

Enhancing Good Governance and Combating Corruption in Brazil: Assessing the Feasibility, Potential, and Limitations of New Technologies

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Abstract

This paper explores the multifaceted corruption issue and its impact on society, governance, and public administration. It discusses strategies such as compliance programs and governance to combat corruption. Additionally, it examines the role of law, good governance, and technology in addressing corruption. The paper also focuses on the potential of technologies like AI, Data Analytics, and Blockchain to fight corruption effectively. It emphasizes the need for ethical considerations, data privacy, and interdisciplinary efforts in leveraging technology for transparent and accountable governance. Through these discussions, the paper highlights the challenges and opportunities associated with implementing technologies for combating corruption in public administration, aiming to build a more just, transparent, and participatory society. The method is deductive and the methodology involves a comprehensive literature and document review.

Keywords

Artificial Intelligence, Good Governance, Corruption, New Technologies, Transparency

1. Introduction

Pursuing robust governance in the fight against corruption is an undeniable ne-

cessity, given the escalating erosion of trust in public institutions and the debilitating effects of corruption on the social fabric. This challenge is notably intricate, given the intricate connections between corruption and the weakening of democracy and the detrimental impacts on public policies, underscoring its magnitude. In light of this panorama, the formulation of effective strategies to combat corruption and promote sound governance undoubtedly requires a systemic and collaborative approach that transcends purely technocratic solutions.

However, achieving truly effective governance is fraught with substantial challenges. Addressing corruption goes beyond the mere enactment of stringent laws; it necessitates the construction of an ingrained culture of transparency and accountability that permeates all layers of society (Fortini & Shermam, 2017).

Establishing genuinely effective governance demands continuous collaboration among government leaders, engaged citizens, and civil organizations to conceive policies that genuinely address the population's needs. The fight against corruption, therefore, demands innovative, flexible approaches, and keen critical insight that guides the transformation towards a just and transparent society.

Embracing new technologies plays a pivotal role in the battle against corruption in the Brazilian context, providing invaluable tools for detecting, preventing, and punishing illicit practices.

Brazil's corruption situation remains a significant concern, with the country scoring 38 points out of 100 on the 2022 Corruption Perceptions Index reported by Transparency International (Trading Economics, 2023). This score has remained unchanged since 2020 (Trading Economics, 2023; Transparency International, 2022). Brazil is ranked as the 94th least corrupt nation out of 180 countries (Trading Economics, 2023). The country's corruption ranking has experienced fluctuations over the years, reaching an all-time high of 106th place in 2019 and a record low of 36th place in 1997 (Trading Economics, 2023). The Brazilian government has faced challenges in addressing corruption, including political interference in law enforcement agencies (Reuters, 2022). This interference has severely affected anti-graft efforts and contributed to Brazil's decline in its global corruption positioning (Reuters, 2022). Despite these setbacks, Brazil has strengthened its anti-corruption and anti-money laundering frameworks (Statista, 2023).

Brazil's corruption situation has been influenced by various factors, such as the country's legal and institutional anti-corruption framework, the independence of its judiciary, and the role of civil society and media (Reuters, 2022). The country has experienced some positive developments, including the continued independence of the Supreme Court and Superior Electoral Court, despite public criticism from President Jair Bolsonaro (The Brazilian Report, 2022).

In conclusion, Brazil's corruption ranking remains a concern, with the country facing challenges in addressing corruption and promoting good governance. To improve its corruption situation, Brazil must continue to strengthen its legal and institutional framework and support the role of civil society and media in

promoting transparency and accountability.

The corrosion caused by corruption in the foundations of Brazilian society is deep-seated, undermining trust in institutions, hindering economic and social progress, and eroding democratic principles. Adopting innovative approaches that expand the sphere of control, transparency, and accountability is crucial to address this persistent challenge.

The integration of new technologies, such as Data Analytics and Artificial Intelligence, enhances the effectiveness of these institutions, enabling the precise analysis of vast volumes of data to identify suspicious patterns and atypical behaviors, thereby expediting investigative processes. In this context, Blockchain technology emerges as a promising tool to ensure the integrity and transparency of transactions and records, hindering data and information manipulation possibilities. The provision of public data through Open Data platforms and the promotion of governmental transparency amplify civil society's oversight and strengthen control over public expenditures. These measures deter corrupt practices and hold public agents accountable for their actions.

Utilizing these technologies demands a multidisciplinary and ethically committed approach, encompassing crucial principles such as privacy and respect for individual rights. Furthermore, effectively implementing these innovations requires solid collaboration among diverse segments of civil society and public institutions. Investments in digital infrastructure, training of public servants, and active engagement are indispensable elements to realize the maximum potential of new technologies in combating corruption.

The hypothesis of this paper is that the strategic implementation of modern technologies, such as AI, Data Analytics, and Blockchain, within the context of public administration can significantly enhance the effectiveness of anti-corruption efforts. When applied with a solid ethical framework, these technologies can provide the tools to detect, prevent, and address corrupt practices more efficiently. However, while technology presents immense potential, it also introduces privacy, data security, and appropriate training and governance challenges. Through careful integration and interdisciplinary collaboration, technology can be harnessed to foster transparency, accountability, and integrity in governance, ultimately reducing corruption and building a more just and participatory society.

What are the challenges, potentialities, and shortcomings associated with implementing new technologies, specifically AI, to enhance good governance and combat corruption in Brazil? The method employed is deductive and involves a comprehensive review of literature and documents.

The first section addresses the complexity of corruption, its relationship with good governance, and how governance practices and tools can be employed to combat this issue. It explores the importance of transparency, accountability, and strengthening the rule of law, as well as the interaction between governance and society as a whole. Additionally, it highlights the need for effective technologies and control systems to prevent and punish illicit acts.

The second section explores how new technologies, such as Data Analytics, Artificial Intelligence, Blockchain, and Data Transparency, can be ethically and multidisciplinary utilized to combat corruption in Brazil, involving collaboration between societal sectors and public institutions.

The third section encompasses the ethical and rational aspects of technologies and the specific challenges faced in areas such as AI, Data Analytics, Blockchain, Open Data, and Public Expenditure Monitoring Platforms. It also underscores the importance of collaboration among involved stakeholders to promote a more fair and transparent society.

2. Fostering Effective Governance in the Fight against Corruption

Corruption constitutes a multifaceted issue and problem that afflicts and interferes with various societies worldwide, undermining trust in institutions, public oversight and regulatory bodies in general, and thus potentially compromising services offered to all. This can also impact social and economic development by distorting necessary public policies in the face of identified or presented deficiencies by the population.

According to [Barros and Coelho \(2019\)](#), corruption in Public Administration needs to be adequately addressed through various mechanisms and mitigation strategies, ranging from compliance stimulation programs to other techniques and modes of operation for good corporate and participatory governance. The indispensability of protecting and ensuring the rights and guarantees of all citizens is emphasized, with public institutions required to comply with current norms and possible acts contrary to the law, performed by public officials in the course of their duties, being nullified and judged for proper punishment within applicable instances and scopes.

The fight against administrative misconduct and, consequently, corruption, gained further momentum and acquired legal normative support with the publication of Law No. 12.846/2013. This law pertains to legal entities' civil and administrative accountability in case of potential practice and identification of acts against the public administration, whether domestic or foreign, thus contributing to combating corruption on a larger scale ([Brasil, 2013](#)).

In this context, the prevailing legal regulations in the national legal system must be followed and executed, especially concerning acts considered intrinsic elements of good governance. This also involves the governance and implementation of new forms of oversight and application of guiding principles, protective rights, and guarantees for all. The mere breach of the normative and social structure by illicit acts can generate consequences at different levels for the general population ([Brasil, 2020](#)).

According to [Petermann and Sousa \(2017\)](#), it is possible to understand that: "Confluence is necessary between rulers (States), citizens, and organizations (organized civil society) in order to build consensus that makes it possible to formulate policies that respond equitably to what society expects from those who

govern. Thus, in a nutshell, governance can be defined as a process used to achieve results through policies and actions on a national or international scale, without the indispensability of state participation” (Petermann & Sousa, 2017: p. 30).

Governance, for conceptual purposes, can be considered the combination of institutional and instrumental elements of states, such as existing decision-making processes, formulation of public policies, arrangements, and flows of intra-governmental information, as well as forms of global institutional relationships between governments and their legal citizens (Faria, 2011).

Furthermore, according to Petermann and Sousa (2017), governance can also be related to aspects of the state apparatus, such as its control and functioning mechanisms, incorporated through instrumental forms in matters and areas of finance, administration, and government power. In essence, it encompasses the various modes of exercising power by the administration over different economic or social resources of a certain territory or country, with the primary objective of development. This also includes combating illicit practices linked to corruption.

In this context, Bugarin (2022) highlights that good governance aligns with combating corruption under the understanding that: “The pursuit of maximum administrative integrity is possible, and the ongoing fight against corruption and fraud in the public sector qualifies as fundamental elements for the consolidation of an effective Democratic Rule of Law in our country. The mechanism of public compliance is inserted as one of the essential instruments for its achievement, in the broad context of so-called integrity programs” (Bugarin, 2022: pp. 2-3).

Nevertheless, as Coutinho and Faria (2016) point out, governance is intertwined with general aspects of planning, implementation, and formulation of new policies and norms to fulfill general and specific functions for the population. For instance, in areas such as health, education, finance, administration, among others, this demonstrates that the breakdown or interruption of the mechanisms governing a society with common goals can be detrimental in various dimensions.

According to the United Nations Office on Drugs and Crime (2022), good governance possesses critical dimensions that can effectively contribute to detecting, preventing, and punishing illicit acts and practices. This can be achieved by opening pathways and incentives for using new theoretical-practical and technological tools that offer diverse and potential insights. These insights can contribute to the formulation of studies, strategies, and policies to strengthen legal investigations for combating corruption.

The conceptual complexity of good governance propels and establishes dynamic multidimensionality regarding the ways in which administrative and political institutions can operate. This must respect their different structures and modes of operation, guided by the constitutional norms, guidelines, and principles governing Public Administration. These include principles like legality,

impartiality, morality, publicity, and efficiency. Each of these principles branches out to other principles such as transparency, reasonableness, probity, among others (Faria, 2011; Brasil, 2020).

The strengthening of democratic institutions, the promotion of greater political stability, and sustainable development find a place in good governance. However, corruption within institutions and public administrative bodies poses a kind of nemesis to progress and positive outcomes. Thus, it can be inferred that there is no possibility of a positive relationship between good governance and corruption. Hence, the continuous discussion of this issue and the development of new tools that can be considered true allies in combating corruption is crucial (Brasil, 2020; Rondônia, 2023).

Reducing corruption levels, considering different social and political contexts and realities, can be better understood and applied through contributions and improvements in governance practices. In a scenario of poor governance, the trend favors illicit practices with greater ease, lacking proper accountability, disrespecting the Rule of Law, transparency, legality, and other essential elements for societal life and the proper functioning of public institutions. This also involves four essential steps, according to Bugarin (2022: p. 5): “[...] identifying, analyzing, preventing, and correcting situations of non-compliance that may generate legal, operational, and moral risks for the public entity.”

Transparency plays an essential role in the fight against corruption within institutions. This requires instruments with greater capacity to aid in oversight and control of administrative actions in the public sphere. By providing more accessible and clear information to the public, pathways are opened for societal scrutiny, thereby hindering corrupt acts and potentially increasing the likelihood of reports and investigations by relevant authorities.

As for responsibility, good governance in combating corruption is also characterized by ensuring that public resources are used while respecting ethical and efficiency principles. This serves to ensure that public officials are duly held accountable for all their actions, especially those that do not follow existing norms (Bugarin, 2022; Rondônia, 2023).

The existence and development of new forms, tools, and internal and external control systems, particularly the execution of independent audits by audit courts and other organs, can also be considered a means of combating corruption within institutional and governmental spaces. This is because the accountability of managers and public agents for corrupt acts is made possible (Brasil, 2018b).

In the midst of this, the Rule of Law also warrants discussion and analysis, being a fundamental aspect of good governance in combating corruption and the means applied. Proper application of theoretical-practical tools and societal and technological advancements can result in better, impartial, and equitable justice, not applying any premise, concept, advantage, or favoritism to the investigated. This thus shrinks spaces for corruption to flourish.

It is plausible that a solid governmental system bears resemblance to the establishment of responsibilities and greater transparency in the face of situations

and risk environments to legal, social, and economic assets of society. By encouraging better contexts for everyone, it becomes possible to eliminate tolerance for corruption. In this context, corruption may find fertile ground where there is a lack of accountability, opacity in decision-making processes, and in the operations of each institution responsible for combating and consequently punishing corrupt and illicit practices.

3. New Technologies for Combating Corruption and the Use of Artificial Intelligence

Brazil's Anti-Corruption Law (Law No. 12, 846) was enacted on August 1, 2013 (Brasil, 2013), in response to international commitments, such as the Organization of American States (OAS) Convention against Corruption, the Organization for Economic Co-operation and Development Convention on Combating Bribery of Foreign Public Officials in International Business Transactions, and the United Nations Convention against Corruption. The law was first regulated at the federal level by Decree No. 8420 in 2015 and later by Federal Decree No. 11, 129 in 2022. The Anti-Corruption Law establishes judicial and administrative sanctions for legal entities involved in acts of corruption, fraud in public tenders, and other related offenses (Buaiz Neto et al., 2023).

Brazil's legal framework for combating corruption includes the Brazilian Criminal Code, which imposes penalties of fines and up to 12 years of imprisonment for individuals who commit acts of corruption. The Brazilian Anti-Bribery Law holds legal entities accountable for bribery and related offenses. The country has also implemented non-criminal proceedings to fight corruption and recover assets, such as the Administrative Liability Proceeding (PAR) and leniency agreements (Global Compliance News, n.d.).

As previously discussed, the effects of corruption are deeply harmful to Brazilian society in various aspects, as they can erode trust in public institutions and agents, undermine the values and principles of democracy, and hinder social and economic development within the Brazilian territory. To combat the perpetuation of corruption in Brazilian society, introducing and utilizing new means and tools that ensure better functioning, oversight, and control are essential.

It is imperative to underscore the system designed to promote good governance and combat corruption within the Brazilian context. This system relies on procedures and mechanisms grounded in transparency and accountability within the sphere of Public Administration, including risk management and establishing audit mechanisms. These components must not be implemented in isolation, as such an approach carries the inherent risk of failing to achieve the intended efficacy.

Within this framework, it is of paramount importance, as asserted by Fortini and Shermam (2017), to elucidate that, when addressing public governance within Brazilian state-owned enterprises, wherein the State occupies the role of proprietor and administrative leaders and public agents hold key positions, the anti-corruption endeavor is underpinned by principles influenced by the Guide-

lines on Corporate Governance of State-Owned Enterprises. These principles are particularly enshrined in Law No. 13, 303/2016, commonly referred to as the Brazilian State-Owned Enterprises Law. This legislative framework also serves the dual purpose of safeguarding integrity and actively addressing the issues of corruption and fraud. Administrators are responsible for participating in events, undergoing training, and divulging information pertaining to their activities, all of which are undertaken to ensure transparency and internal control.

Public governance in Brazil must adhere to foundational tenets, such as the non-negotiability of the public interest, the obligatory nature of accountability, the imperative of moral conduct, efficiency, rationale and substantiated actions, and the principle of impersonality. The latter principle is instrumental in averting conflicts of interest, among other salient considerations.

In light of these considerations, it is pertinent to underscore the document officially promulgated by the Brazilian Federal Court of Accounts (TCU), entitled the Basic Governance Framework Applicable to Public Administration Bodies and Entities. This framework prescribes a suite of procedures encompassing decision-making, analytical processes, monitoring mechanisms, accountability practices, communication protocols, leadership modalities, and control mechanisms. These components collectively aim to enhance the management of internal conflicts, strategically mitigate risks, conduct internal and external audits, and promote transparency and accountability (Brasil, 2014).

The primary instrument underscored by the official document of the Brazilian Federal Court of Accounts in the battle against corruption is the auditing process, complemented by analysis and strategic risk management practices. This strategic approach is indispensable for identifying the origins and systemic deficiencies that facilitate illicit and corrupt activities, which can, in turn, erode public trust in the sphere of Public Administration (Brasil, 2014; Fortini & Shermam, 2017).

As effective strategies and tools for the detection, prevention, and punishment of illicit acts by public agents and managers, the strengthening of Control and Oversight institutions such as Courts of Auditors, the Comptroller General's Office, the Public Prosecutor's Office, among others, can be highlighted. These institutions are crucial as they operate independently, conducting investigations, making accusations, and imposing penalties, all in accordance with current laws, in a transparent and impartial manner (Soares, 2020).

The actions of control and oversight institutions like the Comptroller General's Office, the Public Prosecutor's Office, and Courts of Auditors in general can be enhanced through the implementation of programs, techniques, and strategies that leverage new technologies. This aligns with the changing modes of operation at a global level (Soares, 2020; Murillo et al., 2023).

Given the perspective brought about by globalization, new technologies should be used in ways that optimize processes and tasks performed by individuals. However, they should not replace them entirely or ignore pre-established

premises, codes, customs, or laws.

In **Table 1**, some technological advancements, tools, and new technologies for prevention, investigation, and punishment of corruption are described.

The aforementioned potential tools, aligned with technological advancements aimed at combating corruption in the Brazilian territory, demand a discussion regarding these innovations in terms of a multidisciplinary and collaborative approach to ensure respect for ethical principles and privacy, which are broadly highlighted as fundamental rights for every citizen in the 1988 Federal Constitution.

However, for these technologies to reach their maximum potential, joint actions are required among various sectors of civil society and public administration institutions, involving active engagement and the creation of environments and contexts that incentivize the promotion of a culture of integrity and transparency (Murillo et al., 2023).

In this regard, it is important to provide the necessary incentives for adopting new technologies and increased investments in the existing digital infrastructure of institutions and public agencies. This should also encompass the implementation of training programs for public servants. It's crucial not to overlook the significance of greater dialogue with civil society and organizations to promote transparency, responsibility, and integrity (Murillo et al., 2023).

Continuing the discussions about potential tools and new technologies for combating corruption, Data Analytics and Data Mining can be highlighted for their potential in data and information processing. This is particularly important in internal and external independent audit services conducted by control and oversight bodies such as the Office of the Comptroller General and the Courts of Audit (Campos, 2018; Souza, 2020).

Large volumes of data from various sources are analyzed, facilitating the identification of suspicious and hidden patterns that may be related to actions previously considered lawful. This enables the early detection of illicit activities and paves the way for more efficient investigations with more precise results, all based on applicable legal provisions and norms (Campos, 2018).

According to the Federal Audit Court (Brasil, 2018b), Data Analytics, along with other proactive fraud detection and consequently corruption control methods, “[...] once implemented, automatically detect occurrences based on mapped indicators. There are also proactive controls that require managers to promote them periodically. To achieve this, organizations can employ data analysis techniques and other technological tools to detect fraudulent activities. This set of techniques is known as data mining, data matching, and data analysis. Data analysis makes it possible to identify anomalies and trends within large transactional databases after cleansing and modeling raw data. The difference between this technique and continuous monitoring based on indicators is that in the latter, the manager needs to know and implement the indicators, whereas with the use of data analysis techniques, the technique itself identifies what

Table 1. Technological advancements, tools, and new technologies used to preventing, investigation, and punishment of corruption.

Data Analytics and Data Mining (technique)	Those technologies enable the analysis and identification of anomalies and the recognition of patterns within large volumes of data. This technique is widely employed in investigation processes conducted during both internal and external audits. It also facilitates the detection of fund misappropriation, financial irregularities, and suspicious transactions.
Artificial Intelligence (AI) and Machine Learning (ML)	AI operates by learning from actions, behaviors, and assumptions presented and utilized by users of specific services, devices, or developers. As such, it effectively identifies patterns used in illicit activities, such as embezzlement of public funds, suspicious transactions, and financial irregularities. This involves algorithms for analyzing behavioral patterns, along with the potential utilization of chatbots, also known as virtual assistants, to facilitate anonymous reporting in cases of corruption. Machine learning (ML) is a subset of artificial intelligence that gives systems the ability to learn and optimize processes without having to be consistently programmed.
Blockchain	This tool ensures immutability and transparency in transaction records, which can be utilized in tracking the use of public resources and accounting records. Similarly, it helps ensure the integrity of contracts, bids, and prevents the manipulation of data and information.
Open Data and Transparency	These tools serve to enable the provision of public data to the population, thereby ensuring governmental transparency and social control over public expenditures and actions. This makes it more difficult to conceal practices related to corruption.
Public Expenditure Monitoring Platforms	These platforms encompass digital tools that facilitate the stages of data recording and its publication, whether publicly or privately, enabling the continuous monitoring of public expenditures. This enhances the identification of misappropriation of public funds, deviations, and fraud, while also increasing the accountability of managers and public officials for illicit practices.

Source: Compiled by the authors, based on Campos (2018), Souza (2020), Dantas and Martins (2022), and Murillo et al. (2023).

would be the indicators, in other words, it indicates anomalous and suspicious behavior” (Brasil, 2018b: pp. 67-68).

As potential areas for the use of Data Analytics and Data Mining, there are public procurement, contracts, income declarations, financial transactions, government purchases, among others, analyzing discrepancies, atypical behaviors,

and automatically providing alerts in possible cases of corruption (Brasil, 2018a; Campos, 2018).

Data Mining can also be used for the detection and prevention of corrupt acts as it can identify their networks, structures, organizations, and modes of operation, thus aiding in concentrating efforts, resources, and more targeted actions against a problem that afflicts Brazilian society and exacerbates the needs of the population in various aspects and spaces (Brasil, 2018a; Campos, 2018; Souza, 2020).

The possibility of explaining and providing transparency in data and algorithms offered by Data Analytics is fundamental. It is important that possible decision-making based on the analysis of this new AI technology is presented in a clear, justifiable, correct, legal, and understandable manner to avoid any hasty or mistaken conclusions. This is especially relevant in the detailed analysis of data, resources, modes of operation, and the execution of public contracts or tenders (Brasil, 2018a; Campos, 2018; Murillo et al., 2023).

According to a document published by the Ministry of Science, Technology, and Innovation, Artificial Intelligence, concerning the promotion of good governance, aligns as a mechanism to prevent biases in decision-making, in the means, systems, and processes of accountability, in the organization of government bodies and entities for an operation based on legal principles, as well as in encouraging awareness among public agents and managers about the need to combat corruption (Brasil, 2021).

From the same document, it is also possible to highlight the need to create an ecosystem and incentive platform for users to participate, generate, and share data and information related to actions linked to government actions, that is, to the acts of the Public Administration, aiming at transparency and public accountability, in accordance with the precautionary principle, taking into account modern data protection laws such as the General Data Protection Law (LGPD), in force in Brazil since 2018 (Brasil, 2021).

It is worth mentioning that data protection during processing carried out by AI-based programs is essential and guaranteed by legal principles in force in Brazil, such as privacy, human dignity, security, purpose, adequacy, necessity, free access, transparency, prevention, non-discrimination, accountability, and provision, especially as outlined in both the Federal Constitution of 1988 and the LGPD (Brasil, 1988; Brasil, 2018a).

As an example of AI usage in the fight against corruption in the Brazilian territory by public agencies, especially those involved in conducting audits and other mechanisms to promote greater transparency, the Federal Court of Accounts (TCU) uses “Alice,” which analyzes Bids and Notices that are duly published in Official Gazettes, potentially identifying possible signs of fraud. Another tool, “Sofia,” is assigned to the System of Guidance on Facts and Evidence for the Auditor, capable of assisting the auditor in the processes and stages of Internal and External Auditing to detect possible inconsistencies in the information provided by the parties involved, which may indicate errors or lack of validity of

specific documents and data (Brasil, 2021).

In 2016, “Alice” was used by TCU auditors, specifically, to identify irregular contracts in the state of Goiás, resulting in the suspension of two bids. In Roraima, the same public agency, through the aforementioned AI, revealed inconsistencies and irregularities in bids for renovations of the Ministry of Foreign Affairs, which were to be funded with public resources from the National Institute of Historic and Artistic Heritage (Gomes, 2018; Costa & Bastos, 2020).

TCU also employs an AI called “Monica” in the area of Integrated Monitoring for Procurement Control, especially concerning public purchases made at the federal level, whether by the Executive, Legislative, or Judicial branches, analyzing the conducted auctions and quickly searching for information about the items acquired, aiming to preserve the public interest, prevent overspending, and detect fraud (Brasil, 2021).

The Office of the Comptroller General of the Union also has a system with AI-based functionality, which enables the visualization of potential risks, corruption, and issues in contracts and suppliers, as well as another system capable of presenting indications of deviations in the performance of its employees. Thus, AI also serves as an important tool for good governance and the fight against corruption in government agencies (Costa & Bastos, 2020; Brasil, 2021).

In this regard, training professionals are again necessary, considering the importance of clear, objective, legal, ethical, and fair results and conclusions using data. As stated by Campos (2018), Data Analytics can be understood as: “[...] the science of examining raw data to find patterns and draw conclusions about this information, applying an algorithmic or mechanical process to obtain insights. Data analysis techniques can reveal trends and metrics that would otherwise be lost in the mass of information. This information can be used to optimize processes or to increase the overall efficiency of a business or system” (Campos, 2018: p. 32).

According to the above-mentioned author, Data Analytics relates to analyzing the algorithmic process of obtaining information, possessing its techniques and modes of analyzing collected data that could be lost in a large volume of information, thereby optimizing business efficiency and analysis.

The advantages of new technologies like Data Analytics and Artificial Intelligence in combating corruption and promoting sound governance are multifaceted. They excel in early detection of illicit activities, analyzing vast data sources to uncover suspicious patterns and actions previously deemed lawful, expediting investigations, and enhancing precision in combating corruption. Moreover, they enhance transparency and accountability in government processes, ensuring decisions align with legal principles and fostering ethical conduct among public agents and managers. These technologies prioritize data protection, aligning with established legal principles like privacy and transparency. Public agencies such as the Federal Court of Accounts (TCU) benefit significantly from AI tools, streamlining auditing processes and effectively detecting irregular contracts and inconsistencies. AI also offers preventive measures by identifying

corrupt networks and modes of operation, mitigating corruption's societal impact. Data Analytics empowers data-driven decision-making and operational efficiency. Collaborative efforts and comprehensive training programs are essential for the responsible and effective utilization of these transformative technologies.

4. Challenges and Opportunities in the Implementation of Technologies for Combating Corruption in Public Administration

The technologies employed across various areas and services by the Public Administration in the execution of its functions, responsibilities, and obligations to the population need to be seen and implemented in a broader sense. However, analyzing possible positives, negatives, and challenges in these paths and applications is also necessary.

Silva (2020) addresses certain issues that accompany the use of Artificial Intelligence in the Judiciary and other areas, such as Public Administration, highlighting that: “[...] one must not think that new technologies will offer only benefits, but they will also have negative consequences, like any other recent human invention, which must be observed. Even though technology has presented new methods of legal operation, it cannot be claimed to be a quick and neutral solution. The idea of rationality and neutrality in AI stems from its understanding in computer science” (*Silva, 2022: pp. 100-101*).

Regarding Data Analytics and Data Mining in the context of combating corruption, it is important to emphasize specific challenges, such as collecting and processing personal data, where the protection of the right to privacy is necessary. This is supported by the General Data Protection Law (Law No. 13, 709/2018), ensuring that the treatment and transmission of information are done ethically and legally, safeguarding the individual rights of those involved.

Another challenge and need are the continuous training of teams of agents, and public servants engaged in combating corruption using new technologies. For instance, auditors and analysts must be trained to interpret data correctly to avoid unnecessary and detrimental errors or misconceptions during investigations and prevention efforts.

For *Campos (2018)* and *Souza (2020)*, AI poses specific challenges and deficiencies, similar to those presented regarding Data Analytics, specifically the possibility that the data being analyzed might contain inconsistencies within factual contexts. They might even be biased themselves, potentially invalidating the work done by this new technology. Thus, algorithms must be appropriately handled to better clarify errors and injustice explanations.

Furthermore, the lack of greater understanding regarding the operation and development of new AI models poses a barrier to its broader adoption. In certain instances, contexts, and distinct cases, AI may process data, information, and results that are highly complex to explain. This could generate distrust or even resistance from authorities, institutions, and consequently, citizens (*Brasil,*

2022).

Consequently, ensuring data protection during AI processing is essential. If there is no proper control and governance over this technology, it could be used for various inappropriate purposes, invading the privacy of the population and disrespecting fundamental rights and guarantees established by the 1988 Constitution (Bugarin, 2022; Murillo et al., 2023).

There is also a need for greater investments in proprietary research to develop technologies based on ethics, transparency, and lack of bias, aiming for solid governance combined with AI in various investigations and anti-corruption actions.

While the Blockchain technology discussed earlier encompasses essential elements for combating corruption, certain challenges must be addressed. One of them is the scalability of the technology. Public Blockchains have certain limitations to their usage and operation and have a restriction on their storage capacity. This limitation could be an obstacle to its widespread adoption or long-term use (Santos & Angelo Junior, 2022; Dantas & Martins, 2022).

On the other hand, Figueiredo Junior (2020) and Santos and Angelo Junior (2022) also emphasize the interoperability between different Blockchains as a challenge. There isn't a standardization of this technology and its development, leading to certain incompatibility issues across different networks, systems integration processes, and sharing of information between organizations and institutions, affecting and limiting its effectiveness in combating corruption, but not rendering it useless for this purpose.

It's important to note that Blockchain technology doesn't provide a single solution. It can be used in conjunction or complemented with other new technologies to promote good governance that also encloses anti-corruption efforts. Therefore, government institutions, as well as civil society organizations and businesses, need to adequately prepare for the use of this technology more effectively (Figueiredo Junior, 2020; Souza, 2020; Murillo et al., 2023).

Data privacy should also be discussed here. Full availability and publication of analyzed and preserved information to all participants in the network can be viewed as invasive and in violation, in some cases, of constitutional precepts. A balance must be struck between the ideal of transparency and the protection of individuals' privacy.

Nevertheless, despite the potential of Open Data as a mechanism for government transparency, certain issues and challenges need to be addressed. The quality and standardization of the data made available is one such challenge. Open data can be presented in various formats, making it difficult to analyze and compare. In some cases, information might not be complete or up-to-date, compromising the ability of civil society to monitor and oversee (Dantas & Martins, 2022).

Resistance from some managers or public officials to sharing accurate and detailed information about acts and practices also needs to be addressed. This highlights a lack of transparency culture and political will to disclose sensitive

data or data that might contain negative elements for specific political interests. Similarly, to Data Analytics, Open Data also faces the challenge of finding a balance between transparency, through data and information disclosure and the right to privacy and data protection established by LGPD to prevent content misuse (Murillo et al., 2023).

Thus, it is important to emphasize that the mere opening and publication of data is insufficient for combating corruption. Multidisciplinary actions are necessary, with public institutions prepared to provide services and operate efficiently in accountability, detection, prevention, and punishment of individuals engaged in illegal activities.

In conclusion, the adoption of new digital technologies for promoting good governance and combating corruption needs to address several challenges and promote democratic values and understanding of these tools. With the collective effort of all stakeholders, these technologies can become powerful tools in building a more just, transparent, and participatory society that seeks the common good for all.

5. Conclusion

The pursuit of robust governance in combating corruption is undeniably essential, considering the increasing erosion of trust in public institutions and the debilitating impacts of corruption on the social fabric. The complexity of this challenge is widely emphasized by the intricate interconnections between corruption and the weakening of democracy, as well as its detrimental effect on public policies. In this context, formulating effective strategies to address corruption and foster strong governance undoubtedly requires a systemic and collaborative approach beyond merely technocratic solutions.

However, the realization of effective governance is fraught with significant obstacles. Confronting corruption goes beyond the mere enactment of stringent laws; it involves building a deeply rooted culture of transparency and accountability that permeates all layers of society. Building truly efficient governance demands constant collaboration between government leaders, engaged citizens, and civil organizations to create policies that genuinely meet the needs of the population. The fight against corruption, therefore, requires innovative, flexible approaches and a critical vision that guides transformations toward a just and transparent society.

In summary, the incorporation of new technologies plays a prominent role in the battle against corruption in Brazil, providing invaluable tools for detecting, preventing, and punishing illicit practices. The corrosion caused by corruption in the foundations of Brazilian society runs deep, eroding trust in institutions, hindering economic and social development, and undermining the pillars of democracy. To confront this persistent challenge, the adoption of innovative approaches that expand the sphere of control, transparency, and accountability is imperative.

Numerous strategies and tools have been proposed to counter corruption, fo-

cusing on strengthening control and oversight of institutions. These institutions' independent and transparent operation is of utmost importance to investigate, report, and penalize illegal acts, relying on existing legislation. The incorporation of new technologies, such as Data Analytics and Artificial Intelligence, enhances the effectiveness of these institutions by allowing precise analysis of large volumes of data to identify suspicious patterns and unusual behaviors, thereby expediting the investigation processes.

In this context, Blockchain technology emerges as a promising tool to ensure integrity and transparency in transactions and records, mitigating the possibilities of data and information manipulation. Providing public data through Open Data platforms and promoting government transparency amplifies civil society oversight and strengthens control over public expenditures. These measures curb corrupt practices and hold public agents accountable for their actions.

However, using these technologies demands a multidisciplinary and ethically committed approach encompassing crucial principles such as privacy and respect for individual rights. Furthermore, the effective adoption of these innovations requires robust cooperation between various segments of civil society and public institutions. Investments in digital infrastructure, training of public servants, and active engagement are indispensable elements to fully harness the potential of new technologies in combating corruption.

In conclusion, the incorporation of Data Analytics, Artificial Intelligence, Blockchain, and other emerging technologies provides a valuable opportunity to reshape the fight against corruption in Brazil. However, this endeavor must be conducted with ethical discernment and responsibility to strengthen transparency, accountability, and integrity, thereby contributing to the restoration of trust in public institutions and creating a more equitable and just environment for all citizens.

In the wake of recent decades, the growing infusion of technologies into the sphere of Public Administration has triggered a complex and ambivalent scenario. A thorough analysis of technologies applied to combating corruption reveals a multifaceted reality, where the promise of effectiveness and transparency intertwines with considerable challenges. The notion that the adoption of Artificial Intelligence, Data Analytics, and Blockchain technologies could represent a panacea for corruption is undeniably subject to questioning in light of the discussed nuances. It's undeniable that such innovations carry significant potential; however, as the authors point out, this technological ascent is not free from risks and ethical imperatives.

It's worth highlighting that despite the commendable effort in the pursuit of more solid and transparent governance, the delicate balance between data disclosure and safeguarding citizen privacy cannot be neglected. The intersection of Open Data with the General Data Protection Law (LGPD) presents a frontier fraught with challenges, where the need for genuine transparency must harmonize with stringent privacy and security measures. Additionally, the inherent complexities associated with Blockchain technology and the requirement for

continuous training of public agents position the path toward responsible and sustainable innovation adoption under a broad perspective. Ultimately, the interweaving of these technologies demands a holistic approach that transcends strictly technocratic solutions, involving broad and coordinated collaboration between governmental actors, civil society, and businesses, with the purpose of fully maximizing their dividends in the fight against corruption while preserving democratic foundations and individual rights.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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