

PROJECT MANAGEMENT IN THE PUBLIC SECTOR: LESSONS FROM THE LITERATURE

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ABSTRACT

This paper aims to investigate project management methods in the public sector context, identifying the distinctive characteristic of this kind of project. The research design merges bibliometric and content analyses in a systematic literature review about the theme. The sampling process was carried out in the Scopus and Web of Science Core Collection databases. The keywords used for research were: "project management" AND ("public sector" OR "government"). After the screening process based on the inclusion and quality criteria, the final sample was composed of 146 articles. The bibliometric analysis was developed with VosViewer and Minitab 17 softwares. Descriptive statistical analysis of the data and network analysis were performed in keywords, outliers, hot topics, among others. For the content analysis, a coding schema was developed. A methodological triangulation was applied for understanding in-depth the insights of the three methods applied. Due to the complex nature of project management in public sector, the choice of control variables represented a particularly important issue in the literature, particularly country and sector. The project management context stood out in the literature, such as in developing countries where there is a need to cut government spending, but still foster infrastructure and economic development with the efficiency of the public service. However, the bureaucracy and corruption affect negatively the project success, with some evidence of the increase of costs, delays in infrastructure governmental programs, and corruption involving the public sector and large contractors in cases from Asia. In consequence, one key knowledge area is the project procurement management and bidding design and implementation processes. The literature is concentrated in a large range of sectors, particularly on construction, infrastructure, transportation, defense and security, aerospace industry, public administration, agriculture, environment and information

technology. Themes such as critical success factors in projects, negotiation and renegotiation of contracts, concession period of infrastructure and selection of consortium responsible for works and operations were identified. These discussions can help governments to better design bidding process avoiding negative factors discussed. For companies, the paper helps to identify the critical risk to be involved in public and private partnerships. The results reveal that Project Management approach and tools in the public sector play a key role for project success, showing the importance of governmental step towards governance with a focus on transparency, accountability, efficient and effective usage of public resources, implementation of policies and changes and mainly towards the maintenance of public reliability.

Keywords: Project Management; Public sector; Bibliometrics

INTRODUCTION

Project management is deeply rooted in the public sector, however, there is little specific research in this field (Winch and Sanderson, 2015). Since the 1980s, many governments have attempted to change certain characteristics of public organizations in order to respond to growing pressure to reduce budgets as well as increase the quality of public services. Thus, there was a great movement towards the revision of procedures and structures in order to follow principles of economy, efficiency and effectiveness with the application of business elements and projects aiming at the modernization of the public apparatus (Arnaboldi et al., 2004). Public projects are political (Azman et al., 2013), are subject to the attention of the media and stakeholders (Crawford and Helm, 2009), have government laws and are subject to public pressure (Kwak and Anbari, 2012) as well as they demand governance with a focus on transparency (Crawford and Helm, 2009).

On the other hand, project management in the public sector involves public-private partnerships (PPPs) (Aritua et al., 2011; Xu et al., 2012; Hanaoka and Palapus, 2012). Since the 1970s, privatizations have been government-generated actions to raise quality levels in the provision of essential public services (Lee and Yu, 2011) due to budget constraints and the need for infrastructure modernization (Carbonara et al., 2014), being vital for economic growth and development (Hanaoka and Palapus, 2012). This kind of partnership affects the risk management of the projects (Aritua et al., 2011; Xu et al., 2012; Hanaoka and Palapus, 2012), the management of procurement and bidding processes (Hwang et al., 2013; Ling et al., 2014) and they are more susceptible to corruption (Ling et al., 2014; Khang and Moe, 2008).

The management of projects in the public sector has difficulties in methodologies used in the business environment for the public context, bringing to the fore the discussion of which would be the most significant critical success factors (Arnaboldi et al., 2004). However, the importance of project management within the public sector has been consolidated as a government initiative associated

with public criticism and the need to extract value from public spending (Crawford and Helm, 2009) so that they still have significant research gaps (Winch and Sanderson, 2015).

In this way, the purpose of this paper is to investigate project management methods in the public sector context, identifying the distinctive characteristic of this kind of project. The research design is a systematic literature review, merging semantic analysis, bibliometric and content analyses. The sampling process was carried out in the Scopus and Web of Science Core Collection databases. The bibliometric analysis was developed with VosViewer and Minitab 17 softwares. For the content analysis, a coding schema was developed. A methodological triangulation was applied for an in-depth understanding of the insights of the three methods applied.

This work is structured in five sections. Section 2 presents the literature review of the paper. Section 3 presents the description of the research method applied. The analyses and discussion of the results in section 4. Finally, Section 5 presents the conclusions from this paper.

LITERATURE REVIEW

According to Senge (2006), organizations exist for a purpose. Thus, Dewhurst et al. (1999) characterize public organizations as being those that are not profit-oriented, whereas Fryer et al. (2007) define the public sector as the set of organizations that provides goods and services to a government at a local or national level. Therefore, Fryer et al. (2007) point out that the distinction between the public sector and the private sector has four aspects: (i) the main objective is not profit maximization; (ii) lack of clarity about who the actual customers are in line with the different needs of customers; (iii) large number of stakeholders; (iv) the public sector is subject to the controls and oversights of governments.

If for Azman et al. (2013) public projects are political, Crawford and Helm (2009) point out that the responsible use of public money in policy implementation and in the provision of services and infrastructure through government is subject to the attention of the media and stakeholders, therefore, it may cause political harm to the responsible government. Crawford and Helm (2009) point out that the value of project management in the public sector focuses on its contribution to governance with a focus on transparency, accountability, efficiency and effectiveness in resource use, policy implementation and change, mainly, in the maintenance of public trustworthiness. Kwak and Anbari (2012) point out that the emphasis on performance measurement in governments continues to be a current and growing demand as a result of government laws and public pressure to do so, especially in project management, programs, portfolios and public money.

Fryer et al. (2007) infer that there is a porosity in the boundaries between the public sector and the private sector and that there is also the overlapping of one

sector by the other in many areas. According to Carbonara et al. (2014), governments have encouraged private sector involvement in public investment projects because of budget constraints and the need to modernize national infrastructure. Other studies corroborate this view of increasing pressures for reduced budgets (Arnaboldi et al., 2004) and increased demand for quality of public services (Arnaboldi et al., 2004; Lee and Yu, 2011).

The project management scope in a variety of government sectors and partnership with the private sector opens up a wide range of topics to be addressed such as risk management and allocation, project selection, legal and contractual aspects, political and governmental influence, critical success factors as well as financial and organizational aspects. Sarantis et al. (2011) point out that e-government projects transform relationships in a hierarchical way into an interactive collaboration between government, citizens, businesses, civil servants and other governments in general so that they need flexibility and ability to address changes.

Aritua et al. (2011) address risk management as central to organizations' decisions on capital infrastructure investments whereas, for the UK public sector, risk management is central to good governance. Xu et al. (2012) point out to the need for the public and private sectors to consider risks in Public-Private Partnership (PPP) projects, whereas Hanaoka and Palapus (2012) point out the necessity to incorporate risk impacts into Build-Operate-Transfer (BOT), consequently, to achieve the objectives of the public and private sectors. According to Hwang et al. (2013), risks are important factors in project procurement and, therefore, risk management is fundamental to achieve the objectives of those involved. Deng et al. (2014) explain that the need for large international contractors to consider and know how to manage political risks in operations in other countries and that failure in this management would undermine the strategic, market and stability objectives in these countries.

However, Ling et al. (2014) evidence the benefits that the cooperative approach to mutual gains through the adoption of relational contracts would bring to the relationship between public and private sectors in project management. For Hanaoka and Palapus (2012) large infrastructure projects involving the private sector are essential to ensure the infrastructure needed to sustain economic growth and development.

RESEARCH METHODS

The research method used was the bibliometric approach to establishing scientific communication networks and production activities in the field of project management in the public sector. The researches were carried out in the Scopus and Web of Science Core Collection databases, and for the papers identified in the first base, only those that were present in the Web of Science Core Collection database were considered but did not appear in the search results held at the

Web of Science Core Collection. The terms used for research were: "project management" AND "public sector" OR "government".

This method analyzes the publications in specialized journals related to engineering, administration and business in subjects where there is a notorious public sector presence such as construction, infrastructure, transportation, defense and security, aerospace industry, public administration, agriculture, environment and information technology. The selection of journals was based on the objective of identifying publications in journals relevant to the themes addressed and for the management of projects so that they could aggregate in quality and relevance to this research.

Finally, based on the reading of the abstracts of each paper to determine which would be included in the final sample and which would be discarded, the final database totalled 146 articles. The networks were developed with VosViewer and Minitab 17 softwares. The results refer to the descriptive analysis of the data and the interpretation of the networks of relationships between authors, papers' subjects, countries, keywords, among others.

RESULTS AND DISCUSSIONS

The first publication identified was dated 1988 with the work of Tomlinson and Rhomberg (1988). However, in the period from 1989 to 1993 and in the year of 1996, no papers related to this topic were identified. The evolution of the number of publications is expressed in Figure 1, with an accelerated increase in publications from 2007 onwards with peaks of publication in 2007 (15 publications) and 2009 (16 publications).

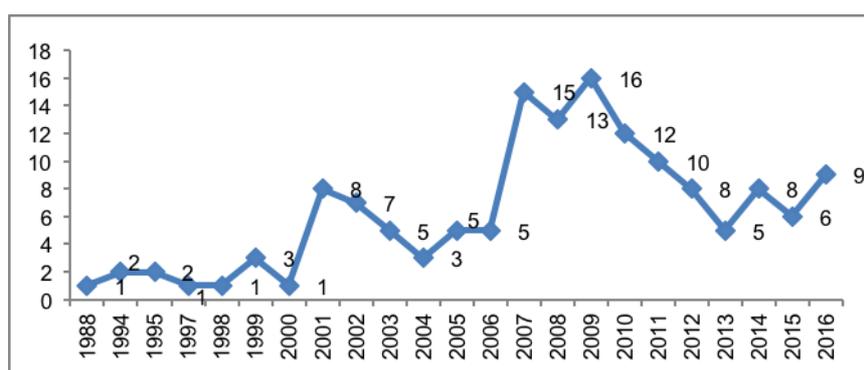


Figure 1: Yearly evolution of publications

In the year of 2007, the journal with the largest amount of publications is the "Journal of Construction Engineering and Management (ASCE)" and they discuss IT governance projects, Build-Operate-Transfer (BOT), construction projects, Design Build (DB). In 2009, the main themes of the articles were: risk management, Design Build (DB), Build-Operate-Transfer (BOT) and innovation in

public projects. The main journal in this year was the “International Journal of Project Management” as seen in Table 1.

Table 1: Yearly evolution of journals

| Journals | Impact Factor (2016) | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | total | | | | | | |
|--|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|------------|
| International Journal of Project Management | 2,885 | | | | | | | | | | | | | | | 8 | 6 | 2 | 3 | 4 | 2 | 3 | 5 | 33 | |
| Journal of Construction Engineering and Management- ASCE | 1,78 | 1 | 1 | | | 1 | | 4 | 4 | 2 | 2 | 2 | 4 | 3 | 3 | | | | 1 | 1 | | | | | 31 |
| Journal of Management in Engineering | 1,56 | | 1 | 1 | | | | 2 | 1 | 1 | | 1 | 2 | 3 | | 1 | | | | | 3 | 2 | | | 18 |
| Project Management Journal | 1,43 | | | | | | | | | | | | | 3 | 2 | 2 | 3 | 2 | | | | | | | 12 |
| Canadian Journal of Civil Engineering | 0,85 | | | | | | | 1 | | | | 1 | 2 | 1 | | | | | | | | | | | 5 |
| Transportation Research Record | 0,556 | | | | | | | | | | | | 3 | 1 | | 1 | | | | | | | | | 5 |
| Total | | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 6 | 6 | 3 | 2 | 3 | 3 | 11 | 11 | 13 | 10 | 5 | 6 | 5 | 5 | 5 | 5 | 104 |

Note: Journals with at least 5 papers.

In total, 37 journals (total journals of the database) were identified with publications related to the topic of project management in the public sector. Table 1 shows the evolution of publication per year and per journal only for journals with at least 5 papers. Among the journals, six of them concentrated 71.2% of the published papers, and the “International Journal of Project Management” alone accounted for 22.6% of the publications, followed by the “Journal of Construction Engineering and Management (ASCE)” (21.2%), “Journal of Management Engineering” (12.3%), “Project Management Journal” (8.2%), “Canadian Journal of Civil Engineering” (3.4%) and “Transportation Research Record” (3.4%).

The core papers of the sample were identified towards the citation and co-citation analyses, which are quantitative techniques applied to capture the impact and relevance of either an author or an article (Garfield and Merton, 1979). However, this relevance evaluation should also consider the journal impact, besides the total citation, or yearly average citation counting, because it “can change the position of one paper in the ranking of citations” (Carvalho, Fleury and Lopes, 2013, p.1421). Table 2 presents the calculated article impact index (AIF) according to the AIF calculation proposed by Carvalho, Fleury and Lopes (2013), as shown in Equation (1).

$$AIF = \text{Yearly average Citation} * (1 + JCRIF) \quad (1)$$

Table 2: List of most cited papers.

| Authors | Paper Title | Journal | Citations | JCR IF | AIF |
|---------------------------------|--|---|-----------|--------|--------|
| Toor and Ogunlana (2010) | Beyond the 'iron triangle': Stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects | International Journal of Project Management | 74 | 2,885 | 287,49 |
| Ke et al. (2010) | Preferred risk allocation in China's public-private partnership (PPP) projects | International Journal of Project Management | 54 | 2,885 | 209,79 |

| | | | | | |
|--|---|---|----|-------|--------|
| Chan et al. (2001) | Design and build project success factors: Multivariate analysis | Journal of Construction Engineering and Management - ASCE | 66 | 1,780 | 183,48 |
| Barlow, Bayer and Curry (2006) | Implementing complex innovations in fluid multi-stakeholder environments: Experiences of 'telecare' | Technovation | 54 | 2,243 | 175,12 |
| Bannerman (2008) | Risk and risk management in software projects: A reassessment | Journal of Systems and Software | 70 | 1,424 | 169,68 |
| Shen, Li and Li (2002) | Alternative concession model for build operate transfer contract projects | Journal of Construction Engineering and Management - ASCE | 60 | 1,780 | 166,8 |
| Shen et al. (2007) | Using bargaining-game theory for negotiating concession period for BOT-type contract | Journal of Construction Engineering and Management - ASCE | 50 | 1,780 | 139,0 |
| Ruuska and Teigland (2009) | Ensuring project success through collective competence and creative conflict in public-private partnerships-A case study of Bygga Villa, a Swedish triple helix e-government initiative | International Journal of Project Management | 30 | 2,885 | 116,55 |
| Catsbaril and Thompson (1995) | Managing information technology projects in the public-sector | Public Administration Review | 28 | 2,636 | 101,81 |
| Zhang and Kumaraswamy (2001) | Hong Kong experience in managing BOT projects | Journal of Construction Engineering and Management - ASCE | 36 | 1,780 | 100,08 |
| Zhang (2005) | Financial viability analysis and capital structure optimization in privatized public infrastructure projects | Journal of Construction Engineering and Management - ASCE | 30 | 1,780 | 83,40 |
| Bakatjan, Arikan and Tiong (2003) | Optimal capital structure model for BOT power projects in Turkey | Journal of Construction Engineering and Management - ASCE | 27 | 1,780 | 75,06 |
| Dilts and Pence (2006) | Impact of role in the decision to fail: An exploratory study of terminated projects | Journal of Operations Management | 15 | 4,000 | 75,00 |
| Hwang, Zhao and Gay (2013) | Public private partnership projects in Singapore: Factors, critical risks and preferred risk allocation from the perspective of contractors | International Journal of Project Management | 19 | 2,885 | 73,82 |
| Chen (2009) | Can the pilot BOT Project provide a template for future projects? A case study of the Chengdu No. 6 Water Plant B Project | International Journal of Project Management | 18 | 2,885 | 69,93 |
| Sun, Fang, Wang, Dai and Lv | Safety risk identification and assessment for Beijing Olympic venues | Journal of Management in Engineering | 27 | 1,560 | 69,12 |

| (2008) | construction | | | | |
|----------------------------------|---|---|----|-------|-------|
| Zhang (2006) | Factor analysis of public clients' best-value objective in public-privately partnered infrastructure projects | Journal of Construction Engineering and Management - ASCE | 24 | 1,780 | 66,72 |
| Glagola and Sheedy (2002) | Partnering on defense contracts | Journal of Construction Engineering and Management - ASCE | 24 | 1,780 | 66,72 |
| Love and Smith (2003) | Benchmarking, benchaction, and benchlearning: Rework mitigation in projects | Journal of Management in Engineering | 25 | 1,560 | 64,00 |
| Liou and Huang (2008) | Automated approach to negotiations of BOT contracts with the consideration of project risk | Journal of Construction Engineering and Management - ASCE | 23 | 1,780 | 63,94 |
| Subprasom and Chen(2007) | Effects of regulation on highway pricing and capacity choice of a build-operate-transfer scheme | Journal of Construction Engineering and Management - ASCE | 23 | 1,780 | 63,94 |
| Zhang et al. (2002) | Concessionaire selection for build-operate-transfer tunnel projects in Hong Kong | Journal of Construction Engineering and Management - ASCE | 23 | 1,780 | 63,94 |

Note: Papers in descending order of article impact index (AIF).

Figure 2 presents these outliers papers in the boxplot chart. The identified citation values represent papers from the sample whose article impact indexes are extreme outliers, performing more than 30 citations. It evidences also the medium outliers (dots), of which citations values vary between 13 and 30, considering the impact factor. In view of the impact factor of the "International Journal of Project Management", for instance, the paper from Toor and Ogunlana (2010), about performance measurement in a construction project in Thailand showing performance measurement as a mix of both quantitative and qualitative performance measurement on large-scale public sector development projects.

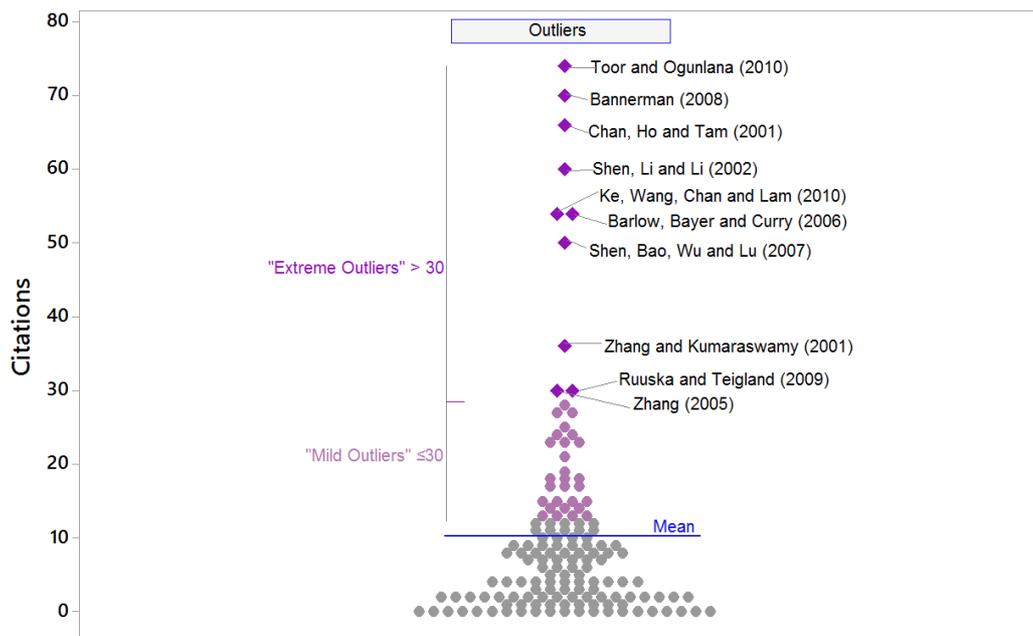


Figure 2: Articles outliers in number of citations from sample.
Note: Papers in descending order of citations

The Table 3 summarize the main information about the extreme outliers (10 papers) from analysed database.

Table 3: Analyses of objectives, objects of study and results of the 10 extreme outliers of the database.

| Paper | Total Citations | Purpose | Focus on | Results |
|--------------------------|-----------------|--|---|--|
| Toor and Ogunlana (2010) | 74 | Investigates the perception of stakeholders about performance indicators (KPIs) in projects. | Project managers, deputy project managers and line managers participating in the construction project at Bangkok International Airport in Thailand. | Although the respondents recognize the iron triangle of construction as a way of measuring mega projects, the study identified that there is a growing concern with efficiency and safety so that the measurement should be defined according to the project and stakeholder view. |
| Bannerman (2008) | 70 | Reviews and evaluate the literature and practice on risk and risk management. | Software projects at government agencies in an Australian state. | Three main results: (i) training in risk management has relevant importance in the management of software projects; (ii) the conceptualization and development of risk management theory in the literature lacks the practical requirements to handle the threats associated with the uncertainties of software projects and (iii) the practice of risk management lacks the understanding and prescriptions |

| Paper | Total Citations | Purpose | Focus on | Results |
|----------------------|------------------------|--|---|---|
| | | | | of risks and risk management found in the literature. |
| Chan et al. (2001) | 66 | Identifies success factors for Design & Build (D&B) projects and their importance to the projects results. | Clients, contractors and construction companies participating in D&B public sector projects in Hong Kong. | Six success factors for D&B projects were identified: (i) commitment of the project team; (ii) contractor power; (iii) risk assessment; (iv) customer skills; (v) end user needs and (vi) limitations imposed by end users. Factors (i), (ii) and (iv) were critical for the overall performance of D&B projects. |
| Shen et al. (2002) | 60 | Builds an alternative model to determine the concession period for Build-Operate-Transfer (BOT) | Build-Operate-Transfer (BOT) Infrastructure Projects | Development of a quantitative model to determine a concession period that can incorporate and preserve the interests of the public and private sectors. |
| Barlow et al. (2006) | 54 | Explores how project complexity, organizational context, and project management approach interacted during phases of telecare planning and implementation. | Projects to install telecare services by British public sector medical authorities. | The dynamic organizational environment has proved difficult for project managers to identify stakeholders. In addition, the complexity of the service to be implemented has not proved to be a significant factor for successful project implementation. Finally, project management helps to compensate for deficiencies in knowledge or skills whereas collaborating with the integration of a new service into the service delivery system. |
| Ke et al. (2010) | 54 | Identifies risk allocation preferences in Public-Private Partnerships (PPP) projects. | Professionals of the academic and industrial areas in Mainland China and Hong Kong. | 37 risks were identified. Of these, only 1 (expropriation and nationalization) was allocated entirely to the public sector. 12 risks were identified as more likely to be allocated to the public sector and basically relate to the government or its employees. 14 risks were equally divided between the public and private sectors. The private sector should bear the greatest responsibility for 10 identified risks. However, none of the identified risks was considered to be entirely the responsibility of the private sector. |

| Paper | Total Citations | Purpose | Focus on | Results |
|------------------------------|------------------------|---|---|--|
| Shen et al. (2007) | 50 | Expands the concession model of BOT-type projects developed by Shen et al. (2002) with the incorporation of the Games of Bargain. | Build-Operate-Transfer (BOT) projects. | The proposed model states that the selection of a concession period within the range already proposed by the work of Shen et al. (2002) is a bargaining process and, therefore, incorporates it within this model. The expanded model allows the identification of a concession period that is pleasant to both parties. |
| Zhang and Kumaraswamy (2001) | 36 | Discusses the experiences of the Hong Kong government in implementing BOT-type projects. | BOT projects in tunnels built in Hong Kong. | The BOT Project model in Hong Kong is useful for projects developed in the country, but could benefit from modifications regarding the nature of projects. However, it must include guarantees to remove risks that may affect in the participation of private sector. |
| Ruuska and Teigland (2009) | 30 | Answer the following questions: What are the challenges to developing collective competence in public-private partnerships? and How can these challenges be overcome to achieve project success | Public-private partnership in e-government in Sweden, Bygga Villa, that involved 16 organizations from academia, government, and industry to develop an innovative internet portal for the private construction industry. | The potential for conflict due to differing goals, resource scarcity, and interdependence of tasks was the greatest challenge for Bygga Villa's ability to develop collective competence whereas the partnership overcame this challenge through (1) co-developing a clear project charter, (2) recruiting a project leader with strong knowledge broker skills, (3) conducting joint problem-solving tasks using boundary objects, and (4) ensuring an understanding of the "big picture" through continuous open and balanced communication. |
| Zhang (2005) | 30 | Develops a methodology for capital structure optimization and financial viability analysis that reflects the characteristics of project financing, incorporates simulation and financial engineering techniques, and aims for win-win results for both public and private sectors | Public and private sectors | The financial evaluation methodology proposed in this paper follows a public-private win-win principle, considering the interests, concerns, and requirements of different participant |

The themes of these 10 papers gravitate around Public-private partnerships (PPP) and other project methods such as Build-Operate-Transfer (BOT) and

Design-Build (DB) as well as risk in projects. To understand the research collaboration, the first network performed was the country co-authorship, performed with the software VosViewer (Van Eck and Waltman, 2010). Figure 3 shows the relation among countries. Of the total of 10 extreme outliers of Figure 2, five authors are from China. In this view, countries are indicated by a circle. The more important an item, the larger its circle, each item's circle is displayed in the color of the item.

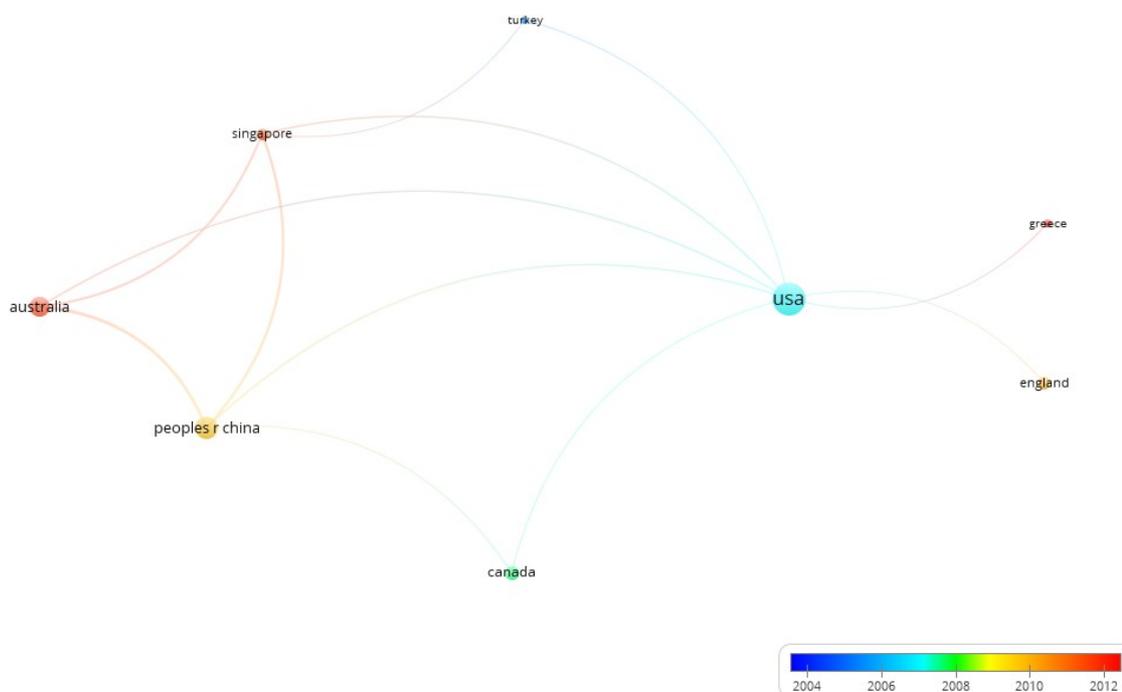


Figure 3: Countries co-authorship for the sample. Note: This network was performed with threshold criteria of at least 3 articles per country. VosViewer software utilized with data from database.

Also, the colors vary according to the year, so the first year is 2004 (blue) and last year 2012 (red) in this analysis, the papers with at least 3 co-authorship are between 2004 and 2012 and the colors of circles indicates the year of this occurrence.

The countries co-authorship network is composed of four clusters. The main cluster in terms of number of publications is the England, Greece and USA cluster, followed by the Australia and China cluster. Singapore and Turkey formed another grouping, and finally Canada is a cluster alone. This network highlights the great co-relationship between China, Australia, Singapore and USA (see the lines), but the countries with more citation and documents are China and USA (according to circle's sizes).

Figure 4 shows the clusters formed by the sample authors, with the first cluster grouping the authors Wang, Chan and Ke; the second Kuramaswamy, Shen and

Zhang. Being the most cited singly are Chan (140 citations), Shen (116 citations) and Zhang (130 citations).

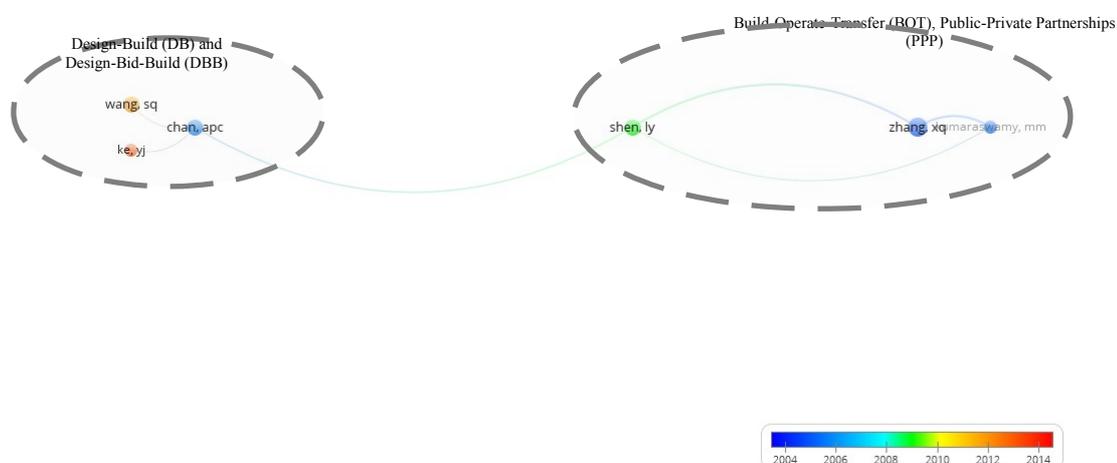


Figure4: Authors' Citation. Note: This network was performed with threshold criteria of at least 3 citations of a cited reference. VosViewer software utilized with data from database.

The analyses of networks aim to understand the patterns of relationship between published papers on project management in the public sector.

Analysing the most used keywords in these papers, seen Figure 5, the keywords are grouped in clusters, this means that the papers used these groups of words to deal with the subject that is proposed and it is noticed that the clusters are also related. This analysis presents five keywords clusters. The keywords are grouped according to the relationship between them and it is also possible to note that the term "Project management" is in the centre of the figure which corresponds to the most cited word in the papers, the frequency of occurrence of the keywords are indicated in Table 4.

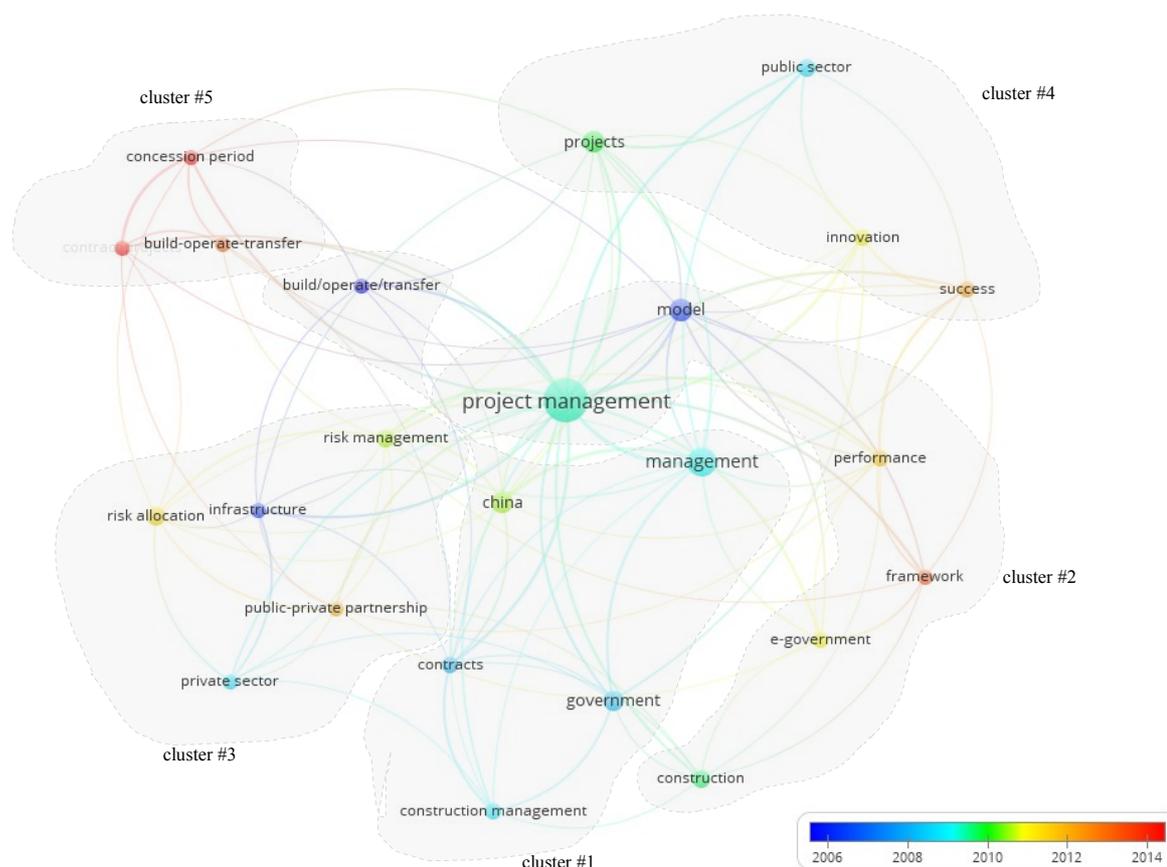


Figure 5: Co-occurrence of all keywords. Note: This network was performed with threshold criteria of at least five occurrences. VosViewer software utilized with data extracted from database.

Table 4 - Keywords frequency

| Keywords | Occurrence |
|---|------------|
| project management | 42 |
| management | 19 |
| model | 12 |
| China; projects | 10 |
| government | 9 |
| risk allocation | 8 |
| risk management; public sector; construction | 7 |
| Performance; success; innovation; contracts; e-government; construction management | 6 |
| concession period; framework; infrastructure; public-private partnership; contract projects; build-operate-transfer; private sector; build/operate/transfer | 5 |

As analysed before, the main terms related to Project management in public sector in these bases are risk, construction/infrastructure and BOT and as shown in Table 4 and mainly studied in China.

Figure 5 shows the hot topics analysis. To find hot topics related to this study, a scan was executed on the sample using NVivo software (Bazeley and Jackson, 2013). A frequency of words in article titles, author keywords, abstracts, and key keywords were explored for the most promising research topics and as future trends. To complete a "hot topics" analysis, a corresponding analysis was performed combining the recurrent topics of Figure 5, which offered the HB index (Hirsch, 2005). Using a survey by Banks (2006), the M index of Figure 5 was calculated in the work as a linear mathematical relationship between hb and the number of years n (n = 27 years), elapsed since a first publication (in this case, 1988). The terms for the interpretation of the index were published in Figure 5, according to the criteria of Banks (2006), Equation 2.

$$HB \sim M * n \quad (2)$$

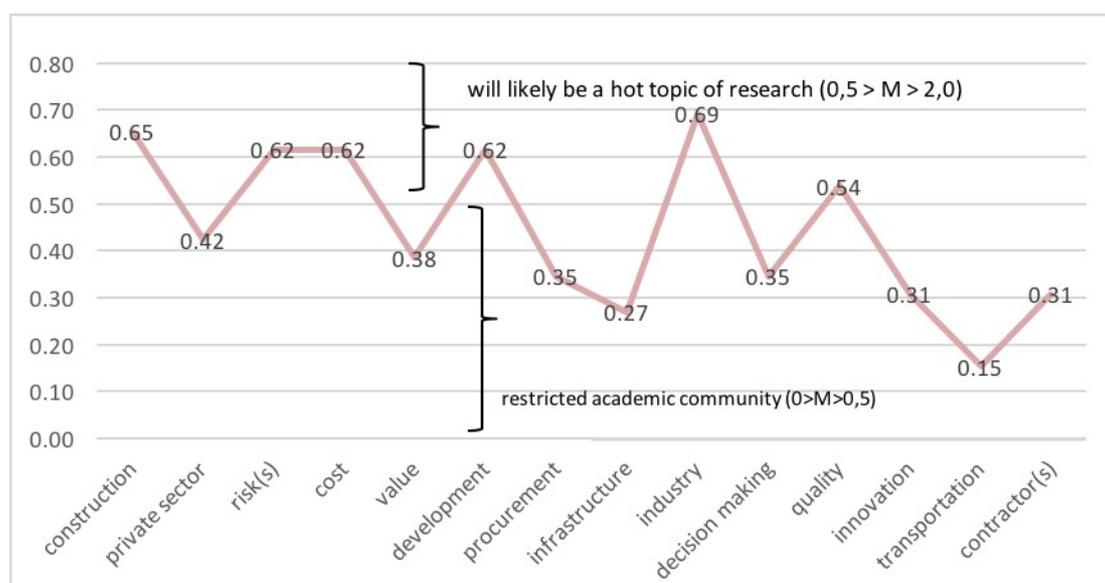


Figure 5: Hot topics analysis.

In Figure 5, the interpretation shows that industry, construction, risks, cost, development and quality are likely to be hot topics of research as their M score falls between 0,5 and 2. On the other hand, other topics are restricted academic communities within project management in the public sector such as value, procurement, infrastructure, decision-making, innovation, transportation and contractors.

In sequence, Figure 6 presents the co-citation network. This network is useful as it helps to understand the theoretical structure of the articles and how group of authors and their affinities are related (Carvalho et al., 2013). The co-citation network in Figure 6 shows the most used references by the articles in the

sample. These articles in the co-citation network are considered the theoretical pillars and considering a minimum of 4 citations, the network had 35 articles.

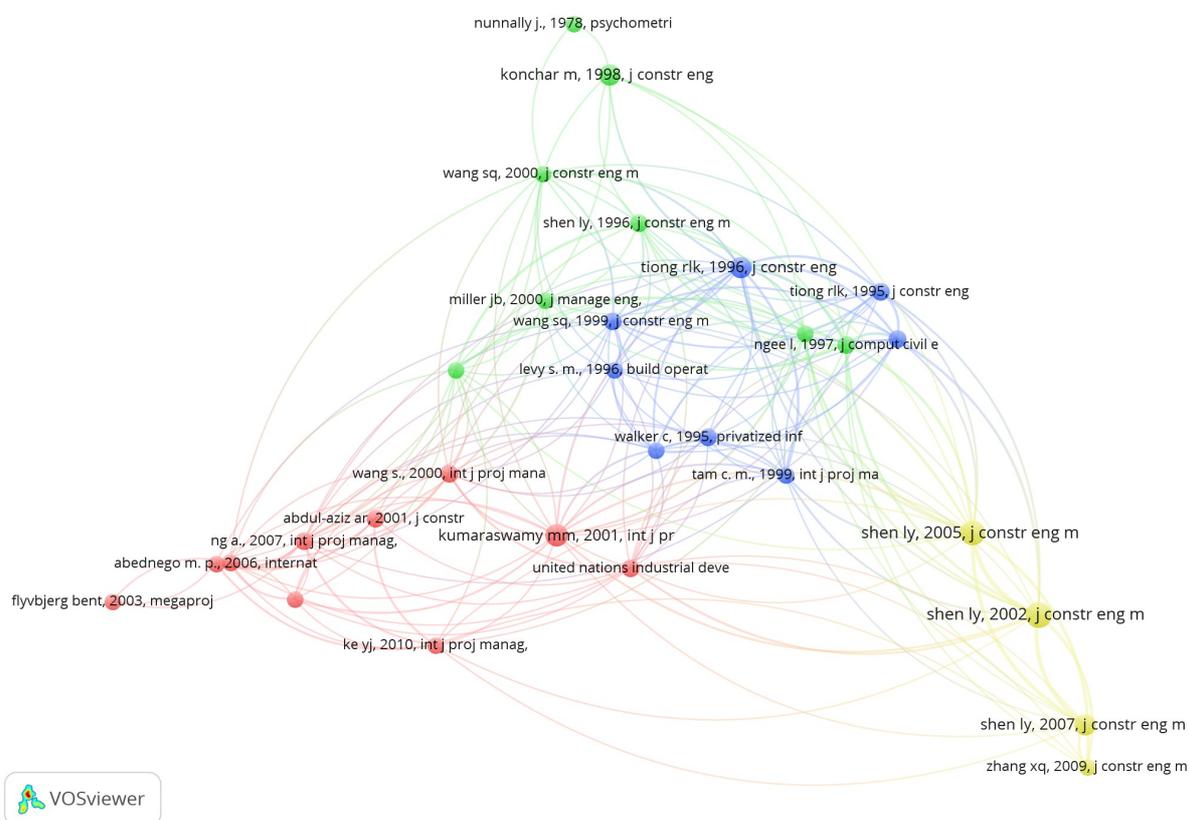


Figure 6: Co-citation network including citations with a minimum of 4 citations. Note: this network was created using VosViewer software with data from database.

In the co-citation network, Build-Operate-Transfer (BOT) model was widely discussed (Kumaraswamy and Zhang, 2001; Ngee, Tiong and Alum, 1997; Qiao et al., 2001; Shen et al., 2007; Shen, Li and Li, 2002; Shen and Wu, 2005; Tam, 1999; Tiong, 1995, 1996; Tiong and Alum, 1997; Wang and Tiong, 2000; Wang et al., 1999, 2000; Yang and Meng, 2000; Zhang and Kumaraswamy, 2001) along with public-private partnerships (Abednego and Ogunlana, 2006; Ke et al., 2010; Rouboutsos and Anagnostopoulos, 2008; Shen, Platten and Deng, 2006; Zhang, 2009).

Within the BOT model, a diverse range of topics were covered such as concession period (Shen, Lee and Zhang, 1996; Shen et al., 2007; Shen, Li and Li, 2002), risks (Shen and Wu, 2005; Tam, 1999; Wang et al., 1999, 2000), negotiation in BOT (Ngee, Tiong and Alum, 1997; Tiong and Alum, 1997), critical success factors (Qiao et al., 2001; Tiong, 1996), financial packages (Tiong, 1995), selection and evaluation of highway projects under BOT scheme (Yang and Meng, 2000), Hong Kong experience with BOT model (Zhang and Kumaraswamy, 2001),

identification of potential segments for BOT projects in China (Shen, Lee and Zhang, 1996) as well as governmental role (Kumaraswamy and Zhang, 2001) and governmental guarantees and initiatives (Wang and Tiong, 2000). For public-private partnerships (PPP), the recurring topics in the articles were similar to those for BOT such as concession period (Zhang, 2009), risks (Abednego and Ogunlana, 2006; Ke et al., 2010; Ng and Loosemore, 2007; Roumboutsos and Anagnostopoulos, 2008; Shen, Platten and Deng, 2006). Although BOT and PPP were prevalent in the co-citation network, other articles dealt with the proposal of a new model that uses multiple project delivery methods simultaneously (Miller et al., 2000), the comparison of multiple project delivery systems in the US (Konchar and Sanvido, 1998) as well as analyzes a private water consortium in Malaysia (Abdul-Aziz, 2001).

CONCLUSIONS

This paper contributes to narrow the gap in the Project Management literature on public sector. A large sample of 146 articles was surveyed. Due to the complex nature of project management in public sectors, the choice of control variables represented a particularly important issue in the literature, particularly country and sector. The project management context stood out in the literature, such as in developing countries where there is a need to cut government spending, but still, foster infrastructure and economic development with the efficiency of the public service. However, the bureaucracy and corruption affect negatively the project success, with some evidence of the increase of costs, the delays in infrastructure governmental programs, and corruption involving the public sector and large contractors in cases from Asia. In consequence, one key knowledge area is the project procurement management and bidding design and implementation processes. The literature is concentrated in a large range of sectors, particularly on construction, infrastructure, transportation, defense and security, aerospace industry, public administration, agriculture, environment and information technology.

There is a preponderance of management methods and execution of projects primarily in construction and infrastructure that, initiated by the public sector, incorporate the private sector participation. Under the broad names of Public-Private Partnership and Private Financing Initiative, methods such as Build-Operate-Transfer, Design-Build and Design-Bid-Build are the world's way of increasing value by investment and incorporating technical skills and management of the private sector at the same time as economic development.

From the bibliometric analysis, observation of the development of the theme around the elaboration of methods, models and tables with empirical application to address diverse themes such as risk management and analysis, project selection criteria, capital structure and financing. Critical success factors in projects, negotiation and renegotiation of contracts, contractual incompleteness, concession period of infrastructure and selection of consortium responsible for works and operations. As practical implications of this research, it can be helpful for governments to better design bidding process avoiding negative factors

discussed. For companies, the paper helps to identify the critical risk to be involved in public and private partnerships.

The present paper has some limitations, the paper sampling process can promote some bias due to database selected (Scopus and Web of Science), the search string and inclusion and quality criteria adopted. Besides, the screening process of the sample, based on the reading of the text by the researchers can bring subjectivity to the discard process. Thus, some relevant paper can be lost in these processes. In addition, the topic of project management and global application and field of study in developing countries, there is still a need for further research on the trade-off of management of government spending, but rather to foster an infrastructure and economic development with efficiency of public service. Further researches are also needed in understanding the increasingly cost and the delay in infrastructure projects of governments, and the increase of corruption cases involving the public sector and large contractors, particularly in development countries. Thus, studies are also need in project procurement and bidding process to help the development of government policies for concessions of highways, railways, ports and airports as well as the preparation of the country for the world sport events such as Olympic Games.

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