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# The key aspects of procurement in project management: investigating the effects of selection criteria, supplier integration and dynamics of acquisitions

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## Abstract

**Paper aims:** This study aims to identify the key aspects of procurement in the Project Management context and their relation to project success. Particularly, the effects of selection criteria, supplier integration and the dynamics of acquisitions are investigated.

**Originality:** This study contributes to the literature by analysing in depth a large sample of articles that deal with procurement in the Project Management context. This study also presents implications for practice by exploring how procurement management affects project success.

**Research method:** The methodological approach is a systematic literature review, combining bibliometrics and content analysis.

**Main findings:** The results show that academic literature focuses on the dynamics of acquisitions, lacking studies on the spectrum of supplier integration and supplier selection criteria. A strong relationship between the dynamics of acquisitions and project success dimensions could be established. Several insights into this relationship can be pointed out, as the effect of synergy with suppliers on the success dimension related to impact on the team.

**Implications for theory and practice:** The study contributes by identifying the relationship between the selection criteria, levels of supplier integration and dynamics of acquisitions with project success. Possible research gaps and trends are presented for future research.

## Keywords

Procurement. Procurement management. Project management. Supplier. Systematic literature review.

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## 1. Introduction

In turbulent and complex environments, companies are making even more efforts for greater supply chain collaboration (Zhang & Cao, 2018). Well-managed partnerships between buyers and suppliers are useful for achieving collaboration fluency and improving procurement effectiveness (Grudinski et al., 2014).

Companies have a vital role to play in the overall performance of a project. Select the most suitable supplier (San Cristóbal, 2012), and evaluate are relevant procurement processes for a project's success (Araújo et al., 2017), which contributes to the effective management of the supply chain (Rao et al., 2017). However, the selection of a supplier requires considerable effort in any organization (Zolghadri et al., 2011). Zolghadri et al. (2011) state that supplier selection has been studied as a procurement department issue; however, in order to take advantage of collaboration in the supply chain, the suppliers' integration is both necessary and complex. Collaborative advantages are achieved by sharing information, synchronizing decisions, sharing complementary resources, and aligning incentives with suppliers' costs and risks (Cao & Zhang, 2010).



Therefore, company-supplier integration requires appropriate safeguards and coordination mechanisms to succeed. The higher the level of integration, the greater the role of suppliers in project decision-making, and different levels of integration will have distinct impacts on the project's success (Petersen et al., 2005).

The interest in the relationships between companies and suppliers has increased in many industries, however, there is still a lack of comprehensive conceptual frameworks. There is a need for practices that allow for a detailed and systemic understanding of how suppliers are integrated into project-based supply chains (Eriksson, 2015).

This study seeks to narrow the gap by investigating the key aspects of procurement in the project management context and their relationship with a project's success. To achieve this goal, a systematic literature review was conducted, combining bibliometrics and content analysis techniques. The following research questions guide this research: (RQ1) What are the key aspects in the literature on procurement in project management? (RQ2) What is the relationship between procurement management and a project's success?

The study contributes by identifying the relationship between the selection criteria, the levels of supplier integration, and the dynamics of acquisitions, as shown in the literature with the project's success. Possible research gaps and trends are presented for future research. The paper is structured as follows: the following sections present the literature review on the topic, the research methods, the results and discussions and, the last one, the conclusions.

## 2. Literature review

### 2.1. Procurements in projects

Companies are seriously exploring the potential of supply chain management (SCM) (Gunasekaran et al., 2008). The procurement process is an area of interest to organizations responsible for project delivery for better performance in product quality, cost, cycle time, and responsiveness (Sanderson & Cox, 2008).

The procurement process is composed of different stages (pre-acquisition phase, tender process and contract award, contract and supplier management), each one requiring a specific and careful design capable of guaranteeing the best possible results (Baldi et al., 2016).

Besides, the literature suggests that supplier performance should be monitored and controlled regularly so that any failures can be identified and corrected (Ng et al., 2002). The evaluation of the supplier's performance throughout the project's implementation is important to ensure the success of the project (Araújo et al., 2017).

Designing a supply chain and selecting suppliers to take considerable effort in any organization. The company needs to understand what is important for it in the selection of a particular supplier or, in other words, it needs to define the evaluation criteria (Zolghadri et al., 2011).

The selection of a supplier is one of the main activities of the procurement area. Without an adequate and precise method to select the most appropriate supplier, the performance of the whole project may be affected (Cheng & Li, 2004). This task is difficult and challenging, replete with many uncertainties. It is a complex process, which requires individuals to make judgments and decisions and trade-offs between competing goals and limited resources. The selection of one supplier over another depends largely on the company's preferences in terms of evaluation criteria and weights used, and the commitments the supplier is willing to make (Watt et al., 2009). The criteria most used in the supplier selection process are summarized in Table 1.

Another relevant issue in procurement management is the company-supplier dyad and the form of its relationship. The literature points out that, to obtain collaborative advantages, the integration of a supplier into the company is complex (Zolghadri et al., 2011) and involves appropriate guarantees to be successful, which

Table 1. Selection criteria.

Criteria	References
Experience and knowledge of the company	Bendaña et al. (2008) Watt et al. (2009)
Performance in previous projects	Bendaña et al. (2008) Watt et al. (2009)
Experience in project management	Watt et al. (2009)
Technical aspects, technical experience, and method / technical solution	Bendaña et al. (2008) Watt et al. (2009)
Organizational and human resources aspects, workload / capacity	Bendaña et al. (2008) Watt et al. (2009)
Political, environmental and social aspects and other	Bendaña et al. (2008)
Best proposal in terms of quality issues, proposed timeline, and financial issues	Bendaña et al. (2008)
Position of the company	Watt et al. (2009)
Customer-supplier relationship	Watt et al. (2009)

implies that different levels of responsibility and integration need to be agreed between the company and the supplier (Petersen et al., 2005). The degree of supplier integration can range from none to three different levels. These levels can be described as being three boxes – white, grey and black. In the white level, the supplier is consulted informally on the project, with discussions on specifications and requirements, but the purchasing company makes all the decisions. In the grey level, the project is a formalized joint activity, which may include information and technology sharing and joint decision-making concerning design specifications. Finally, at the black level, the project is a supplier-driven design based on the company's specifications, with only a review and agreement of the specification (Petersen et al., 2005).

## 2.2. Procurement management and a project's success

Araújo et al. (2017) highlight the importance of suppliers in the success or failure of the project. The selection and evaluation of the performance of the supplier play an essential role in the development of the project.

Several researchers have developed decision charts to investigate the criteria for the selection and success rate of suppliers in terms of time, cost and quality. Over the years, however, the selection process has become increasingly complex, mainly as a result of the continued proliferation of different procurement methods, the increasing technical complexity of projects (Agarchand & Laishram, 2017), and the need for greater value for money. Therefore, the classic criteria of time, cost and quality alone are considered very simplistic in the context of complex project environment and, so, decision frameworks need to be updated (Naoum & Egbu, 2015, 2016). The current vision of a project's success is considered multidimensional (Carvalho & Rabechini Junior, 2015; Shenhar & Dvir, 2007), and this comprehensive view should also be considered in a procurement management environment.

Aiming to minimizing the gap between what is hired and delivered, the supplier have to fully understand the company's needs in the procurement process through extensive information sharing and constant communication. Only when a binding mechanism motivates information sharing is it possible to achieve a balanced relationship between the company and the supplier. As the company-supplier mechanism works, risk-averse suppliers are more likely to collaborate to define project scopes (Cheng & Carrillo, 2012).

The integration of product and process design decisions made together by companies and suppliers in the supply chain has been studied from various theoretical perspectives, including transaction cost savings, relational theory, organizational design, and network governance models. All these theories make clear that the company-supplier spectrum of supplier integration requires appropriate safeguards and coordination mechanisms to succeed (Petersen et al., 2005).

Cao & Zhang (2010) suggest four components of the advantages of collaborating in the supply chain: (1) collaborative advantages are achieved through supply chain partnering activities, such as sharing information, synchronizing decisions, sharing complementary resources, and aligning incentives with partners' costs and risks; (2) the benefits are greater when acting together rather than independently; (3) there are some leverage effects or synergistic results; and (4) it is not just about collaborative transactions: it involves the joint creation of knowledge and innovation. Based on this, the authors point to five dimensions of the advantages of supply chain collaboration: process efficiency, flexibility, business synergy, quality, and innovation.

## 3. Research methods

Aligned with the objective of this study, a systematic literature review was carried out. A systematic literature review (SLR) aims to comprehensively identify and synthesize research on a specific topic (Carvalho et al., 2013) and differs from traditional narrative reviews (Tranfield et al., 2003) because they use structured, organized, transparent and replicable procedures at each stage of the process (Carvalho et al., 2013; Littell et al., 2008). One of the main benefits of using this approach is to minimize bias by completing an exhaustive literature search (Cook et al., 1997). There are different ways of conducting a literature review, including bibliometrics analysis, meta-analysis and content analysis (Carvalho et al., 2013).

### 3.1. Sampling process

To obtain an overview of the literature on the topic of interest – procurements in project management – the ISI Web of Knowledge (Web of Science) and Scopus databases were consulted. The Web of Science (WoS) database was selected because it contains a variety of world-class research literature linked to a core of rigorously selected

journals (Clarivate Analytics, 2017); in addition, articles published in indexed journals and with impact factor calculated by Journal Citation Reports (JCR) are located on this database. The Scopus database was chosen as the largest database of abstracts and citations of peer-reviewed literature (Elsevier, 2017).

The data collection phase was performed on 17/10/2017, with the use of the following logical strings and connectors: “*procurement*” AND “*project management*”. These strings were searched in the fields “*Topic*” (in the WoS database) and “*Article Title, Abstracts, Keywords*” (in the Scopus database). Initially, 301 results were returned from the WoS Main Collection and 2,314 from Scopus. Then, the results were refined in the following order: first, the document type was refined to “*Article*” or “*Review*” (WoS) and “*Article*”, “*Review*” or “*Article in Press*” (Scopus); second, the language was filtered to “*English*” (WoS and Scopus); and third, only literatures from the areas of management, business and operations were considered. For this latter filter, the results were refined to “*Management*”, “*Operations Research Management Science*”, “*Business*” or “*Business Finance*” (WoS) and “*Business, Management and Accounting*” (Scopus). The result of these refinements was a database composed of 52 WoS articles and 440 Scopus articles (see Figure 1 and Table 2).

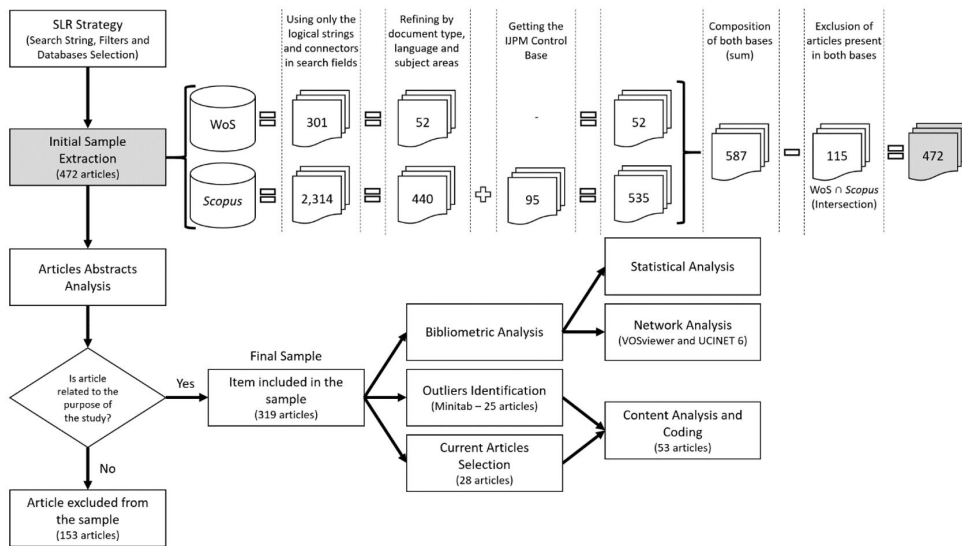


Figure 1. Systematic literature review research flow and search outputs.

Table 2. Search criteria.

Phases	Strings, Fields and Refinements		Nº of Results	
	WoS	Scopus	WoS	Scopus
1ª – Search	String: “ <i>procurement</i> ” AND “ <i>project management</i> ” Fields: “ <i>Topic</i> ”	String: “ <i>procurement</i> ” AND “ <i>project management</i> ” Fields: “ <i>Article Title, Abstracts, Keywords</i> ”	301	2,314
2ª – Filter in Document Type	<i>Article; Review</i>	<i>Article; Review; Article in Press</i>	164	1,157
3ª – Language Filter	<i>English</i>	<i>English</i>	162	1,103
4ª – Area Filter	<i>Management; Operations Research Management Science; Business; Business Finance</i>	<i>Business, Management and Accounting</i>	52	440
5ª – Adition of IJPM Articles (Control)	-	String: “ <i>procurement</i> ” Source: <i>International Journal of Project Management</i>	-	+95
Total			52	535

As an additional control base for the study, a new search was performed in the Scopus database, using only the search string “*procurement*” and refining the result by source. The authors’ source of interest is the “*International Journal of Project Management*”, owing to its high impact factor (4.034 for the year 2016 according to JCR) in the project management literature. This second search returned 95 articles.

The resulting sample consisted of 472 articles, excluding 115 duplicate articles (present in both databases). As shown in Figure 1, after the structured search in the databases and the extraction of the results, the abstracts of the remaining articles were analyzed. Studies that were not directly related to the subject were excluded from the sample. The final sample consisted of 319 articles. Figure 1 shows the methodological workflow performed in this study, adapted from Homrich et al. (2018).

The sample of 319 publications was distributed in 62 journals. There is a concentration of publications in journals related to the areas of management, administration, engineering, construction, contracting, and procedures.

Approximately 67% of the articles were published by six journals. The journal with the largest number of publications was the “*International Journal of Project Management*” (74 articles – 23%), followed by two journals in construction engineering – “*Construction Management and Economics*” (47 articles) and the “*Journal of Construction Engineering and Management*” (31 articles). The “*Journal of Construction Engineering and Management*” led the number of publications in the period between 1985–1994. However, in subsequent periods, it lost the leadership position to the “*International Journal of Project Management*”.

### 3.2. Data analysis

The final sample, composed of 319 articles, was analyzed in two ways: bibliometric analysis and content analysis and coding. It should be emphasized that the analyses are based only and exclusively on the data obtained through the specific sampling process adopted in this study. The bibliometric analysis and content analysis and codification will be explained in more detail in the following paragraphs.

The bibliometric analysis includes statistical and network analysis and aims to answer the research question RQ1.

For network analysis, VOSviewer software was used because it offers a series of graphical analyses, such as the co-citation of authors (Van Eck & Waltman, 2010; Van Eck et al., 2010). The software generates the networks of connections and segregates the analyzed items into groups called clusters. Each cluster is represented by a color and aggregates all items considered similar. The size of the circles of the maps shows the number of occurrences of the item, and the proximity between two items reveals their degree of relation, the closer, and the more related. The more important an item, the larger the size of its label and the size of its representative circle (Van Eck & Waltman, 2010).

To obtain the centrality values, UCINET 6 software was used. UCINET 6 is a software package for data analysis of social networks; it also has network visualization tools (Borgatti et al., 2002).

For content analysis and coding, the authors decided to select the outliers of the final sample. An outlier is an atypically observation that may have disproportionate effects on the statistical results of a sample, such as the average, which may result in misinterpretations (Minitab, 2017). According to Figueira (1998), an outlier is characterized by its relation to the remaining observations (data) that are part of the sample. The distance between the outlier and these observations is fundamental for their correct characterization. Outliers are also known as abnormal, contaminating, strange, extreme, or aberrant observations (Figueira, 1998).

Initially, the outliers were identified regarding total citations. For this reference, 22 outliers were found. Then a new analysis was made to identify the outliers with regard to the average citations per year. For this last scenario, 15 outliers were identified, of which 12 were considered in the first analysis (reference of total citations). The two analyses together compound a sample of 25 outliers. The outliers identified are presented in Figure 2, all obtained through Minitab software.

As this type of analysis (total citations and average citations per year) tends to exclude several current articles that have not yet reached a high number of citations, and considering the objectives of this study (tendencies and contributions of the literature on the subject of procurement in project management), we decided to add to this sample of outliers all articles of 2016 and 2017 (28 studies), resulting in a sample of 53 articles that compose the content analysis and coding of this study.

A coding schema was developed to perform the content analysis based on the in-depth analysis of the articles. The coding scheme is presented in Table 3 with six codes: Kind of Study (KS), Approach (A), Dynamics

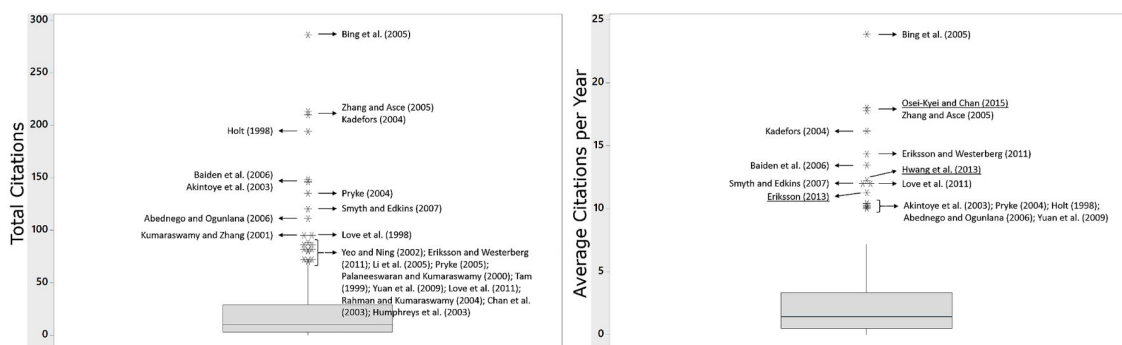


Figure 2. Outliers: total citations and average citations. Note: Metadata of 319 articles treated in MINITAB.

of Acquisitions (DA), Spectrum of Supplier Integration (SSI), Supplier Selection Criteria (SSC) and Success Dimensions (SD).

The two codes related to research design, Kind of Study (KS) and Approach (A), were defined as proposed by Franco et al. (2018) and Carnevali & Miguel (2008). The Dynamics of Acquisitions (DA) code was based on Madureira & Carvalho's (2015) classification. The Spectrum of Supplier Integration (SSI) code is based on the study of Petersen et al. (2005), deployed in three levels. The Supplier Selection Criteria (SSC) code was obtained from the work of Araújo et al. (2017) and the Success Dimensions (SD) code was deployed in seven dimensions according to Shenhar & Dvir (2007) and Carvalho & Rabechini Junior (2015). Table 3 shows the detailed coding schema and a statistical summary of the main results of the content analysis results. The relative value

Table 3. Main results of content analysis and coding.

	Codes	Occurrences	%
Kind of Study (KS)	KS1 – Modelling	6	11.32%
	KS2 – Theoretical-conceptual	12	22.64%
	KS3 – Literature Review	15	28.30%
	KS4 – Simulation	2	3.77%
	KS5 – Survey	14	26.42%
	KS6 – Case Study	26	49.06%
	KS7 – Action research	0	0.00%
	KS8 – Experimental	0	0.00%
Approach (A)	A1 – Qualitative	27	50.94%
	A2 – Quantitative	9	16.98%
	A3 – Both	17	32.08%
Dynamics of Acquisitions (DA)	DA1 – Synergy	5	9.43%
	DA2 – Learning	2	3.77%
	DA3 – Power Balance (Symmetric X Asymmetrical)	0	0.00%
	DA4 – Complementarity	10	18.87%
	DA5 – Trust	10	18.87%
	DA6 – Cooperation	14	26.42%
Spectrum of Supplier Integration (SSI)	SSI1 – White	1	1.89%
	SSI2 – Grey	8	15.09%
	SSI3 – Black	4	7.55%
	SSC1 – Quality	4	7.55%
Supplier Selection Criteria (SSC)	SSC2 – Cost/Price	8	15.09%
	SSC3 – Staff Features	4	7.55%
	SSC4 – Financial	1	1.89%
	SSC5 – Company Management	4	7.55%
	SSC6 – Experience	5	9.43%
	SSC7 – Time	2	3.77%
	SD1 – Product/Service	8	15.09%
Success Dimensions (SD)	SD2 – PM Efficiency	15	28.30%
	SD3 – Impact on the Team	1	1.89%
	SD4 – Current Impact on the Company	7	13.21%
	SD5 – Future Impact on the Company	7	13.21%
	SD6 – Impact on the Customer	5	9.43%
	SD7 – Social and Environmental Impact	10	18.87%

Note: Relative percentages compared to 53 articles in content analysis.

("%" column) was calculated according to the number of articles marked for each category ("Occurrences" column) and the total number of articles analyzed and coded (53 articles).

The articles selected for content analysis and coding were thoroughly analyzed by all the researchers for coding. Each article could be classified into no, one, or more categories for each code. Appendix A presents the coding summary for the articles analyzed according to the coding schema presented in Table 3.

After the coding process, UCINET was applied for core-periphery analysis and code relations network. IBM SPSS software was used for correlation analysis among codes.

## 4. Results

### 4.1. Key studies

Considering the most cited articles of the sample, 15 articles present average citations per year above ten (see Appendix A). Among the most cited articles, three articles are related to public-private partnerships (PPP). The study by Bing et al. (2005) focuses on risk allocation in PPP contracts in the United Kingdom and aims to

identify the preference for the allocation of specific risks between the public and private sector and both (shared). Osei-Kyei & Chan (2015) systematically review the literature on critical success factors for PPP contracts, in which they present a list containing 37 critical success factors identified from the analysis of 27 articles. The research by Zhang & Asce (2005) also deals with critical success factors for PPP contracts. Zhang & Asce (2005) present five critical success factors (macro) composed of 47 success sub-factors (micro). The other most cited studies are related to the dynamics of acquisitions. Kadefors (2004) discusses factors that influence the development of trust and cooperation between company and supplier. Eriksson & Westerberg (2011) propose a model for analyzing how procurement impacts project performance criteria, considering the cooperative environment as a mediating (one scenario) and moderating (in another) variable (see Appendix A).

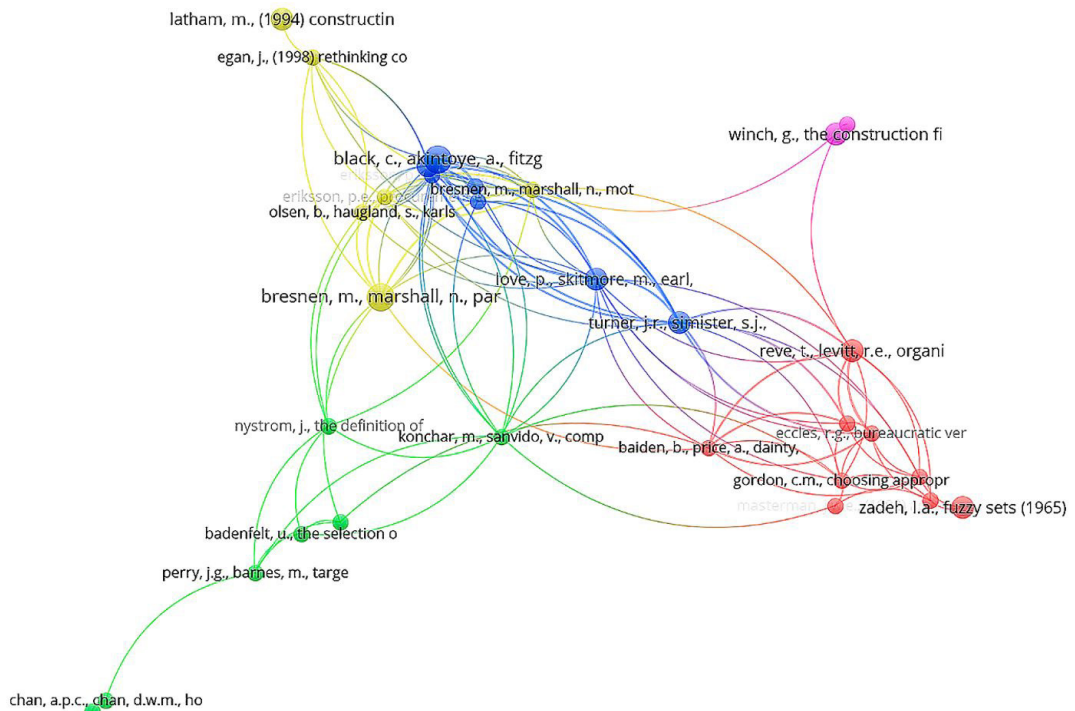
A recurrent topic of the analyzed articles is PPPs. The database contains papers about the critical success factors for PPPs contracts (Hwang et al., 2013; Li et al., 2005; Osei-Kyei & Chan, 2015; Yuan et al., 2009; Zhang & Asce, 2005), the preference for risk allocation in PPPs (Abednego & Ogunlana, 2006; Bing et al., 2005; Hwang et al., 2013), relationships that are established in a PPP contract (Smyth & Edkins, 2007) and key performance indicators for PPPs contracts (Yuan et al., 2009).

The term “costs” frequently appears because it is a variable of analysis of several studies. As shown by the main results of the content analysis and codification presented in Table 3, the project success dimension impacted by the procurements most adopted by the studies is project management efficiency (PM Efficiency), in which the variable “costs” is considered.

The network of co-citation of cited references was generated using VOSviewer software and is shown in Figure 3.

The two most frequently cited references (cited in the core sample of 319 articles) are Black et al. (2000) and Bresnen & Marshall (2000), both with five co-citations, followed by Zadeh (1965), Reve & Levitt (1984), Winch (1989), Latham (1994), Love et al. (1998a), Turner & Simister (2001) and Alderman & Ivory (2007), all with four co-citations (see Figure 3).

The two most co-cited studies have as their central theme partnership in the construction industry. Black et al. (2000) analyze the success factors and benefits of partnerships. Bresnen & Marshall (2000) study the link between partnerships and cultural changes within the industry.



**Figure 3.** Network of co-citation of cited references. Note: Metadata of 319 articles treated in VOSviewer software with threshold criteria of at least three citations per reference. The base used in this study has 9,718 references, of which 47 meet the threshold criteria configured. Articles that meet the threshold criteria configured do not appear on the network if they are not connected to any other study – only 31 references appeared on the network. Each color represents a cluster and aggregates all items considered similar.

## 4.2. Key topics

The analysis of keywords and terms most widely used can help researchers in the definition of research topics in their future researches and studies (Van Eck & Waltman, 2010). The network of co-occurrence of keywords was generated with the metadata of the 319 articles of the final sample. Initially, the metadata from both bases (WoS and Scopus) were imported with the VOSviewer software. Then the “pajek” files were extracted and imported into the UCINET 6 software to perform the co-occurrence keywords and centrality and intermediation indexes, as shown in Figure 4.

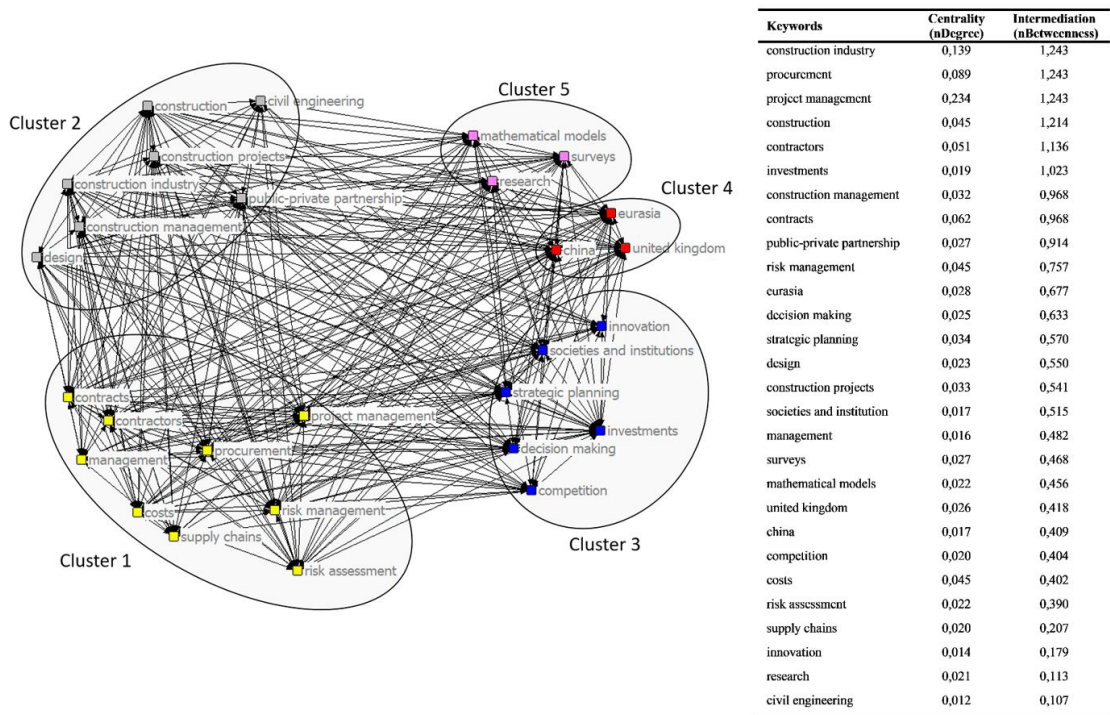


Figure 4. Network and indexes of co-occurrence of keywords. Note: Metadata of 319 articles treated in UCINET software from the “pajek (network, partition, and vector)” files extracted from VOSviewer software with threshold criteria of at least 15 occurrences per keyword. The base used in this study has 1,934 keywords, of which 28 meet the threshold criteria configured.

The keywords were organized into five clusters. The first cluster deals with project procurement management and its relationship with other PM knowledge areas, particularly cost and risk management. The second cluster is related to the field of studies. The centrality index shows that the majority of the studies contained in the database belong to the construction industry and major infrastructure projects (see Figure 4). For these cases, several studies related to PPPs are noted. Studies related to PPPs mention projects developed in the United Kingdom, China, Eurasia, Singapore, Australia, among others, which were grouped in cluster 4.

The third cluster brings together topics related to strategic issues for sustainability with a focus on the social dimension, issues such as strategic planning, decision-making, investments, and competition. And finally, the fifth cluster grouped the research methods that appeared in the analyzed database.

The detailed content analysis based on the coding schema is presented in Table 3 and Appendix A.

The Dynamics of Acquisitions (DA) codes that appeared the most in the analyzed articles were Cooperation – DA6 (26.42%), followed by both codes Complementarity – DA4 and Trust – DA5 (18.87%). Just a few articles focused on Synergy – DA1 (9.43%), Learning – DA2 (3.77%), and no study dealt with Power Balance – DA3.

Just a few articles explored the Spectrum of Supplier Integration (SSI), in the grey box – SSI2 (15.09%) is more frequent, followed by the black box – SSI3 (7.55%). Only one study addressed the white box – SSI1.

All categories of code related to Supplier Selection Criteria (SSC) were identified. The criteria for Cost/Price – SSC2 (15.09%) were predominant, followed by the criteria of Experience – SSC6 (9.43%), Quality – SSC1 (7.55%), Staff Features – SSC3 (7.55%) and Company Management – SSC5 (7.55%).

All the codes related to the project Success Dimensions (SD) were identified. The most frequent dimension was the iron triangle (scope, time, and cost), present in the PM Efficiency dimension – SD2 (28.30%) with greater representativeness of the variable “costs”. The second most frequent success dimension was Social and Environmental Impact – SD7 (18.87%), followed by Product/Service – SD1 (15.09%), Current Impact on the Company – SD4 (13.21%) and Future Impact on the Company – SD5 (13.21%). The strong presence of SD7, which is not common in other project management studies (Carvalho & Rabechini Junior, 2017), can be explained by the high number of studies related to PPPs, such as Akintoye et al. (2003), Bing et al. (2005), Eriksson & Westerberg (2011), Osei-Kyei & Chan (2015) and Zhang & Asce (2005).

### 4.3. Trends and gaps

The content analysis shows a gap of confirmatory and quantitative researches; just 16.98% of the content analysis sample were quantitative studies, and 26.42% were Survey – KS5. The Kind of Study (KS) predominant is case studies – KS6 (49.06%) and Literature Review – KS3 (28.30%). Regarding the Approach (A), Qualitative studies – A1 (50.94%) predominate in the analysed sample (see Table 3).

The engineering-procurement-construction (EPC) and PPP methods are highlights in the discussions, with many articles taking these approaches and reinforcing the value of developing partnerships. The increasing importance of partnership relationships in the procurement process and supply chain management stands out in the most recent articles found in the literature. Aspects such as collaboration and trust are increasingly being considered important issues in procurement management.

In EPC studies the partnership strategy to integrate stakeholders into the project is highlighted as it significantly facilitates not only design management and risk management, but also improves project performance and creates strategic long-term benefits (Wang et al., 2016b). Other recent issues on EPC procurement are related to suppliers' claims (Shen et al., 2017) and procurement processes (Thangavel & Yogananth, 2016).

In PPPs studies, collaborative procurement and trust building mechanisms (Challender, 2017) are highlighted. Trust issues are proving to be an integral part of stakeholder experiences in procurement environments, with recognized benefits (Strahorn et al., 2017). In the procurement process, it may be necessary to consider new perspectives for supplier selection and evaluation, owing to the importance of having partnerships with suppliers that meet organizational needs (Araújo et al., 2017).

Recent studies on what are known as social procurements, in which the procurement process is used to leverage extra social benefits and create social value for local communities, could also be a new research stream. Social procurements differ from traditional procurements by specifying products in projects that promote or require suppliers to employ disadvantaged groups in society (ethnic minorities, disabled, long-term unemployed, ex-offenders, etc.). However, numerous changes would need to be made to the current procurement process, and this could be addressed in a future research agenda to understand the barriers to social procurement and the potential role that social enterprises, clients, governments, and other stakeholders could play (Loosemore, 2016).

However, in times of crisis, the effects of the economic situation on collaborative work with an emphasis on trust in these relationships mean that organizations return to conventional methods of competitive procurement, seeking to reduce risks and maintain control (Challender et al., 2016).

PPPs studies evaluate whether a project pipeline is an effective tool for proposal development by suppliers (De Clerck & Demeulemeester, 2016a). The effect of corruption is analysed in procurement management, as it aggravates cost, time, performance, and the benefits delivered. However, there are different types of corruption and different project characteristics that are most likely to suffer from it (Locatelli et al., 2017).

## 5. Discussion

Through the analysis comprised in this article, it was possible to investigate RQ1 – What are the key aspects of the literature on procurement in project management?

The keywords network analysis of the 319 articles reveals the link between project procurement management and cost and risk project management knowledge areas. It also shows that studies are focused on the construction industry and major infrastructure projects developed in China, the United Kingdom, and Eurasia. Strategic issues are also relevant in procurement management, as they deal with the partnership, competition, and social impact.

The cross-analysis of the coding schema allowed the identification of the core themes in the studied sample. Core-periphery analysis showed that the core class memberships are composed of the codes Dynamics of Acquisitions (DA) (Complementarity DA4 and Cooperation DA6) and Success Dimensions (SD) (Product/Service SD1, PM Efficiency SD2, Current Impact on the Company SD4, Future Impact on the Company SD5, and Social and Environmental Impact SD7). The link between the Dynamics of Acquisitions (DA) and Success Dimensions (SD) with a core/periphery fit (correlation) of 0.7702 is shown in Figure 5.

	SD7	SD2	SD5	DA4	SD1	DA6	SD4	SS	DA	DA	SS	DA	SS	SS	SS	SS	DA	SS	SD	SS	SS	SD	SS
SD7	10	6	5	4	8	6	3				1	1							1			3	
SD2	6	15	5	5	6	6	6	2		3	1	1					1		1	1		4	
SD5	5	5	7	2	5	4	5	1				2										3	
DA4	4	5	2	10	4	7	3	3		3	1	1				1	3		1	1	1	1	
SD1	8	6	5	4	8	6	3					1								1		3	
DA6	6	6	4	7	6	14	3	3		3	3	2		1	2		1	1		2	2	1	1
SD4	3	6	5	3	3	3	7	2		1		1					1		1			2	
SSI2			2	1	3		3	2		8	3	2			1	1	4		1	1	2	1	
DA3																							
DA5			3		3		3	1	3		10	3			1	1	2			1	2		
SSC2	1	1		1		3		2		3	8		1	4	5	2	1	1		1	4		4
DA2	1	1	2	1	1	2	1					2										1	
SSC4												1		1	1	1	1				1		1
SSC5						1					4		1	4	4	1		1			2		4
SSC6						2							1	4	5	1		1			3		4
SSC7				1							1	2		1	1	2	1				2		1
DA1			1		3		1	1	4		2	1				1	5		1	1	1	1	
SSI1						1					1			1	1			1			1		1
SD3		1		1			1										1		1			1	
SSI3	1	1		1	1	2			1		1	1					1			4			
SSC1					1	2			2		2	4		1	2	3	2	1	1		4		2
SD6	3	4	3	1	3	1	2		1				1				1		1			5	
SSC3						1						4		1	4	4	1		1		2		4

Core/Periphery fit (correlation) = 0,7702  
Core: DA4 DA6 SD1 SD2 SD4 SD5 SD7  
Periphery: DA1 DA2 DA3 DA5 SSI1 SSI2 SSI3 SSC1 SSC2 SSC3 SSC4 SSC5 SSC6 SSC7 SD3 SD6

Figure 5. Core-periphery analysis. Note: Analysis performed in UCINET software with cross-tabulation data. DA = Dynamics of Acquisitions; SSI = Spectrum of Supplier Integration; SSC = Supplier Selection Criteria; SD = Success Dimensions.

The cross-analysis of the sample also allowed the exploration of RQ2 – What is the relationship between procurement management and the project's success?

The cross-analysis of the relationship between the key variables and the project's Success Dimensions (SD) are shown in Figure 6. The cross-tabulation and correlation between variables are presented in Table 4.

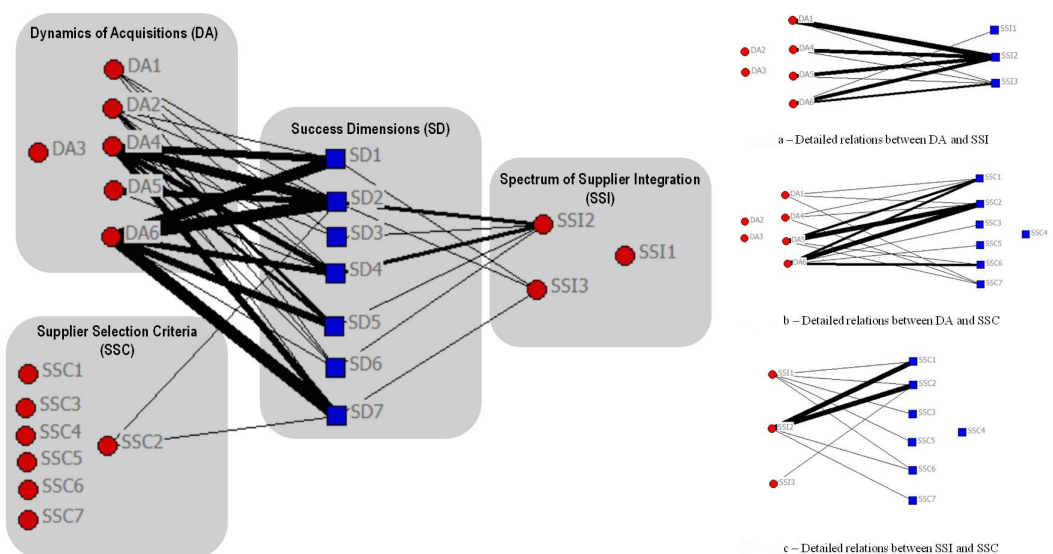


Figure 6. Relations between key variables. Note: Network performed in UCINET software with cross-tabulation data. DA = Dynamics of Acquisitions; SSI = Spectrum of Supplier Integration; SSC = Supplier Selection Criteria; SD = Success Dimensions.

Cross-tabulation																						
	DA1	DA2	DA4	DA5	DA6	SS11	SS12	SS13	SSC1	SSC2	SSC3	SSC4	SSC5	SSC6	SSC7	SD1	SD2	SD3	SD4	SD5	SD6	SD7
DA1	5	0	3	2	1	0	4	1	1	1	0	0	0	0	1	0	1	1	1	0	1	0
DA2	0	2	1	0	2	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	2	1
DA4	3	1	10	3	7	0	3	1	1	1	0	0	0	0	1	4	5	1	3	2	1	4
DA5	2	0	3	10	3	0	3	1	2	3	0	0	0	1	1	0	3	0	1	0	0	0
DA6	1	2	7	3	14	1	3	2	2	3	1	0	1	2	0	6	6	0	3	4	1	6
SS11	0	0	0	0	1	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
SS12	4	0	3	3	3	0	8	1	2	2	0	0	0	1	1	0	2	1	2	1	1	0
SS13	1	0	1	1	2	0	1	4	0	1	0	0	0	0	0	1	1	0	0	0	0	1
SSC1	1	0	1	2	2	1	2	0	4	4	2	1	2	3	2	0	0	1	0	0	0	0
SSC2	1	0	1	3	3	1	2	1	4	8	4	1	4	5	2	0	1	0	0	0	0	1
SSC3	0	0	0	0	1	1	0	0	2	4	4	1	4	4	1	0	0	0	0	0	0	0
SSC4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0
SSC5	0	0	0	0	1	1	0	0	2	4	4	1	4	4	1	0	0	0	0	0	0	0
SSC6	0	0	0	1	2	1	1	0	3	5	4	1	4	5	1	0	0	0	0	0	0	0
SSC7	1	0	1	1	0	0	1	0	2	2	1	1	1	1	2	0	0	0	0	0	0	0
SD1	0	1	4	0	6	0	0	1	0	0	0	0	0	0	0	8	6	0	3	5	3	8
SD2	1	1	5	3	6	0	2	1	0	1	0	0	0	0	0	6	15	1	6	5	4	6
SD3	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0
SD4	1	1	3	1	3	0	2	0	0	0	0	0	0	0	0	3	6	1	7	5	2	3
SD5	0	2	2	0	4	0	1	0	0	0	0	0	0	0	0	5	5	0	5	7	3	5
SD6	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	3	4	1	2	3	5	3
SD7	0	1	4	0	6	0	0	1	0	1	0	0	0	0	0	8	6	0	3	5	3	10
Correlations																						
DA1	1	-.064	.339*	.174	-.047	-.045	.585**	.152	.152	.044	-.092	-.045	-.092	-.104	.275*	-.136	-.059	.430**	.065	-.126	.117	-.156
DA2		1	.158	-.095	.331*	-.027	-.083	-.057	-.057	-.083	-.057	-.027	-.057	-.064	-.039	.193	.095	-.027	.215	.508**	.275*	.158
DA4			1	.137	.477**	-.067	.201	.045	.045	-.069	-.138	-.067	-.138	-.156	.158	.335*	.232	.288*	.239	.097	.009	.260
DA5				1	.039	-.067	.201	.045	.227	.201	-.138	-.067	-.138	.009	.158	-.203	.018	-.067	-.046	-.188	-.156	-.233
DA6					1	.231	.106	.153	.153	.106	-.009	-.083	-.009	.099	-.119	.465**	.194	-.083	.145	.272*	-.047	.367**
SS11						1	-.058	-.040	.485**	.329*	.485**	-.019	.485**	.430**	-.027	-.058	-.087	-.019	-.054	-.045	-.067	-.067
SS12							1	.079	.279*	.117	-.120	-.058	-.120	.044	.193	.178	-.031	.329*	.147	-.009	.044	-.203
SS13								1	-.082	.079	-.082	-.040	-.082	-.092	-.057	.079	-.021	-.040	-.111	-.092	.045	-.045
SSC1									1	.678**	.459**	.485**	.459**	.641**	.693**	-.120	-.180	-.040	-.111	-.092	-.138	-.069
SSC2										1	.678**	.329*	.678**	.470**	.318*	-.178	-.148	-.058	-.164	-.164	-.136	-.069
SSC3											1	.485**	.000**	.885**	.318*	-.120	-.180	-.040	-.111	-.092	-.138	-.069
SSC4												1	.485**	.430**	.700*	-.058	-.087	-.019	-.054	-.045	-.067	-.067
SSC5													1	.885**	.318*	-.120	-.180	-.040	-.111	-.092	-.138	-.069
SSC6														1	.275*	-.136	-.203	-.045	-.126	-.104	-.156	-.095
SSC7															1	-.083	-.124	-.027	-.077	-.064	-.095	-.067
SD1																1	.437**	-.058	.303*	.405**	.874**	-.339*
SD2																	1	.221	.497**	.373**	.370**	.339*
SD3																		1	.355**	-.054	.430**	-.067
SD4																			1	.671**	.255	.239
SD5																				1	.446**	-.339*
SD6																					1	.339*
SD7																						1

\*Pearson Correlation is significant at the 0.05 level (2-tailed); \*\*Pearson Correlation is significant at the 0.01 level (2-tailed). DA3 was deleted because it has no occurrence.

Figure 6 shows that the relationship between the Dynamics of Acquisitions (DA) and Success Dimensions (SD) is the strongest, corroborating with core-periphery analysis. The correlation analysis shows that several connections between DA and SD are significant (see Table 4). Four correlations are significant at the 0.01 level: the correlation between Synergy (DA1) and Impact on the Team (SD3), the correlation between Learning (DA2) and Future Impact on the Company (SD5), the correlation between Cooperation (DA6) and Product/Service (SD1) and with Social and Environmental Impact (SD7). Four correlations are significant at the 0.05 level: the correlation between Learning (DA2) with Impact on the Customer (SD6), correlation between Complementarity (DA4) with Product/Service (SD1) and Impact on the Team (SD3), and correlation between Cooperation (DA6) with Future Impact on the Company (SD5).

Considering the other relationships between key variables, some of the correlations seem interesting for future research. Particularly, the relationship of Dynamics of Acquisitions (DA) with the Spectrum of Supplier Integration (SSI) and with the Supplier Selection Criteria (SSC) is significant at the 0.01 level for Synergy (DA1) and Grey box (SSI2), and significant at the 0.05 level for Synergy (DA1) and Time (SSC7). This can be explained by the studies concerned with the involvement of suppliers in the initial phases of the project (Kadefors, 2004; Laryea & Watermeyer, 2016) and the sharing of information with suppliers (Love et al., 1998b) and present as micro-level risks (Bing et al., 2005).

Regarding the Dynamics of Acquisitions (DA), the dynamics that present the greatest relationship with the Success Dimensions (SD) are Cooperation (DA6), Complementarity (DA4), and Learning (DA2). We did not observe relationships between the dynamic Power Balance (DA3) and the Success Dimensions (SD) within the sample analyzed in this study, which may correspond to another research gap. The most present Success Dimensions (SD) are Product/Service (DS1), PM Efficiency (DS2), and Social and Environmental Impact (DS7).

## 6. Conclusion

This study contributes to the literature by analyzing in-depth, a large sample of articles that deal with procurement in the context of project management. Based on the analysis, it was possible to answer the two research questions proposed. First, it shows that the academic literature focuses on the dynamics of acquisitions and lacks studies on the spectrum of supplier integration and supplier selection criteria. Moreover, the research is concentrated on the construction industry and infrastructure projects, lacking researches related to other types of projects. Second, the relationship between the dynamics of acquisitions and success dimensions is well covered by the literature; however, the relationship between the spectrum of supplier integration and supplier selection criteria with success dimensions is poorly explored.

This study presents implications for practice by exploring how procurement management affects the project's success. Several insights of this study have managerial implications, as it shows that more synergy with suppliers can lead to a positive impact on the team. Besides, focusing more on the learning process with the supplier can positively affect the future impact on the company and positively impact on the customer. Cooperation with suppliers also has a positive effect on the product/service, has a positive future impact on the company and a positive social and environmental impact.

Furthermore, the study shows the main trends and gaps in the literature. The emerging trend on topics regarding procurement management appears to be social procurement. There is a lack of studies with a focus on the relationship between the spectrum of supplier integration, supplier selection criteria, and success dimensions. These are areas that can be explored in-depth in future researches. The content analysis also shows that the research in this field is mainly qualitative, through case-based research, so there is room for future confirmatory studies. In particular, following the research variables and relationships explored in this study (see Figure 6) would be helpful in future field researches.

This paper has inherent limitations in the research methods adopted. First, the databases and research strings selected might lead to limitations in the studied sample. Relevant studies could be missed in our search mechanisms. The inherent subjectivity of the content analysis process performed by the researchers also presents limitations, although the selection criteria and the use of three researchers in the analysis minimize this issue.

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Appendix A. Articles coding classification.

References	Total Citations	Average Citations per Year	KS	A	DA	SSI	SSC	SD
Bing et al. (2005)	286	23.83	KS5	A3	DA4; DA6	LIS3	-	SD1; SD7
Zhang & Asce (2005)	213	17.75	KS3; KS5; KS6	A3	DA4; DA6	-	-	SD1; SD2; SD7
Kadefors (2004)	210	16.15	KS2	A1	DA5; DA6	LIS3	SSC2	SD2
Holt (1998)	194	10.21	KS2	A1	-	-	-	-
Baiden et al. (2006)	148	13.45	KS3; KS6	A1	DA4; DA5	-	-	SD2
Akintoye et al. (2003)	146	10.43	KS2; KS5; KS6	A3	DA4; DA6	-	-	SD1; SD2; SD4; SD5; SD7
Pryke (2004)	135	10.38	KS2	A1	-	-	-	-
Smyth & Edkins (2007)	120	12.00	KS5	A2	DA5	-	-	-
Abednego & Ogunlana (2006)	111	10.09	KS3; KS6	A1	-	-	-	SD1; SD2; SD4; SD5; SD6; SD7
Kumaraswamy & Zhang (2001)	95	5.94	KS3; KS6	A1	-	-	-	SD1; SD5; SD6; SD7
Love et al. (1998b)	95	5.00	KS2	A1	-	LIS2	-	SD2; SD4; SD5
Yeo & Ning (2002)	88	5.87	KS2	A1	DA5	-	-	SD2; SD4;
Eriksson & Westerberg (2011)	86	14.33	KS3	A1	DA6	-	-	SD1; SD2; SD4; SD5; SD7
Li et al. (2005)	86	7.17	KS3; KS5	A3	-	-	-	-
Pryke (2005)	82	6.83	KS6	A1	-	-	-	-
Palaneeswaran & Kumaraswamy (2000)	82	4.82	KS3; KS5; KS6	A1	-	-	SSC2; SSC3; SSC5; SSC6	-
Tam (1999)	81	4.50	KS2	A1	-	-	-	-
Yuan et al. (2009)	80	10.00	KS3; KS5	A3	DA2; DA6	-	-	SD1; SD2; SD5; SD6; SD7
Love et al. (2011)	72	12.00	KS6	A1	-	-	-	-
Rahman & Kumaraswamy (2004)	72	5.54	KS5	A3	DA1; DA4; DA5	LIS2	SSC1; SSC2; SSC7	-
Chan et al. (2003)	71	5.07	KS3; KS5	A3	DA1; DA4; DA5; DA6	LIS2	-	-
Humphreys et al. (2003)	70	5.00	KS6	A1	DA5; DA6	LIS2	SSC1; SSC2; SSC6	-
Hwang et al. (2013)	49	12.25	KS3; KS5	A2	DA4; DA6	-	-	-
Eriksson (2013)	45	11.25	KS2	A1	DA2; DA4; DA6	-	-	SD4; SD5
Osei-Kyei & Chan (2015)	36	18.00	KS3	A2	DA4; DA6	-	-	SD1; SD2; SD7
Yun et al. (2016)	6	6.00	KS3; KS5; KS6	A1	-	-	-	SD2
Loosemore (2016)	6	6.00	KS6	A1	-	-	-	SD7
Franz & Leicht (2016)	4	4.00	KS3; KS5	A3	-	LIS2; LIS3	-	-
Ballesteros-Pérez et al. (2016)	4	4.00	KS6	A2	-	-	-	-
Berente et al. (2016)	3	3.00	KS6	A1	-	-	-	-
De Clerck & Demeulemeester (2016b)	3	3.00	KS4	A2	-	-	-	-
Jelodar et al. (2016)	3	3.00	KS3; KS6	A1	DA5	-	-	-
Wang et al. (2016b)	3	3.00	KS6	A3	DA1	LIS2	-	-
Locatelli et al. (2017)	3	0.00	KS6	A3	-	-	-	SD2
Laryea & Watermeyer (2016)	2	2.00	KS6	A1	DA1; DA4	LIS2	-	SD2; SD3; SD4; SD6

Note: KS = Kind of Study; A = Approach; DA = Dynamics of Acquisitions; SSI = Spectrum of Supplier Integration; SSC = Supplier Selection Criteria; SD = Success Dimensions.

## Appendix A. Continued...

References	Total Citations	Average Citations per Year	KS	A	DA	SSI	SSC	SD
Challender et al. (2016)	1	1.00	KS6	A1	DA6;	LIS2	-	-
Wang et al. (2016a)	1	1.00	KS6	A3	DA1	LIS3	-	-
Melo et al. (2016)	1	1.00	KS6	A1	DA6	LIS1	SSC1; SSC2; SSC3; SSC5; SSC6	-
Alim (2016)	1	1.00	KS2	A1	-	-	SSC2	SD7
De Clerck & Demeulemeester (2016a)	1	1.00	KS1	A2	-	-	-	-
Challender (2017)	1	0.00	KS5; KS6	A3	DA5	-	-	-
Araújo et al. (2017)	1	0.00	KS3	A1	-	-	SSC1; SSC2; SSC3; SSC4; SSC5; SSC6; SSC7	-
Güngör & Gözlü (2017)	0	0.00	KS4	A2	-	-	-	SD2; SD6
Apa & Sedita (2017)	0	0.00	KS5	A2	-	-	-	-
Strahorn et al. (2017)	0	0.00	KS6	A1	DA6	-	-	-
Safa et al. (2017)	0	0.00	KS1	A2	-	-	SSC2; SSC3; SSC5; SSC6	-
Teo & Bridge (2017)	0	0.00	KS2	A1	-	-	-	-
Shen et al. (2017)	0	0.00	KS6	A3	-	-	-	-
Ju et al. (2017)	0	0.00	KS1; KS2; KS6	A3	DA6	-	-	-
Xu & Zhao (2017)	0	0.00	KS1; KS6	A3	-	-	-	-
Attarzadeh et al. (2017)	0	0.00	KS1; KS6	A3	-	-	-	-
Park & Kwak (2017)	0	0.00	KS1	A3	-	-	-	SD2
Thangavel & Yogananth (2016)	0	0.00	KS2	A1	-	-	-	-

Note: KS = Kind of Study; A = Approach; DA = Dynamics of Acquisitions; SSI = Spectrum of Supplier Integration; SSC = Supplier Selection Criteria; SD = Success Dimensions.