critical risks and propose methods for effective risk management. Those studies have used techniques such as real options pricing, fuzzy inference rules and sensitivity analysis. However, the techniques are complex and PPP practitioners are reluctant to use them. This is an issue for PPP practice.

3.3 Challenges related to financial management

Studies have focused on developing more robust financial models for PPP projects. Sharma *et al.* (2010) and Bonnafous (2012) developed methods/models to optimise the capital structure of PPPs from the interests of public and private parties. Laishram and Kalidindi (2009) used desirability rating analytical tool to address the desirability of the project from a debt financing perspective. They found that the desirability rating profiles of the project provide valuable information for decision making and can help in formulating strategies on improving the performance of the project where it is not performing satisfactorily. Chiang *et al.* (2009) introduced three reliable and consistent internal rate of return (IRR) methods to solve the problem of addressing multiple sign changes. This study guides industry's practitioners to use proper IRR methods for selecting private finance initiative (PFI) projects. It also provides academic researchers a platform to explore more robust methods. The method introduced by De Marco *et al.* (2012) can be useful to refine the decision criteria for determining the level of public funding of a BOT hospital project in order to gain an understanding of the value that could be obtained from funding similar projects. Most of these studies have simulated a financial model and have tested it with hypothetical cases as a means of model validation. It is now appropriate to repeat the testing regimes with real case studies. The value of the models could be developed further by facilitating the proposed model with a follow-up financial management framework to be used by PPP practitioners.

Soomro and Zhang (2013) explored three failure drivers related to financial aspects of a PPP project where financial problems occurred with the concessionaire at an early stage of the project, due to a lack of financing capacity of the lenders and leading to the concessionaire's insolvency. According to them, the three failure mechanisms are initiated through a single failure driver, i.e., lack of the financing capacity of financiers or financing institutions. Research is needed into how due-diligence investigation could be used to mitigate this risk in PPPs.

Some models have been developed to attempt to manage the financial risks of PPPs effectively. Ng *et al.* (2010) and Wibowo and Alfen (2013) developed financial management models using Monte Carlo simulation. The suitability of other risk analysis approaches may be used to build the risk-fit-in automatic approach to smooth the progress of the PPP projects. Further, none of these studies have assessed their reliability of their models through several real PPP project scenarios. All the above studies have explored the reliability through only one case study. In summary of this challenge, more practical research could be undertaken to explore the practicality of assessing the financial capacity of the concessionaire at the very early development stage of PPP projects. The research could focus on developing a list of financially related management factors to be considered when selecting a private sector concessionaire.

3.4 Challenges related to stakeholder management

Poor management of stakeholder relationships has been found to be a contributory cause of failure of PPP projects in the global context (El-Gohary *et al.*, 2006; Smyth and Edkins, 2007). However, few studies relating to the SM practices of real PPP projects were retrieved from the 2008–2017 review period.

De Schepper *et al.* (2014) explored SM-related issues in PPPs in Belgium and made a number of recommendations, such as standardising PPP contracts, pursuing political alignment or political support across all institutional levels, and optimising the time span between project initiation and contract close. Verweij (2015) found that both the private and public sectors do not allocate sufficient resources to SM when implementing PPP projects. Mok *et al.* (2015) reviewed SM-related studies in very large construction projects by categorising them into stakeholder interests and influences, SM processes, stakeholder analysis methods and stakeholder engagement. Finally, they identified the importance of SM research into the areas of identifying the impact of national culture on SM in large construction projects, developing an SM model for the entire lifecycle of such projects, managing stakeholder relationships in such projects by using social network analysis, and establishing a database for managing and engaging stakeholders. Chowdhury *et al.* (2011) conducted a study related to stakeholder analysis, and confirmed the application of network theory to identify and distinguish potential stakeholders in PPP affiliation who can effectively contribute to an in-depth analysis of the relationships between participating partners. De Schepper *et al.* (2014) found that PPP entails a more complex stakeholder environment than other types of procurement, and highlighted the need to develop an improved SM system. Majamaa *et al.* (2008) and Ng *et al.* (2013) developed public engagement models for PPP project success. Smyth and Edkins (2007) proposed that greater strategic and tactical consideration be given to proactive SM approaches for PPP projects. However, a comprehensive SM framework for PPP projects is yet to be developed.

3.5 Challenges related to managing operational phase

Cheung *et al.* (2010) confirmed that the delivery of VfM in PPPs should rely on its effectiveness during the operational stage at a high level. In an Australian context, neither the Partnerships Victoria (2003) nor the Infrastructure Australia (2008) guidelines include management aspects relating to the operational phase of PPPs. According to English (2006), confirming VfM in the operating stage is problematic and does not appear to have been widely investigated by Australian auditors general. Long-term performance monitoring during the concession period should sustain the defence of the long-term operational viability and success of a PPP compared to alternative procurement methods, but there is a serious lack of such studies in the literature.

Liu *et al.* (2015) explored the CSFs during the whole lifecycle of PPP, using opinion surveys for data collection, with Likert scale measures of agreement for question responses. Management of the operational phase of PPPs is thus seriously under-researched, and requires appropriate case study investigation to yield robust findings. Performance management during the operational phase of PPPs is an integral part of operational management. Yuan *et al.* (2009) developed key performance indicators (KPIs) for PPP project success. Performance measurement and management through KPIs provides not only an important area for PPP research, but also an opportunity to propose and develop a series of methodologies to assist the public and private sectors in making decisions and managing PPP projects (Pavlov, 2010). Furthermore, the relationships among identified KPIs should also be clarified to determine which KPIs contribute most significantly to project success.

The first generation of PPPs (i.e. initiated in the early 1990s) is now reaching the termination stage of their concessions. This provides an unrepeatability opportunity to gather valuable empirical evidence of successes and failures that can be used, for improving the performance of the procurement model. Case study research should be undertaken to explore the lessons learnt during the operational stage. Given that some of the main problems in the use of PPPs relate to a project's operational life, the areas of operational management, contract administration, concession termination, renegotiation and even project failure are very likely to become increasingly important as PPP research topics.

Life-cycle costs (LCC) are also under-researched. LCC analysis attempts to model the costs involved over the whole life of a project, from inception to final disposal. Swaffield and McDonald (2008) acknowledged the importance of LCCs being considered in PFI projects in the UK. However, their findings, based on a combination of a questionnaire opinion survey and semi-structured interviews, show that private partners (especially contractors in the SPV) generally do not sufficiently consider LCCs and instead procure products/elements on the basis of lowest capital cost. There is thus a lack of knowledge about the use of LCCs in PPP projects and greater attention should be given to increasing awareness of the need to incorporate life-cycle costing into the assessment of PPP projects. Comparative studies could assess the differences between the outputs of life-cycle costing and lowest capital cost methods.

3.6 Challenges related to PPP project procurement

Using detailed analysis of publicly available data for a sample of 21 PPP projects and 33 traditionally procured projects, Raisbeck *et al.* (2010) found that the cost and schedule efficiencies of PPPs are considerably higher than those for alternative procurement system in Australia. Chasey *et al.* (2012) found that the average cost and time overruns in the delivery phase are lower in PPPs compared with the design and build system. Data insufficiency weakens these findings, and they need to be confirmed by more extensive study across more jurisdictions and across more procurement alternatives.

More than five studies in the review literature were undertaken to assess the suitability of PPPs in country-specific contexts using case studies in Hong Kong, Australia, the UK, North America and China. Another five studies assessed the suitability of PPPs for specific projects such as a stadium project in China, water plant projects in China and Taiwan, a transport interchange project in Madrid, a school project in Portugal, a villa project in Sweden and an airport project in Sweden. These studies each found that PPP is a feasible procurement method for these types of project investigated. They also proposed recommendations for the further development of PPPs in different aspects of PPP project management. For example, Chen (2009) proposed that the government should re-define its role as the client and improve the institutional settings for consortium members to better understand the PPP structure from the public partner's perspective. More research would be helpful, using case studies to summarise lessons learnt, in order to better address country- and project-specific issues in PPPs. Particularly useful would be the exploration of circumstances where PPP was not found to be suitable as a procurement system.

Some efforts have been made to develop models/methods to evaluate the suitability of PPPs. For example, Decarla-Souza *et al.* (2013) investigated how benefit-cost analysis considerations can be used to compare PPPs with conventional procurement allowing a broader perspective that could include the perspectives of users and non-users, including non-users outside the jurisdiction of the project sponsor. Anastasopoulos *et al.* (2011) proposed a procedural framework for PPP evaluation for road projects using cost savings for assessing the benefits of different contracting approaches. However, cost savings should not be the main benchmark in selecting PPPs for infrastructure projects according to Tsamboulas *et al.* (2013) who developed an evaluation method that considers other criteria such as environmental and safety impacts, public response, market response and impacts of the global economic crisis.

Despite the availability of other models, the public sector continues to use the Public Sector Comparator (PSC) as the primary benchmark for choosing PPPs over traditional procurement. However, the PSC has been criticised by several authors in Australia and in the international context. One criticism is that, as a PSC is a theoretical calculation of long-term forecasts, it is highly susceptible to biases and errors. Therefore, making a decision (between a PSC and a PPP proposal) solely based on a simple comparison between the two alternatives is not accurate (Cruz and Marques, 2013) or reliable. The PSC has also been

criticised on the grounds of the lack of transparency (Regan *et al.*, 2011; Cruz and Marques, 2013) and accuracy (Pollock *et al.*, 2002). Cruz and Marques (2013) also found that, as a PSC is strongly based on historical data, many issues arise due to a lack of suitable and reliable data. The difficulties relating to the PSC suggest that alternative and more robust methods should be developed to evaluate PPPs in public procurement.

4. Conclusions

The aim of this paper was to review the challenges relating to PPP projects and how they are addressed in the existing literature. More than 200 papers, selected through a two-stage process and derived from six major journals, were reviewed. The review explored six main challenges for PPP projects relating to financial management, operational period, concession periods and price determination, risk management, PPP project procurement and SM. While the PPP literature shows an increasing trend in terms of publication counts, there still remain PPP project challenges that are yet to be addressed in the research agenda. There are also areas where confirmatory research should be undertaken.

Financial management of PPPs was found to be the area of greatest international concern to researchers. But there are some topic challenges yet to be addressed. Evaluating the financial capacity of the concessionaire during the initial stage is very important and it is one of the main reasons for PPP project failure. However, none of the reviewed publications focused on the selection of a suitable concessionaire in terms of financial aspects of a PPP project. Future studies might include developing a list of factors related to financial aspects of a project when selecting the PPP concessionaire.

Research has also been undertaken to identify the critical success factors for PPPs; to compare the PPPs over more traditional procurement options; to assess the suitability of PPPs in country/ project specific instances; and to identify PPP risk factors. However, none of the research has focused on the operational phase of PPP projects. Future research could now explore the operational aspect of PPP projects in these areas as many PPPs are now reaching the end of their concession periods.

Other gaps for researchers to focus upon include contract management during the operational phase, concession termination, renegotiation and that factors that determine PPP project failure. There is a lack of knowledge about, and implementation of, life-cycle costing for PPPs; and what might be considered as over-reliance on the PSC. Most of the PPP projects continue to be assessed on the basis of lowest capital cost, although LCC concepts are appropriate in the PPP project context. The PSC should be developed into a more robust instrument for PPP comparison with other procurement options. Many of the models developed for effective risk allocation, suitability of PPPs and efficient financial management are too complex to adopt in real projects and discourage practitioners from using them. Simpler models should be developed with a guided framework.

The review has also revealed that SM in PPPs is the less targeted researched area of PPP. Many of the challenges in PPP projects are directly or indirectly related to SM. Among the potential future research directions for PPP SM, investigating SM-related issues, developing a set of best practice guidelines for successful SM and developing a practical management framework for effective SM should be given priority.

Above all, perhaps, the review has shown the urgent need for case-based research into the challenges facing PPP procurement. Opinion surveys will not provide the essential robustness in findings if the outcomes are to be translated into improvements in PPP practice. The current study contributes to the PPP literature by summarising research topics and exploring research gaps, it also has some limitations. Therefore, during the research methods/topics identification process, subjective decision will be made to categorise specific method or topic when the dividing line is not clear and simple for some papers.

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