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Automation and public oversight in Brazil: evaluating the monitoring of fiscal management reports

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Abstract: This study aims to the relationship between the implementation of automation solutions in the analysis of FMRs and the efficiency of oversight activities carried out by the TCU. Despite regulatory and theoretical advances in public sector automation, empirical gaps remain regarding the quantitative effects of technologies like Robotic Process Automation (RPA) on audit efficiency. To address this, a quantitative methodology was applied, using multiple linear regression models and correlation analysis. Data were collected from 42 FMR monitoring processes conducted by the TCU between 2010 and 2024, drawn from the institution's digital platform. The sample includes processes with and without RPA usage, allowing comparative analysis. The results demonstrate that RPA implementation has a statistically significant negative effect on process duration and a positive impact on the length of reports. Specifically, RPA contributed to an average reduction of 72 days in process duration and an increase of 14 pages per report, highlighting gains in both efficiency and content depth. The study confirms theoretical expectations from the Unified Theory of Acceptance and Use of Technology (UTAUT), particularly regarding performance expectancy. This research contributes to the public administration literature by empirically validating the role of automation in improving audit efficiency, offering practical insights for TCU's decision-makers and other oversight institutions. The findings suggest that automation can streamline processes, reallocate human resources to more complex tasks, and enhance transparency. The results also support further investment in digital tools, paving the way for integrating advanced technologies such as artificial intelligence in fiscal oversight.

Keywords: automation, public oversight, fiscal management reports, Brazil

JEL: H83, H61, O33

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Introduction

Public control and fiscal oversight are undergoing significant transformations in response to the increasing integration of digital systems and technologies (Zhao, 2024). While these advancements optimize processes and reduce operational distances, they also introduce new challenges concerning effectiveness, transparency, and the efficient allocation of audit resources (Nouaje & Benazzou, 2024; Sonjaya et al., 2025). In the context of public administration, process automation has emerged as an essential tool to modernize financial management, enhance efficiency, and promote transparency (Aryani, 2023; World Bank, 2024). The Brazilian Federal Court of Accounts (TCU), the country's Supreme Audit Institution (SAI), has the constitutional mandate to monitor fiscal responsibility materialized through the oversight of the Fiscal Management Reports (FMR) mandated by the Fiscal Responsibility Law (Brazil, 2000), constitutes a fundamental pillar of its supervisory role (Wetzel et al., 2022).

However, the traditional method of analyzing these reports is highly time- and laborintensive, posing a challenge to operational efficiency (Mwamkinga, 2023). To understand the adoption and impact of new technologies, such as automation, within the realm of government oversight, the Unified Theory of Acceptance and Use of Technology (UTAUT), proposed by Venkatesh et al. (2003), provides a robust theoretical framework. UTAUT posits that user intention and actual usage behavior are influenced by four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). In this study, performance expectancy (the belief that technology enhances job performance) and effort expectancy (perceived ease of use) are particularly relevant to understanding how automation may affect the efficiency of FMR monitoring (Assaf et al., 2024).

Automation, by reducing the time and manual effort required for repetitive tasks, allows audit resources to be reallocated to more complex and high-risk analyses, thereby enhancing the effectiveness of oversight (Moffitt et al., 2018). Although the literature highlights the potential benefits of automation in public management and the growing use of tools such as Robotic Process Automation (RPA) and Python scripts to automate audit tasks, there remains a gap in empirical knowledge regarding the specific quantitative impact of these technologies on control process efficiency (Rawashdeh et al., 2024) particularly concerning FMR monitoring in the Brazilian context and, more specifically, within the TCU.

Despite theoretical and regulatory advancements, there is still a significant empirical gap regarding the actual impact of automation on fiscal oversight processes within Brazil's public sector (Iravonga, 2023). Specifically, there is a lack of concrete evidence on the efficiency gains generated by such technologies (Zhao, 2024), especially with regard to FMR monitoring in terms of audit duration, report length, and the number of human resources allocated to this essential and recurrent TCU activity (Muwema & Phiri, 2025).

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Based on this context, the research problem is defined as follows: What is the relationship between the implementation of automation solutions in the analysis of Fiscal Management Reports and the efficiency of oversight actions conducted by the Federal Court of Accounts (TCU)? Accordingly, the objective of this study is to analyze the relationship between the implementation of automation solutions in the analysis of FMRs and the efficiency of oversight activities carried out by the TCU. To achieve this, a quantitative methodology was employed, based on secondary data analysis using a multiple linear regression model to examine the relationship between the automation indicator variable (RPA) and the dependent variables (process duration, report length, and number of human resources employed), controlling for other relevant variables identified in the literature and the institutional context of the TCU (Kutner et al., 2004).

From a theoretical perspective, this research contributes by applying and testing UTAUT constructs (performance and effort expectancy) in the specific context of automation in fiscal oversight conducted by the TCU in Brazil. Furthermore, it provides empirical evidence to the growing body of literature on public sector automation (Adigwe et al., 2024). From a practical standpoint, the results may inform managerial decisions within the TCU regarding the expansion and refinement of automation tools, by quantitatively demonstrating efficiency gains (potentially in terms of time and resource savings), and may also serve as a reference for other oversight institutions considering the implementation of similar technologies (Sonjaya et al., 2025).

1. Literature review

1.1 The Unified Theory of Acceptance and Use of Technology (UTAUT) and automation of public control

The introduction of digital technologies into government oversight has driven significant transformations in the performance of supervisory institutions, while also posing challenges related to their adoption and use by professionals in the field (Nouaje & Benazzou, 2024). This process reflects global trends in digital transformation within the public sector, where audit institutions are increasingly leveraging digital tools to enhance transparency, accountability, and efficiency (OECD, 2020).

Within the context of audit courts, automation emerges as a strategy to increase the efficiency of reviewing Fiscal Management Reports (FMRs), although it requires a clear understanding of the factors that influence the acceptance of such technological innovations by public auditors (Assaf et al., 2024). The success of this transformation largely depends on theoretical approaches capable of explaining organizational behavior in the face of innovation (Rogers, 2018).

Among the leading theoretical frameworks, the Unified Theory of Acceptance and Use of Technology (UTAUT), proposed by Venkatesh et al. (2003), stands out by

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identifying four core determinants of technology acceptance: performance expectancy, effort expectancy, social influence, and facilitating conditions. This theory is widely applied to understand resistance and willingness to adopt new technologies, especially in public and complex organizational environments such as audit institutions (Purwanti et al., 2022).

The foundation of UTAUT lies in earlier models such as the Technology Acceptance Model (TAM), which emphasized perceived usefulness and ease of use as central to adoption behavior (Davis, 1989). The application of UTAUT in the Brazilian public sector has proven useful in the context of implementing new audit tools, as evidenced by studies on the adoption of continuous auditing and automation at the São Paulo State Audit Court (Miranda, 2018). These findings indicate that auditors are more sensitive to perceived productivity gains and usefulness than to social pressure, reinforcing the importance of institutional policies that emphasize practical benefits and technical support (Assaf et al., 2024).

The potential use of technologies in public oversight raises new challenges regarding digital trust and manipulation risks, including threats such as deepfakes (Samuel-Okon et al., 2024). Based on this theoretical approach, technology acceptance can be measured using performance-related indicators, such as the duration of FMR analyses or the length of the reports produced (Chado, 2015). Embedded audit modules were among the earliest strategies for integrating auditing directly into transaction systems (Groomer & Murthy, 1989). The hypothesis that automation reduces such variables is supported by empirical evidence suggesting higher efficiency in executing repetitive and operational tasks, thereby enabling auditors to focus on more strategic activities (Byrnes et al., 2012).

Tools such as Robotic Process Automation (RPA) and programming languages like Python have been adopted as practical solutions in the context of public sector auditing (Moffitt et al., 2018). RPA is part of a broader family of intelligent process automation technologies, as conceptualized in standardized frameworks (IEEE Corporate Advisory Group, 2017). It is particularly effective in handling highvolume, rule-based, and predictable tasks, while Python stands out for its flexibility in data collection, processing, and analysis in more complex audit environments (Rawashdeh et al., 2024). Both technologies contribute to streamlining oversight processes and enhancing the value of audit work (Zhao, 2024).

Studies show that the application of these tools positively impacts the quality and timeliness of audits, as emphasized in the literature on audit innovation (Alles et al., 2004). In particular, the use of RPA and customized scripts has proven effective in integrating systems and automating manual procedures, leading to scale economies and increased accuracy in verification processes (Iqbal, 2023). Moreover, technologies like Python have been associated with improvements in audit testing quality, especially in complex scenarios (Adigwe et al., 2024).

However, it is essential to emphasize that the acceptance of such technologies depends on the availability of technical support, adequate infrastructure, and an organizational culture conducive to innovation (Aguto & Akol, 2018). Elements such as continuous training, clear institutional communication, and top management

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engagement are identified as critical for the successful implementation of automation in audit courts (Mwamkinga, 2023). In the absence of these conditions, the potential of automation remains underutilized, and resistance to change is likely to persist (Mainza, 2022).

The combination of behavioral theories, effective technological tools, and a supportive institutional environment enables external oversight to evolve toward more modern, responsive, and data-driven practices (Hussein et al., 2016). By integrating automation and innovation with strategic management, audit courts can significantly enhance the effectiveness of fiscal oversight in Brazil.

1.2 The structure of fiscal oversight in Brazil

The increasing complexity of public administration, coupled with growing legal requirements for fiscal transparency, has driven the adoption of technologies in governmental oversight. In Brazil, this trend intensified with the enactment of the Fiscal Responsibility Law (LRF), which established the Fiscal Management Report (FMR) as a central instrument for the periodic disclosure of public accounts (Brasil, 2000). The FMR comprises statements on personnel expenses, net consolidated debt, guarantees, credit operations, and outstanding payables, with mandatory publication every four months, constituting a regulatory strategy of accountability and transparency (Brasil, 2023). In developing countries, the implementation of financial information systems often encounters institutional and technical barriers that hinder expected performance outcomes (Diamond & Khemani, 2005). The structured dissemination of fiscal data reinforces the role of oversight institutions, while simultaneously presenting operational challenges in terms of analysis and verification (Sonjaya et al., 2025).

However, the increasing volume, granularity, and frequency of fiscal data produced by public entities has imposed new analytical demands on audit institutions. As the FMR statements became more detailed such as the introduction of monthly breakdowns of personnel expenses, technological solutions have become necessary to process large datasets within regulatory timeframes (Brasil, 2017). This need for automation aligns with international guidelines for implementing Integrated Financial Management Information Systems (IFMIS), which emphasize process reliability, data integrity, and timely reporting in public sector environments (Hashim, 2014).

Among these, Robotic Process Automation (RPA) stands out as a particularly useful tool, enabling the extraction, organization, and preliminary analysis of fiscal data with increased speed and reduced operational error (Moffitt et al., 2018). This shift is aligned with the broader international trend toward digitization and process modernization in public sector auditing (Nouaje & Benazzou, 2024).

At the Brazilian Federal Court of Accounts (Tribunal de Contas da União – TCU), automation was implemented in the monitoring process of the FMR starting in 2019, through the development of scripts that integrate data from Siconfi, the official system for receiving fiscal data declared by public managers and Tesouro Gerencial,

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the financial data warehouse derived from the Federal Government's SIAFI platform (Aryani, 2023). Automation enables systematic comparisons between these two sources, detecting discrepancies and classifying their severity to guide auditors' responses (Iravonga, 2023). This process is executed three times per year, aligned with the FMR's legal deadlines, and provides strategic inputs that enhance the predictive and proactive capabilities of oversight activities (Muwema & Phiri, 2025). Eliminating repetitive manual tasks through automation enables auditors to focus on more qualified analytical activities, thereby fostering institutional efficiency (Chado, 2015). The substitution of operational work with automated routines is anticipated to reduce the time required to issue audit reports, consequently streamlining the monitoring process (Rawashdeh et al., 2024). In this context, Hypothesis H1 is proposed: automation has a negative and statistically significant effect on the duration of the FMR monitoring process. Empirical support for this hypothesis comes from studies indicating that RPA significantly accelerates response times in fiscal and financial oversight settings (Zhao, 2024).

Beyond improving timeliness, automation is anticipated to optimize both the structure and length of audit reports. The use of automated spreadsheet generation and standardized report formats typically reduces redundancy while enhancing the objectivity of final documents (Adigwe et al., 2024). In data-intensive environments such as federal fiscal monitoring, these improvements may result in shorter reports. Therefore, Hypothesis H2 is advanced: automation has a negative and statistically significant effect on the number of pages in audit reports issued during FMR monitoring. This hypothesis aligns with international findings suggesting that automation fosters more concise documentation and enhances clarity in public sector auditing (Assaf et al., 2024). This expectation is further supported by evidence from the implementation of Integrated Financial Management Information Systems (IFMIS), which have shown positive impacts on information efficiency-provided that they are accompanied by clearly defined processes for data verification and cross-validation (World Bank, 2024). The integration of Siconfi and Tesouro Gerencial by the TCU aligns with this model and enhances the reliability of fiscal analyses while reducing the effort required to generate audit documentation (Mainza, 2022). Moreover, the institutionalization of automation within the TCU through the creation of LabContas follows international best practices for digital governance in oversight institutions (KPMG, 2023).

Despite these technological and institutional advancements, there remains a lack of empirical research quantifying the effects of automation on operational variables such as processing time and report length. Most of the current literature is concentrated in descriptive or qualitative approaches, which limits the understanding of the actual impacts of automation on the performance of audit institutions (Miranda, 2018). Even in jurisdictions with more mature digital infrastructure, the quantitative assessment of automation's impact on institutional productivity and reporting remains insufficient (Heeks, 2019).

Although automation has advanced in the public sector, empirical evaluations of its impact on fiscal oversight remain scarce. This study addresses this gap by testing the

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relationship between automation and two dimensions of institutional efficiency in the monitoring of Fiscal Management Reports (FMRs): the duration of the oversight process and the length of the resulting audit reports. By evaluating these hypotheses with quantitative data, the research seeks to generate evidence-based insights on how automation may affect transparency, information governance, and institutional performance in Brazil (Nhial et al., 2025).

2. Research methodology

This research has a quantitative approach, applying the statistical method of multiple linear regression. The model includes two response variables: the duration of the audit process and the number of pages of the final report. This methodological choice allows testing the theoretical hypotheses H1 and H2 and contributes to achieving the research objective. Similar quantitative approaches have been adopted in empirical studies evaluating public sector audit efficiency, innovation impact, or technology implementation, such as those by Adigwe et al. (2024) and Rawashdeh et al. (2024). The data analyzed were obtained from e-TCU, the electronic process management platform of the Brazilian Federal Court of Accounts (TCU). A total of 42 audit processes were selected: 27 without the use of Robotic Process Automation (RPA) and 15 with RPA implemented on the period between the second half of 2010 and 2024, corresponding to the full operationalization of the system. The use of digital systems to support data-driven oversight has proven effective in various public contexts, reinforcing the relevance of this research scope (Aryani, 2023; Lungu & Phiri, 2025).

Audit ordinances and instructions were extracted from e-TCU. The duration of each oversight process was calculated based on the time elapsed between the beginning of the planning phase and the date of the instruction's signature. Other variables include the number of auditors (Nau), the number of pages in the instruction (NP), the number of annexes in the FMR (Nax), and the cumulative experience of the audit team (Exp). These dimensions reflect both procedural volume and team characteristics, consistent with quantitative approaches in performance auditing research (Mwamkinga, 2023). Additionally, the number of person-days of auditing effort (HDF) was gathered from the Planning Secretariat of the TCU for oversight activities from the third quarter of 2015 onward.

Statistical tests were conducted to assess residual normality, independence, and multicollinearity. These conditions are essential to ensure consistent estimation and meaningful inference in regression models, as highlighted by Kutner et al. (2004). All data were processed and analyzed using the Python programming language, which is commonly used in recent studies of audit automation and oversight performance (Zhao, 2024).

2.1 Model estimation and specification

The following econometric models were estimated to analyze the effects of automation and other explanatory variables on audit outcomes:

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 $D = \beta_0 + \beta_1 RPA + \beta_2 F + \beta_3 NP + \beta_4 Nau + \beta_5 Nax + \beta_6 Exp + \beta_7 HDF + \epsilon_i$

and

 $NP = \beta_0 + \beta_1 RPA + \beta_2 F + \beta_3 D + \beta_4 Nau + \beta_5 Nax + \beta_6 Exp + \beta_7 HDF + \epsilon_i$ where: D: Duration of the audit process (in days) NP: Number of pages in the audit instruction RPA: Use of Robotic Process Automation F: Format of the personnel expenditure report Nau: Number of auditors in the process Nax: Number of annexes reviewed Exp: Team experience (in previous FMR audits) HDF: Person-days of audit effort allocated β_0 : Intercept ϵ_i : Error term (residual)

These models allow the identification of relationships between audit efficiency and explanatory factors, including automation. Regression analysis provides insight into the magnitude and direction of these associations, while correlation analysis reveals the strength of dependencies among variables (Kutner et al., 2004). Such specification mirrors the methodological rigor employed in recent empirical studies examining the impact of emerging technologies on auditing practices (Adigwe et al., 2024; Rawashdeh et al., 2024).

3. Research results and discussions

3.1 Descriptive and correlation analysis

Initially, descriptive statistics are presented to summarize general aspects for the key variables related to the monitoring of the Fiscal Management Reports (FMRs): duration (D), number of pages (NP), and auditor workdays (HDF). Table 1 summarizes the main descriptive measures of the variables used in the study.

Variable	Average	Median	Standard Deviation	Minimum	Maximum	
D	98.36	75	58.72	16	295	
NP	47.57	47.5	12.22	25	87	
HDF	87	84.5	34.48	43	193	
$S_{}$						

 Table 1. Descriptive Statistics

Source: Author's contribution.

During the period under review, the mean duration required for the planning, execution, and reporting phases of the monitoring process was 98.36 days, with a median of 75 days. This median value indicates that 50% of the monitoring processes

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were completed within 75 days or less. A standard deviation of 58.72 days reveals significant variability in the durations of the FMR monitoring processes, with observed times ranging from a minimum of 16 days to a maximum of 295 days. This peak duration was recorded in the first four-month period of 2018, a timeframe characterized by elevated complexity, thus representing an outlier compared to other monitoring instances. The pursuit and measurement of such process efficiencies are critical, as evidence suggests that the implementation of integrated systems positively affects the performance of public sector organizations (Njonde & Kimanzi, 2014).

Regarding report length, the dataset shows a mean of 47.57 pages and a median of 47.5 pages, suggesting a symmetrical distribution. The standard deviation of 12.22 pages indicates moderate dispersion, with lengths ranging from 25 to 87 pages. This reflects variations in detail and content, consistent with the complexity of each monitoring process.

The HDF metric averaged 87 days, with a median of 84.5 days and standard deviation of 34.48, indicating variability in team resource allocation—from 43 to 193 working days. Efforts to optimize process duration and resource allocation (HDF) align with findings on the positive impact of automation on audit efficiency (Chado, 2015). This variability reflects differences in complexity and resources across processes, often influenced by analytical demands and data volume. Such assessments support the shift toward dynamic oversight, including analytic monitoring for continuous assurance (Vasarhelyi et al., 2018).

Figure 1 illustrates the evolution of the duration, number of pages, and Human Development Factor (HDF) of the Fiscal Management Report (FMR) monitoring processes over successive four-month periods, with the right axis representing these variables.



Figure 1. Evolution of the Monitoring Processes of the Fiscal Management Report

The number of auditors involved, a critical variable for HDF calculation, is displayed in columns and measured on the left axis. Less pronounced fluctuations in variation

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are observed following the implementation of Robotic Process Automation (RPA), except for recurrent increases during third four-month periods, which include the review of Annex 5 and coincide with auditor allocation to the President's Annual Accounts Report. The significant peak in duration recorded in 2018 is likely due to the introduction of the new personnel expenditure reporting format. Conversely, the HDF did not reflect this peak, possibly indicating limited auditor availability during the audit cycle.

Following the descriptive analysis, Pearson's correlation coefficient was employed to examine the relationships among the variables used in the study, in accordance with the model's structure, in order to highlight the direction and intensity of the interactions. Based on the core analyses outlined in the model, the results presented in Table 2 were obtained.

	D	RPA	F	NP	Nau	Nax	Exp	HDF
D	1							
RPA	- 0,009	1						
F	0,1683	0,820	1					
NP	0,4149	0,4954	0,5115	1				
Nau	-0,015	0,3286	0,3345	0,2311	1			
Nax	0,3090	2,93E-18	-0,033	0,3596	0,0268	1		
Exp	0,1111	0,8383	0,8535	0,3901	0,5363	-0,0008	1	
HDF	0,3215	0,5664	0,6388	0,3797	0,4082	0,2549	0,7559	1

 Table 2. Correlation Matrix of the Variables Analyzed

Source: Author's contributio	n
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The correlation matrix reveals moderate to strong relationships among key variables, particularly between RPA and the number of findings (r = 0.820), as well as between experience and the Human Development Factor (HDF) (r = 0.7559). These findings suggest that automation, alongside accumulated auditor expertise, significantly influences audit process outcomes. The positive correlations between the number of pages and process duration (r = 0.4149), and between findings and experience (r = 0.8535), reinforce the notion that audit workload intensity is linked to institutional performance. These results are consistent with studies identifying automation as a driver of efficiency in the public sector by standardizing procedures and reducing repetitive manual tasks (Rawashdeh et al., 2024).

Furthermore, the signs of the coefficients provide insight into the direction of interactions. With the exception of minor variations—such as the slightly negative correlation with the number of auditors (Nau)—all variables exhibit a positive

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association with HDF. The moderate correlation between RPA and HDF (r = 0.5664) supports the hypothesis that the adoption of automation technologies is positively associated with increased workforce productivity in public auditing. This finding aligns with the literature highlighting the role of Robotic Process Automation (RPA) in enhancing auditors' analytical capacity by freeing up time and minimizing operational errors (Moffitt et al., 2018). Table 3 summarizes the directions found and compares them with those expected.

Dependent veriables	Direction of correlation with the dependent variable			
Dependent variables	Expected	Found		
RPA	Negative	Negative		
F	Positive	Positive		
NP	Positive	Positive		
Nau	Negative	Negative		
Nax	Positive	Positive		
Exp	Positive	Positive		
HDF	Positive	Positive		

 Table 3. Comparison between Expected and Found Correlations of Model

Source: Author's contribution

Table 3 complements this analysis by confirming that all observed correlation directions are consistent with the theoretically expected outcomes. The negative relationship between RPA and process duration supports well-established hypotheses in the literature, while variables such as findings (F), experience (Exp), and annex complexity (Nax) exhibit positive correlations with HDF, as anticipated. This consistency between empirical results and theoretical assumptions strengthens the robustness of the model adopted in this study and aligns with accumulated evidence regarding the positive impacts of technological innovation on public sector governance (Adigwe et al., 2024).

3.2 Analysis of regression results

Regression analyses were conducted, adopting a significance level (α) of 5% (α = 0.05) for result interpretation. In accordance with statistical principles, "when the pvalue of a hypothesis test is less than the chosen value of α , the test procedure leads to the rejection of the null hypothesis" (Hill et al., 2006, p. 119).

In the estimated models, normality was validated, with residuals demonstrating independence and homoscedasticity. Following the established modeling framework, regression was performed using the primary verification variable and all control variables. Tables 4 and 5 present the summarized results of the model.

Table 4.	Regression	results t	for the d	ependent	variable	duration

Coefficients Standard error	Stat t	p-value
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Intersection	2,135	90,145	0,024	0,981
RPA	-72,634	35,650	-2,04	0,049
F	12,357	36,523	0,338	0,737
NP	2,314	0,910	2,544	0,016
Nau	-19,230	16,320	-1,178	0,247
Nax	7,463	20,285	0,368	0,715
Exp	0,540	1,180	0,458	0,650
HDF	0,385	0,272	1,418	0,165

Source: Author's contribution

The regression model yielded a coefficient of determination (R^2) of 0.362 and an adjusted R^2 of 0.231, indicating that 36.2% of the variation in monitoring duration between 2010 and 2024 is explained by the independent variables. This suggests that the model's explanatory power remains limited. The F-statistic of 2.758, with an associated p-value of 0.0221, demonstrates that the overall model is statistically significant at the 5% level ($\alpha < 0.05$).

As shown in Table 4, the Robotic Process Automation (RPA) variable was statistically significant, with a p-value below 0.05, supporting theoretical Hypothesis H1 that RPA has a negative and statistically significant effect on monitoring duration. The regression coefficient for RPA is -72.63 (p = 0.049), indicating that the adoption of RPA is associated with a reduction of approximately 72 days in the duration of Fiscal Management Report (FMR) monitoring processes, holding other variables constant. This finding aligns with prior studies emphasizing that RPA implementation in public auditing enhances operational efficiency by reducing manual workload and accelerating procedures (Rawashdeh et al., 2024).

The coefficient for the number of pages is 2.31 (p = 0.016), suggesting that longer reports are associated with lengthier monitoring processes. This result is consistent with the literature on audit analytics, which highlights that increased data volume and complexity tend to expand the processing time in oversight activities (Alles et al., 2004). The remaining variables in the model did not demonstrate statistical significance, as their p-values exceeded the 0.05 threshold.

Table 5 summarizes the regression results with the number of pages as the dependent variable.

	Coefficients	Standard error	Stat t	p-value
Intersection	-5,010	15,555	-0,322	0,749
RPA	14,378	6,043	2,379	0,023
F	11,852	5,987	1,980	0,056
D	0,069	0,027	2,544	0,016
Nau	4,562	2,769	1,648	0,109
Nax	7,217	3,287	2,195	0,035
Exp	-0,357	0,195	-1,830	0,076
HDF	-0,014	0,048	-0,294	0,770

Table 5. Regression results for the dependent variable number of pages

Source: Author's contribution

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The regression model yielded a coefficient of determination (R^2) of 0.56, with an adjusted R^2 of 0.470, accounting for the number of explanatory variables. This indicates that 56% of the variation in the number of pages between 2010 and 2024 is explained by the regressors. The F-statistic of 6.192, with an associated probability of 0.0001, suggests that the overall model is highly significant.

According to the results presented in Table 9, the RPA variable is statistically significant, with a p-value below 5%, supporting theoretical Hypothesis H2 that this variable is positive and statistically significant in explaining the behavior of the number of pages. The regression coefficient for RPA is 14.38 (p = 0.023), which, given its positive sign, indicates an increase of approximately 14 pages in monitoring reports, holding the other variables constant.

The coefficient for duration is 0.069 (p = 0.016), and for the number of annexes, it is 7.22 (p = 0.035), suggesting that both variables positively influence the number of pages. The remaining variables did not exhibit statistical significance in this model, with p-values above 0.05.

The statistically significant relationship between RPA and the number of pages provides evidence that automation does not merely enhance efficiency in terms of time reduction but also influences the comprehensiveness and formatting of audit outputs. Additionally, the significance of report duration and annex count as predictors underscores the importance of procedural complexity and documentation in shaping final report length—an aspect often overlooked in evaluations of audit system performance.

The absence of statistical significance for other variables in the model suggests that, within the analyzed context, the explanatory power for report size is concentrated in process duration, annex content, and the presence of RPA. These findings contribute to the theoretical and methodological understanding of how digital tools alter audit deliverables, aligning with recent studies on automation's transformative role in public financial oversight (Rawashdeh et al., 2024; Adigwe et al., 2024). As such, this research offers valuable insights for Supreme Audit Institutions seeking to balance automation with reporting standardization, while also identifying promising directions for further investigation into the broader implications of digital transformation in the public sector.

4. Conclusions

This study analyzes the relationship between the implementation of automation solutions in the analysis of FMRs and the efficiency of oversight activities carried out by Brazil's supreme audit institution (TCU). It contributes to the understanding of digital transformation in public control by empirically assessing how the adoption of robotic process automation (RPA) influences both the duration and the informational depth of Fiscal Management Report (FMR) monitoring. Using regression analysis to isolate the impact of automation while controlling for institutional and operational variables, the research provides robust empirical

evidence on the effectiveness of technological integration in improving the performance of government auditing processes.

Descriptive statistics, correlation analysis, and multiple linear regression models were applied to assess the relationship between the use of Robotic Process Automation (RPA) and two key indicators of oversight efficiency: the duration of monitoring processes and the number of pages in audit reports. The analysis drew from 42 fiscal monitoring cases processed through the TCU's digital system (e-TCU), covering the period from 2010 to 2024, and distinguished between automated and non-automated processes.

Regression results confirm both proposed hypotheses. RPA implementation showed a statistically significant negative relationship with the duration of oversight processes and a positive effect on the length of audit reports. Specifically, the presence of RPA was associated with a reduction of approximately 72 days in process duration, and an increase of 14 pages in report length, when other variables were held constant. The correlation analysis also identified moderate positive relationships between duration and report length, and between the number of annexes and duration, reinforcing the internal consistency of the findings.

These findings underscore the potential of automation to streamline procedural execution while enhancing the detail and documentation quality of outputs. The evidence demonstrates that automation not only reduces processing time but also contributes to the production of more robust and comprehensive reports, reflecting a gain in both speed and informational value. Such results align with the UTAUT framework, particularly the dimension of performance expectancy, strengthening the case for continued adoption of automation within fiscal oversight activities.

The implications of these results extend beyond internal process optimization. By demonstrating measurable efficiency gains and increased informational output, the study contributes to the broader literature on digital transformation in the public sector, especially within Supreme Audit Institutions. These findings support strategic decisions concerning the expansion of RPA use and lay the groundwork for incorporating more advanced technologies, such as artificial intelligence, to further enhance the responsiveness and analytical capabilities of public audits.

Nevertheless, some limitations must be acknowledged. The model does not incorporate all possible variables affecting oversight process duration, such as unexpected staff absences, concurrent work demands, or institutional restructuring. Moreover, the binary nature of RPA implementation and the aggregated structure of data may obscure nuances in its application and effectiveness across different oversight scenarios. Future studies should consider panel data designs with broader variable inclusion and explore process-level data for greater granularity.

Future research may also benefit from comparative studies across other national audit bodies or from investigating the long-term effects of automation on institutional performance and accountability. Expanding the empirical basis of technology adoption in public auditing could provide further insights into the evolving role of Supreme Audit Institutions in the digital era and strengthen the alignment between innovation, transparency, and fiscal responsibility.

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Conflict of Interest Statement

The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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Not the case.

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