

Overview Of The Use Of Quantitative Methods In Performance Evaluation Research Within Electronic Public Procurement

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Abstract:

This study seeks to delineate the use of quantitative methods in research pertaining to performance evaluation in electronic public procurement. The methodology employed for the selection of the research sample was the Knowledge Development Process – Constructivist (ProKnow-C), a structured approach for literature review and synthesis. This selection process yielded a sample of 16 articles that utilised quantitative methods relevant to the research theme. Key findings include: (i) A predominance of non-probabilistic samples, with expert judgment sampling being particularly noteworthy; (ii) The frequent application of multiple regression analysis for exploring relationships between variables, and structural equation modelling for testing theoretical models, as the statistical techniques of choice; (iii) The predominant use of SPSS software; and (iv) Notable keywords: e-procurement and public procurement. The contributions of this research aim to enhance the understanding of the application of quantitative methods in this field, highlighting the importance of the adoption of suitable techniques. Additionally, the paper proposes several avenues for future research.

Keyword: Quantitative Methods. Statistics. Electronic Public Procurement. Performance Evaluation. Public Administration.

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I. Introduction

Research has shown that interest in the performance evaluation of the public sector has expanded over recent decades. This concern is driven by demands from the public and media for a more efficient and streamlined public organisation that meets societal needs and delivers results through the proper use of public resources^{1,2}.

Public procurement is a significant process for public organisations as it involves the acquisition of goods and services essential to their operation and can account for nearly 50% of government expenditures and up to 20% of a country's Gross Domestic Product (GDP), estimated at over 7% of the Global GDP^{2,3}. Thus, measuring the performance of public procurement emerges as a key element in developing a sustainable growth strategy in the medium and long term, necessary for reflecting achieved results as well as improvement indicators and project management⁴.

The advancement of technology has also brought changes to public procurement. The adoption of Information and Communication Technology (ICT) tools is increasing worldwide, and electronic public procurement, or public e-procurement, is one of the main trends in this area. Electronic public procurement is defined as the use of ICT by governments to link and integrate organisational processes and systems through an internet-based protocol, in the procurement relationship with bidders for the acquisition of goods, works, and services for the public sector⁵.

It is acknowledged that the validity of results presented in scientific research is intrinsically linked to the research quality, particularly concerning the selection, form, presentation, measurement, and interpretation of the obtained data^{6,7}. Although the process of article evaluation is frequently subject to criticism, the reality remains that a significant portion of articles are of questionable quality due to the failure to verify essential aspects during the research process^{8,9}. Consequently, the methodological appropriateness of the research has proven to be the principal criterion adopted by reviewers for the approval of scientific articles¹⁰.

The rigour required in knowledge development processes ensures greater reliability in the data and outcomes. Therefore, before defining the research strategy, it is essential to determine the method, given that each method embodies its own specificities^{6,7}. In quantitative research, the choice of statistical technique is crucial for the proper organisation and analysis of the collected data^{9,11,12,13,14}. Quantitative methods assist in identifying strategies to be adopted in order to solve problems through assertive actions¹⁵.

Regarding the selection of the research topic, the researcher needs to be aware of what is already known and, more importantly, what is not yet documented. This study of pre-existing publications is termed Literature Review and aims primarily to narrow the scope of the investigation and to convey to the reader the significance of studying the chosen topic¹⁶. For the selection of the literature segment to be analysed, the Knowledge Development Process-Constructivist - ProKnow-C was employed^{17,19,20,21}.

Literature review articles are less common in the fields of Business Administration, Accounting, and Tourism than in other empirical sciences. This may suggest that, in the absence of a comprehensive overview of the state of the art, researchers might be replicating studies that have already been conducted. As a result, research in these areas could become increasingly saturated without yielding significant advancements²².

A research study should be original, significant, and feasible²³. In the current study, originality stems from the specific observation of quantitative methods that have been employed in the performance evaluation of electronic public procurement. Conversely, significance is derived from focusing on the electronic public procurement process, and previous research provides evidence of ongoing attention to the topic. Finally, feasibility is supported by the existence of previous research on the quantitative methods used^{8,10,11,13,14,15,24,25,27,28,29,30,31,32,39} and access to the available collection in databases which constitute evidence to be analysed.

The aim of this study is to identify the use of quantitative methods in research on performance evaluation in electronic public procurement. To this end, an analysis was conducted on the application of methods in articles on the subject, published in English during the period from 2012 to 2022, in the Scopus and Web of Science databases. This is a descriptive study with a quantitative approach.

For clarity, this article is structured into four sections beyond this introduction. The next section offers a brief literature review; the third section elucidates the methodological procedures adopted for the research. The fourth section presents the analysis and discussion of results, and the final section deals with concluding remarks, synthesising the work as well as suggestions for future research.

II. Literature Review

In quantitative research, determining the most appropriate statistical technique and test for the case is crucial. The 'choice' must consider, among other factors, the sample size, the metrics of the variables, the data distribution, and the tests associated with the type of distribution, implying that it is more about fitting the specific case under study than a personal preference of the researcher^{33,34}. Methodological innovations in the choice of technique are not recommended, and once adopted, they require a scientifically justified and accepted rationale. This is because methodological inadequacy can compromise the results and quality of the research.

Previous research and the statistical methods employed in research questions provide a methodological perspective that guides future investigations¹¹. In this context, the literature review of this article provides a succinct analysis of prior studies, highlighting and examining the quantitative methods used, summarising their most significant results and conclusions, especially regarding quantitative techniques.

Key factors for the rejection of Brazilian and Latin American papers in American journals have been identified⁹. They concluded that the safest way to publish articles is to conduct statistical analyses, as these are easier for reviewers to evaluate. Moreover, they suggested that to enhance research quality, it is important to prioritise empirical articles with quantitative data analysis.

Given that Management is one of the most significantly multidisciplinary fields of knowledge, encompassing areas such as Psychology, Philosophy, Economics, Mathematics, Accounting, and Sociology, there are numerous instances where the quantitative method is more suitable¹². Since the beginning of the 20th century, research in the field of applied social sciences has been growing substantially, with the use of quantitative methods in research seeing a significant increase during the 1980s and 1990s worldwide, and in Brazil particularly towards the end of the 1990s³⁵.

Methodological articles provide researchers with important information for methodologically informed decisions, introduce new approaches, modifications to existing methods, and discussions on quantitative and data analytical approaches³⁶. According to the APA Publication Manual, 7th edition, such articles offer details that allow researchers to assess the applicability of the methodology to their research problem, enabling the reader to compare the proposed methods with those in use³⁶.

The landscape of quantitative methods usage in research towards achieving sustainable development goals in Higher Education Institutions has been outlined³⁷. In a sample of 17 articles, the authors observed the use of descriptive statistics in 47% of the articles and the use of structural equation modelling technique in 23%. The research concluded that the use of impact variables, perception, and awareness combined with the application of quantitative methods and statistical techniques has garnered the scientific community's attention.

The landscape of quantitative methods usage in research on the evaluation of electronic system adoption in public administration has also been outlined³⁸. In a sample of 27 articles, it was found that the most

employed technique was descriptive statistics (66.7%), followed by Structural Equation Modelling (51.9%) and Confirmatory Factor Analysis (44.4%).

An analysis of scales and satisfaction measures in distance learning identified the use of three statistical techniques: Exploratory Factor Analysis, Confirmatory Factor Analysis, and Structural Equation Modelling²⁴. According to the research, 35.7% of the studies exhibited biases in their analyses regarding techniques and result analysis, with insufficient statistical rigour for the replication of studies.

An assessment of the use of statistical tools in research on standardisation processes in institutions of incarceration, in a sample comprising 21 articles, found that descriptive statistics were used in 70.83% of the research, with the questionnaire being the most utilised data collection instrument, present in 66.67% of the articles¹⁴.

A survey of the use of quantitative methods in research on knowledge sharing and transfer in Public Administration evaluated a portfolio comprising 28 articles, published between 2012 and 2022, within the Scopus and Web of Science databases. In this study, the authors noted that the most prominent statistical methods were: Descriptive Statistics, Confirmatory Factor Analysis, and Structural Equation Modelling; and the most frequently used reliability analysis technique was Cronbach's Alpha, present in 71.42% of the sample articles³⁰.

An examination of the quantitative methods employed in gender studies research within police organisations has been conducted. In a sample consisting of 18 articles published between 2018 and 2022, researchers found that the most commonly used data collection scale was the 5-point Likert scale, present in 33.3% of the studies. Furthermore, there was a predominance of probabilistic samples of the random type, found in 12 studies¹¹.

It is observed that the application of statistical techniques ranges from simpler instruments such as rates and percentages, means, standard deviations, to more complex techniques like correlation coefficients, regression analysis, among others³⁵. Having presented a brief overview of articles that investigated the statistical techniques used in research in the field of Administration, the next subsection aims to describe the methodological procedures of the current study.

III. Methodological Procedures

This section is dedicated to presenting the methodological procedures employed in the conduct of this research, the characteristics of the research design, and is divided into two parts, namely: (i) methodological framework and ProKnow-C intervention tool, and (ii) procedures and selection of the bibliographic portfolio.

This research is characterised as exploratory, descriptive, bibliographic, and predominantly quantitative in nature regarding its approach, utilising secondary data. As exploratory research, it aims to furnish the researcher with knowledge about the subject by generating information on the study object. Its descriptive nature is evident in the analysis, recording, and selection of the listed bibliography, aiming to comprehensively elucidate a topic previously researched by others. In terms of approach, it is predominantly quantitative, as it relies on the precise counting of a behaviour, knowledge, opinion, or attitude, employing statistical procedures¹⁶.

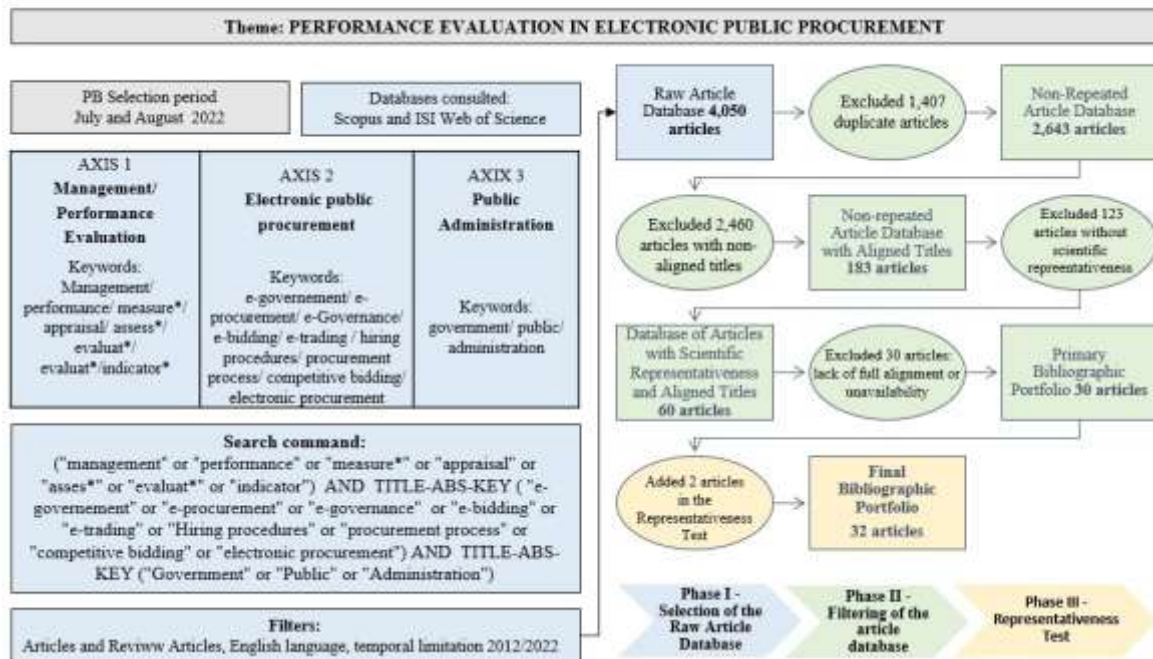
The portfolio derived from this study was sourced from secondary data. To select a Bibliographic Portfolio (BP) aligned with the objectives and delimitations defined by the researchers, and following the necessary methodological rigour in a structured and gradual manner, the Knowledge Development Process – Constructivist (ProKnow-C) intervention tool was employed^{18,20}.

The ProKnow-C tool enables researchers to assess and identify the knowledge boundaries concerning the chosen topic²⁰ through the systematisation of the knowledge development process about the state of the art on the subject with the search and selection of articles. It is structured into four stages, namely: (i) selection of bibliographic portfolio; (ii) bibliometrics; (iii) systemic analysis; and, (iv) formulation of research questions and objectives. The knowledge construction is achieved during the interaction between the researcher and the article selection process that will compose the BP related to the theme "performance evaluation in electronic public procurement".

The Bibliographic Portfolio (BP) can be defined as a restricted set of scientific articles; relevant and recognised, representing the fragment of literature the researcher is interested in investigating^{18,20}. Following the ProKnow-C intervention protocol, the selection stage comprises three phases: (a) selection of the Raw Articles Database; (b) filtering of the article database; and, (c) testing the representativeness of the bibliographic portfolio.

Upon completing the stages, a set of articles relevant from the researchers' perspective and aligned with their research is obtained, which corresponds to the Final Bibliographic Portfolio. The BP Selection process of the current research, grounded in the above-described procedures through the adoption of the ProKnow-C intervention tool, is summarised in Figure 1.

Figure 1. Selection of the Bibliographic Portfolio



Thus, having completed the 3 phases of selection as prescribed in the ProKnow-C protocol, the Final Bibliographic Portfolio comprised 32 articles. Of these, it was found that 16 utilised quantitative methods, which are the focus of the present study, while the remaining 16 that employed qualitative methods were excluded. The articles constituting the sample of the current study are listed in Table 1.

Table 1. Articles Constituting the Sample

	Articles	Citations
1	Ahmad, H., Hassan, S. H. A., & Ismail, S. (2021). Transparency level of the electronic procurement system in Malaysia. <i>Journal of Financial Reporting and Accounting</i> . doi.org/10.1108/JFRA-07-2021-0181	7
2	Ali, M., & Obaid, F. O. (2022). Analysis of factors affecting efficiency of UAE E-Government Procurement System. <i>International Journal of Sustainable Construction Engineering and Technology</i> , 13(2), 195-202.	0
3	Ali, M., & Obaid, F. O. (2022). Construction of PLS-SEM model of organizational factors affecting the efficiency of Emarati Electronic Government Procurement Platform (EEGPP) implementation in UAE. <i>International Journal of Sustainable Construction Engineering and Technology</i> , 13(2), 8-24.	0
4	Basheka, B. C., Oluka, P. N., & Mugurusi, G. (2012). Adopting new approaches for public procurement efficiency: critical success factors (CSFs) for the implementation of e-procurement in Uganda's public sector. <i>International Journal of Procurement Management</i> , 5(6), 712-732. doi.org/10.1504/IJPM.2012.049711	31
5	Chomchaiya, S., & Esichaikul, V. (2016). Consolidated performance measurement framework for government e-procurement focusing on internal stakeholders. <i>Information Technology & People</i> . doi.org/10.1108/ITP-12-2013-0210	39
6	Costa, A. A., Arantes, A., & Tavares, L. V. (2013). Evidence of the impacts of public e-procurement: The Portuguese experience. <i>Journal of Purchasing and Supply Management</i> , 19(4), 238-246. doi.org/10.1016/j.pursup.2013.07.004	104
7	Kassim, E. S., & Hussin, H. (2013). A success model for the Malaysian Government e-procurement system: The buyer perspective. <i>International Journal of Electronic Government Research (IJEGR)</i> , 9(1), 1-18. doi.org/10.4018/ije.gr.2013010101	37
8	Kit, S. K., Ahmed, E. M., & Tan, K. S. (2021). Social influences' effects on Malaysia's SMEs' public electronic procurement usage. <i>International Journal of Electronic Government Research (IJEGR)</i> , 17(1), 68-82. doi.org/10.4018/IJEGR.2021010105	10
9	Lewis-Faupel, S, Yusuf N., Olken B. A. & Pande, R. (2016). Can electronic procurement improve infrastructure provision? Evidence from public works in India and Indonesia. <i>American Economic Journal: Economic Policy</i> , 8(3), 258-283. doi.org/10.1257/pol.20140258	317
10	Mélon, L., & Spruk, R. (2020). The impact of e-procurement on institutional quality. <i>Journal of Public Procurement</i> , 20(4), 333-375. doi.org/10.1108/JOPP-07-2019-0050	20
11	Nurmandi, A., & Kim, S. (2015). Making e-procurement work in a decentralized procurement system: A comparison of three Indonesian cities. <i>International Journal of Public Sector Management</i> , 28(3), 198-220. doi.org/10.1108/IJPSM-03-2015-0035	113

12	Tutu, S. O., Kissi, E., Osei-Tutu, E., & Desmond, A. (2019). Evaluating critical factors for the implementation of e-procurement in Ghana. <i>International Journal of Procurement Management</i> , 12(1), 1-14. doi.org/10.1504/IJPM.2019.096994	48
13	Patrucco, A. S., Agasisti, T., & Glas, A. H. (2021). Structuring public procurement in local governments: the effect of centralization, standardization and digitalization on performance. <i>Public performance & management review</i> , 44(3), 630-656. doi.org/10.1080/15309576.2020.1851267	31
14	Rotchanakitumnuai, S. (2013). Assessment of e- procurement auction with a balanced scorecard. <i>International Journal of Physical Distribution & Logistics Management</i> , 43(1), 39-53. doi.org/10.1108/09600031311293246	53
15	Rotchanakitumnuai, S. (2013). The governance evidence of e- government procurement. <i>Transforming Government: People, Process and Policy</i> , 7(3), 309-321. doi.org/10.1108/TG-01-2013-0004	74
16	Seo, D., Tan, C. W., & Warman, G. (2018). Vendor satisfaction of E-government procurement systems in developing countries: an empirical research in Indonesia. <i>Information Technology for Development</i> , 24(3), 554-581. doi.org/10.1080/02681102.2018.1454878	27

Collectively, the articles constituting the sample have accrued 911 citations on Google Scholar (Table 1). Subsequently, an analysis and discussion of the findings related to the quantitative methods employed in the articles are presented.

IV. Results

This section aims to identify and present the quantitative methods utilised in the 16 articles comprising the sample, which focus on the performance evaluation of electronic public procurement.

Sample - Size and Type: The sampling process seeks to extract a small portion (sample) from the whole (population) and, from this, to conduct analyses and draw conclusions applicable to the entire population. The definition of the sample is a crucial step in the research process, as it involves deciding whom to study⁴⁰. Through the sampling process, social researchers aim to generalise from a sample.

The primary sampling methods are divided into two categories: probabilistic or random samples and non-probabilistic or non-random samples. Probabilistic sampling is used when all elements of the population intended for analysis have the same probability of being selected, while non-probabilistic sampling is employed when only some elements have a chance of being chosen⁴⁰.

The articles analysed in this study predominantly utilise non-probabilistic samples, accounting for 81.3% of the articles: judgment sampling, purposive sampling, typical case sampling, expert sampling, and snowball sampling. Among the non-probabilistic samples, judgment sampling is most notable, featuring in 9 articles, corresponding to 77.78% of the studies.

Purposive sampling (judgment sampling) is the most popular non-probabilistic method and the one that differs least from everyday sampling procedures. In this method, logic, common sense, and critical capacity can be employed by the researcher in selecting the sample, so the chosen elements are those deemed typical of the population under study. In other words, the researcher includes the most convenient cases and excludes the inconvenient ones⁴¹.

It was found that the sampling conducted in the research was particularly concerned with the stakeholders involved in the electronic public procurement process. This finding aligns with the results regarding the predominant adoption of non-probabilistic samples.

The use of probabilistic samples was mentioned in 3 articles, employing systematic sampling, random sampling, and stratified random sampling methods. Regarding the size of the samples analysed in the articles, there was diversity in the number of individuals, as demonstrated in Table 2.

Table 2. Absolute and Relative Frequency of Sample Sizes

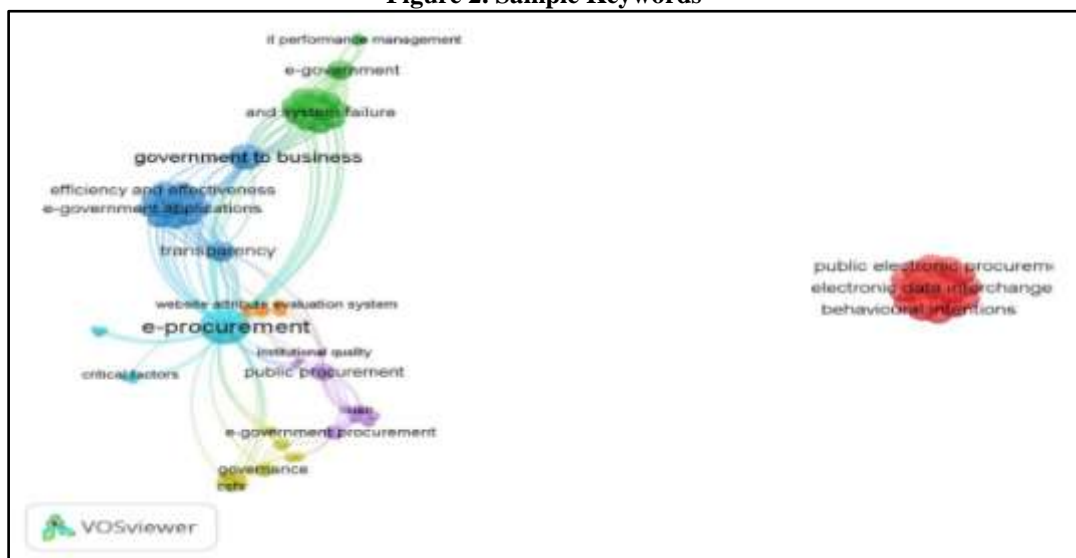
Sample Size	n	%
< 75	1	6.25
≥ 75 < 150	2	12.50
≥ 150 < 225	8	50.00
≥ 225 < 300	2	12.50
≥ 300 < 375	0	0.00
≥ 375	2	12.50
Lacks information	1	6.25
Total	16	100.00

The most frequently used sample size ranged between 150 and 225 individuals, with samples smaller than 225 present in 68.75% of the analysed articles, corresponding to 11 articles. A variation from 60 to 421 components in the samples was identified, averaging 191 components.

Eight articles referenced the use of questionnaires for data collection, with 5 of them employing a 5-point Likert scale, making it the most used scale, in line with the literature³⁹.

Keywords: Keywords play a crucial role in scientific articles, acting as indexers and serving as an essential bridge between the author and potential readers. Furthermore, they function as precise indicators of the scope and focus of the study, enabling other researchers to quickly identify relevant works in their own investigations. In the articles comprising the sample, 80 keywords were identified, depicted in Figure 2.

Figure 2. Sample Keywords



The keywords with the highest absolute frequency were 'e-procurement', appearing 10 times, followed by 'public procurement' five times, and 'e-government procurement' three times. Additionally, 9 keywords were mentioned twice, and 68 keywords appeared once. In the figure, the words that appear larger correspond to those most cited, and the connections between keywords can be observed through the lines linking them.

Statistical Techniques: From the comprehensive review of the articles in the sample, 7 different quantitative methods were identified, as indicated in Table 3.

Table 3. Statistical Techniques used in the research

Statistical Technique	n	%
Multiple Regression Analysis	6	35.29
Structural Equation Modelling	4	23.53
Descriptive Statistics	3	17.65
ANOVA (Analysis of Variance)	2	11.76
Factor Analysis	1	5.88
t-Test	1	5.88
Total	17	100.00

The most frequently employed method was Multiple Regression Analysis, utilised in 35.29% of the analysed articles, aligning with findings observed in the literature³⁸. Multiple regression analysis is a statistical technique that allows for estimating the impact of various independent variables on a dependent variable⁴².

Three articles employed Structural Equation Modelling (SEM), making it the second most used statistical technique, as also seen in the literature^{37,38}. SEM is a family of statistical models aiming to explain relationships between multiple variables and is known by various names such as covariance structure analysis and latent variable analysis⁴².

In addition to statistical techniques, the articles mentioned the use of other secondary tests such as the Kaiser-Meyer-Olkin Test (2), Cronbach's Alpha (6), Harman's Test (1), Levene's Test (1), Tukey's Test (1), Welch's Test (1), Chi-Square (3), and Pearson's Correlation (2).

Three articles mentioned the sole use of Descriptive Statistics for processing the collected data, which enables researchers to organise, describe, and interpret data in a manner that is readily understandable⁴².

Not all researchers report the use of software for data analysis in quantitative research. Table 4 presents the software and the frequency with which they were mentioned in the 16 articles comprising the sample; it is noted that 5 articles did not describe which statistical software was used by the authors for data analysis.

Table 4. Absolute and Relative Frequency of Software Used

Software	n	%
SPSS	6	37,50
Not reported	5	31,30
SmartPLS	3	18,80
Stata	1	6,30
SPSS with AMOS	1	6,30
Total	16	100,00

It is observed that, as identified in the literature^{25,30,31}, the Statistical Package for the Social Sciences (SPSS) software was the most used, being adopted in 43.8% of the sample articles. The software, developed by IBM, is one of the most popular statistical software packages globally, utilised by researchers from various fields, including social sciences, natural sciences, and business administration.

Supporting Bibliography: To verify the existence and identify the supporting bibliography for the quantitative methods used in the analyses conducted, an examination of the bibliographic references listed in the sample articles was undertaken. In seven of the 16 articles, no indication of specific quantitative methods bibliography was found. In total, 30 references to titles pertaining to quantitative methods were cited, of which only two articles included more than one citation, as shown in Table 5.

Table 5. Supporting Bibliography – Articles

Reference	n	Citation	Citations in Google Scholar
Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. <i>Journal of marketing research</i> , 18(1), 39-50.	3	Seo et al. (2018); Ali e Obaid (2022); Kit et al. (2021)	107.113
Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. <i>Journal of the academy of marketing science</i> , 16, 74-94.	2	Ali e Obaid (2022); Kit et al. (2021)	35.198

Upon consulting Google Scholar, it was found that the two references cited more than once have over 142,000 citations combined and are documents from the 1980s. Both pertain to the statistical method of Structural Equation Modelling (SEM), the second most utilised statistical technique in the sample articles.

Among the references, nine books were cited, with John Ward Creswell being the only author repeated in more than one work (Table 6). Creswell is renowned for his contributions to mixed methods research and has authored several journal articles and books on mixed methods research, research methodologies, and qualitative research.

Table 6. Supporting Bibliography – Books

Book (title in portuguese)	Cited by
Blumberg, B., Cooper, DR e Schindler, PS (2008), “Pesquisa quantitativa e qualitativa”, M. Hill, <i>Business Research Methods</i> , 2008,	Ali e Obaid (2022b)
Bryman, A. (2008), <i>Métodos de Pesquisa Social</i> , 3ª ed., Oxford University Press, Nova York, NY.	Chomchaya e Esichaiikul (2016)
Creswell, J.W (2014), “Abordagens de métodos qualitativos, quantitativos e mistos”, Sage.	Ali e Obaid (2022b)
Creswell, J.W, e Creswell, JD (2017), “Design de pesquisa: métodos qualitativos, quantitativos e mistos abordagens”, publicações Sage	Ali e Obaid (2022b)
Fowler, FJ, 2009. <i>Métodos de Pesquisa de Levantamento</i> . Sage Publications, Califórnia, p. 201	Costa et al. (2013)
Harman, HH (1967). <i>Análise fatorial moderna</i> . Chicago, IL: University of Chicago Press.	Seo et al. (2018)
Kline, RB (2011). <i>Princípios e prática para modelagem de equações estruturais</i> (3ª ed.). Imprensa Guildford	Kit et al., (2021)
Kothari, CR (2004) <i>Metodologia de Pesquisa</i> , 2ª ed., New Age International Pvt. Ltda., Nova Deli, Índia.	Basheka et al. (2012)
Newman, I, Benz, CR e Ridenour, CS (1998), “Metodologia de pesquisa qualitativa-quantitativa: Explorando o continuum interativo”, SIU Press.	Ali e Obaid (2022b)

The 30 supporting bibliography references encompass 49 authors, with 11 of them being authors of more than one referenced document, as detailed in Table 7.

Table 7. Most Cited Authors in the Supporting Bibliography for Quantitative Methods

Author(s)	n	%
Fornell, C.	3	6.12
Bagozzi, RP	3	6.12
Yi, Y.	3	6.12
Larcker, DF	3	6.12
Creswell, JW	2	4.08
Hair Jr, JF	2	4.08
Afthanorhan, A.	2	4.08
Sarstedt, M.	2	4.08
Chin, WW	2	4.08
Awang, Z.	2	4.08
Wong, KKK	2	4.08
Mamat, M.; Gelbach, JB; D'ambra, J.; Ringle, CM; Johns, R.; Benz, CR; Sax, LJ; Schindler, PS; Matthews, LM; Wallin, L.; Nassen, KD; Bryant, NA; Kothari, CR; Cooper, DR; Moulton, BR; Akter, S.; Kuppelwieser, VG; Amato, S.; Esposito Vinzi, V.; Creswell, JD; Fowler, FJ; Hårenstam, A.; Gilmartin, SK; Berntson, E.; Harman, HH; Tenenhaus, M.; Kline, RB; Asri, MAM; Ray, P; Cameron, AC; Miller, DL; Carruthers, J.; Newman, I.; Hopkins, L.; Ridenour, CS; Choy, LT; Blumberg, B.; Bryman, A.	1	2.04

Notably, authors David F. Larcker, Youjae Yi, Richard P. Bagozzi, and Claes Fornell each have three referenced documents. In the table, it is important to note that all authors with only one referenced document are listed in the last row.

V. Conclusion

This research aimed to analyse the literature to outline the landscape of quantitative methods used in studies on performance evaluation in electronic public procurement. The bibliographic portfolio resulting from the selection process comprises 16 scientific articles, published between 2012 and 2022, aligned with the research theme.

The selection of the Bibliographic Portfolio (BP) was conducted using the Knowledge Development Process – Constructivist (ProKnow-C) intervention tool, which provided the necessary methodological rigour in a structured and gradual manner. Initially, 4,050 articles from two pre-selected databases were chosen, which, after various processes and filters, resulted in the Final Bibliographic Portfolio.

Through the analysis of the selected bibliographic portfolio, the mapping allowed the identification of 80 keywords, with the most used being “e-procurement”, “public procurement”, and “e-government procurement”, demonstrating alignment with the search criteria for portfolio selection.

Non-probabilistic sampling was the most utilised, with judgment sampling being the technique employed in 9 of the 16 articles analysed. It was observed that, given the research focus on the public sector procurement process, particularly electronic public procurement, the individuals chosen for the sample were those deemed typical of the population intended for study⁴⁰.

Based on the results, it was noted that quantitative methods are quite varied, with the onus on the researcher to determine the most suitable method for their research. Two methods were particularly prominent, given the frequency of their use: Multiple Regression Analysis and Structural Equation Modelling, accounting for 58.82% of the techniques used. Two articles, corresponding to 18.7% of the sample, described the use of a single statistical method for data processing.

The limitations identified are primarily based on the lack of complete information regarding the methodological procedures adopted, most notably concerning the data collection instrument, particularly the composition of the questionnaires, and data processing, which impacted the analysis of the studies and quantitative methods employed.

In conclusion, the scientific articles that comprise the analysed literature selection are restricted to the results obtained from the two mentioned databases that are freely available in full and did not aim to exhaust the subject but rather contribute to the understanding of quantitative methods used in the theme. Future work could expand the databases and consider including publications in languages other than English, as well as incorporating works from theses, dissertations, and other events.

References

- [1]. Nishiyama MA, Lima Mvad, Ensslin L, Chaves LC. Modelo Multicritério Para Avaliação De Desempenho: Um Estudo De Caso Para Gestão De Compras No Setor Público. *R Ci Adm.* 2017 May 1;19(47):09-28. Doi: 10.5007/2175-8077.2017v19n47p9.
- [2]. Patrucco AS, Agasisti T, Glas AH. Structuring Public Procurement In Local Governments: The Effect Of Centralization, Standardization And Digitalization On Performance. *Public Performance & Management Review.* 2021 May 4;44(3):630-56. Doi: 10.1080/15309576.2020.1851267.
- [3]. Lewis-Faupel S, Neggers Y, Olken BA, Pande R. Can Electronic Procurement Improve Infrastructure Provision? Evidence From Public Works In India And Indonesia. *American Economic Journal: Economic Policy.* 2016 Aug 1;8(3):258-83. Doi: 10.1257/Pol.20140258.
- [4]. Chomchaiya S, Esichaikul V. Consolidated Performance Measurement Framework For Government E-Procurement Focusing On Internal Stakeholders. *Information Technology & People.* 2016 Jun 6;29(2):354-80. Doi: 10.1108/ITP-12-2013-0210.
- [5]. Tutu SO, Kissi E, Tutu EO, Desmond A. Evaluating Critical Factors For The Implementation Of E-Procurement In Ghana. *IJPM.* 2019;12(1):1.
- [6]. Yin RK. *Pesquisa Qualitativa: Do Início Ao Fim.* Porto Alegre: Penso; 2016.
- [7]. Cooper DR, Schindler PS. *Métodos De Pesquisa Em Administração.* 12th Ed. São Paulo: McgrawHill Brasil; 2016.
- [8]. Bastos KV, Soares SV, Martins C, Soares TC, Mussi CC, Junges I, Nunes NA. Quantitative Methods In Research On The Use Of Information Technology In Budgetary Processes. *IOSR J Bus Manag.* 2023;25(7):28-35. Doi: 10.9790/487X-2507042835.
- [9]. Serra FAR, Fiates GG, Ferreira MP. Publicar É Difícil Ou Faltam Competências? O Desafio De Pesquisar E Publicar Em Revistas Científicas Na Visão De Editores E Revisores Internacionais. *RAM, Rev Adm Mackenzie.* 2008 Jun;9(4):32-55. Doi: 10.1590/S1678-69712008000400004
- [10]. Paschoiotto WP, Soares SV, Lima CRM. Mapeamento Dos Métodos Quantitativos Empregados Na Pesquisa Sobre E-Liderança Em Periódicos Internacionais De Alto Impacto. *MétPesq Adm.* 2021;6(2):18-34. Doi: 10.22478/Ufpb.2525-3867.2021v6n2.54774.
- [11]. Farias LKF, Martins C, Dutra ARA, Gois E. Overview Of The Use Of Quantitative Methods In Research On Gender Studies In Police Organisations. *IOSR J Bus Manag.* 2023;25(7):52-60. Doi: 10.9790/487X-2507055260.
- [12]. Fiates GGS, Serra FAR, Martins C. A Aptidão Dos Pesquisadores Brasileiros Pertencentes Aos Programas De Pós-Graduação Stricto Sensu Em Administração Para Pesquisas Quantitativas. *RAUSP.* 2014;49(2):384-98. Doi: 10.5700/Rausp1153.
- [13]. Machado SCB, Soares SV, Mazon G, Junges I, Martins C, Casagrande JL. Panorama Do Uso De Métodos Quantitativos Em Pesquisas Sobre Universidade Corporativa E Aprendizagem Organizacional. *R G Secr.* 2023 Aug 9;14(8):13158-80. Doi: 10.7769/Gesec.V14i8.2480.
- [14]. Menezes SB, Nunes NA, Pazetto AZ. Panorama Da Aplicação De Métodos Quantitativos Em Pesquisas Sobre Os Processos De Normalização Nas Instituições De Privação De Liberdade. In: *Anais Do 10º Congresso De Administração Do Sul De Mato Grosso E Do 2º Congresso Da Faculdade De Ciências Aplicadas E Políticas;* 2022 May 15-17; Rondonópolis, Brasil. Rondonópolis: UFMT; 2022.
- [15]. Gonçalves A, Soares SV, Lima CRM. Emprego De Métodos Quantitativos Em Pesquisas Sobre Gestão De Riscos De Acidentes De Trabalho. *S&G.* 2023 Jun 14;18(1):76-88. Doi: 10.20985/1980-5160.2023.V18n1.1660.
- [16]. Creswell JW, Creswell JD. *Projeto De Pesquisa: Métodos Qualitativo, Quantitativo E Misto.* 5th Ed. Porto Alegre: Penso; 2021.
- [17]. Ensslin L, Ensslin SR, Pinto Hdm. Processo De Investigação E Análise Bibliométrica: Avaliação Da Qualidade Dos Serviços Bancários. *Rev Adm Contemp.* 2013 Jun;17(3):325-49. Doi: 10.1590/S1415-6552013000300005.
- [18]. Ensslin L, Dezem V, Dutra A, Ensslin SR, Somensi K. Seaport-Performance Tools: An Analysis Of The International Literature. *Marit Econ Logist.* 2018 Dec;20(4):587-602. Doi: 10.1057/S41278-017-0083-7.
- [19]. Ensslin L, Gonçalves A, Ensslin SR, Dutra A. Bibliometric And Systemic Review Of The State Of The Art Of Occupational Risk Management In The Construction Industry. *International Journal Of Occupational Safety And Ergonomics.* 2023 Jul 3;29(3):1107-20. Doi: 10.1080/10803548.2022.2111893.
- [20]. Dutra A, Ripoll-Feliu VM, Fillol AG, Ensslin SR, Ensslin L. The Construction Of Knowledge From The Scientific Literature About The Theme Seaport Performance Evaluation. *International Journal Of Productivity And Performance Management.* 2015 Feb 9;64(2):243-69. Doi: 10.1108/IJPPM-01-2014-0015.
- [21]. Luz R, Mussi CC, Dutra A, Chaves LC. Implementation Of Large-Scale Health Information Systems. *REGE.* 2021 Jul 9;28(2):106-32. Doi: 10.1108/REGE-06-2019-0064.
- [22]. Soares SV, Picolli IRA, Casagrande JL. Pesquisa Bibliográfica, Pesquisa Bibliométrica, Artigo De Revisão E Ensaio Teórico Em Administração E Contabilidade. *RAEP.* 2018 May 1;19(2):308-39.
- [23]. Castro CM. *A Prática Da Pesquisa.* 2nd Ed. São Paulo: Pearson; 2006.
- [24]. Buffon G, Moraes MCB, Tezza R. Satisfação Na Educação A Distância: Uma Revisão Da Literatura Sobre Técnicas Estatísticas. *R G Secr.* 2023 Jun 9;14(6):8920-42. Doi: 10.7769/Gesec.V14i6.2273.
- [25]. Cavalcanti Codp, Soares SV. Panorama Dos Métodos Quantitativos Usados Em Pesquisas Com O Instrumento Libqual, Em Instituições De Ensino Superior. *RACEF.* 2023 Apr 4;14(1):21-41. Doi: 10.13059/Racef.V14i1.914.
- [26]. Fuchs P, Soares SV, Martins C, Dutra ARAD, Guerra JBSOAG. Panorama Do Uso De Métodos Quantitativos Em Pesquisas Sobre Avaliação Da Pegada De Carbono Nas Instituições De Ensino Superior. *Reat.* 2022 May 10;16(1):88-109. Doi: 10.15210/Reat.V16i1.1474.
- [27]. Garcia ACF, Soares SV, Lima CRM. O Uso De Métodos Quantitativos Em Pesquisas Sobre A Aplicação Da Servqual Na Avaliação De Sistemas De Informação. *Rev OPARA.* 2022;12(1):1-15.
- [28]. Moreno EA, Soares SV, Dutra A. Panorama Do Uso De Métodos Quantitativos Em Pesquisas Sobre A Abordagem Da Sustentabilidade Na Gestão De Bibliotecas. *Rev ACB.* 2023;28(1):1-24.
- [29]. Santos AF, Soares SV, Martins C. Panorama Do Uso De Métodos Quantitativos Em Pesquisas Sobre Educação Financeira. *Cad Acad (UNISUL).* 2023;9(1):101-16.
- [30]. Sell DSR, Martins C, Mussi CC. Panorama Do Uso De Métodos Quantitativos Em Pesquisas Sobre Compartilhamento E Transferência De Conhecimento Na Administração Pública. In: *Anais Do 10º Congresso De Administração Do Sul De Mato Grosso E Do 2º Congresso Da Faculdade De Ciências Aplicadas E Políticas;* 2022 May 15-17; Rondonópolis, Brasil. Rondonópolis: UFMT; 2022.
- [31]. Smania GR, Soares SV, Lima CRM, Becker DE. Utilização De Métodos Quantitativos Em Pesquisas Sobre O Uso Da Escala Servqual Em Instituições De Ensino Superior. *Rev Pernambuco Adm.* 2022;2(1):1-22.
- [32]. Vaz KKR, Soares SV, Martins C, Herzmann Jr. N. Utilização De Métodos Quantitativos Em Estudos De Transparência Em Portais Eletrônicos Governamentais. *Ágora Rev Divulg Cient.* 2022;27:45-68. Doi: 10.24302/Agora.V27.3742.
- [33]. Hair Jr. JF, Babin B, Money AH, Samouel P. *Fundamentos De Métodos De Pesquisa Em Administração.* Porto Alegre: Bookman; 2005.

- [34]. Lana J, Partyka RB, Alberton A, Marcon R. Caso Para Ensino: O Processo De Escolhas Metodológicas Em Uma Abordagem Quantitativa. *Rev Contab Organ.* 2018 Dec 10;12:E148286. Doi: 10.11606/Issn.1982-6486.Rco.2018.148286.
- [35]. Dallabona LF, Rodrigues Junior MM, Hein N. Métodos Estatísticos: Análise Dos Estudos Publicados Nos Anais De Congressos Da ANPAD. In: *Anais Do 14º Seminários Em Administração (SEMEAD)*; 2011 Sep 8-10; São Paulo, Brasil. São Paulo: USP; 2011.
- [36]. American Psychological Association. *Manual De Publicação Da APA: O Guia Oficial Para O Estilo APA.* 7th Ed. Porto Alegre: Artmed; 2022.
- [37]. Buhr EA, Martins C, Dutra ARA. Panorama do uso de métodos quantitativos em pesquisas para o alcance dos objetivos de desenvolvimento sustentável em instituições de ensino superior. In: *Anais do 20º Colóquio Internacional de Gestão Universitária*; 2021 Dec 3-5; Florianópolis, Brasil. Florianópolis: UFSC; 2021.
- [38]. Koerich AB, Soares SV, Martins C, Casagrande JL. Panorama do uso de métodos quantitativos em pesquisas sobre avaliação da adoção de sistemas eletrônicos na administração pública. In: *Anais do 18º CONTECSI - International Conference on Information Systems and Technology Management*; 2021 Jun 2-4; São Paulo, Brasil. São Paulo: FEAUSP; 2021.
- [39]. Borges GJR, Soares SV, Lima CRMd, Sarquis AB, Boing IR. Panorama do Uso de Métodos Quantitativos em Pesquisas sobre Marketing de Relacionamento com Egressos. *RevAdm, SocInov.* 2020 Sep 1;6(3):78-97. doi: 10.20401/rasi.6.3.451.
- [40]. Barbetta PA. *Estatística aplicada às ciências sociais.* 9th ed. Florianópolis: Ed. da UFSC; 2017.
- [41]. Levin J, Fox JA, Forde DR. *Estatística para ciências humanas.* 11th ed. São Paulo: Pearson; 2012.
- [42]. Hair Jr. JF, Black WC, Babin BJ, Anderson RE, Tatham RL. *Análise multivariada de dados.* 6th ed. Porto Alegre: Bookman; 2009.