

Implementation of public e-procurement in Brazil: proposition of a theoretical model and prognosis of the use of AI

Rafael Wallbach Schwind¹

Renato Ribeiro Fenili²

The recently published Law No. 14,133, of 2021, is the first general law on bidding and contracts in Brazil created in the e-procurement paradigm. It transcends the simple use of electronic transactional systems, now envisaging the adoption of a single national portal with broad tools for planning, supplier selection and contract management. The innovation was possible due to the implementation of this archetype, starting in 2019, with Federal Decree No. 10,024, of 2019 as its starting point. Since then, 2,734 municipalities have adopted the Federal Government's Purchasing System, adding to the 1,183 that were already using it before the Decree came into effect³. Several other electronic portals, public and private, increased their user base. Currently, the government development portfolio is focused on creating a public procurement marketplace and the use of various applied AI functionalities. The use of machine learning in initiatives such as fraud detection, analysis of complex documents and lowering the entry barrier for bidders is of expanding projects. Little attention, however, was given in academic literature to this success story. This paper proposes an underlying explanatory model, aimed at the implementation and development of e-procurement in Brazil, since 2019, clarifying, from a longitudinal perspective, the main predictive variables and the development prognosis in the short and medium terms. In conclusion, the paper suggests improvements in the theoretical model, and consolidates the research agenda.

¹ Ph.D. and Master of State Law from the University of São Paulo. Visiting Scholar at the University of Nottingham (2016). Fellow of the Chartered Institute of Arbitrators (CI Arb). Partner at Justen, Pereira, Oliveira e Talamini Law Firm (Brazil).

² Ph.D. and Master of Management from the University of Brasília. Deputy Secretary of Management of the Government of São Paulo. Former National Secretary of Management.

³ Data from: <https://www.gov.br/compras/pt-br/cidadao/painel-municipios>. Access in March, 29th, 2024.

1. Introduction

How was the implementation of electronic public procurement in Brazil carried out?

This question carries with it the premise that the implementation of electronic public procurement is a completed, uniformly consolidated process in a country of continental dimensions. However, a closer look reveals heterogeneous nuances, bound by the same political, social, and cultural heterogeneity so characteristic of Brazil. Without a new perspective, the risk would be to start this article with some kind of bias, albeit unintentional, a sort of fallacy.

As a simple correction, the more appropriate question is: "How is the implementation of electronic public procurement in Brazil taking place?". Beyond a correction of verb tense, the revised inquiry gives rise to an analysis, not just a synthesis. It prompts an approach to a dynamic phenomenon that has evolved significantly in the recent past through legal and sub-legal innovations, combined with a peculiar federative arrangement with reflections on the regulatory framework of public procurement. It is also catalyzed by the SARS-CoV-2 pandemic and by the development and expansion of the scope of information and communication technology (ICT) platforms focused on governmental logistics.

At the same time, it is a phenomenon that encounters structural resistances, which defy the objective aspect of the public policy of digital inclusion. Cultural traits of the Brazilian public administration, rooted in an entrenched patrimonialistic paradigm, as well as in reformism and aversion to entrepreneurship and risks⁴, hinder the institutionalization of the new archetype of electronic procurement.

This article proposes a theoretical model on the implementation of electronic public procurement in Brazil, dedicated to the transformations that have occurred in the logistics landscape since 2019. By clarifying and characterizing the variables that make up the model, it substantiates an analytical tool whose relevance rests on theoretical and managerial pillars. The theoretical contribution lies in the proposition of a model that relates to public e-procurement and cultural practices, as well as in the expansion of the theme beyond the formal and legal arenas⁵, still predominant. Furthermore, the backdrop

⁴ CARBONE, P. P. Cultura organizacional no setor público brasileiro: desenvolvendo uma metodologia de gerenciamento da cultura. *Revista de Administração Pública*, v. 34, n. 2, p. 133 – 144, 2000.

⁵ TRIDAPALLI, J. P.; MACHADO, W. V.; FERNANDES, E. E-procurement in Brazil's State Governments. Curadoria ENAP, 2010. Disponível em: <https://exposicao.enap.gov.br/items/show/819>. Acesso em 28.03.24.

is the vision of the implementation of e-procurement as an innovation in services in the public sector, given in the face of an established cultural substrate. Despite the relevance of the role that culture plays in the performance and innovation of the public sector, there is a prevailing limitation of understanding on how, in fact, this role is exercised⁶.

The instrumental relevance is grounded in the provision of a cognitive framework capable of elucidating the strengths and challenges, from a management perspective, in the implementation of electronic public procurement in Brazil. The offered toolkit suggests that public managers can advance in the greater institutionalization of this facet of digital government.

Finally, this article addresses the prognosis of the development of the electronic procurement paradigm in Brazil in the medium and long term, emphasizing vectors that should compose the agenda of governmental projects.

2. The concept of public e-procurement and its dimensions of horizontal and vertical diffusion

E-procurement refers to the use of technology to conduct procurement activities such as supplier registration and selection, contracting, and payment through online platforms⁷. In the public sphere, it relates to a comprehensive process in which governments employ information and communication technology (ICT) systems, usually with internet functionalities, as a way to establish administrative contracts⁸.

The approach to the implementation of electronic public procurement leads to the notion of the existence of exclusive, binary models, namely, those of face-to-face and electronic bidding. In these terms, when conducting a procurement in which supplier selection is done via an online competition, one would be facing a full exercise of e-procurement. However, e-procurement can involve various stages or phases of a procurement process, either entirely or partially⁹.

⁶ WYNE, J. ; VERHOEST, K. Do NPM-Type Reforms Lead to a Cultural Revolution within Public Sector Organizations? *Public Management Review*, v. 17, n. 3, p. 356 – 379, 2013.

⁷ KUMAR, P.; KHAN, A. M.; AZIZ, S. Factors Affecting the Integration of E-Procurement in the Public Sector of Pakistan with Emphasis on Combating Corruption. *Dutch Journal of Finance and Management*, v. 6, n. 2, p. 1 – 16, 2023.

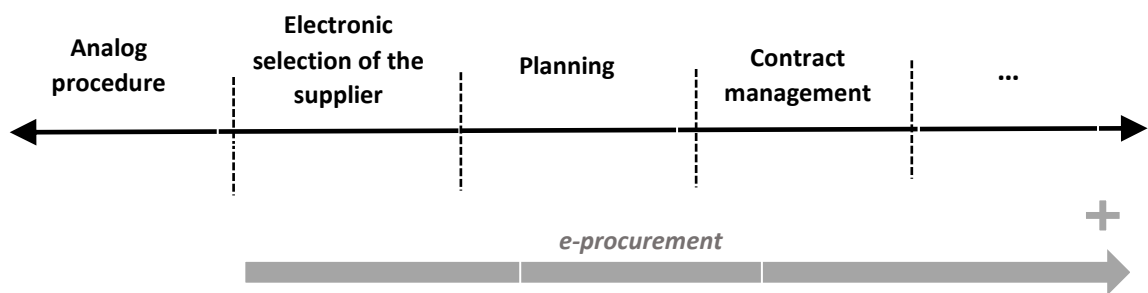
⁸ ZULKARNAIN, Z.; MUDA, I.; KESUMA, S. A. Factors Determining the Adoption of E-Procurement in Developing Countries: A Systematic Literature Review. *International Journal of Social Service and Research*, v. 3, n. 2, p. 585 – 594, 2023.

⁹ CROOM, S.; BRANDON-JONES, A. Impact of e-procurement: Experiences from implementation in the UK public sector. *Journal of Purchasing & Supply Management*, v. 13, p. 294 – 303, 2007.

Regarding government procurement, electronic tools on web-based platforms can be applied solely in the supplier selection stage or, alternatively, also reach the planning and contract management phases. This extension process is usually evolutionary and entails significant costs for system development and infrastructure support, as well as the development of competencies for public managers and the market. In such an extension, there is a process referred to as vertical diffusion of e-procurement, a kind of densification within the intricacies of the public procurement process itself.

In this sense, e-procurement moves away from a dichotomous conception regarding a paradigm of face-to-face arrangements: there would exist different frameworks in a continuum between a purely analog model and another completely digital one, as illustrated in Figure 1.

Figure 1. *Degrees of implementation of public e-procurement*



In each of the stages represented in Figure 1, there is significant granularity of levels, so that the degree of implementation of public e-procurement approaches the nature of a continuous variable, rather than a discrete one. For example: electronic selection of the suppliers may only allow for manual submission of electronic bids, or it may allow for automatic parameterization by the entity conducting the bidding procedure. Planning, on the other hand, could involve only the optimized digital preparation of preliminary studies or, beyond that, offer tools for price quoting, drafting of bid documents, and even incorporate artificial intelligence functionalities for prospecting better solutions and document creation. Alternatively, only certain bidding modalities would take on electronic form, coexisting with others conducted in person.

Finally, the right limit of this continuum assumes the inherent dynamism of technological advancements applicable to the public procurement process. In this sense, e-procurement is a living, impermanent construct. For example, at the beginning of 2022, the discussion about the application of artificial intelligence in public procurement

procedures was limited in Brazil; by 2024, with the dissemination of tools like ChatGPT, public e-procurement gained greater depth, extending the potentialities of the continuum.

Horizontal diffusion of e-procurement refers to its geographical spread at the national level, for the purposes of this article. It occurs mainly through coercive isomorphism (through legal and sub-legal force) and normative isomorphism (via the sharing of interorganizational practices)¹⁰. In this view, there is the hypothesis that e-procurement is the result of the pursuit of legitimacy and compliance, whereas a new legal framework that establishes it would be the result of a non-isomorphic change¹¹⁻¹².

For the purpose of this article, it is important to address the processes of horizontal and vertical diffusion of public e-procurement in Brazil. The temporal framework dates back to the publication of Federal Decree No. 10.024 in 2019, which served as a catalyst for geographical diffusion. Prior to this approach, however, we will examine the inherent mechanism of said isomorphism, namely, the Brazilian federative organization regarding public procurement, which will be discussed in the next section.

3. The Brazilian Federative Organization Regarding Public Procurement

Specialized literature presents estimative data on the economic magnitude of public procurement in Brazil, with figures hovering around 15% of the GDP, expenditures by agencies and entities dispersed across the federation levels¹³.

The form of the Brazilian state is federal, with a political-administrative organization comprising four levels of government: federal, state, federal district, and municipal, structured with defined competencies in terms of areas of operation, budgetary and financial prerogatives, and regulatory authority. As the representative of the federal government domestically and of the Federative Republic of Brazil externally, the Federal

¹⁰ ASHWORTH, R.; BOYNE, G.; DELBRIDGE, R. Escape from the Iron Cage? Organizational Change and Isomorphic Pressures in the Public Sector. *Journal of Public Administration Research and Theory*, v. 19, n. 1, p. 165-187, 2007.

¹¹ An effort to merge the models of BERGER and LUCKMAN (1967) and GREENWOOD, SUDDABY, and HININGS (2002) inspires the proposition that normative externalization - both legal and infra-legal - is a triggering factor (or jolt) for both the institutionalization of a particular innovation and the deinstitutionalization of the previous order.

¹² The cause-and-effect relationship outlined presupposes normative innovation followed by the diffusion of ICT systems capable of giving rise to the legal command, in a logic that privileges the ordinary procedure inherent to the principle of legality.

¹³ RIBEIRO and INÁCIO JÚNIOR (2019) estimate it at 12.5% of GDP, analyzing the historical series from 2006 to 2017. The OECD, in turn, points to 15.2% in 2019 (OECD, 2021). Meanwhile, the Open Contracting Partnership indicates 8.2% in 2017. The statistical inaccuracy ends up being overcome by common sense, reported in articles of lower scientific rigor, suggesting that the figure is approximately 12% of the Brazilian GDP.

Union constitutes a legal entity under public law, autonomous entity in relation to the 27 states, the 5,568 municipalities, and the Federal District.

The vertical system of competence distribution, provided for in the Federal Constitution (Brazil, 1988), reserves to the Federal Union the exclusive authority to issue general bidding rules, reaching all federative entities, in both direct and indirect administrations. The other entities are responsible for complementing these general rules, issuing specific commands where applicable. According to MARÇAL JUSTEN FILHO (2021), the concept of general rule refers to an indeterminate legal concept, simultaneously enjoying areas of positive and negative certainty, interspersed by a gray area.

In the Brazilian case, we observe limited spaces of regulation for the sub-national entities, occasionally untouched by federal regulations of a general nature, or assuming the aspect of specific rules¹⁴. With this arrangement, the Federal Union ends up assuming preeminence in the establishment of public procurement practices, which are replicated in the other levels of the federation.

In terms of institutional prominence in Brazil, two national laws concerning public procurement rules can be identified:

- a) Federal Law No. 13.303, enacted in 2016, which regulates the legal status of public companies, mixed economy companies, and their subsidiaries.
- b) Federal Law No. 14.133, enacted in 2021, which establishes general rules for bidding and contracting.

A characteristic trait of Brazil is the financial transfers from the Federal Union to states and municipalities, as well as to public consortia and nonprofit entities, for cooperation or assistance purposes, aiming at the execution of public policies of common interest between the federal government and the beneficiary, or as required by law. These transfers from the Federal Union, of various kinds, include voluntary transfers, which serve as a means of disseminating the public procurement rules established by the federal government. In 2023, there were 10,168 voluntary agreements signed, with a total value

¹⁴ FENILI, R. R. The Different Shades of Public Procurement in Brazil. In: LISBOA, E.; GOMES, R. C.; MARTINS, H. F. (eds.) *The Brazilian Way of Doing Public Administration*. Emerald Publishing Limited, Leeds, p. 71 – 82, 2023.

of BRL 20.4 billion (USD 4 billion), with all 27 states and approximately 95% of Brazilian municipalities participating in the terms¹⁵.

Here is the mechanism to be highlighted: the aforementioned diffusion of federal rules occurs through coercive isomorphism, a dynamic historically endorsed by the Budgetary Guidelines Law¹⁶, as well as by settled jurisprudence in Brazil. Given that these transfers are voluntary, the bidding process must follow federal rules mandatorily¹⁷. Historically, this prerogative ends up being a central point for the horizontal diffusion of public e-procurement, as will be addressed in the next section.

4. Historical Implementation of Public E-Procurement – From 2019 to 2024

For better logical coherence in this article, the analysis of the historical implementation of public e-procurement in Brazil will be conducted according to its diffusion dimensions. The Federal Government Procurement System will be taken as the focus of examination, given its representativeness in the public procurement portals scenario¹⁸, without neglecting considerations for other governmental and private platforms.

4.1. Vertical Diffusion

Vertical diffusion refers not only to the optimization of electronic tools' use in transactions with the market but also to the densification of the use of ICT functionalities throughout the meta-process of public procurement, enhancing and extrapolating beyond

¹⁵ Data available at <https://clusterqap2.economia.gov.br/extensions/painel-gestao-transferencias/painel-gestao-transferencias.html> (accessed on March 30, 2024). Conventions and transfer contracts were considered as voluntary transfer modalities.

¹⁶ In the current Budget Guidelines Law - Law No. 14,791/23, the following provision is found: "Article 92. Voluntary transfer is characterized as the delivery of current or capital resources to the States, the Federal District, and Municipalities, as cooperation, aid, or financial assistance, not arising from constitutional or legal determination, or destined to the SUS, as provided for in the heading of article 25 of Complementary Law No. 101, of 2000 - Fiscal Responsibility Law.

§ 1 Without prejudice to the requirements provided for in Complementary Law No. 101, of 2000 - Fiscal Responsibility Law, the entities benefiting from the transfers referred to in the heading must observe the norms issued by the Union regarding the acquisition of goods and the hiring of services and works, especially in electronic form, except in cases where the law or specific regulation governing the transfer modality provides for a different form for contracts with transfer resources."

¹⁷ BRASIL. Tribunal de Contas da União. *Convênios e outros repasses*, 6ª edição. Brasília: Secretaria-Geral de Controle Externo, 2016.

¹⁸ The Federal Government Purchasing Portal, available at www.comprasnet.gov.br, is the most widely used platform in Brazil for public e-procurement purposes. Its use is mandatory for the federal Executive branch and can be adopted, at no cost, by other branches of government and federative entities. Currently, it has 70.38% of municipalities registered. Data available at: <https://www.gov.br/compras/pt-br/cidadao/painel-municipios> (access on March 30, 2024).

the strict phase of supplier selection to cover instrumentalities inherent in planning and contract management.

Considering the role of the Federal Union as a protagonist in establishing public procurement practices in Brazil, it is important to address vertical diffusion in the Federal Government Procurement System, given its inter-federative capillarity.

A prominent role in the recent evolution of the government procurement agenda in Brazil is attributed to the top-down innovation flow derived from recommendations of the Federal Court of Accounts (TCU), starting from 2015, when the institution entered the governance in procurement field¹⁹. The jurisprudence created since then has brought various recommendations aimed at enhancing the meta-process of public procurement, many of which go beyond the supplier selection stage and are specifically directed at the central public logistics agency of the federal government²⁰.

Such recommendations – such as the establishment of annual procurement plans, clear guidelines for contract management, among others – were received by the Secretariat of Management, and initially, the effort was made for the elaboration of sub-legal regulations. Only in the medium term were the new routines incorporated into the federal e-procurement system.

Until 2018, the Federal Government Procurement System was focused on the disclosure and conduct of tenders. Only auxiliary functionalities to supplier selection – such as material and service cataloging, supplier registration, issuance of commitment of expenditure notes, and contract registration – were included. In the following years, however, the platform underwent a continuous process of evolution, mainly as a reflection of sub-legal regulatory innovations drafted by the so-called central logistics agency of the federal Executive branch, namely, the Secretariat of Management. Table 1 depicts the main milestones of this chronology.

¹⁹ In 2013, the Federal Court of Accounts (TCU) conducted a study with the aim of obtaining and systematizing information on the governance and management of acquisitions in organizations of the Federal Public Administration, the "S" system, federal councils, and others that manage federal resources and have national scope. An evaluation questionnaire was applied to 376 organizations, and the analysis resulted in a diagnosis of weaknesses and deficiencies in the governance and management systems of procurements. This survey culminated in Ruling No. 2,622/15 - TCU Plenary, which brought a series of recommendations aimed at inducing improvements in governance. These diverse guidelines have been reiterated and refined in extensive jurisprudence since then.

²⁰ The Secretariat of Management of the Federal Executive Power in Brazil is considered, by virtue of Decree-Law No. 200, of 1967, as the central body of public logistics, responsible for establishing government procurement policies and managing the Federal Government Procurement System - compras.gov.br.

Table 1. Key milestones of the vertical diffusion of the Federal Government Purchasing System (from 2019 onwards)

Year	Functionality
2019	PGC System - Planning and Contract Management - module dedicated to the preparation and execution of annual contracting plans
	Mobile application for bidder registration
2020	Digital ETP System - module for the preparation of preliminary technical studies
2021	Electronic waiver - module for conducting direct contracting through bidding exemption
	Risk Management Module - functionality dedicated to the preparation of risk maps
	Purchases Contracts Module - subsystem dedicated to contract management
2022	Digital TR System - module for the preparation of terms of reference
	Price research - tool to assist in conducting price research
	Electronic ineligibility - module for registering the ineligibilities of bidding
2023	Evolution of the mobile application for participation in electronic waivers
	Digital bidding documents module - functionality dedicated to the preparation of bidding documents and notices for direct contracting

Source: Developed by the authors.

During the drafting of the bill that resulted in Law No. 14.133, of 2021 (which is the new general law for public procurement and public contracts in Brazil), several practices already adopted within the federal Executive branch were replicated in the legal text. Therefore, the current status includes, for example, the adoption of an annual procurement plan, risk management maps, preliminary technical studies, and specific contract management procedures at various federative levels.

Within this context, private e-procurement platforms have similarly focused on their vertical diffusion. They have enhanced functionalities and expanded the scope of their electronic logistics solutions, in reflection of the competitive government, a mandate of entrepreneurial public management²¹. The evolutionary prognosis will be addressed at the end of this article.

²¹ OSBORNE, D.; GAEBLER, T. *Reinventing Government: how the entrepreneurial spirit is transforming the public sector*. Reading, MA: Addison-Wesley, 1992.

4.2. Horizontal Diffusion

The typical contracting model in Brazil is bidding through auctions for common goods and services, always selected based on the lowest price (“reverse auction”). The statistical exception consists of cases of bidding for works and direct contracts. Criteria based on technical aspects, artistic content, or economic return are rarely adopted by the Brazilian Administration. Table 2 summarizes contracting data via bidding through the Federal Government Procurement Platform:

Table 2. Logistic options for bidding by the Public Administration on the Federal Government Procurement Portal

Type of procedure	Quantity				Value (BRL)			
	2020	2021	2022	Total	2020	2021	2022	Total
Conventional auction	23.808	28.826	27.859	80.493	23.661.567.134,18	32.864.968.048,01	33.341.941.453,82	89.868.476.636,01
Auction through Price Registration System (SRP)"	25.567	32.776	30.818	89.161	50.131.843.902,35	72.841.446.932,77	66.773.281.205,35	189.746.572.040,47
Conventional bidding	133	116	83	332	879.513.120,69	878.002.151,74	2.849.528.789,11	4.607.044.061,54
Competition through Price Registration System (SRP)"	4	7	4	15	12.090.467,12	22.781.596,14	5.555.056,50	40.427.120,86
International competition	1	1	2	4	611.926,70	85.339,69	19.688.424,97	20.385.691,36
Contest	7	16	4	27	1.360.300,00	847.361,45	249.000,00	2.456.661,45
Bid solicitation	696	474	322	1.492	433.926.711,54	261.718.242,30	209.893.854,24	905.538.808,08
Differentiated Hiring Regime (RDC)"	1.026	1.432	1.642	4.100	3.535.824.187,66	12.048.386.540,47	5.014.736.465,40	20.598.947.193,53
TOTAL	51.242	63.648	60.734	175.624	78.656.737.750,24	118.918.236.212,57	108.214.874.249,39	305.789.848.212,20

*Data from January 2020 to November 2022. Values (BRL) refer to homologated amounts. They represent contracts from federal executive branch agencies and entities, as well as from other federative entities and other branches of government that are users of Compras.gov.br.

Source: Data extracted from the Brazilian Federal Government Procurement Portal.

Between 2019 and 2022, a staggering 96.6% of the auctions on the Federal Government Procurement Portal were conducted under the auction modality, amounting to 91.4% of the total value auctioned during that period. These numbers undeniably underscore the predominant influence that this modality holds in Brazil, shaping the discourse on the implementation of e-procurement strategies, with auctions at its core.

The introduction of electronic formats in public procurement did not occur contemporaneously and uniformly across the federal levels in Brazil. The federal government took the pioneering step by regulating electronic auctions through Decree No. 5.450 in 2005. In the following decade, electronic auctions experienced significant juridical impetus, emerging as the primary option for public procurement, especially at the federal level. This was primarily because electronic auctions reduce transaction costs for interested parties, resulting in increased competition and consequent price reductions for the Public Administration.

However, the electronic process was limited to the supplier selection stage. The planning and contract management phases remained analog. Moreover, as a general rule, electronic auctions, with a few exceptions, were not required at the state and municipal levels.

After 14 years, the aforementioned regulation was revoked by Federal Decree No. 10.024 in 2019. Its Article 1, § 3, stipulated the following:

"Art. 1, § 3: For the acquisition of goods and contracting of common services by federative entities, using Union resources resulting from voluntary transfers, such as agreements and transfer contracts, the use of the electronic auction modality or electronic dispensation shall be mandatory, except in cases where the law or specific regulations governing the transfer modality provide differently for contracts with transfer resources."

By taking the legal rules governing voluntary transfers as the driving force, it is evident that the federal government employed coercive isomorphism to proliferate the paradigm of electronic procurement in Brazil, which until then had seen scant institutionalization at the municipal and certain state levels²². Compliance with this

²² Until 2019, just over 3% of the municipalities in the state of Minas Gerais used electronic bidding (ARCCO, 2019). In August 2021, the percentage of municipalities using the federal procurement platform reached 52.75% (<https://www.gov.br/compras/pt-br/transparencia/painel-municipios>).

provision could be achieved through adherence to the federal procurement system or by using another public or private platform, provided it complied with Decree No. 10.024/19.

The timeline for compliance with the provision was established by Normative Instruction No. 206 of 2019 from the Ministry of Economy's Secretariat of Management²³. This instruction primarily adopted the municipality's population size as the determining criterion, as illustrated in Table 3.

Table 3. *Horizontal diffusion timeline of public e-procurement applied to electronic auctions in Brazil*

Requirement of using electronic auctions when there's execution of voluntary transfers from the Federal Union	
States and Federal District	Starting from October 28, 2019"
Municipalities with over 50,000 inhabitants	Starting from February 3, february
Municipalities with populations between 15,000 and 50,000 inhabitants	Starting from May 6, 2020
Municipalities above 15.000 inhabitants	Starting from partir de 1º de junho de 2020

Source: Developed by the authors, based on Normative Instruction - SEGES No. 206/19.

Throughout the fulfillment of the schedule depicted in Table 3, the Sars-Cov-2 pandemic erupted. On March 20, Brazil declared a state of public calamity through Legislative Decree No. 6 of 2020. Social isolation as a strategy to flatten the curve of coronavirus contagion hindered the holding of in-person bidding processes, at a time when the Public Administration was largely operating under the home office regime²⁴.

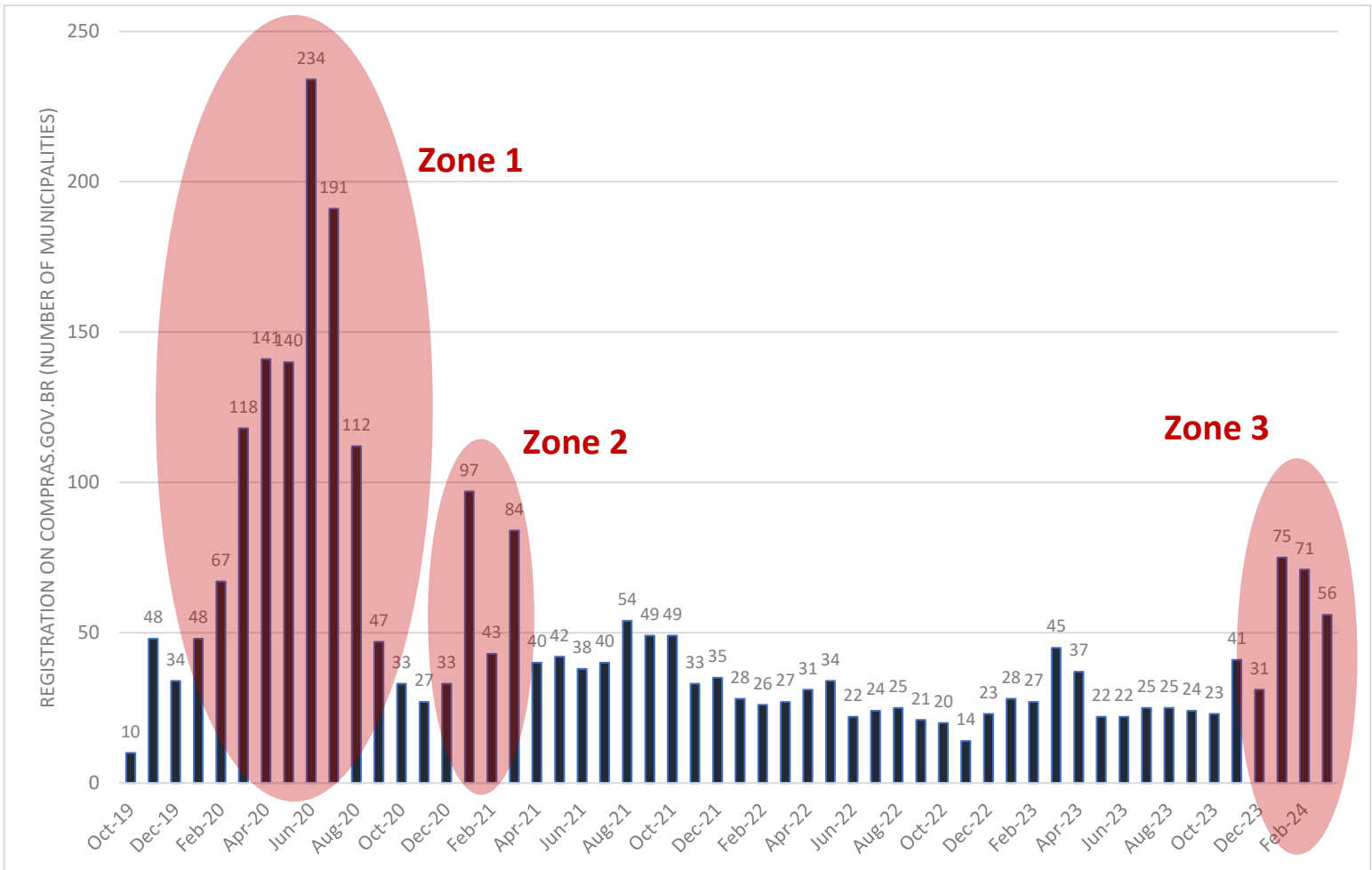
The pandemic-induced situation acted as a catalyst for compliance with the federal regulatory diffusion schedule. Between March and August 2020, 936 municipalities joined the Federal Government's Purchasing System, whereas before Federal Decree No. 10,024/19, only 1,185 municipal units were registered.

Since then, the municipal adherence rate to the Federal Government's Purchasing System has remained constant, ranging between 25 and 40 registrations per month. However, two positive fluctuations should be noted: the first, in early 2021, and the second, more recently, in early 2024. The profile of such municipal adhesions is presented in Graph 1.

²³ Available at: <https://www.gov.br/plataformamaisbrasil/pt-br/legislacao-geral/instrucoes-normativas/instrucao-normativa-no-206-de-18-de-outubro-de-2019> (access on April 1, 2024).

²⁴ FENILI, R. R. *Governança em Logística Pública no Enfrentamento à Covid-19: arcabouço legal em visão sistêmica e aplicada*. Belo Horizonte: Fórum, 2020.

Graph 1. Municipal registrations in the Federal Government's Purchasing System.



Source: adapted by the authors based in information available at: <https://www.gov.br/compras/pt-br/cidadao/painel-municipios>

Zone 1 refers to the geographical diffusion boom of e-procurement, as previously explained. Zones 2 and 3 lack study in order to accurately identify the main predictors of the depicted fluctuation. As a hypothesis, it is assumed that the approval of the New Procurement Law and the repeal of the old bidding regime in Brazil prompted a growing interest in the Federal Purchasing System – a pioneer in adapting to the new legal framework as a form of compliance with the newly established legal framework²⁵.

²⁵ One of the key points in this context is the legal requirement for the interconnection of public and private systems with the National Public Procurement Portal (PNCP), a single web location for the entire federation, aimed at, among other things, providing publicity for essential acts as prescribed by law (www.pncp.gov.br). The integration with the PNCP is done via data APIs, and it is not a trivial task, so the search for a system already integrated with the Portal - such as compras.gov.br - proved to be significant.

Zone 2 refers to the period leading up to the publication of the New Procurement Law – which was approved by the National Congress at the end of 2020. Zone 3, on the other hand, refers to the subsequent period after the repeal of the previous bidding regime, when only Law No. 14,133 of 2021 became effective for the direct, autarchic, and foundational public administration.

5. Proposition of a theoretical model

Based on the exposition of the previous section, a theoretical model dedicated to identifying the main predictors of the implementation of public e-procurement in Brazil is proposed in Figure 2.

The vertical and horizontal diffusions are considered as mediating variables, following BARON and KENNY's conception²⁶, so they account for the relationship between the predictor and dependent variables²⁷.

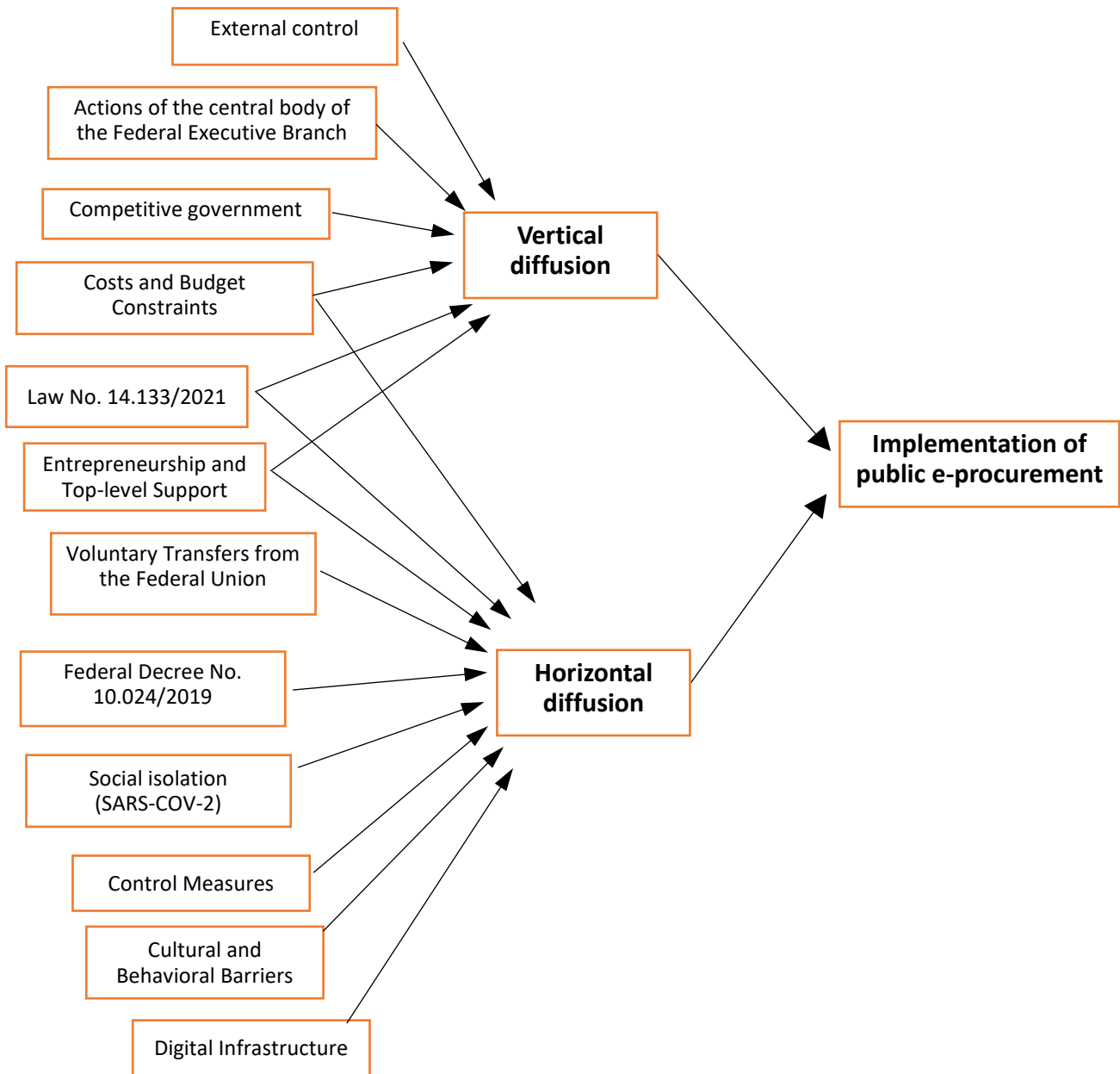
It is noteworthy that the size of the institution should be considered when applying the model in practice. According to HOLLANDERS et al.²⁸, the innovation trend in service grows linearly with the size of public institutions, so the variable requires testing as a relational moderator.

Figure 2. *Theoretical Model for Implementing Public e-Procurement in Brazil (post-2019)*

²⁶ BARON, R. M.; KENNY, D. A. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 1986.

²⁷ In the research agenda, for the purpose of validating the model, it is necessary to test the effective role of horizontal and vertical diffusions as mediators, as well as potentially moderating the relationship between independent and dependent variables.

²⁸ HOLLANDERS, H.; ARUNDEL, A.; BULIGESCU, B.; PETER, V; ROMAN, L.; SIMMONDS, P. *European Public Sector Innovation Scoreboard 2013: a pilot exercise*. European Union Publications Office, 2013.



Source: Developed by the authors.

The variables are analytically described in Table 4.

Table 4. Variables of the Theoretical Model

Variable	Associated Mediating Variable	Description
v1 – external control	Vertical diffusion	Action, especially led by the Federal Court of Accounts, since 2015, in terms of recommendations for the advancement of public procurement governance, encompassing the optimization of the Federal Government Procurement System.
v2 – actions of the central body of the Federal Executive Branch		Projects aimed at advancing the Federal Government Procurement System, with the Federal Executive Management Secretariat as the business area.

v3 – competitive government		Trend of competitiveness between public and private platforms focused on electronic procurement, aiming for the best offer of functionalities and an increase in market share.
v4 – costs and budget constraints	Vertical and horizontal diffusion	Applicable to government agencies when developing ICT functionalities applied to the public procurement process. It concerns financial and time costs of development, as well as the restriction of resources in a broad sense: development squads, requirement analysts, unavailability of the business area, operational capacity, etc. The variable also encompasses constraints on procurement sector resources, especially turnover and its effects on skills gaps.
v5 – Law No. 14.133/2021		Principles of digital government outlined in the New Law on Bidding and Contracts, involving, in a systemic manner, the public procurement process.
v6 – entrepreneurship and top-level support		Entrepreneurial behavior and organizational leadership support for process innovation aimed at strengthening the paradigm of electronic public procurement. This is a variable with political and cultural relevance.
v7 – voluntary transfers from the Federal Union	Horizontal diffusion	Possibility of using voluntary transfers as a mechanism of coercive isomorphism by the Federal Union.
v8 – Federal Decree No. 10.024/2019		Infra-legal norm that has currently been repealed relied on an imperative rule for states, municipalities, and the Federal District to adopt electronic bidding for the execution of agreements.
v9 – social isolation (Sars-Cov-2)		Social isolation imposed by the pandemic, hindering in-person bidding processes.
v10 – control measures		Internal and external control actions aimed at thoroughly verifying compliance with current regulations.
v11 – cultural and behavioral barriers		It refers to cultural traits such as risk aversion, personalism in dealing with the local market, few incentives for innovation, etc. ²⁹
v12 – digital infrastructure		Local and regional availability of satisfactory internet access, as well as hardware for the Public Administration and the market.

Source: Developed by the authors.

6. Final Remarks and the Forecast of the Evolution of Public E-Procurement in Brazil

The theoretical model represented in Figure 2, dedicated to the implementation of e-procurement by the Brazilian Public Administration, reveals factors common to similar research conducted on the adoption of this paradigm. Various social influences, expectations of improved performance, support from top management, transformational

²⁹ MULGAN and ALBURY (2013) identify seven factors that can act as barriers to innovation in the public sector, which relate to item v12, namely: pressures for delivery and administrative burdens; short-term budgets and planning; few rewards and incentives for innovation; risk-averse culture; low skills in risk and change management; reluctance to phase out inefficient solutions, and attachment to technologies that constrain cultural arrangements.

leadership, internet availability, competitive pressure, among others, are portrayed in studies conducted in emerging countries in Africa and Asia, in recent times³⁰.

The relevance of the model presented here refers not only to the uniqueness of the Brazilian case but also to the greater detail, in terms of analysis, of the predictive variables. The mechanism of clarified coercive isomorphism, specific legal and infra-legal acts, the enforcement action of federal external control, the role of the central logistics body of the Executive Branch and other elements give particular concreteness to the portrayed model.

As a prognosis in the medium and long term for e-procurement in Brazil, increasing trends are envisioned in both vertical and horizontal diffusion.

Private e-procurement platforms aimed at public sector clients have, in recent times, evolved their dedicated systems. In this context, a characteristic trait stands out: although the ICT system is private, the business rules related to the contracting process are public, based on infra-legal regulations issued by bodies and entities. After the enactment of Law No. 14,133, of 2021, these infra-legal regulations did not exist, so private portals remained inert, in expectation. Currently, the rules are externalized, making accelerated development possible by the private sector.

In this path of technological evolution of public e-procurement in Brazil, two vectors that compose the disruption forecast in the medium and long term are identified:

- (i) The development of public procurement marketplaces.
- (ii) The use of artificial intelligence tools throughout the public procurement process.

Regarding the development of marketplaces, current initiatives, still in the status of projects under discussion or execution, focus on accreditation in fluid markets, starting from the understanding that marketplaces have dynamic pricing.

In this context, some questions arise, such as: compliance with mechanisms to promote the hiring of micro and small businesses and their adaptation to the virtual environment of e-marketplaces, the necessary means to ensure purchases of quality products within e-marketplaces, mechanisms aimed at enabling the penalization of contractors who have not performed well in their contracts and the role of marketplaces

³⁰ A comprehensive analytical compilation of research can be found in: MUSA, U.; JAAFAR, M.; RASLIM, F. M. E-procurement adoption in Nigeria: perceptions from the public sector employees. Arab Gulf Journal of Scientific Research, DOI: 10.1108/AGJSR-10-2022-0224, 2023.

in this context, and the possibility of avoiding the so-called "exorbitant clauses" in purchases made through e-marketplaces.³¹⁻³²⁻³³

As for the use of artificial intelligence, four main aspects to be improved in the short and medium term are identified, as shown in Table 5.

Table 4. Trends in the use of artificial intelligence in public procurement in Brazil.

Optimization of Control Actions	Use of AI for Document Analysis in the Procurement Process, Identifying Signs of Deviation, Illegalities, and Fraud ³⁴ .
Optimization of Solution Identification	Applicable for use during the preparation of preliminary technical studies, facilitating the exploration of better solutions and contractual models.
Optimization of Document Preparation	Utilization of AI in the drafting of preliminary studies, terms of reference, price surveys, draft bidding documents, etc."
Learning Support Artifact	Employment of AI in legal, sub-legal, and jurisprudential consultation, revealing trends

Finally, and in light of the analyzed panorama, a tripartite research agenda is proposed:

- (i) Conducting qualitative research to refine the proposed model: within this scope, multi-case studies are proposed, segmented into clusters divided by federative level, so that the infra-legal regulatory framework can be taken as a control variable;

³¹ Regarding the issue of exorbitant clauses in public procurement through e-marketplaces, see: MIGUEL, Luiz Felipe Hadlich. *Compras públicas inteligentes: e-marketplace público e o fim das cláusulas exorbitantes*. Rio de Janeiro: Lumen Juris, 2024.

³² In Brazil, for historical reasons, one of the central characteristics of public contracts in general is the provision of exorbitant clauses, which grant the government entity the ability to make certain unilateral changes to the contracts, which are mandatory for the contractor (within certain limits). However, the mandatory nature of exorbitant clauses, at least in certain types of less complex public procurement, has been heavily questioned, as they may increase the transaction costs for contractors without providing effective advantages to the government. This is precisely the issue at stake in the context of public procurement via e-marketplaces.

³³ The difficulties in implementing e-marketplaces in public procurement are not exclusive to Brazil. Regarding the subject in the context of the United States, please see: YUKINS, Christopher; YOUNG, Abraham; ITTIG, Kristen; VALLE, Eric. GSA's Commercial Marketplaces Initiative: Opening Amazon and Other Private Marketplaces To Direct Purchases By Government Users, Briefing Papers (Thomson Reuters), No. 20-13 (Dec. 2020).

³⁴ A success case in this regard is the Bidding and Tender Analysis System - ALICE, already in use in Brazil since 2017.

(ii) Conducting quantitative research to validate the proposed model, including the construction and validation of a scale for the implementation of public e-procurement in Brazil;

(iii) Bibliometric survey on the predictive variables of the implementation of electronic public procurement, especially in emerging economies, establishing a comparative framework.

These research endeavors, outlined in three specific lines, are still to be developed and should allow for a more objective visualization of the evolution of the use of artificial intelligence mechanisms in the context of public procurement in Brazil.

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