

Project management in public-private partnerships: a conceptual framework based on a systematic literature review

Gestão de projetos em parcerias público-privadas: uma estrutura conceitual baseada em uma revisão sistemática da literatura

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Abstract: Despite the increasing number of Public-Private Partnerships projects, the results have shown little effectiveness and difficulties in several aspects of project management. This study performs a systematic literature review combining bibliometric analysis and content analysis to identify the challenges in managing these projects and techniques to overcome them, highlighting the critical success factors for project management. The results indicate an increasing number of researches in the field, but there is still a lack of systematization of the management tools and absence of critical success factors during the accomplishment of this type of project. This study proposes a systematization of these elements throughout the project cycle, allowing project managers to visualize challenges and techniques to increase the results related to the main success factors of each stage.

Keywords: Project management; Public-private-partnerships; Systematic literature review.

Resumo: Apesar do crescente número de projetos de Parcerias Público-Privadas, os resultados têm apontado pouca eficácia e dificuldades em diversos aspectos da gestão de projetos. Este estudo realiza uma revisão sistemática de literatura, combinando análise bibliométrica e análise conteúdo para identificar quais os desafios na gestão desses projetos e técnicas para superá-los, destacando os fatores críticos de sucesso para gestão de projetos. Os resultados apontam que o número de pesquisas é crescente, mas ainda há falta de sistematização das ferramentas de gestão e ausência dos fatores críticos de sucesso ao longo da realização deste tipo de projeto. Este estudo propõe então uma sistematização desses elementos ao longo do ciclo do projeto, sendo subsídio para gestores de projetos visualizarem desafios e técnicas para aumentarem os resultados relacionados aos principais fatores de sucesso de cada etapa.

Palavras-chave: Gestão de projetos; Parcerias-público-privadas; Revisão sistemática de literatura.

1 Introduction

The relevance and popularity of the Public-Private Partnership projects (PPPs) were intensified in the 80s and 90s with governments, historically recognized as basic infrastructure providers for the population, faced with the challenge of reducing public deficits and increasing investment in public infrastructure (Tang et al., 2010); PPPs also gained strength in times of international crisis as of mid-2007 to 2008 (Osei-Kyei & Chan, 2015). In this sense, studies show that the main objective of the PPP projects is the transference of risks from the public sector to the private sector as a way to facilitate and accelerate infrastructure plans for the common good, on the other hand this relationship causes various conflicts of interest (Hwang et al., 2013; Liu, J., et al., 2016b).

Despite the popularity of PPP projects, the results of such projects are still presented as inefficient (Flyvbjerg, 2013) or with critical success factors poorly explored and systematized (Liu, T., et al., 2016a). Concentrated mostly in Asian context and more specifically in China (Zhang et al., 2016a), qualitative surveys as the one done by and Verweij (2015b) highlight the use of bad indicators for evaluating management between different stakeholders and general outcomes of PPP projects. In Brazil, although the use of this type of project is recent (Federal law regulating PPPs was enforced in 2004 - Brasil, 2004), there is a high expectation that this is one of the solutions to overcome deficiencies in the country infrastructure, encouraged by hosting of major international events (World Cup and Olympics) in the last five years. The reality, however, points out that despite all promises, this model has great difficulties to take off in the country, especially because of bureaucratic barriers, uncertainty for investors working with volatile governments, lack of tradition in the area and corruption scandals in recent years involving both parties (public and private institutions) (Thamer & Lazzarini, 2015).

In this sense, one of the most critical points raised is the relationship management between the public and private body, which bring different interests and cultures in a long-term project. Despite the contributions of Wang & Liu (2015) analyzing excessive rates of profitability and its relation to the risks assumed by the private partner and of Zhang et al. (2015) that focus on systematizing governance models for the implementation phase of the project, the literature lacks a review to examine the challenges, solution proposals and success factors from a global perspective, that considers entire life cycle of this type of project, from the definition phase to long-term project maintenance.

Thus, in order to fill this research gap, this study aims to carry out an analysis and systematization of the literature on public-private partnerships in the project management (PM) field, seeking answer for the following research questions (RQs): RQ1: What are the main challenges for PM in the context of PPPs? RQ2: What techniques have been used to solve or mitigate the PM difficulties in PPPs? RQ3: How the PM success factors apply to the PPP context?

Given the recent BNDES report (Pinto & Ang, 2015) indicating that, today, more than ever, it is important to discuss the PPP model in Brazil, this study aims to fill this literature gap by systematizing key concepts for successful project management in PPP, a topic of increasing academic interest (Quelin et al., 2014), and to bring higher input and a greater understanding of the subject to practitioners on the most important points to consider when performing projects of this nature, given the difficulty that exists to make this model work engage in many emerging countries, as in Brazil. As a consequence, this research also aims to bring a better understanding

on public-private interactions that can greatly assist the design and execution of PPPs which meet the needs of the population and bring welfare, appointed as required by Thamer & Lazzarini (2015). To achieve these goals, this research includes the identification of the most influential articles, relevant research initiatives and studies, the identification of the most common elements from challenges in managing such projects. The methodological approach for the systematic literature review combines two methods: a bibliometric approach and content analysis. The sample was extracted from the scientific bases Web of Knowledge, Scopus and International Journal of Project Management (journal with highest impact factor in project management area, according the Journal Citation Report).

This article is structured as follows: section 2 presents a literature review on the topic, Section 3 presents the methodological approach; Section 4 presents the literature review based on the results of bibliometric analysis, network analysis and content analysis; Section 5 presents the discussion of the results obtained by bibliometric analysis and content analysis, finally, section 6 presents a conclusion and contributions of this research.

2 Literature review

The PPP concept begins in the moment that the public sector decides to solve the financial constraints to provide public facilities and services, recurring to the private sector skills to increase efficiency, effectiveness and quality of services offered to the population (Treasury, 2006). Despite strong growth in the realization of PPP between the 80 and 90, private investments in public infrastructure can be found since the 18th century in several countries. In Europe we have the example of the Suez Canal and railroads, examples can also be found United States, China and Japan (Kumaraswamy & Morris, 2002)

Through PPPs the public sector employs private resources to carry out public infrastructure works (Skietrys et al., 2008), benefiting from the expertise of companies and the use of efficient management practices for the development of public works (Akintoye et al., 2003). One of the main characteristics of PPPs is risk sharing between the public and private sector (Ke et al., 2010a), the risks are identified and allocated to the part with best skills, techniques and resources to mitigate them (Li et al., 2005a). Tang et al. (2010) point out advantageous aspects of PPPs found in several studies: improving the partnership between the public and private sectors, better risk management, clearer government policies, critical success factors disclosure, improved contract maturity and more appropriate financial analysis.

In this context, various types of partnership began to be made between government and the private sector. According to Li et al. (2005a) the UK government recognizes eight different forms of this partnership model: Asset Sales: it is selling surplus assets of the public sector, the broader market: introduces the skills of private sector funding to help better use of assets of the public sector. Business Sales: it is the sale of shares in public enterprises by flotation or trade sale, Partnership Companies: includes the introduction of the property of the private sector in state owned enterprises, while preserving the public interest through legislation, regulations, etc. Private Finance Initiative, joint ventures, in which public companies and industry partners pool their resources together and live under joint management. Investments in partnerships, in which the public sector contributes to the financing of investment by the private sector, to ensure that the public sector takes part in the

return generated. Political partnerships, in which individuals from the private sector, or parts, are involved in the development or implementation of public sector policies. The Private Finance Initiative is the most common model in the UK and other countries.

The PPPs allow governments to focus their attention and resources on their core competencies without needing to spend the public funds in complex projects which are unfamiliar to them (Cumming, 2007). By applying techniques, experience, technology and innovation of the private sector the resources, assets, the knowledge of the public sector can be used more efficiently by reducing costs and increasing the quality of facilities and utilities (Edkins & Smyth, 2006). Regarding economy and efficient use of resources, PPPs can produce a large reduction in the cost of public projects because the private sector brings greater discipline to the execution of projects which reduces the risk of cost overruns and project delays; additionally due to private sector interest in recovering their investments the PPP model leads to a reduction in the project life cycle costs and guarantees the expected return rate for government investment (Li & Akintoye, 2003).

Despite the many advantages presented by PPPs Kumaraswamy & Zhang (2001) present several cases of PPP which had problems such as cost overruns, unrealistic price and revenue projections and legal disputes between the private sector and the government. Flyvbjerg (2013) points out that most of the mega-projects exceed the budget, present schedule delays and fail to deliver the expected results, it is suggested that the main cause for these problems are failures in planning caused by ineffective planning methods that don't use distributional data from similar enterprises or misrepresentation of the facts motivated by interests of planners to achieve an objective their own interest, for example, win the bid for a project. Other obstacles to the adoption of PPPs are high transaction costs, unattractive financial market, lack of appropriate skills, incomplete risk transfer, higher rates to end users (Aritua et al., 2009).

The benefits of adopting PPPs, potential barriers to success and complexity of PPP project management, particularly in the areas of risk management, relationship management, finance and critical success factors contribute to the importance of an extensive review and structuring of PPP project management studies that will contribute to the practitioners to be better informed and prepared, which will increase the chances of successful implementation of PPPs.

3 Research method

Project Management (PM) and Public-Private Partnership (PPP) topics, despite the high intersection, need to be reviewed to organize the existing literature. In order to answer the research questions, this study proposes a systematic literature review (SLR) to evaluate the studies that have synergy with these two issues.

SLR is composed of a multiple method, comprising a bibliometric network analysis and subsequent analysis of content. A bibliometric analysis with networks provides the construction of an overview of the issues from a quantitative and unbiased approach, while the content analysis can identify and summarize the main challenges, solutions and PM success factors in PPPs (Carvalho et al., 2013).

3.1 Sample collection

For the construction of the initial sampling, this study did a search for publications indexed in two academic scientific basis, Web of Science and Scopus, whose search process was triangulated with searches in the journal *International Journal of Project Management - IJPM*.

The Web of Science was initially chosen because covers only the results of most relevant journals (journals with impact factor (JCR) calculated in the period from 1980 to 2014) of several other databases such as ProQuest, Wiley and Scopus (Carvalho et al., 2013).

Thus, for the first data collection, held in September 2016, a search by the union of strings of words was made: "project management" and "public private partnership*" in the Web of Science. The research result was filtered to display only "articles" in the parameter "document types", as these are publications that have gone through the review process (Carvalho et al., 2013). The size of the sample was collected 23 articles.

Then searches were conducted in the scientific basis Scopus, which like Web of Science is also a database aggregator, but also presents articles journal that are not classified by impact factor metrics - JCR from Thomson Reuters. Following the same process, the searching and filtering described above for the Web of Science were presented 238 results.

The last phase for the sample publications in this study included the search for journal articles in the most relevant PM area, IJPM, according to the JCR impact factor of 2.885. Whereas the articles in this journal are also analyzed in the other two bases, this quest served as a critical review of the results of the previous searches. The result was 123 samples, with an intersection of only 37% with the sum of the samples from the databases. Web of Science and Scopus. With the composition of the three different searches, the result was a total of 319 different publications.

3.2 Studies selection

The samples were stored in an Excel spreadsheet, containing all information relevant to each publication (title, year of publication, number of citations, keywords, abstract, etc.). To identify which of the studies had effective relationship with the studied subjects, a quick scan was performed in three steps (Croom, 2009), as shown in Figure 1.

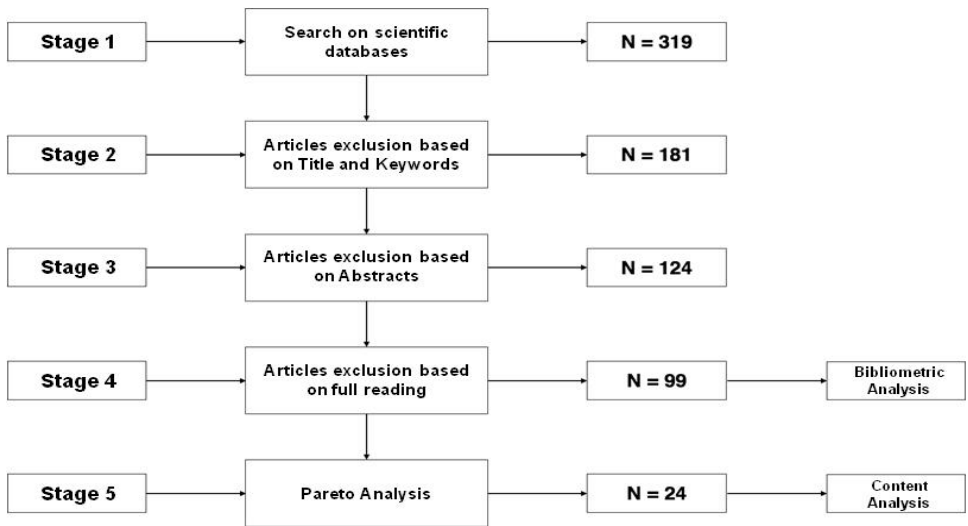


Figure 1. Process for selection of studies.

As Figure 1 indicates, in the first stage were evaluated titles and keywords of the articles, by all researchers of the group. Those that were clearly outside the scope were removed from the sample and, if this first analysis was inconclusive (lack of consensus), the articles remained in the sample. After filtering the first, 72 files were considered within the scope and 109 inconclusive, thus achieving 181 results. In the second step, to the 109 items that could not be classified as inside or outside of the subjects was performed similar validation process of abstracts. At the end of this second stage, the sample contained 88 items classified as within the scope and 36 articles still lacking of consensus among researchers. In the last stage, the 36 articles were read by complete and 11 of them were directly related to the topics of PM and PPP, composing a final sample of 99 articles for analysis bibliometric data.

To perform the content analysis, we selected only the most relevant items according to their impact factor. To calculate the impact factor of each article, it was considered according Equation 1, the average number of citations and the journal impact factor in which was published by the Journal Citation Report (JCR) and held in Takey & Carvalho (2016).

$$I = C *(JCR + I) \tag{1}$$

Whereas the equation impact factor (1), Pareto analysis was performed to select 24% of items (24 items in this case) that represent more than 80% of the sample impact total for content analysis (Takey & Carvalho, 2016).

3.3 Data analysis

The first part of the data analysis comprises a bibliometric study and analysis of separate networks in three stages. The objective of the first stage of the bibliometric analysis was identification of the most relevant journals for the subject and the development of publications on the subject among the years. To identify the most relevant journals, it was considered the following factors: number of publications (Np),

Number Quote (Nc) and Impact Factor (Fi). Periodicals were ordered according number of quotes. Then, as a way of assessing how publications have evolved over time, the number of stratified Publications by journal per year was assessed.

For the second step, in order to characterize the publications on the subject changes in the number of publications per year, it were analyzed considering the method and the focus of study. For the definition of the categories method, it was used the reference scheme proposed by Carvalho et al. (2013), and, for setting the focus of study categories, it was used an adaptation scheme proposed by Tang et al. (2010), considering a single set of categories for both types of studies: conceptual and empirical. The category of Concession Period was unified with the category of Finance. Table 1 shows the encoding scheme used to classify the articles and the results are presented in Appendix A.

Table 1. Codification scheme for articles classification.

Method	
PC1	Literature Review
PC2	Simulation or Theoretical Modeling
PE1	Survey
PE2	Case Study
PE3	Action Research
Focus	
T1	Relationship & Stakeholders
T2	Risks
T3	Finances
T4	Project Success Factor
T5	Concession Period

For the third stage, we considered the 24 publications of highest impact factor as the sample for content analysis. The articles were analyzed for the development of two networks: Co-occurrence Keyword (The relationship between the items is determined based on the number of documents in which they occur together), Bibliographic sharing (The relationship between the items is determined based on the references they share). For the development of networks, it was used the software VOSviewer version 1.6.5; the database built for analysis was in CSV (Comma Separated Values) format in the export of Scopus. Finally, in order to understand the relevance of the articles to the dynamics of publications on the subject, an assessment of the evolution of the number of citations per article stratified per year was conducted.

Next, a content analysis was performed through the full text of the articles, in two phases: categorization and find connections. In this analysis, it was made a review of the project management constructs applied to the environment of public-private partnerships. Then, to answer the research questions are synthesise in a theoretical model the main challenges and techniques of project management and how these impact the success of projects in PPPs and how they fit into each stage of the project life cycle, from the moment that the state draws a project and decide that a partnership with the private sector will be beneficial to post-project implementation time.

4 Results

4.1 Sample characterization

Considering the number of publications (N_p), the number of citations (N_c) and the impact factor (Fi) described in Table 2, it was identified the "International Journal of Project Management" as the main vehicle for publication theme, featuring 57% of the publications, 70% of the citations and 86% of the sample impact factor considered, in addition to having the largest JCR sample (3.411). However, evaluating the number of citations and impact factor, it can be identified two other relevant vehicles: the "Construction Management and Economics", with 6% of the publications, 11% of the citations and 3% of the impact factor - its relevance is due mainly to a specific publication: the article Zhang (2005), with 7% of the citations and 2% of the sample impact factor. The second is the "Journal of Construction Engineering and Management", with 2% of the publications, 7% of the citations and 5% of the impact factor - in this case, the relevance is due mainly to the article Li et al. (2005a), that has 6% of the quote and 5% of the sample impact factor. Both articles are focused on critical success factors for PPPs. Because the search strategy, it could be expected a greater representation of the "International Journal of Project Management". Comparing the results of this study with the results obtained by Tang et al.(2010), it can be seen that the first 4 pointed periodic coincide in both studies, despite this present study have included papers from 1994 to 2016 and focus on project management topic at PPP, while the study of Tang et al. (2010) has articles from 1998 to 2007 and has a broader focus on PPP projects.

Table 2. Number of publications, citations and impact factor of the periodicals of the sample.

	Source	N_p		N_c		Fi	JCR	
			%		%	%		
1	International Journal of Project Management	56	57	1885	70	8315	86	3.41
2	Construction Management and Economics	6	6	287	11	287	3	0.00
3	Journal of Construction Engineering and Management	2	2	177	7	483	5	1.73
4	Engineering, Construction and Architectural Management	2	2	91	3	91	1	0.00
5	International Journal of Public Sector Management	1	1	44	2	44	0	0.00
6	Journal of Infrastructure Systems	2	2	38	1	96	1	1.51
7	Journal of Professional Issues in Engineering Education and Practice	1	1	30	1	54	1	0.79
8	Environment and Planning C: Government and Policy	2	2	28	1	28	0	0.00
9	International Public Management Journal	1	1	25	1	71	1	1.84
10	Public Administration and Development	2	2	15	1	36	0	1.39
11	Journal of Urban Planning and Development	1	1	13	0	41	0	2.18
12	European Planning Studies	1	1	13	0	31	0	1.37
13	Journal of Management in Engineering	3	3	9	0	29	0	2.22
14	Built Environment Project and Asset Management	3	3	8	0	8	0	0.00

Table 2. Continued...

	Source	<i>N_p</i>		<i>N_c</i>		<i>F_i</i>		JCR
15	Science and Public Policy	1	1	8	0	20	0	1.52
16	Transport Reviews	1	1	5	0	20	0	3.02
17	Public Administration	1	1	5	0	16	0	2.27
18	Proceedings of the Institution of Civil Engineers: Civil Engineering	1	1	5	0	7	0	0.42
19	Journal of Civil Engineering and Management	1	1	2	0	5	0	1.42
20	Proceedings of the Institution of Civil Engineers: Municipal Engineer	1	1	2	0	3	0	0.33
21	Project Management Journal	1	1	1	0	3	0	2.03
22	Journal of Modern Project Management	1	1	1	0	1	0	0.00
23	Ekonomski Pregled	1	1	1	0	1	0	0.00
24	Proceedings of Institution of Civil Engineers: Management, Procurement and Law	1	1	1	0	1	0	0.00
25	Engineers Australia	1	1	1	0	1	0	0.00
26	Journal of Applied and Industrial Mathematics	1	1	0	0	0	0	0.00
30	European Journal of Transport and Infrastructure Research	1	1	0	0	0	0	1.06
27	Public Works	1	1	0	0	0	0	0.00
28	Railway Gazette International	1	1	0	0	0	0	0.00
29	Water and Wastewater International	1	1	0	0	0	0	0.00

Evaluating the number of publications per journal per year according to the data shown in Table 3, we find that the first article related to PPP and Project Management was published in 1994 in the “International Journal of Project Management”. However, between 1994 and 2002 just four articles were published, in which these 3 were in “International Journal of Project Management”. In the period 2002 to 2006, it were published 18 articles, a number of approximately 3.6 times greater than the previous period, with approximately 56% of the period articles published in “International Journal of Project Management”. In the period between 2007 and 2011, it were published 24 articles, representing an increase of 33% over the previous period, with approximately 83% of the articles of the period published in the “International Journal of Project Management”. Finally, for the period between 2012 to 2016, it were published 52 articles, a number approximately 2.2 times greater than the previous period, with 29 articles published in “International Journal of Project Management” (approximately 56%). From these figures it can be concluded that the subject has been little explored between 1997 and 2001 (5% of publications), had a period of consistent publications between 2002 and 2011 (42% of posts) and in the last five years showed a large growth (53% of publications), showing that PPPs are a trend not only in the practical field, but are in high growth publications in the academic field as well. Throughout the period between 1994 to 2016, the “International Journal of Project Management” has emerged as the dissemination channel with the greater number of relevant publications on the subject, keeping rates of at least 56% of publications.

Table 3. Number of publications by periodical and year.

	Source	JCR	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total	%	
1	International Journal of Project Management	3.411	1	0	0	1	0	0	1	1	1	0	1	1	7	4	2	1	4	2	1	3	12	7	6	56	57	
2	Construction Management and Economics	-	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0	0	6	6	
3	Journal of Construction Engineering and Management	1.731	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	2	2	68%
4	Engineering, Construction and Architectural Management	-	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2	2	
5	International Journal of Public Sector Management	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	
6	Journal of Infrastructure Systems	1.514	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2	2	
7	Journal of Professional Issues in Engineering Education and Practice	0.791	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	
8	Environment and Planning C: Government and Policy	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2	2	8%
9	International Public Management Journal	1.838	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	
10	Public Administration and Development	1.39	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	2	2	
11	Journal of Urban Planning and Development	2.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	
12	European Planning Studies	1.37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	
13	Journal of Management in Engineering	2.223	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	9%
14	Built Environment Project and Asset Management	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	3	3	
15	Science and Public Policy	1.515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	
16	Transport Reviews	3.017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	15%
17	Public Administration	2.273	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	

Table 3. Continued...

18	Proceedings of the Institution of Civil Engineers: Civil Engineering	0.424	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1		
19	Journal of Civil Engineering and Management	1.419	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	
20	Proceedings of the Institution of Civil Engineers: Municipal Engineer	0.326	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	
21	Project Management Journal	2.031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	
22	Journal of Modern Project Management	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
23	Ekonomski Pregled	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
24	Proceedings of Institution of Civil Engineers: Management, Procurement and Law	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	
25	Engineers Australia	-	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
26	Journal of Applied and Industrial Mathematics	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
30	European Journal of Transport and Infrastructure Research	1.056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	
27	Public Works	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
28	Railway Gazette International	-	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
29	Water and Wastewater International	-	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	Total		1	0	1	1	0	0	1	1	1	1	1	7	8	6	4	4	6	4	8	6	16	14	8	99			
	%		1%	0%	1%	1%	0%	0%	1%	1%	1%	1%	7%	8%	6%	4%	4%	6%	4%	8%	6%	16%	14%	8%					
			5%				18%				24%				53%														

In the bibliographic coupling network (see Figure 2), the lines connecting the items that share references and the line width determines the intensity of this sharing. Thus, the temporal component influences the establishment of relations, as older articles have less reference share with other old ones, but with young ones (when they were already cited for further evidence) it can be identify three distinct groups of articles that share references at higher intensity. Group 1 showed greater focus on Project Management. In group 2, with an emphasis on risk management, it can be seen the greatest amount of relations in sample of articles, showing that there is a consolidated literature on risk management topic in PPPs. The strongest relationship occurs between Hwang et al. (2013) (connections 7) and Ke et al. (2010a) (6 connections) in the risk allocation context. Article Jin & Zhang (2011) (8 connections) focuses on risk allocation, while the article Shen et al. (2006) focuses on the context of PPPs role for risk management in public sector projects. Group 3 is primarily critical success factors and stakeholder management, with a low share of references, indicating that these topics are still not consolidated. Finally, the article Tang et al. (2010) (10 connections), been a review article in PPP project management in the construction industry, is the only item that connects all the groups and has a great intensity sharing with Ke et al. (2010a) and Hwang et al. (2013).

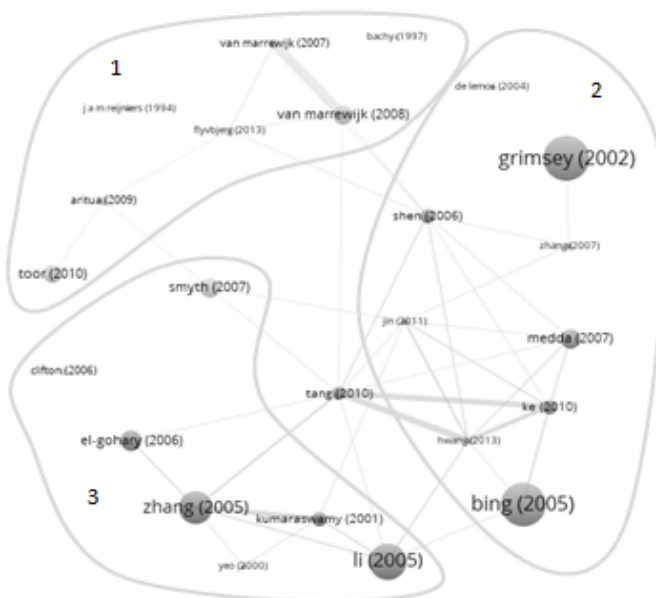


Figure 2. Bibliographic Coupling Network.

4.2 Main themes

The bibliometric network analysis allows to evaluate trends in the topic. In the co occurrence network keywords shown in Figure 3, the lines connects the joints keywords cited in the sample and the line width demonstrates the strength of these relationships. To simplify the network, different synonyms for Public-Private Partnerships (Public-Private Partnerships) were edited to be represented by this spelling, as well as Private Finance Initiatives synonyms (Private Finance Initiatives)

were edited to be represented by this spelling. The filter used for analysis was a minimum of three occurrences of each keyword, which resulted in a sample of 17 keywords that met the requirement and total 155 quotes. The three most often cited keywords were: Public-Private Partnerships (51 quotes), Project Management (18 quotes) and Risk Management (10 citations). In addition to stronger relationships between PPP and Project Management, it is worth noting the connections between PPP and Risk Allocation, PPPs and Initiative Private Financing, PPP and Critical Success Factors, as main focus of discussion at the intersection of these themes, and justifying also with these being the categories of classification of studies focuses, mentioned above (Relationship, Risk, Finance and Success Factors and Project).



Figure 3. Keyword co-occurrence network.

Table 4 shows the changes in trends of publications classified by the method and the focus of the study into four periods: Period 1: 1994-2001, Period 2: from 2002 to 2006, Period 3: 2007-2011 and Period 4: 2012-2016.

Considering the focus of this study, about 47% of the studies are related to Project success factors (T4) which includes critical success factors for structuring PPPs and PPP projects, best practices and project management methodologies in PPPs. This topic has consistently been addressed since the first article in 1994, being the only topic to present growth trend among all periods. The second most discussed focus is Risk (T2), which includes best practices and methodologies for risk management, allocation and risk reducing in PPPs. Despite an upward trend between the first and second periods, the topic do not grow in publications between the second and third period, but resumed the growth trend between the third and fourth quarter, proving to be a relevant topic. The relationship of topics (T1) (including the understanding of the relationship between the public and private spheres, between the actors involved in PPPs and best practices and methodologies for management of relationships) and

Finance (T3) (understanding of the financial dimension of PPP, financial modeling and studies on PPPs, study the concession periods, PPP pricing methods and best practices and methodologies for finance in PPPs) presents the greatest variation between the third and fourth periods, which features a strong growth trend in the topics and as potential areas for future studies.

As for the methodological studies, it can be seen a prevalence of empirical methods (67 posts) on conceptual methods (32 posts). Between empirical methods, the case study is the most used (42 publications), showing that issues related to the theme are still being explored in different contexts and dimensions. The consolidation of knowledge in PPPs and project management in PPPs is presented as a substantial challenge as regional and specific characteristics of each country and legislation, economic and political environment. Culture and behavior of the public and private sectors generate different specific challenges for each application. Moreover, the nature of PPP projects, to be “made once”, difficult to standardize approaches. However, some issues, such as risk allocation, have evolved through empirical studies such as surveys and have begun to be addressed in mathematical models for defining models generalizable.

The PPP project management theme can benefit even more by comprehensive and consistent literature review that seek to compare features in different contexts to the consolidation of an universal and generalizable knowledge on the subject. This method is the least used, but shows a strong growth trend between the fourth and fifth period, indicating an effort to consolidate the great empirical knowledge base generated.

Table 4. Publications by period grouped according to the Method and Focus of the study.

Method		Period						Total	
		1994 - 2001	2002- 2006	Trend	2007- 2011	Trend	2012-2016		Trend
PC1	Literature Review	1	2	↗	1	↘	5	↗	9
PC2	Simulation or Theoretical Modeling	1	4	↗	5	↗	13	↗	23
PE1	Survey	0	5	↗	9	↗	11	↗	25
PE2	Case Study	3	7	↗	9	↗	23	↗	42
PE3	Action Research	0	0	→	0	→	0	→	0
Total		5	18		24		52		99
Focus									
T1	Relationship & Stakeholders	0	3	↗	2	↗	10	↗	15
T2	Risks	1	7	↗	5	↗	9	↗	22
T3	Finances	0	3	↗	3	↗	7	↗	13
T4	Project Success Factor	4	5	↗	14	↗	24	↗	47
T5	Concession Period	0	0	→	0	→	2	↗	2
Total		5	18		24		52		99

5 Discussion

The purpose of this article is to contribute to theory by answering the three research questions set out in the introduction section. Combining the key issues of analysis regarding challenges, techniques and critical success factors, a conceptual framework oriented to the PPP project life cycle is proposed, as shown in Figure 4.

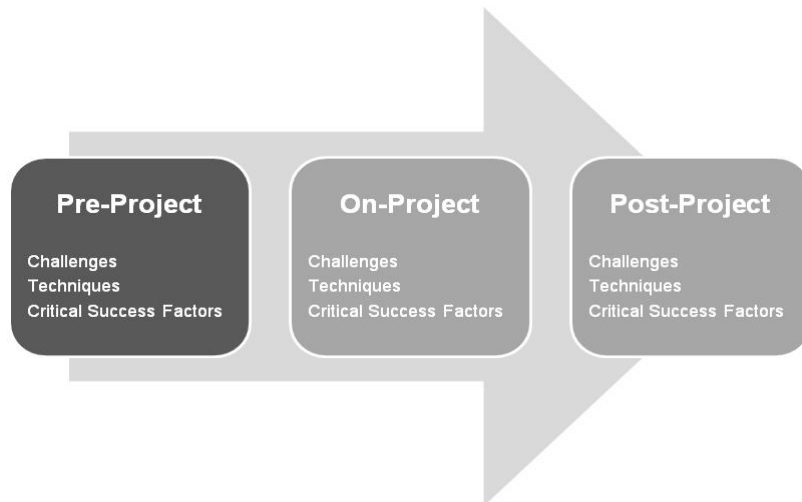


Figure 4. Conceptual framework based on literatura analysis.

The life cycle of a PPP project begins with the creation of the business case, where the public sector decides whether the PPP model provides better value for money (VfM) then developing properly (Clifton & Duffield, 2006). Then it is sent a proposal to tenderers, which must carry out the declaration of interest. Soon after defining the interested parts, there is a bidding process to select a partner from the private sector able to meet the budget expectations, techniques and proven experience to the project, in which there is a negotiation with a final list of bidders to choose partner and signature of the contract (De Lemos et al., 2004). All the mentioned steps which happens before the signing of contract will be treated from now as the phase pre-project of PPP.

On-project, the two parties (public and private sectors) organizes the project planning in more detail. At this stage the goals, conditions, milestones and project activities are discussed. With the validation of the two parties, the implementation of the project is made up until the finalization of the defined scope and evaluation of what has been built (Reijniers, 1994).

After its conclusion, comes in a phase of post-project, where usually the private party carry out the operation of the project/system created until expiration or termination of the partnership contract (Clifton & Duffield, 2006).

5.1 Challenges

As the first item in content analysis, Table 5 indicates the main challenges encountered in managing PPP projects.

Table 5. Challenges in Project Management of PPPs.

PRE-PROJECT	References	ON-PROJECT	References	POST-PROJECT	References
1. Allocation of risk based on different interests and abilities among the main stakeholders of the project, in order to achieve goals and take advantage of the abilities of each player.	Grimsey & Lewis (2002), Bing et al. (2005), Li et al. (2005a), Shen et al. (2006), Ke et al. (2010a), Tang et al. (2010), Hwang et al. (2013)	1. Ensure involved funding is able to continue until the project end.	Yeo & Tiong (2000)	1. Cash-oriented contracts are often not flexible enough to facilitate long-term operational gains.	Van Marrewijk (2007)
2. Choose which project risks to allocate to each of the stakeholders involved.	Bing et al. (2005), Shen et al. (2006), Ke et al. (2010a), Hwang et al. (2013), De Lemos et al. (2004)	2. The techniques used to make long-term project estimations are flawed and determine the success or failure of the project.	Flyvbjerg (2013)	2. There are no consolidated frameworks for measuring success in mega projects, such as PPPs, where evaluation for the three basic project management factors (budget, time and scope) is not enough.	Toor & Ogunlana (2010)
3. The way of conducting the negotiation process of risk allocation in PPP projects can lead to moral issues.	Medda (2007)	3. Planning is poorly done and generally cannot match complexity of PPP projects.	Bachy & Hameri (1997)	3. Despite the popularity, mega PPP projects generally have far worse outcomes than planned, especially as regards budget, time, and scope.	Van Marrewijk et al. (2008), Reijniers (1994), Yeo & Tiong (2000), Flyvbjerg (2013)
4. Risk assessment techniques in large PPP projects are generally flawed.	Jin & Zhang (2011), Reijniers (1994), Flyvbjerg (2013)	4. The poorly executed project of a large construction usually results in immense rework or drastic consequences in the desired quality.	De Lemos et al. (2004)	4. It is a challenge to ensure project quality and public opinion satisfaction with the project, considering end users.	Kumaraswamy & Zhang (2001)
5. The Government favors a good environment of economic policies and stability that encourage the private investment.	Kumaraswamy & Zhang (2001), Tang et al. (2010), Yeo & Tiong (2000), De Lemos et al. (2004)	5. Involvement of local stakeholders affected by large PPP projects (residents, NGOs, associations, etc.)	El-Gohary et al. (2006)	5. Very late definition of tariffs applied in the future operation lead to disagreements between organizations and discontent of end users.	Yeo & Tiong (2000)

Table 5. Continued...

PRE-PROJECT	References	ON-PROJECT	References	POST-PROJECT	References
6. Pre-contractual negotiation between organizations can be very exhausting.	Yeo & Tiong (2000)	6. The relationship between public and private organizations in a PPP project is poor, and poor relationship management often leads long-term projects to fail.	Smyth & Edkins (2007), Tang et al. (2010), Reijniers (1994)		
7. In addition to surveying project risk events, project vulnerability points are also rarely mapped, which may be eroding and causing negative effects throughout the project.	Zhang (2005)	7. Public and private organizations have very different internal cultures and working methods.	Reijniers (1994)		
		8. Because they are large projects, the project management of a PPP needs to give great weight to the adaptation of the project to external factors, such as risks and external adversities, which greatly influence the project.	Aritua et al. (2009), Yeo & Tiong (2000)		
		9. Organizational Cultures can become dysfunctional throughout the project and project managers must be aware of any change needed in the project culture.	Li et al. (2005a)		

It is observed in Table 5, that literature emphasis more the challenges before or on-project (9), while less emphasis is given to the challenges of post-project phase (5).

In the analysis of the challenges in the pre-project phase, it is dominant issues on the PPP project risk management which, according to Grimsey & Lewis (2002), is one of the major points of divergence between the different stakeholders participating on the project. There is also a concern in understanding the different interests and abilities of stakeholders and, as Bing et al. (2005) points out, meeting the goals of the public sector by passing most of the risks to the private sector. Some publications (Bachy & Hameri, 1997; Bing et al., 2005; Shen et al., 2006; Ke et al., 2010a; Hwang et al., 2013), study specifically the creation of models to facilitate the allocation of risk between public and private, using different forms of classification of items contained in the project risks while Medda (2007) points possible moral problems in the form of division of these items and other studies (Reijniers, 1994; Jin & Zhang, 2011; Flyvbjerg, 2013) identify flaws in the assessment of the risks involved. Finally, another popular challenge pointed, both in the literature review of Tang et al. (2010) and other studies (Yeo & Tiong, 2000; Kumaraswamy & Zhang, 2001; De Lemos et al., 2004), is the challenge of maintaining a political and national economic environment that encourages large private investments in conjunction with the public sector.

on-project, the main challenges are the financial factors involved, and Yeo & Tiong (2000) raises the challenge of maintaining the funds involved in the project's long-term and Flyvbjerg (2013) raises the attention for wrong estimates to support the long-term planning, which may result in cancellation of the project by not meeting the budget. From the point of view of challenges in project planning and design, some studies (Bachy & Hameri, 1997; De Lemos et al., 2004) show cases that demonstrate the negative and tragic consequences of ill done plans. Phase "on-project" is also marked by great challenges in maintaining and developing a good relationship between public and private organizations. Besides Reijniers (1994) points out that organizational cultures are very different, which brings challenges to mutual understanding, and also, along with Tang et al. (2010) and Smyth & Edkins (2007), states that the level of relationship and exchange of feedback between the organizations is very low. Finally, other references (Yeo & Tiong, 2000; Li et al., 2005a) point out the difficulties in managing the internal culture environment of the project team, composed of professionals from these different cultures together.

In the post-project phase, despite being the result of actions taken (or not taken) in the previous phases of the project, the post-project phase is when the team is faced with challenges of evaluating the project results, and various studies (Reijniers, 1994; Yeo & Tiong 2000; Van Marrewijk et al., 2008; Flyvbjerg, 2013) mention outcomes generally far worse than expected in the planning phase in PPP projects. Kumaraswamy & Zhang (2001) identify difficulties regarding the approval of public opinion, while Toor & Ogunlana (2010) raises an important discussion on how to evaluate success in PPP projects. Finally, Yeo & Tiong (2000) indicate that defining the rates for the end user later on is a major problem of this phase, which ends up generating disagreement and dissatisfaction.

5.2 Techniques

The main techniques to overcome or mitigate some of the challenges raised are systematized in Table 6. It is observed that there is greater emphasis on techniques to the stage on-project (16), while the post-project phase, received little attention (2).

In the pre-project phase, Bing et al (2005) and several other studies (Grimsey & Lewis, 2002; Shen et al., 2006; Ke et al., 2010b) focus on systematizing, allocation suggestions of joint ventures in PPP projects between the public and private sectors, from surveys to understand the preferences of project managers and analysis of case studies. Clifton & Duffield (2006) and Zhang (2007) suggest tools for reducing unforeseen events in the project by offering other forms of risk analysis or inclusion of project vulnerability analysis tools. Finally, Kumaraswamy & Zhang (2001) also shows ways of selecting of private sector bidders for the project.

On stage “on-project”, to avoid big unexpected events in the project, Flyvbjerg (2013) proposes both an external review to assess the estimates used in the planning as a method to reward and punish good and bad estimates, while Kumaraswamy & Zhang (2001) care to propose frameworks and regulatory frameworks to minimize the effect of unforeseen arising from political and national economic environment. Several studies (Li et al., 2005a; El-Gohary et al., 2006; Smyth & Edkins, 2007; Tang et al., 2010; Yeo & Tiong, 2000) proposes tools to improve the efficiency in relationship between organizations, as increased traffic information between the players, techniques of Relationship Management or concerns to establish a win-win relationship. Other studies Reijniers (1994) and Kumaraswamy & Zhang (2001), draw attention to forms of continuous evaluation of the project to monitor its progress.

Finally, in the post-project phase, the literature shows few tools for post-project PPP phase. Kumaraswamy & Zhang (2001) point out the need to set billing mechanisms to the private partner, which does not harm the profitability of the operation, while Toor & Ogunlana (2010) is mentioned to present ways to evaluate the success of PPP projects more broadly than the classic triad assessment of “budget, time and scope”.

Table 6. Techniques to increase success in PPPs.

PRE-PROJECT	References	ON-PROJECT	References	POST-PROJECT	References
1. Use trend mapping in project risk allocation between project partners to optimize and improve the risk allocation process for new projects.	Grimsey & Lewis (2002), Bing et al. (2005), Shen et al. (2006), Ke et al. (2010a)	1. Establish a legal and regulatory framework to minimize the influence of political instability.	Kumaraswamy & Zhang (2001)	1. Mechanisms for generation of accountability on private partner.	Kumaraswamy & Zhang (2001)
2. Modeling through artificial neural networks for risk management allows considering non-	Clifton & Duffield (2006)	2. Early commissioning of facilities to produce anticipated cash flow and control project costs in advance.	Flyvbjerg (2013)	2. Development of local frameworks to measure success in different projects with different objectives	Toor & Ogunlana (2010)

Table 6. Continued...

PRE-PROJECT	References	ON-PROJECT	References	POST-PROJECT	References
probabilistic and non-linear systems, such as PPP projects, in order to improve the decision-making process.					
3. A well-structured process for evaluating bidders to ensure the best supplier.	Kumaraswamy & Zhang (2001)	3. "External Vision" approach to audit the project plan.	Flyvbjerg (2013)		
4. Establish supporting mechanisms to foster the national market around PPPs projects.	Kumaraswamy & Zhang (2001)	4. Reward accurate estimates and punish inaccurate estimates.	Flyvbjerg (2013)		
5. Use of alliances between the parties to divide project risks and gains.	Clifton & Duffield (2006)	5. More rigorous planning with Product Breakdown Structure (PBS), Assembly Breakdown Structure (ABS), Work Breakdown Structure (WBS), Organizational Breakdown Structure, detailed project planning and schedule detailing.	Bachy & Hameri (1997)		
6. Inclusion of techniques for analysis and project vulnerability management.	Zhang (2005)	6. Use of models with indications of tools already used in the management of stakeholders for project managers.	El-Gohary et al. (2006)		
		7. Inclusion of Relationship Management techniques for a proactive attitude in relationship management between the project organizations.	Smyth & Edkins (2007), Yeo & Tiong (2000)		
		8. Establishment of a win-win relationship between project partners.	Kumaraswamy & Zhang (2001)		
		9. Increase information traffic	Aritua et al. (2009)		

Table 6. Continued...

PRE-PROJECT	References	ON-PROJECT	References	POST-PROJECT	References
		between project teams and organizations.			
		10. Constant control of project critical success variables.	Yeo & Tiong (2000)		
		11. Project managers to use more extensively case studies in PPPs within the same industry or with similar management characteristics.	Van Marrewijk et al. (2008)		
		12. Project success continuous evaluation techniques.	Kumaraswamy & Zhang (2001)		
		13. Constant feedback to capture external changes and suit project to reality.	Aritua et al. (2009)		
		14. Inclusion of a "milestones" plan with moments to verify project quality.	Reijniers (1994)		
		15. Agile and short decision processes.	Reijniers (1994)		
		16. Maintain a project management team that involves high-level members of the organizations involved.	Reijniers (1994)		

5.3 Critical Success Factors of PM in PPP

Similarly to the previous sections this content analysis extracts from articles the critical success factors (CSF) of PM in PPP projects. CSF are separated at each stage of the project and summarized in Table 7.

The CSF of the pre-project phase highlights risk management, which plays an important role in the partnership between the public and private sectors. In this sense, Grimsey & Lewis (2002) stated that the different needs of each of the parties need to be satisfied in the risk allocation process. Similarly, Bing et al. (2005) suggest that the two parties need to reach a mutual agreement in allocating acceptable risks to both parties before signing the contract. This subject of the importance of allocating appropriate risk early in the project is also raised in other studies (Reijniers, 1994; De Lemos et al., 2004; Shen et al., 2006; Ke et al., 2010a; Jin & Zhang, 2011). Kumaraswamy & Zhang (2001) indicate that another critical factor for the project's success is to create a well structured process of evaluating the bidders to ensure the

best supplier, even at this point, the process should carry out an audit to ensure control over the estimates by each of the proponents (Bachy & Hameri, 1997; Flyvbjerg, 2013). In Tang et al. (2010), Zhang (2005) is also used as a reference for survey of project's CSF in PPP, for the pre-project stage were cited: favorable environment for investment, economic feasibility, reliable partnership with strong technical competence, solid financial package, appropriate allocation of risk with reliable contractual arrangements (Tang et al., 2010). This last question of the need for a contract with well defined scope and avoid rework later is also a success factor evidenced in (Reijniers, 1994; De Lemos et al, 2004). For construction projects, especially the careful choice of where the project will be developed, has an important role in the outcome of the project as a whole, according to Yeo & Tiong (2000). As in Tang et al. (2010), the same authors point to the need to create a favorable investment environment where rates of return are attractive to the private sector and consequently the balancing of the interests of stakeholders of the project (Yeo & Tiong 2000).

CSF on-project, particularly at the planning stage and construction of the project, an important point raised in literature is stakeholder management. In this regard it is crucial for the project to get involved local stakeholders throughout the entire project so that they feel that their interests are being contemplated (El-Gohary et al., 2006). This continuous involvement of stakeholders in the project is also addressed by other studies of the sample (Reijniers, 1994; Bachy & Hameri, 1997; Kumaraswamy & Zhang, 2001). Another subject that is important in this relationship between stakeholders is the trust between the parties, that when established, promote win-win results on-project (Smyth & Edkins, 2007). Another aspect also commented as a critical success factor for the PPP projects is the management of its internal culture. When the internal culture of the team is aligned with the project's external expectations there is a tendency for greater cooperation between the parties, to achieve the project objectives (Van Marrewijk, 2007; Van Marrewijk et al, 2008). The planning stage as a whole is regarded as critical to the project by some authors (Reijniers, 1994; Clifton & Duffield, 2006) as well as quality management especially at the beginning of the project (Flyvbjerg, 2013). Similarly to other projects in other contexts, achieving budgets, deadlines and requirements are still the most critical success factors for PPP projects. In addition, metrics such as safety, efficiency of resource use and effectiveness (doing the right thing) are highly relevant to the perceived success of the project by the stakeholders (Toor & Ogunlana, 2010). Reijniers (1994) allude to other success factors as the creation of metrics, clear goals and outcomes to guide the project team, which in turn must be independent, qualified, working with proven techniques and methods on the market (Yeo & Tiong, 2000) and report to the managers of the two sectors, and managers must constantly monitor the work on the proposed metrics and results. During the whole project, the entrepreneurial character of the private sector should also be encouraged to foster better outcomes for the project (Yeo & Tiong 2000; Flyvbjerg, 2013).

Some critical success factors raised above also have impacts on post-project. The continued involvement of the stakeholders in the project is one of these examples. El-Gohary et al. (2006) states that global stakeholders have a greater concern for project monitoring to ensure that project impacts are still within the estimated during the planning phase, it is a feature that persists until the end of the contract, which is of great importance especially for the private sector, which tends to take greater risks on-project as a whole (Clifton & Duffield, 2006).

Table 7. Critical Success Factors in PPPs.

PRE-PROJECT	References	ON-PROJECT	References	POST-PROJECT	References
1. Appropriate risk allocation.	Reijniers (1994), Grimsey & Lewis (2002), De Lemos et al. (2004), Bing et al. (2005), Li et al. (2005a), Shen et al. (2006), Ke et al. (2010a), Tang et al. (2010), Jin & Zhang (2011)	1. Clear definition of scope.	Flyvbjerg (2013)	1. Achieve budget, time and specified requirements, as well as security, efficiency of resource use.	Toor & Ogunlana (2010), Bachy & Hameri (1997)
2. Proper choice of the best supplier.	Kumaraswamy & Zhang (2001), Flyvbjerg (2013)	2. Continuous involvement of Stakeholders.	Reijniers (1994), Bachy & Hameri (1997), Kumaraswamy & Zhang (2001), El-Gohary et al. (2006)	2. Continuous involvement of Stakeholders.	El-Gohary et al. (2006)
3. Favorable environment for investment.	Reijniers (1994), Tang et al. (2010)	3. Trust between the parties.	Reijniers (1994) Smyth & Edkins (2007)		
4. Economic viability and attractive return rate of the project.	Tang et al. (2010)	4. Project design and culture.	Van Marrewijk et al. (2008)		
5. Reliable consortium.	Tang et al. (2010)	5. Internal company culture aligned with as external expectations.	Van Marrewijk (2007)		
6. Reliable contractual agreement.	Reijniers (1994), Tang et al. (2010)	6. Proper preparation of the project.	Reijniers (1994)		
7. Accurate selection of the location.	Reijniers (1994)	7. Clear metrics, goals, and outcomes to guide the project team.	Reijniers (1994), Bachy & Hameri (1997)		
8. Balancing stakeholder interests.	Reijniers (1994)	8. Trained project team.	Yeo & Tiong (2000)		
9. Appropriate estimates for the project.	Flyvbjerg (2013)	9. Use of market proven techniques and methods.	Yeo & Tiong (2000)		
		10. Appropriate quality management.	Flyvbjerg (2013)		

The findings on critical success factors of this research corroborate the study of Osei-Kyei & Chan (2015), which in turn worked just these issues of CSF in PPP projects. Analyzing the studies of Osei-Kyei & Chan (2015) and Liu, T., et al. (2016a), it is clear that risk management, allocation and appropriate sharing of risk, reliable consortium beneficial legal agreements the two sides, clear project scope definition, as well as a management, stakeholder proper choice of supplier process procurement, transparent and competitive commitment and continuous monitoring in the project by both parties, trust between them and clear definition of responsibilities between the two sectors are the most important aspects to be considered for PM in PM this project template. The studies are complementary, so that in Osei-yei & Chan

(2015), highlight the environmental conditions and skills of the parties as CSF at various points like - political and community support for the project, stable economy, financial capacity of the private sector and guarantees provided by the public sector, long-term demand for the project and political stability - whereas the present study complements the first work with factors linked to culture and attention to the iron triangle (scope / quality, cost and time) as important for these projects: design project culture, the internal culture of the team alignment, using proven techniques and methods on the market to meet budget, schedule, quality and safety within the specified requirements.

The projects developed in the public private partnership model presents a rich field of study for project management, as usually involve contexts of large projects and high complexity, where there are multiple stakeholders (public, private, community, etc.) and often the project period with its concession can reach decades, thus requiring procurement processes and complex contractual definitions. This environment covers in depth risk management, stakeholder management as well as addresses competition themes, competence, monitoring, sustainability, among others. Thus the process of systematization of the challenges, techniques and critical success factors for project management in PPP is complex as it needs to capture knowledge of specific project contexts in different areas and produced in different countries and environments.

Our findings show that most of the challenges, techniques and project success factors identified in the literature are concentrated mainly in the previous steps to contract signing. The perceptions found in this systematic literature review are consistent with the study by Liu, T., et al. (2016a), except for the issues intrinsic to the public sector such as, government powers and governance of their structures that permeate all stages of the project, all other factors are related to previous activities that take place before the project starts, they are the factors related to the creation of a business case, building a suitable briefing for the project to third parties and the factors linked to competition between the private sector for competitive and transparent processes. Unlike the usual project management we found great occurrences of points of attention not only in the planning stage, but also during the implementation of this, which points out that the management of stakeholders in this project model has a particular aspect.

Table 8 shows a distribution of references to Critical Success Factors, Challenges and Techniques, grouped by project phase.

Table 8. Number of publications grouped by topic and project phase.

	Critical Success Factors	Challenges	Techniques	Total	%
Pre-Project		Reijniers (1994)			
		Yeo & Tiong (2000)			
	Reijniers (1994)	Kumaraswamy & Zhang (2001)			
	Kumaraswamy & Zhang (2001)	Grimsey & Lewis (2002)	Kumaraswamy & Zhang (2001)	32	46
	Grimsey & Lewis (2002)	De Lemos et al. (2004)	Grimsey & Lewis (2002)		
	De Lemos et al. (2004)	Bing et al. (2005)	Bing et al. (2005)		
	Bing et al. (2005)	Shen et al. (2006)	Clifton & Duffield (2006)		

Table 8. Continued...

	Critical Success Factors	Challenges	Techniques	Total	%
	Shen et al. (2006)	Medda (2007)	Shen et al. (2006)		
	Ke et al. (2010a)	Zhang (2007)	Zhang (2007)		
	Tang et al. (2010)	Ke et al. (2010a)	Van Marrewijk et al. (2008)		
	Jin & Zhang (2011)	Tang et al. (2010)	Ke et al. (2010a)		
	Flyvbjerg (2013)	Jin e Zhang (2011)			
		Hwang et al. (2013)			
		Flyvbjerg (2013)			
	Reijniers (1994)		Reijniers (1994)		
	Bachy & Hameri (1997)	Bachy & Hameri (1997)	Bachy & Hameri (1997)		
	Yeo & Tiong (2000)	Yeo & Tiong (2000)	Yeo & Tiong (2000)		
	Kumaraswamy & Zhang (2001)	De Lemos et al. (2004)	Kumaraswamy & Zhang (2001)		
On-Project	El-Gohary et al. (2006)	Li et al. (2005a)	El-Gohary et al.(2006)	25	36
	Smyth & Edkins (2007)	Tang et al. (2010)	Smyth & Edkins (2007)		
	Van Marrewijk (2007)	Aritua et al. (2009)	Van Marrewijk et al. (2008)		
	Van Marrewijk et al. (2008)	Flyvbjerg (2013)	Aritua et al. (2009)		
	Flyvbjerg (2013)		Flyvbjerg (2013)		
		Reijniers (1994)			
		Yeo & Tiong (2000)			
	Bachy & Hameri (1997)	Kumaraswamy & Zhang (2001)			
Post-Project	El-Gohary et al. (2006)	Van Marrewijk (2007)	Kumaraswamy & Zhang (2001)	12	17
	Toor & Ogunlana (2010)	Van Marrewijk et al. (2008)	Toor & Ogunlana (2010)		
		Toor & Ogunlana (2010)			
		Flyvbjerg (2013)			
Total	22	28	19	69	
%	32%	41%	28%		

Another important insight of the literature review is that the challenges, techniques and critical success factors, are often heavily influenced by the context and environment variables where the project is located, as different studies point to different points of attention. In this way, the practitioner needs, in addition to analyzing the points already raised attention in the literature due to past projects, understand and adapt adequately to the environmental demands of the project. This insight has its bases in contingency theory, which can be synthesized by Scott (1981, p. 114) in the phrase: "The best way to organize depends on the nature of the environment in which the organization needs to relate."

6 Conclusion

The current literature on project management in the context of public private partnerships addresses as major issues the challenges, techniques and success factors in this project format, but does so separately and without reference to their

impact on the project life cycle, thus hindering the analysis for a researcher or practitioner in the area to understand what are the major focuses of attention and opportunities to be explored.

To fill this gap in the literature, this study realizes a systematic literature review based on the main journals and authors of these themes to systematize and facilitate the knowledge of these areas, mainly from a perspective of the different phases of the project, which facilitates understanding and focuses the attention of managers to specific challenges of each period for the long-term view. For this purpose, this study developed a bibliometric analysis based on 99 articles relevant to the PM and PPP context, and a content analysis around the 24 publications with major impact in the academy.

The bibliometric analysis, not only explains the increasingly importance of public private partnership theme for literature and practice as an alternative to enable complex works of great impact to society, points to stakeholder management, risk management and analysis of the critical success factors as main focuses of attention for PM in projects of this nature. Content analysis, in turn, identified how each of these focuses of attention impact the project during its life cycle, with an emphasis on the early stages of it. The main difficulties and challenges of this model of project show that many problems on-project occur due to failures or ill defined and / or planned activities in its beginning, but that sometimes only arise at later stages.

The results thus bring contributions to academy organizing the knowledge on the area and providing a rich discussion of potential studies to be conducted in project management in PPP. The findings also provide for practitioners - a greater understanding of the challenges that must be concerned during each phase of the project and the techniques used today to solve or mitigate these challenges, as well as which of the success factors are more relevant. The study also shows the importance for practitioners to use these findings from the initial stages of the project, where exactly there is a greater focus of attention to be considered.

Considering the limitations of scope and time frame of this research, this study is limited to a number of scientific basis and the combination of keywords searched displayed in the search method section and possibly previous studies in the area may have been left out of the final sample. As the objective of this research was to focus on quality and not quantity, as discussed above, it is believed that the selected studies are sufficient to identify the current state of the PM literature on PPP and the most relevant information for the area.

Note that there is no correlation between the authors of this research with the selected items. One indication is that there are no jobs selected in the same country where this research was conducted.

As detailed in the method section for content analysis articles were analyzed and reviewed by different people to reduce possible biases and inconsistencies. Still, the content analysis stage is more susceptible to human error and the interpretation, categorization, and clustering information intra and inter articles.

This systematic literature review presents both academic implications as to practitioners in the field. To academy, the findings show a fertile literature field that can be better exploited (Thamer & Lazzarini, 2015), because it is a comprehensive field, with various consequences for important issues such as risk management and stakeholder management, which in turn can be referenced for risk and stakeholder management from other areas (Tang et al., 2010). In this sense, it was found several points that could be better exploited by future research. Toor & Ogunlana (2010)

indicates that there are few studies that combine quantitative to qualitative studies for evaluation of projects and creation of key performance indicators (KPI) of PPP projects, as well as a relationship with these critical success factors identified in literature. Work on KPI's could also assist in studies of decision-making tools in this type of project (Aritua et al., 2009). In relation to risk management, Jin & Zhang (2011) point to the creation of models based on neural networks to improve estimates and reduce risks on-project, while the risk sharing study with the hybrid model of alliance can deliver results beneficial for both parties (Clifton & Duffield, 2006). As the model of Alliance, it could be conducted studies to identify cases of success in PPPs to increase the attractiveness of this project for the private sector (Hwang et al., 2013). Another area that could be considered is the dichotomy between models of management hard and soft for PPPs (Yeo & Tiong, 2000). Thamer & Lazzarini suggest further studies on the factors: trust, culture and incentives in building these partnerships, more efficient and transparent mechanisms for PPP approval step.

For practitioners in the field, it is clear that the challenges faced on-project, as well as the methods and techniques to overcome these difficulties to achieve the critical success factors need to be analyzed separately within each design time and that most concern of managers in this area is concentrated at the beginning of the project, showing that if some points have been forgotten or made without due attention, problems may appear in the result of the project, hindering the overall success.

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Appendix A. Characterization of studies according to method and focus.

	Reference	Method	Focus
1	Grimsey & Lewis (2002)	PE2	T2
2	Bing et al. (2005)	PE1	T2
3	Zhang (2005)	PE1	T4
4	El-Gohary et al. (2006)	PC2	T1
5	Smyth & Edkins (2007)	PE1	T1
6	Van Marrewijk et al. (2008)	PE2	T4
7	Medda (2007)	PC2	T2
8	Toor & Ogunlana (2010)	PE1	T4
9	Shen et al. (2006)	PE2	T2
10	Kumaraswamy & Zhang (2001)	PC1	T4
11	Ke et al. (2010a)	PE1	T2
12	Tang et al. (2010)	PC1	T4
13	Aritua et al. (2009)	PC2	T4
14	Li et al. (2005a)	PE1	T4
15	Van Marrewijk (2007)	PE2	T4
16	Clifton & Duffield (2006)	PC2	T4
17	Jin & Zhang (2011)	PE1	T2
18	Zhang (2007)	PC2	T2
19	Reijniers (1994)	PE2	T4
20	Hwang et al. (2013)	PE1	T2
21	Yeo & Tiong (2000)	PE2	T2
22	Flyvbjerg (2013)	PE2	T4
23	Bachy & Hameri (1997)	PC2	T4
24	De Lemos et al. (2004)	PE2	T2
25	Zou et al. (2014)	PE1	T4
26	Singh & Kalidindi (2006)	PE2	T2
27	Devapriya (2006)	PC2	T3
28	Ke et al. (2010b)	PE1	T2
29	Edelenbos & Klijn (2009)	PE1	T4
30	Daube et al. (2008)	PC2	T3
31	Li et al. (2005b)	PE1	T3
32	Yu & Kwon (2011)	PE1	T4
33	Xu et al. (2012)	PE2	T3
34	Yang et al. (2010)	PE1	T4
35	Yuan et al. (2009)	PE1	T4
36	Biesenthal & Wilden (2014)	PC1	T4
37	Edkins & Smyth (2006)	PE1	T1
38	Liu & Wilkinson (2014b)	PE2	T3
39	De Schepper et al. (2014)	PE2	T1
40	Ling et al. (2014)	PE1	T1
41	Carbonara et al. (2014)	PE2	T5
42	Tang & Shen (2013)	PE1	T1
43	Jacobson & Ok Choi (2008)	PE2	T4
44	Cheung & Chan (2011)	PE1	T2
45	Osei-Kyei & Chan (2015)	PC1	T4
46	Guo et al. (2014)	PE2	T2
47	Kakabadse et al. (2007)	PE2	T3
48	Verweij (2015a)	PE2	T4
49	Liu et al. (2014b)	PC2	T3
50	Henisz (2006)	PE2	T2
51	Codecasa & Ponzini (2011)	PE2	T4
52	Edelenbos & Teisman (2008)	PE2	T4
53	Pitsis et al. (2014)	PC2	T4
54	Liu et al. (2014a)	PC2	T4
55	Jefferies & McGeorge (2009)	PE2	T3
56	Heravi & Hajhosseini (2011)	PE2	T2
57	Ye et al. (2014)	PE1	T3

	Reference	Method	Focus
58	Kwak et al. (2014)	PE2	T4
59	Fogelberg & Thorpenberg (2012)	PE2	T1
60	Roumboutsos & Pantelias (2015)	PE2	T2
61	Chen et al. (2006)	PC2	T1
62	Lenferink et al. (2013)	PE2	T1
63	Chowdhury et al. (2011)	PC2	T1
64	Henjeweile et al. (2014)	PE2	T4
65	Dulaimi et al. (2010)	PE2	T4
66	Rajan et al. (2013)	PC2	T4
67	Wang (2015)	PE2	T2
68	Chou & Pramudawardhani (2015)	PE1	T3
69	Bayley (2003)	PE2	T3
70	Yun et al. (2015)	PE1	T4
71	Mistarihi et al. (2013)	PE2	T1
72	Mota & Moreira (2015)	PC2	T4
73	Liu & Wilkinson (2014a)	PE2	T4
74	Carpintero & Petersen (2015)	PE2	T2
75	Liu et al. (2015)	PC1	T4
76	Atmo & Duffield (2014)	PC2	T3
77	Chang (2013)	PC1	T2
78	Abdul-Aziz (2012)	PE2	T1
79	Kayaga & Zhe (2007)	PE2	T4
80	Santosh Kumar Delhi et al. (2012)	PE2	T4
81	Skander & Préfontaine (2014)	PE2	T1
82	Perić (2012)	PE2	T4
83	Amponsah & Forbes (2012)	PC2	T4
84	Lilley (2005)	PC1	T2
85	Zhang et al. (2016b)	PC2	T5
86	Padalkar & Gopinath (2016)	PC1	T4
87	Roberts & Siemiatycki (2015)	PE2	T1
88	Lavlinskii et al. (2016)	PC2	T4
89	Keck (1996)	PE2	T4
90	Hughes (2005)	PE2	T4
91	Pankratz & Walkenmeyer (2005)	PC1	T4
92	Lenferink et al. (2014)	PC2	T4
93	Chou & Leatemia (2016)	PC2	T4
94	De Clerck & Demeulemeester (2016)	PC2	T3
95	Loosemore & Cheung (2015)	PE2	T2
96	Cheng et al. (2016)	PE1	T4
97	Koops et al. (2016)	PE1	T4
98	Liu, T., et al. (2016a)	PE1	T4
99	Verweij (2015b)	PC2	T1