

Performance Indicators as a Decision-Making Tool for the Procurement Sector in the Construction Industry – A Bibliographical Analysis

M. Elane G. Magalhães¹, R. L. R. Gomes²

¹ Bachelor's degree in Business Administration from UNIFAMETRO; currently pursuing an MBA in Supply Chain Management at IEL – Euvaldo Lodi Institute, Ceará Branch; Certified in: Internal Quality Auditor, Negotiation and Influence, Emotional Intelligence, Technical Consultant Academy in Logistics; Supply Assistant at Diagonal Empreendimentos e Engenharia.

² Professor of the Methodology of Scientific Work Discipline (Advisor) – Euvaldo Lodi Institute; FBUNI; Ph.D. in Biological Sciences - FICL; M.Sc. in Phytotechnics - Federal University of Ceará; Specialist in Science Teaching Methods - UECe; B.Sc. in Agronomy - UFC; Licentiate in Natural Sciences, Mathematics, and their Technologies - UVA; Additional Training Courses in People Management, Project Management, Education, Leadership, Auditing, and Health at: HARVARD; IDB; FIOCRUZ; JOHNS HOPKINS UNIVERSITY (JHBSPH); International Consultant for Scientific Laboratories at the World Bank. Scientific Consultant Corresponding Author: R.L.R. Gomes; <https://orcid.org/0000-0001-6101-9571>.

ABSTRACT

Due to intense competition, the construction sector in Brazil demands that projects operate with restricted and highly efficient financial resources. This makes the procurement area a crucial component in organizations, constantly pressured to negotiate advantageous deals. The current study adopts a research method identified as literature review, following a qualitative approach. Information analysis was conducted through exploratory reading of materials from previous research, books, articles, theses, and online and printed documents, using a qualitative approach. The general objective of this study is to conduct a qualitative exploration of literature contributions regarding the relevance of performance indicators in the procurement and supply area. Additionally, the research aims to delve into three indicators identified by the author as fundamental and highly applicable in the context of civil construction: cost, deadline, and savings. Furthermore, this study sought to provide contributions to continuously improve procurement management in civil construction, consolidating the foundation for a more agile and resilient operation in the face of current market challenges.

Keywords: Procurement; Civil Construction; Indicators; Economy.

Date of Submission: 12-04-2024

Date of Acceptance: 25-04-2024

I. INTRODUCTION

In the dynamic scenario of the construction industry, it is crucial for companies in the sector to carry out efficient procurement and supply management to achieve operational success. Facing challenges such as fluctuations in raw material prices, variable demands, and strict deadlines, the ability to effectively manage acquisition resources becomes a significant competitive advantage.

In construction, procurement and supply management go beyond simple material acquisition, involving a complex network of processes that directly impact project execution. In this context, it becomes imperative to apply performance indicators. These provide a clear and objective view of process progress, enabling informed and precise decision-making.

Performance indicators offer tangible metrics to assess the effectiveness of procurement and supply practices, from supplier selection to inventory management. This metric-based approach not only facilitates the identification of improvements but also enables proactive adaptation to market demand changes, thus promoting resilience and competitiveness in the sector.

This study aims to qualitatively explore the literature regarding the importance of these performance indicators in the procurement and supply area, delving into three indicators considered indispensable and highly applicable in the construction context: cost, schedule, and savings. Careful analysis of these indicators will not only contribute to understanding internal processes but also provide valuable insights for process optimization and efficiency enhancement in procurement management.

The current study adopts a research method identified as bibliographic research, following a qualitative approach. Information analysis was conducted through exploratory reading of material sourced from previous research, books, articles, theses, and online and printed documents, using a qualitative approach.

The general objective of this study is to perform a qualitative exploration of literature contributions regarding the relevance of performance indicators in procurement and supply. The specific objectives determined are as follows: demonstrate the relationship of construction with the procurement sector; discuss the strategic vision of the procurement sector; elaborate on performance indicators and provide an analytical account of the schedule, cost, and savings indicators.

This scientific article is organized into five sections. The first is the introduction, highlighting the research objectives. The second section is the theoretical framework, featuring contributions from authors researching the same investigated theme. The third section is reserved for explaining the methodological procedures adopted during the research. The fourth section is dedicated to the development of the analytical account concerning three key performance indicators (KPIs) considered important, and finally, in the fifth and last section, the final considerations were elaborated.

II. MATERIAL AND METHODS

The present study constitutes a research procedure characterized as bibliographic research, which followed a qualitative approach. According to Almeida (2011), bibliographic research seeks relationships between concepts, characteristics, and ideas, often combining two or more themes [1].

The analysis of information was conducted through exploratory reading of the material found, employing a qualitative approach. According to Severino (2007), this type of research is characterized by available records resulting from previously conducted research, found in books, articles, theses, and printed documents [2].

This work relied on the contributions of authors such as Baily et al. (2008), Silva and Lima (2015), Quesado and Costa (2017), Martins (2020), and Soares, Mota, and Barboza (2022). All of them emphasized the importance of procurement management as a strategic area and its significance in achieving the organization's long-term objectives through the monitoring of indicators and its ability to positively influence various aspects of business performance.

III. THEORETICAL FRAMEWORK

The foundation was organized into three subtopics. The first addressed the economic scenario in Brazil and its impact on the construction industry over the years. The second discussed the strategic importance of the procurement sector for the survival of organizations. Lastly, the third subtopic delved into performance indicators with a focus on the construction industry and their relevance in decision-making.

3.1 Construção Civil and its Relationship with the Procurement Sector

In recent years, the productive and economic landscape of the country has undergone significant changes, presenting considerable challenges for the productive sector in general, with more specific and pronounced impacts on companies in the construction industry. Adapted to an economy where the price of the final product was the result of the sum of the company's production costs and previously arbitrated profit, we have transitioned to a new formulation where profit becomes the result of the differential between the market price and the company's costs. Addressing direct and indirect costs becomes, therefore, a fundamental issue [3].

Since the 1990s, the construction industry has become increasingly involved in the pursuit of Total Quality, encompassing the entire production and business process, from planning the work to its delivery and maintenance. One focus of this process is Supply Management, which concerns the acquisition of materials in a multifunctional way, involving various sectors such as design, procurement, and execution, allowing for integrated work among them [4].

The federal government launched the third version of the Growth Acceleration Program (PAC) in September of last year, promising significant benefits to the construction industry. The program aims to invest R\$ 1.4 trillion in infrastructure by 2026 and R\$ 320.5 billion after 2026, totaling R\$ 1.7 trillion. Caixa Econômica Federal will operate as the financing agent for program projects, confirming that the construction sector can expect significant investments for 2024. To help the country progress, the PAC aims to support ecological transition and neoindustrialization. As a result, the creation of new jobs and business opportunities for construction companies is one of the main benefits for society and, primarily, for the construction industry. Although it is a federal government program, the PAC Political Action Committee relies on essential support from private companies, municipalities, states, and social movements. As officially announced, the goal is to increase social inclusion and economic growth through job creation and income [5].

3.2 Strategic Vision of the Procurement Sector

Due to intense competition, the Brazilian construction market demands that works operate with limited and extremely tight budgets, making the procurement sector an essential department within companies, continuously required to develop good deals. According to Viana (2012, p. 42): "The purchasing activity aims to meet the company's needs by acquiring materials and/or services, emanating from user requests, aiming to identify in the market the best commercial and technical conditions [6]."

A well-known concept presented by Baily et al. (2008, p.31) regarding purchasing objectives, although considered superficial and simplistic by some authors, is: "buying the right quality material, at the right time, in the right quantity, from the right source, at the right price [7]." Following Baily et al.'s (2008) line of reasoning, the idea that the procurement function is no longer merely a daily "order" management activity is becoming more accessible. In contrast to its previous reactive role, the procurement area now plays a proactive role [7].

According to Soares, Mota, and Barboza (2022, p. 04):

[...] within the general scope of procurement [...], processes that affect the entire organization comprise a series of challenges, which include not only the elements of bureaucracy itself but also governance, risks, transparency, and rethinking in order to replace sluggish and outdated systems [8].

Efficient procurement management can bring agility to operations and increasing acquisition quality to an organization, enhancing productivity and product quality, and thus customer satisfaction, becoming a strategic area for an organization [8]. Today, the procurement area has become extremely important and is seen as a strategic sector that adds value and brings competitiveness to organizations, among other things, by relating in a systemic and harmonious way with all other areas, optimizing time, reducing costs, and consequently contributing to increasing the profitability of organizations.

3.3 Performance Indicators

Peter Drucker (quoted in Bastos, 2020), considered the father of modern management, once said, "If you can't measure it, you can't manage it." It is precisely for this reason that measuring the performance of organizational processes, i.e., at the operational, tactical, and strategic levels, is of paramount importance. It determines how effective and efficient management has been so far and allows for setting future goals [9].

According to Pinheiro (2011, quoted in Neiva; Andrade, 2016), performance indicators consist of quantitative expressions and offer information created by measurements and evaluations of a production structure, processes, and resulting products. They are used to evaluate and assist in decision-making. It is a basic management technique that should be part of the daily routine of any organization that wants to be competitive in the market and gain greater control over its activities, regardless of the industry or size of the company [10].

As reported by Silva and Lima (2015), performance indicators allow for the monitoring of situations and provide support for decision-making to maintain, change, or adapt decision-making strategies [11]. Companies increase the likelihood of success and satisfaction of the end customer by using performance indicators that can improve and increase profits in the sectors involved. As a result, we can conclude that the implementation of these configurations is essential for optimal supply chain management [12].

IV. ANALYTICAL ANALYSIS OF THE LEAD TIME, COST, AND SAVING INDICATORS

According to Turi et al. (2014), quantitative, qualitative, input (resources spent during the manufacturing of the final product), financial, and process (process efficiency) indicators are the most important [13]. Moktadir et al. (2020) state that establishing clearer objectives and making goals more achievable is possible through the careful combination of these quantitative and strategic measures [14]. Organizations use the term Key Performance Indicators (KPIs) to describe these indicators [15].

In this study, three suggestions of indicators focused on the procurement sector will be analyzed to measure, evaluate, and, based on these results, assist managers in better managing sector performance and increasing activity efficiency. Such information was based not only on the literature but also on the practical experience of the author of this study.

4.1 Lead Time for Order Closure

The lead time for order closure or purchase lead time is an indicator used to calculate the procurement time, in other words, the time it takes for the order to be closed and for a certain product or service to be delivered or performed to the end consumer, in this case, construction projects. More specifically, it indicates the period from when a material or service was requested until a demand is fulfilled, or in other words, until the order is closed. Let us see Figure 1 for how this indicator is calculated:

Figure 1: How to Calculate the Lead Time Indicator

$$\text{Formula} = \frac{\text{Total of Orders Closed on Time}}{\text{Total Orders}}$$

Source: Developed by the authors

By understanding the interval that purchases take to be finalized, managers can better plan the entire material acquisition process and maintain the continuous flow of operations. Thus, when the purchase lead time is too high, it is up to managers to align and rethink processes to make them faster, less bureaucratic, and more effective. The central idea of this indicator is, therefore, to ensure the success of the purchasing processes so that construction projects are completed on time and respecting the schedule, thus avoiding delays and rework. In

this sense, in addition to the times of approvals and internal procedures, it is also interesting to observe other factors that may cause delays in closing the order, such as lack of specification of the request, increase in the number of urgent demands, scarcity of product in the market, or lack of suppliers for a certain service or product.

4.2 Cost Indicator

As mentioned earlier, construction projects are forced to work with increasingly limited and extremely tight budgets due to the high market competition. For this reason, the cost indicator is one of the most relevant when it comes to the construction industry, as it measures the percentage of the total purchases versus the budget value of the project. In other words, it shows how much % was saved or exceeded in relation to the budget allocated for a particular project. Figure 2 below displays the formula for obtaining these data:

Figure 2: How to Calculate the Cost Indicator.

$$\text{Formula} = \frac{\text{Total in \$ Orders Closed}}{\text{Total Budgeted}}$$

Source: Developed by the authors

This refers to the total amount paid compared to the budgeted value in relation to the goods or services (whether the product was purchased at a lower or higher price than budgeted). The result of this assessment reveals the financial gain or loss that the company experienced as well as the need for process improvement in requisition or adoption of measures to reduce costs. Several important measures can be adopted by the procurement department to minimize unnecessary budget overruns, such as: • Purchasing in bulk as the buyer will have greater bargaining power not only in terms of values, but also in terms of terms and delivery conditions, but this has a direct impact on points such as inventory and movement, which need to be considered carefully; • The procurement department being aligned with the replenishment schedule of the project, as this allows for the development of a more efficient procurement plan;

This KPI should be monitored frequently, even in calm market conditions, to identify possible bottlenecks before they become complex problems. Additionally, good old-fashioned communication between projects and the procurement department is crucial for aligning information and seeking continuous improvement in processes.

4.3 Indicator: Saving

The Saving, translated from English, meaning economy, is one of the most important indicators in the procurement sector, as its objective is to determine precisely how much buyers are able to save in their negotiations, while also considering return on investment (ROI). Therefore, it proposes to calculate the difference between the value of the initial proposal presented by the supplier versus what was actually purchased, thus highlighting how much in currency (R\$) the buyers managed to save. In Figure 3, one can observe how the calculation of this indicator is performed:

Figure 3: How to Calculate the Saving Indicator

Example 1	Item price	Quantity of Items	Calculation in Brazilian Reais	Total in Brazilian Reais
Initial Price (per unit)	R\$ 119,00	200	Unit Value x Quantity of Items R\$ 119,00 x 200	R\$ 23.800,00
Negotiated Price (per unit)	R\$ 98,00	200	Negotiated Price (per unit) x Quantity of Items R\$ 98,00 x 200	R\$ 19.600,00
Discount Obtained (per unit)	R\$ 21,00	200	Initial unit price - Negotiated unit price x Quantity of Items R\$ 119,00 - R\$ 98,00 x 200	R\$ 4.200,00

Source: Electronic Market, 2023.

In this example, the saving, that is, the amount saved in Brazilian Reais as a result of the buyer's negotiation, was R\$ 4,200.00. In Figure 4, we will see the calculation of the percentage saving of the total purchase value:

Figure 4: How to calculate the Saving of the total purchase amount

Initial Price - Baseline (per item)	-	Final Negotiated Price (total value)	×	100/Budgeted Initial Price	=	= %
Ex.: R\$ 23.800,00		- R\$ 19.600,00 = 4.200		$4.200 \times 100 = 420.000 / 23.800,00$		= 17,64%

Source: Electronic Market, 2023.

Currently, there are platforms available that automatically perform this calculation and provide reports with indications of which quotation is more advantageous in this regard, along with other parameters chosen by the procurement department.

4.4 Summary of the Analytical Report on the Key Performance Indicators Timeframe, Cost, and Saving

Given the prior knowledge of the discussed indicators Timeframe, Cost, and Saving, below is a simulation using fictitious numbers of how the biannual monitoring of these data would be:

Figure 5: Biannual Monitoring of Key Performance Indicators (KPIs)

KEY PERFORMANCE INDICATOR (KPI)	FORMULA	TARGET 2023	jan/23	fev/23	mar/23	abr/23	mai/23	jun/23	SEMESTRAL CONSOLIDATED
TIMEFRAME	ORDERS CLOSED ON TIME/TOTAL ORDERS	92%	↓ 87,7%	↓ 89,8%	↑ 93,4%	↑ 95,1%	↑ 95%	↑ 93,0%	↑ 92,3%
COST	TOTAL R\$ OF ORDERS CLOSED ON TIME/TOTAL BUDGETED	13%	↓ 10%	↓ 10%	↓ 12%	↓ 10%	↑ 15%	↑ 13%	↓ 11,7%
SAVING	TOTAL DISCOUNT/TOTAL R\$ OF ORDERS	8%	↓ 5%	↑ 10%	↑ 8%	↓ 7,3%	↑ 10%	↑ 10%	↑ 8,4%

Source: Researchers' data

If we observe the last column, we understand that from a biannual perspective, the average of orders closed within the timeframe managed to meet the target, which in this example was set at 92%. In the construction industry, a timeframe of 30 days is typically used for non-urgent orders and 7 days for urgent orders, however, this is not a rule and may vary from company to company.

On the other hand, the cost indicator target was not achieved, as we only obtained 11.7%. This means that 1.3% of savings were missed compared to the budget allocated for the project. It might seem like an insignificant number, but we are talking about millions in Brazilian Reais, and in the end, it does make a difference. Even though the target of 100% wasn't reached, it would be inaccurate to say that there wasn't a significant cost saving.

Lastly, the biannual average of the saving indicator was 8.4%, highlighting that the negotiations conducted by the procurement department not only were excellent but also exceeded the target set at 8%. The use of a good software is essential for automatically obtaining these data to facilitate their analysis by the department manager.

IV. DISCUSSION AND CONCLUSION

The present study aimed to examine the literature regarding methods of performance analysis and measurement, with a focus on three main indicators in the construction industry, considered by the author of this research as important tools for controlling activities carried out by the procurement sector. Additionally, this study sought to provide contributions for the continuous improvement of procurement management in the construction industry, strengthening the foundation for a more agile and resilient operation in the challenging market context.

The study highlighted that performance indicators assist in monitoring the fulfillment of strategic objectives that directly affect the timely delivery and financial cost of construction projects. Their purpose is to ensure effective control and optimization of processes through proactive management, enabling the periodic monitoring of indicators and early identification of potential bottlenecks. This facilitates the generation of corrective actions, minimizes impacts, supports decision-making, and identifies trends. Continuous monitoring of these indicators allows for anticipating challenges and improvement opportunities, fostering transparent communication, providing a clear view of sector performance, and fostering communication with other areas. It

also promotes operational efficiency and process optimization, ensuring continuous flow and minimizing disruptions and rework, while striving for continuous improvement.

For the purpose of improvement and comparison, it is suggested to conduct a study regarding the difficulties of implementation, as well as comparing results between the same periods of research time with the development of these indicators.

REFERENCES

- [1]. Almeida, M. de S. (2011). Project, undergraduate thesis, dissertation and thesis writing: A simple, practical and objective approach. São Paulo: Atlas.
- [2]. Severino, A. J. (2007). Methodology of Scientific Work. São Paulo: Cortez.
- [3]. Araújo, C. H. de, Guimarães, I. F. G., Nascimento, A. B. S., & Andrade, P. A. F. L. (2023). Lean construction: Perspectives in the scope of Brazilian civil construction. *GeSec Journal*, 14(2), 2545-2561. <http://doi.org/10.7769/gesec.v14i2.1729>.
- [4]. Martins, T. C. M. (2020). Solid waste management on a building rehabilitation site: A case study (Monograph). Bachelor's degree in Environmental Engineering, UTFPR, Francisco Beltrão: UTFPR.
- [5]. Brazil. (2023). Check the institutional measures of the new PAC. Brasília: Civil House.
- [6]. Viana, J. J. (2012). Material Management: A Practical Approach. São Paulo: Atlas.
- [7]. Baily, P., et al. (2008). Procurement: Principles and management. São Paulo: Atlas.
- [8]. Soares, J. C. A., Mota, F. P. B., & Barboza, S. I. S. (2022). The Comfort Zone of Bureaucracy: Governance in Public Procurement Process. *Alcance Journal*, 29(3), 328-342. [http://doi.org/10.14210/ALCANCE.V29N3\(SET/DEZ\)](http://doi.org/10.14210/ALCANCE.V29N3(SET/DEZ))
- [9]. Bastos, R. M. (2020). Communication between the sectors of a company as the main quality tool in lean production (Dissertation). Postgraduate Program in Process Engineering - Professional Master's in Process Engineering, Federal University of Pará, Belém: UFFPa.
- [10]. Neiva, I. B. B., & Andrade, D. F. (2016). The use of Six Sigma methodology: A study in a small-sized company. XXIII Production Engineering Symposium (SIMPEP), Bauru, São Paulo.
- [11]. Silva, E. H. D. R., & Lima, E. P. (2015). The study of performance indicators from the perspective of organizational strategic management. *GEPROS (Production Management, Operations and Systems)*, 10(3), 159-175.
- [12]. Rodrigues, A. C., & Canelada, M. (2015). Use of KPIs - Performance indicators in the supply chain. A case study in a metallurgical industry in the construction sector (Undergraduate Thesis). Eurípides de Marília University Center, Marília.
- [13]. Turi, A., Gonçalves, G., & Mocan, M. (2014). Challenges and Competitiveness Indicators for the Sustainable Development of the Supply Chain in the Food Industry. *Procedia-Social and Behavioral Sciences*, 124, 133-141.
- [14]. Moktadir, A. M., Dwivedi, A., Rahman, A., Jabbour, C. J. C., Paul, S., Sultana, R., & Madaan, J. (2020). An investigation of key performance indicators for operational excellence towards sustainability in the leather products industry. *Business Strategy and the Environment*, 29(8), 3331-3351.
- [15]. Quesado, P. R., & Costa, C. S. O. da. (2017). The balanced scorecard and key performance indicators: A case study in a public transport company. *Management Control Review*, 2(1), 2-19.