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Can ChatGPT improve the readability of financial reporting by the public sector entities? The case of Lisbon municipality

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ABSTRACT

The readability of financial reporting from the users' perspective is an essential element to ensure its usefulness and, therefore, its relevance. Through the lens of Cognitive Load Theory and plain language principles, this quasi-experimental research aims to assess whether an artificial intelligence tool, specifically ChatGPT in its GPT-4 model, can be effective in enhancing the readability of the Lisbon municipality's annual reports and accounts for the year ending in 2023. For this purpose, six surveys, each one including two versions of six different excerpts collected from that source (an original version and a modified one), were distributed among twelve (one survey by two of them) experts on public sector financial matters. The findings globally indicate higher readability levels of the modified version of the excerpts, that is, the one produced by ChatGPT from the original version and following a prompt proposed by researchers. Respondents argued that benefits mostly relate to the text's form and content. Although exploratory, this study may contribute to the literature by highlighting the potential benefits of using ChatGPT to enhance the readability and overall usefulness of public financial reports for a broader audience, thereby benefiting various stakeholders, including preparers, users, regulators, policymakers, and auditors.

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Introduction

Communication has long been recognised as a function of financial reporting; without it, financial reporting loses its usefulness (Smith & Smith, 1971). However, concerns about the complexity of disclosed information have also been long pointed out by researchers, with Barnett and Leoffler (1979), for instance, highlighting that the notes to financial statements were considered difficult to read.

These concerns have been growing since international accounting and financial reporting standards, such as those prepared under the International Financial Reporting Standards (IFRS) issued by the International Accounting Standards Board (IASB), are becoming increasingly difficult for users to understand (Howieson et al., 2024). Nonetheless, this is a non-consensual matter in the literature. Although some authors argue that IFRS-based disclosures are significantly longer but more readable (Cheung & Lau, 2016), others stress that they have increased narrative complexity (Efretuei et al., 2022) and significantly lower readability than those based on local accounting standards (Jang & Rho, 2016).

Readability 'attempts to measure the ability of the reader to decipher the intended message' (Loughran & McDonald, 2016, p. 1188) and enhance the quality and usefulness of financial reporting (Arianpoor & Sahoor, 2023; Toerien & du Toit, 2024). Most readability studies have focused on reports based on English narratives (Moreno & Casasola, 2016; Telles & Salotti, 2024) and have concluded that they are difficult to read (Howieson et al., 2024; Moreno & Casasola, 2016). However, annual reports can exhibit some levels of obfuscation in every language, particularly by using a complex writing style (Gutiérrez Ponce et al., 2023). Therefore, since IFRS standards are originally written in English, understandability and literal

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translation may not be a good match (Jang & Rho, 2016), indicating that these findings should be considered with caution. Nonetheless, Moreno and Casasola (2016) studied the readability evolution of annual report narratives written in Spanish and concluded that, despite improving over the years, they are also (and still) difficult to read.

Additionally, research has linked the readability of financial disclosures to several corporate topics, such as company performance prediction (Herenia et al., 2024; Kim et al, 2024b; Lin et al., 2024; Li & Yang, 2024), influence on investors' assessment of investments (Liu et al., 2024), and financial reporting quality (Arianpoor & Sahoor, 2023). More recently, sustainability reports have also been pointed out as having low readability, making it difficult for users to interpret and understand (Adhariani & du Toit, 2020).

Regardless of the source used for this assessment, accounting literature generally agrees that less readable financial documents lead to negative outcomes for decision-makers, and the authors argue that readability moderates the influence of language sentiment, especially for less sophisticated stakeholders (Tan et al. 2014). For instance, investors' less readable annual reports hinder the efficient and accurate assimilation of information into stock prices, leading to greater equity mispricing (Chen et al., 2023).

The Cognitive Load Theory (CLT) (Sweller, 1988) provides a theoretical foundation for understanding how learners process information. CLT posits that cognitive resources are limited, so the way information is presented plays an important role in minimising cognitive load. Therefore, clear and well-structured language reduces cognitive load and facilitates processing (e.g. Chandler & Sweller, 1991; García-Gorrostieta et al., 2025; Sweller, 1988, 2010, 2023).

Moreover, a key strategy for improving readability is the use of plain language (Škorić et al., 2023). The plain language standard developed through the International Organisation for Standardisation (ISO) establishes that plain language enhances written communication by using words, structure and design that are so clear that the intended reader can easily find what they need, understand it and use it. In addition to enhancing readers' understanding, plain language also fosters trust between organisations and their stakeholders (ISO, 2023).

This perspective may help explain why readability has been influencing auditing processes, where a negative relationship between the readability of financial statements and the issuance of going-concern opinions has suggested that auditors view hard-to-read reports as a risk factor (Salehi et al., 2020). Moreover, the low readability of audit reports weakens the informational value of financial statements, leading users to struggle to interpret their content, reducing trust in corporate disclosures, and resulting in financial statements losing relevance and usefulness (Fakhfakh, 2016).

Considering the increasing volume of financial and non-financial information currently disclosed, the range of documents used for this purpose, the growing adoption of digital tools and social media, generative Artificial Intelligence (AI) technologies, particularly large language models (LLMs) like ChatGPT present significant opportunities for enhancing communication and processing financial information (Bochkay et al., 2023; Dong et al., 2024; Fisher et al., 2016; Gandía & Huguet, 2021; Loughran & McDonald, 2016).

The use of ChatGPT to improve information readability has been studied in several areas, with a great focus on medicine (e.g. Butler et al., 2024; Zhang et al. 2024). Moreover, regarding education, GPT-4 was able to generate more readable feedback on students' writing assessment tasks and with greater consistency than human instructors (Dai et al., 2024). Furthermore, it has proven to be a successful tool for increasing the readability of accounting texts (Albuquerque & Gomes dos Santos, 2024; Emett et al., 2023; Kim et al., 2024a; Voshaar et al., 2025).

Concerning financial reporting, ChatGPT literature highlights that it can be a valuable tool for generating text and improving the clarity of financial disclosures (Dong et al., 2024). Nonetheless, according to Dong et al. (2024), most studies using ChatGPT in financial accounting and reporting focus on corporate disclosures, with a gap in public sector accounting (Maione & Leoni, 2021).

The International Public Sector Accounting Standards (IPSAS) issued by the International Public Sector Accounting Standards Board (IPSASB) aims to enhance the comparability of public sector financial reporting and is mostly based on IFRS (IPSASB, 2020). According to the IPSASB (2020), the Conceptual Framework for General Purpose Financial Reporting by Public Sector Entities (the Conceptual Framework) defines the concepts used to develop the IPSAS, guiding the preparation and presentation of general-purpose financial reports (GPFRs) for public sector entities. The latter intends to meet the information needs of users who cannot request tailored financial reports to suit their requirements (IPSASB, 2020).

GPFRs present financial and non-financial information with certain attributes (qualitative characteristics) useful for accountability and decision-making. One such attribute is understandability, which enables users to comprehend its meaning. The Conceptual Framework highlights that GPFRs

> Should present information in a manner that responds to the needs and knowledge base of users' (IPSASB, 2020, paragraph 3.17). Although it is argued that 'understandability is enhanced when information is classified, characterised, and presented clearly and concisely'.

(IPSASB, 2020, paragraph 3.17), the Conceptual Framework also stresses that 'the actual comprehension or understanding of information depends largely on the users of the GPFRs' (IPSASB, 2020, paragraph BC3.18), suggesting that information 'should be written in plain language, and presented in a manner that is readily understandable by users' (IPSASB, 2020, paragraph 3.17).

Although concise financial documents enhance information processing and support better decision-making, their readability role remains neglected in accounting practice (Besuglov & Crasselt, 2021). Furthermore, IPSAS are IFRS-based (IPSASB, 2020); thus, their annual report narratives are complex and difficult to read (e.g. Efretuei et al., 2022; Howieson et al., 2024).

Therefore, this exploratory study aims to assess whether ChatGPT can be useful in enhancing the readability of annual reports of public-sector entities based on IPSAS. Plain language has been shown to improve readability (ISO, 2023; Škorić et al., 2023) and reduce cognitive load (e.g. Chandler & Sweller, 1991; García-Gorrostieta et al., 2025). Given that ChatGPT's has demonstrated capabilities to enhance texts' readability (e.g. Albuquerque & Gomes dos Santos, 2024; Emett et al., 2023; Kim et al., 2024a; Voshaar et al., 2025), the following hypothesis (H) is defined:

H1: ChatGPT-enhanced financial report excerpts receive significantly higher readability ratings than the original ones.

As a novelty, this study relies on the annual report of a Portuguese municipality (written in Portuguese), which is prepared under the Accounting Standardisation System for Public Administrations (SNC-AP, in the Portuguese Acronym) in Portugal, and it is also IPSAS-based (Decree-Law 192/2015, September 11th). To achieve this purpose, a quasi-experimental method was used, with a survey as the tool that aimed to collect the respondents' perspectives on original excerpts directly collected from that report *versus* a modified one produced by ChatGPT in its GPT-4 model.

Given that most studies are based on English narratives (Dong et al., 2024; Moreno & Casasola, 2016; Telles & Salotti, 2024), this study intends to fill another gap pointed out by Dong et al. (2024) regarding the need to gain a more comprehensive understanding of the multilingual capabilities of ChatGPT by further researching less commonly studied languages.

This study contributes to the literature by highlighting the potential benefits of using LLMs tools, such as ChatGPT, one of the most widely used tools based on these models (Dong et al., 2024), to enhance the readability and overall usefulness of public financial reports for a broader audience. Although exploratory, this study may be beneficial to several stakeholders of financial reporting, who can have more readable and understandable information, such as preparers, users, regulators, policymakers, and auditors.

This paper is structured in three sections, in addition to this introduction. The next section identifies the materials and methods underlying the analysis proposed in this study, followed by the results section. Finally, the last section presents the conclusions as well as the limitations and suggestions for future research.

Material & methods

This study is based on quasi-experimental research using a survey conducted in November 2024 to collect data for assessment purposes. For ethical purposes, the survey identified the objective and the researchers and obtained the written consent of each participant and the ethical approval from ISCAL/Instituto Politécnico de Lisboa.

The survey was designed on a single online page and structured into three parts.

The first is an introduction, which provides its main objective, research coordinators and main instructions and estimated time for response. Therefore, it indicates the following information:

> the survey is exclusively for scientific purposes (research), and all responses will be treated anonymously, having the objective of assessing 'the quality of a given text in terms of its readability level, that is, in terms of the ease of reading it presents and the ease of understanding it provides concerning its content from the reader's perspective. To this end, two alternative texts with the same basic content will be presented, for which the reader is asked to assess their level of readability. The estimated average response time is about ten minutes'.

The second requires demographic information to characterise the respondents, namely the respondents' gender, age, years of professional experience in general and those specifically related to matters in the public sector/administration. Finally, respondents indicated how they generally described themselves regarding their main professional activity.

The third and last part of the survey includes three questions, which were the main focus of this research, as follows: the first two questions ask them to indicate the readability level, on a scale of 1 to 100, where 1 means 'completely unreadable' and 100 means 'completely readable', for two versions of an excerpt of the annual report and accounts for the year ending in 2023 of the Lisbon municipality in its Portuguese version, which can be seen as the most relevant one in Portugal considering the size of the population and the revenue volume (Fernandes et al., 2024), being also the most developed, considering the net income of its citizens (INE, 2023). The first version relates to the original excerpt, that is, with no modifications, from that report. In turn, the second one represents the modified version by ChatGPT based on the GPT-4 model. Nonetheless, this information was not provided to them to ensure a blinded assessment. Finally, the third and last question of this part was an open-type, requesting respondents to indicate which one they considered the most readable and why, by comparing the first and second excerpts previously provided. For this purpose, respondents were kindly requested to provide further details and examples of situations that led to the said understanding, namely to illustrate their understanding of the different levels of readability between them.

To obtain the modified version (ChatGPT's version), this AI tool was requested to provide an output through the modification of the original excerpt, then inserted, by responding accordingly to the following prompt in Portuguese, and here translated into English to achieve a wider audience:

> A Portuguese city council prepared its management report for the year ending 2023, within the scope of accountability in the Accounting Standardisation System for Public Administrations (SNC-AP, in the Portuguese Acronym) in force in Portugal. The SNC-AP contains three information subsystems, namely financial accounting, budgetary accounting and management accounting. The management report covers the three subsystems mentioned above.
>
> It is intended that, based on an excerpt from the text extracted from the management report of this chamber, an alternative with greater levels of readability will be presented so that this alternative is more easily understandable to a wide range of those interested in this information. The different interested parties include the various residents of this chamber, in general, and its creditors, in particular.
>
> For this purpose, no relevant information must be omitted, particularly regarding dates (years, months, days or periods), percentages, monetary values and entities. All accounting information provided by the entity must also remain.
>
> After obtaining the proposal presented as an alternative for each section, the various sections will be sent, one at a time.

The prompt was proposed to ensure the proper integration within the underlying framework (the SNC-AP) and the areas under assessment (public accounting subsystems), to avoid any possible detour from ChatGPT. Besides, it seemed relevant to include the intention behind the exercise (this paper's objective), namely, to obtain an overall readable excerpt as output to a variety of interested parties. By doing so, the comprehensiveness of information should be assured, which was also indicated. Finally, the process of getting input-output was not forgotten.

Following this, ChatGPT delivered the following response, also in Portuguese, suggesting an understanding of this task, which is freely translated into English as follows: 'Understood! Please send the first excerpts, and I will present a more readable alternative while keeping all relevant information intact'.

This prompt was defined to indicate the framework that this AI tool should follow and to meet the fundamental qualitative characteristics of financial information, namely faithful representation (for this, it must be complete, neutral, and error-free). This is also expected to be relevant to a wider range of users. Finally, the main objective of this research is to achieve higher levels of understandability than those originally provided by the selected source (the Lisbon municipality). However, this research focused on the main users of financial reports other than the individual representatives, which include, according to the SNC-AP, the service users, resource providers, and taxpayers.

The prompt and complete survey, which includes the modified version of the excerpt proposed by ChatGPT, was designed and distributed in Portuguese since it is the mother language of all respondents. The answers were also provided by them in this language.

Six excerpts from the report and accounts were gathered to cover both public sector accounting subsystems, three of which regarding expenses (budgetary accounting) and the remaining on non-current assets (financial accounting). They were selected to fit three main criteria, regarding the size (it could not be so extensive), the content (it could cover a given topic or matter integrally), and the format (only textual information was valid, i.e. no figures could be included or referenced). A convenient sample of twelve highly experienced professionals was chosen and invited to participate in this experiment. Some of those respondents are highly experienced auditors in several public sector entities, and are also representatives of national entities with a chair in the Portuguese accounting standard setter for public administrations. Some of them also have academic experience.

Then, six versions of surveys were prepared and randomly distributed among them; thus, two respondents had access to the same version of the original and modified excerpts.

The survey was provided in the Portuguese language, which is the native language of all respondents. Nonetheless, as this paper is intended to be published in an international journal, which usually publishes papers in English, the answers are freely translated by this paper's authors (research coordinators) into this language.

Appendix I presents, in the English language, the original and modified excerpts included in the six versions of the Portuguese version that were disseminated to respondents.

Table 1 describes the respondent characteristics based on the first set of questions, and the survey participants were requested to respond to the topic covered by it.

Table 1 indicates that respondents are mostly males (eight out of 12), working predominantly as auditors. On average, they were 51 years old (minimum of 43 and maximum of 58 years) with 28 years of experience (minimum of 20 and maximum of 34 years), of which 24 were in the public sector/administration sector (minimum of 10 and maximum of 30 years). Consequently, this set of highly experienced professionals in accounting and auditing in the public sector or administration can be assumed as a good proxy for users with at least a reasonable understanding of financial information provided by entities from this institutional sector. This follows the assumption regarding the qualitative characteristic of understandability found in the Portuguese version of the SNC-AP framework, which states the following in its free translation into English.

> It is assumed that users of the financial report should have reasonable knowledge of the activities of the public entity and the environment in which it operates to analyse the information with reasonable diligence. Some economic and other phenomena are particularly complex and difficult to represent in financial statements and all efforts must be made to ensure that such phenomena are included in such a way that they are tended by the largest number of users. However, such phenomena should not be excluded from financial statements only with the justification that they are too complex or difficult for some users to understand.

To initially assess the textual characteristics (properties) of both versions of the excerpts proposed to respondents, different measures were used: the length, including the word count, number of characters, and sentences, as well as the readability, measured by the Flesch Index. Grammarly supported the assessment of these elements. The readability score is based on the Flesch index (Flesch, 1948), which ranges from 0 to 100, with higher scores indicating content that is globally easier to understand. This score is based on a formula that considers the following elements in assessing text passages: (1) average

Table 1. Respondents' characteristics by survey and topic.

Respondent (R)		Survey (S)	Topic covered
R1	• Female • 52 years old • 30 years of experience (all in the public sector/administration sector) • Statutory auditor	S1	Expenses
R2	• Male • 54 years old • 30 years of experience (of which 28 years in the public sector/ administration sector) • Director of the accounting department in a relevant body of public administration		
R3	• Female • 54 years old • 27 years of experience (all in the public sector/administration sector) • Economist	S2	
R4	• Male • 58 years old • 29 years of experience (of which 27 years in the public sector/ administration sector) • Professor in a higher education institution		
R5	• Male • 50 years old • 34 years of experience (of which 30 years in the public sector/ administration sector) • Professional in Finance	S3	
R6	• Male • 51 years old • 31 years of experience (of which 24 years in the public sector/ administration sector) • Specialist in public finance		
R7	• Male • 57 years old • 32 years of experience (of which 30 years in the public sector/ administration sector) • Auditor in the public sector	S4	Non-current assets
R8	• Female • 43 years old • 20 years of experience (of which 18 years in the public sector/ administration sector) • Senior technician in public administration, carrying out monitoring functions for local authorities within the scope of the Local Finance Law		
R9	• Female • 47 years old • 23 years of experience (of which 10 years in the public sector/ administration sector) • Chartered accountant	S5	
R10	• Male • 45 years old • 22 years of experience (of which 13 years in the public sector/ administration sector) • Auditor		
R11	• Male • 54 years old • 30 years of experience (of which 25 years in the public sector/ administration sector) • Auditor	S6	
R12	• Male • 47 years old • 24 years of experience (of which 22 years in the public sector/ administration sector) • Statutory auditor		

sentence length in words; (2) average word length in syllables; (3) average percentage of 'personal words'; (4) average percentage of personal sentences. The p-values for the Wilcoxon signed-rank test are additionally provided to robust the findings. As a non-parametric alternative to the t-test for continuous variables, it was chosen considering that it does not require the normality of the distribution, being usually more adequate for small samples as the one underlying this research. IBM SPSS software was used to perform this test. Table 2 provides the main characteristics of the excerpts in their two versions (original and modified ones).

The figures in Table 2 indicate that the modified version of the excerpts (the one provided by ChatGPT) is globally wordier and structured in more sentences, also presenting higher levels of readability based on the Flesch index. The Wilcoxon test globally strengthens this conclusion, considering the p-value is usually lower than 5% (except for the number of characters, for which it is still lower than 10%).

The next section provides the findings regarding readability, now based on the perspective of the respondents who have participated in this research. All findings from this research, despite being obtained in Portuguese, will be freely translated into English by the authors to reach a wider audience.

Results

Table 3 provides the respondents' answers regarding their perspectives on the readability level of both excerpts (the original version and the modified version).

Table 3 shows that the modified version, which is the one provided by ChatGPT, generally achieved higher levels of readability, with only two exceptions: the level attributed to ChatGPT's propositions by R4 for the S2 and R5 for the S3. In the first case, the respondent identified no difference, while the second presented a significant difference between the two versions. The Wilcoxon test also corroborates this conclusion by proving a p-value of 5%.

Nonetheless, the R4 surprisingly indicated within the open question that 'the information in the second text is better organised. The highlights in bold allow the reader to immediately obtain a summary of the subject in question and the main aggregates of information', which contradicts the similar levels attributed. R5, in turn, provided in the open question the shortest answer among all respondents, simply mentioning that it was 'easy to read and well linked'.

Table 2. Textual characteristics by survey and version.

		Textual characteristics			
		Length of the text			
Version	Survey (S)	Word count	Number of characters	Sentences	Readability score
Original version	S1	1,421	212	6	22
	S2	1,357	253	5	24
	S3	783	118	3	17
	S4	712	112	2	7
	S5	1,376	222	7	37
	S6	895	141	4	19
Modified version	S1	1,651	247	14	36
	S2	1,562	234	13	45
	S3	991	156	11	47
	S4	1,972	159	8	30
	S5	1,567	241	15	44
	S6	1,052	152	11	27
p-value for the Wilcoxon test		0.028	0.093	0.024	0.028

Table 3. The readability level attributed by respondents to the excerpts.

Respondent (R)	Survey (S)	(1) Readability level attributed to the original version	(2) Readability level attributed to the modified version	Difference between (1) and (2)
R1	S1	30	90	−60
R2		75	90	−15
R3	S2	20	40	−20
R4		100	100	0
R5	S3	100	30	70
R6		80	90	−10
R7	S4	75	95	−20
R8		60	90	−30
R9	S5	70	95	−25
R10		40	90	−50
R11	S6	20	80	−60
R12		45	60	−15
Average		60	79	−19
p-value for the Wilcoxon test				0.050

Globally, the respondents' answers to the open question highlighted issues regarding both the form (mostly) and the content of the excerpts.

Concerning the first aspect (form), how the text was organised, including the use of bullets and bolds, and the adequate use of symbols and punctuation, were mentioned as relevant aspects to increase the readability of the text, as the examples below provide:

> R1: (…) Use of universal symbols (the '+' and '-' always with the same meaning instead of mixing symbols with different meanings, or the symbol that is once 'about', another time 'more or less' and another 'approximately'); Distinction in the use of '%' whether it is 'variation' or 'weight', always marking what is being talked about; Marking of subjects by 'overlining' (the use of 'bold' to mark the change of subtopic); Arrangement of the text by topics marked by 'bullets' that help organize what is being said, avoiding the dispersion of a very busy text; 6. Placement of punctuation when connecting words and pauses ('In the year 2023,' instead of 'In 2023 they were spent'). Concrete separation of the meaning of numbers, avoiding combining analyses of value variation with percentage variation.

> R2: '…the form of presentation. (…) and then explains in a more organized way than the first (…)'.

More than half (seven out of 12) of respondents exclusively indicated aspects related to the form to explain their answers, as follows:

> R4: 'The information in the second text is better organised. The highlights in bold allow the reader to immediately obtain a summary of the subject in question and the main aggregates of information'.

> R6: 'The reason for the differentiation is essentially due to the form of presentation (more objective and greater clarity) and the detail presented'.

> R7: 'The second text is more explicit, notably due to the separation of paragraphs and the use of a list with points and the use of 'surround' to replace the approximate sign. In the middle of the first text there is no agreement between 'this increase is essentially justified by (…)' and 'just as it was done (…)'. Bold accents also make it easier to quickly grasp the most important aspects'.

> R8: 'Organizing the text with defined paragraphs makes it easier to read and more attractive to read. The first text has very long sentences that do not help with its perception. In the second text, the fact that information that is considered important is highlighted in bold also helps to memorize the data as well as the organization by points'.

> R9: 'The second text, being more schematized, makes reading more understandable and simple'.

> R10: 'Use of 'bullets' to decompose information and bold to highlight information about amounts'.

> R12: 'In the second, the information is presented in a more structured and less confusing way'.

The aspects related to the content indicate how the consistent use of some concepts and the level of explanation were useful in improving the readability of the excerpts. Sometimes, these aspects were also related to the form of the text presentation, as indicated in the responses below.

> R1: 'Consistency in the use of concepts to mean the same (total expenditure in the 2nd text instead of execution in current expenditure and sum in capital expenditure'.

> R2: 'The objectivity of the exhibition, the form of presentation. The second text begins by placing the reader in the execution of the municipal budget and then explains in a more organised way than the first what contributed to the evolution of that execution'.

> R3: 'The first text is written in a confusing, contradictory and with errors. Example: 'The year 2023 maintains the growth trend observed in the first years of the four-year period 2020-2023…'; ~132.4 million euros'.

Regarding content, a single case exclusively stressed the content as the relevant aspect that distinguished the excerpts regarding their readability, as follows:

> R11: 'In the 1st text it is not clear that the entities Parque Junqueira and Valorsul were also entities to which the equity method applied. It seems to follow from the 1st paragraph that they are only those 3 entities with a significant impact, but then 2 more appear without it being clear that they also did part of Lisbon municipality's investments and resulting from the paragraph that after all the equity method only applies to those 2. This makes the interpretation of the text confusing. In the 2nd text, it becomes much clearer to whom the equity method was applied and the impact of this application'.

Neither the topics under assessment nor the size of the excerpts seemed to result in distinct patterns in respondents' perspectives. Then, the readability level, issues raised, and level of detail provided in their answers appear to be explained by their characteristics. Despite this evidence, it is worth stressing that they were globally more focused on the form and structure of the messages, an aspect in which ChatGPT messages performed better.

The next section provides the conclusion of this research.

Conclusion

This quasi-experimental research intended to identify respondents' perspectives regarding the readability of a text produced by ChatGPT compared to the original version provided in the Lisbon municipality's annual report and accounts. Although ChatGPT was globally wordier and structured in more sentences, it presented higher levels of readability based on the Flesch index. The global findings, also strengthened by the Wilcoxon test, offered the same conclusion, corroborating H1, with respondents indicating higher levels of readability measure for ChatGPT versions, which can be interpreted through the CLT and plain language principles.

A plainer and simplified language (ISO, 2023; Škorić et al., 2023) seems to reduce cognitive load, making texts easier to process (Chandler & Sweller, 1991; García-Gorrostieta et al., 2025; Sweller, 1988, 2010, 2023). Notwithstanding, ChatGPT had lower conciseness and higher readability, which is, somehow, contrary to the initial expectations based on the understandability assumption of the SNC-AP framework. However, this lower conciseness was possibly mitigated by a better text structure and design and a better characterisation of the information provided, as stressed by the respondents, who expressed some benefits of the readability of ChatGPT's outputs concerning both the form and content of its messages, particularly focusing on the former. They highlighted particularly the benefits of a more organised approach through the usefulness of language strategies such as bullets, bolds, and the adequate use of punctuation.

It is worth mentioning, however, that the findings from this research are circumscribed to its still exploratory purpose, as an experiment based on a relatively small number of respondents, despite being highly experienced professionals and academics in financial matters of public sector entities. Furthermore, it uses a prompt to influence ChatGPT's outputs on purpose, despite the inherent subjectivity of this choice.

Despite those considerations, the findings from this research corroborated previous research, which concluded that ChatGPT is effective in improving the readability of accounting texts (Albuquerque & Gomes dos Santos, 2024; Emett et al., 2023; Kim et al., 2024a; Voshaar et al., 2025). Given IPSAS's purpose of being useful for accountability and decision-making purposes (IPSASB, 2020), information should be communicated well to be understandable by users. LLMs, such as ChatGPT, may be valuable tools for helping to fulfil this purpose by enhancing readability and, therefore, the quality and usefulness of financial reporting (Arianpoor & Sahoor, 2023; Toerien & du Toit, 2024). Additionally, by studying financial narratives in Portuguese, the findings allow us to study ChatGPT's capabilities in a language other than English.

Therefore, the findings from this research may open the window for discussion regarding the likely benefits of using AI tools to improve readability and, consequently, the usefulness of financial reporting to a larger audience. As this study evidenced, this is now possible by applying the most disseminated and freely available AI tools, such as ChatGPT. Consequently, despite being exploratory, the contributions of this research can be extended to a set of diverse stakeholders of financial information, such as preparers, to assist them in providing and validating the understandability of information before financial reporting disclosures. Besides, it can benefit regulators, policymakers, and auditors to have more readable information after the previous step. It should be highlighted, however, that ChatGPT-generated text brings ethical concerns, namely about transparency and accountability (Li et al., 2024). Thereby, the use of AI, particularly in public sector documents, should follow ethical principles (European Commission, 2021; Wang et al., 2025).

This study has some limitations that must be considered, which can bias the findings and, therefore, lead to possible alternative interpretations. The first relates to the prompt used, which was the researcher's choice. A different choice of words could lead to different results. Despite being defined to achieve the objectives of this investigation, it has an inherent level of subjectivity. Then, the order of inclusion of the two alternative versions of the excerpts within the surveys is another aspect that may influence the findings. Moreover, the areas of financial information and the entity selected can influence the findings to the extent that the underlying level of readability is an element not controlled by researchers. Finally, the relatively reduced sample size, which on purpose included respondents with a known level of expertise in financial areas and the public sector, but, on the other hand, can have a bias of perspectives in some professional areas, such as auditing.

Despite these limitations and the exploratory nature of this study, a broader scope in different fields can be suggested as an avenue for future research.

First, the sample can be increased to include a more heterogeneous group of respondents. Further detailed analysis of the respondents' understanding of readability may be facilitated by the inclusion of demographic and personal characteristics as explanatory factors, which can also be enriched by proposing newer discussions through the lens of diverse theories that may justify the inclusion of these distinctive elements. Other constraints of this research can be mitigated or better assessed through this sample enlargement, namely, the possible influence of the orders of appearance of the alternative excerpts. Additionally, different types of entities, possibly with more diverse levels of influence or geographical areas, can enhance the analysis.

Second, experiments in this area may benefit from the use of the newest technologies, such as eye-tracking analysis, which offers a different perspective on readability, considering its inevitable subjective nature. It might also be beneficial to examine the textual characteristics behind the suggested messages in more depth to determine how those aspects relate to respondents' perceptions of readability. Moreover, since this study was performed in the Portuguese language, a replica of it in English can serve as a proper comparison and robustness test for the findings from this research, despite the unavoidable and non-controlled differences regarding respondents' characteristics.

Third, the inclusion of more diversified areas or topics of analysis by readers can also enhance future research in this field. Then, future investigations can examine topics other than expenses and non-current assets, as well as other areas of entity reporting, such as sustainability matters, to determine if the readability levels found differ from the more traditional scope of this study, which primarily covers financial data.

Finally, the use of prompts based on other specific goals and/or users according to the goals of the investigation can provide additional insights. The assessment of their possible use to lead to bias in reporting through the lens of impression management strategies, such as attribution and obfuscation, can also be of interest to highlight, on the other hand, the harmful use of those prompts.

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Fábio Albuquerque and Paula Gomes dos Santos have read and agreed to the published version of the manuscript. Artificial Intelligence tools were exclusively used to partially produce the surveys as part of this research objective and according to what was indicated within the material and methods section.

Informed consent statement

Written informed consent was obtained from the study participants.

Impact statement

The findings of this study demonstrate the potential of generative artificial intelligence, specifically ChatGPT, to enhance the readability of public sector financial reports. Based on Cognitive Load Theory and plain language principles, the research suggests that ChatGPT can assist in overcoming long-standing challenges of complexity and opacity. It highlights an innovative, scalable method for enhancing transparency, accountability, and inclusivity in government reporting that can be helpful to a wide range of interested parties, including not only readers and analysts but also policymakers, auditors, and report preparers. The study fills a noted gap in the literature regarding IPSAS-based frameworks and non-English language contexts.

Author contributions statement

CRediT: **Fábio Albuquerque**: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing; **Paula Gomes dos Santos**: Data curation, Funding acquisition, Investigation, Methodology, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Data availability statement

The data presented in this study are available on request from the corresponding author.

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Appendix I: Original and modified excerpts by survey (S)

Original excerpt	Modified excerpt
S1: In 2023, ≈1,016.3 million euros were spent, which corresponds to an increase of ≈37.4 million euros (+3.8%) compared to the previous year. The combined effect of the growth in current expenditure, by ≈+48.7 million euros (+6.9%), with the decrease in capital expenditure, of ≈−11.3 million euros (−4.1%), contributed to this variation. Current expenditure has an execution of ≈752.3 million euros and reinforces its relative weight, compared to 2022, constituting ≈74.0% of municipal expenditure. It also registers an increase in all its households, with emphasis on personnel expenses, which show an increase of ≈22.6 million euros/≈+8.1%, mainly based on the application of various measures to value workers in public functions, with a direct impact on certain remunerations, social contributions and supplements awarded, as analysed in more detail in point III of this report. Capital expenditure totalled ≈264.0 million euros and its relative weight (26.0%) in the structure of municipal expenditure decreased by 2.1%, when compared to the previous year. The retraction in capital expenditure is largely anchored in the combined effect of the reduction in Financial Liabilities (≈−12.9 million euros/−31.5%), as a result of the extraordinary amortization, in 2022, of a bank loan resulting from the contracting of a replacement loan, with the increase in capital transfers (≈+3.3 million euros/+12.3%).	S1: In 2023, the City Council recorded a total expenditure of approximately 1,016.3 million euros, which represents an increase of around 37.4 million euros (+3.8%) compared to the amount executed in 2022. This increase resulted from the combined effect of two factors: • The growth in current expenditure, which increased by around 48.7 million euros (+6.9%); • The decrease in capital expenditure, which was reduced by approximately 11.3 million euros (−4.1%). **Current expenditure** reached a total of around 752.3 million euros, representing 74.0% of municipal expenditure in 2023, which indicates an increase in its relative weight compared to 2022. All components of current expenditure increased, with a highlight to: • Personnel expenses, which increased by around 22.6 million euros (+8.1%). This growth is mainly due to the application of measures to value workers in public functions, which had a direct impact on fixed remuneration, social contributions and supplements. These aspects are analysed in more detail in point III of this report. On the other hand, **capital expenditure** totalled approximately 264.0 million euros in 2023, corresponding to 26.0% of municipal expenditure. This figure represents a reduction of 2.1% in the relative weight of capital expenditure compared to the previous year. The reduction in capital expenditure is largely due to the following factors: • A decrease of around 12.9 million euros (−31.5%) in financial liabilities, due to the extraordinary amortization of a bank loan in 2022, which was made possible thanks to the contracting of a replacement loan; • An increase of around 3.3 million euros (+12.3%) in capital transfers.
S2: The year 2023 maintains the growth trend seen in the first years of the four-year period [2020; 2023], namely in terms of current expenditure and with greater expression in the years 2021, due to the induction of measures to combat the pandemic, which implied a considerable increase in current transfers and subsidies, and in 2023, in a generalized increase but with a greater incidence in personnel expenditure. In the comparison of the extreme years of this four-year period, current expenditure shows an increase of ≈132.4 million euros (+21.36%), which occurs in all the aggregates that comprise it, with particular emphasis on personnel expenditure with an increase of ≈45.5 million euros (+17.9%). Also noteworthy is the current debt burdens which, in 2023, interrupt a long period of continuous reduction, due to the rise in indexes along with the beginning of interest maturity for some tranches of loans contracted. From this comparison, and with regard to capital expenditure, there is an increase of ≈41.7 million euros, although there is no regular variation over the four years and in the various items that make up this expenditure segment. Despite the weak budgetary expression, expenditure on the acquisition of capital goods decreased by ≈−1.8 million euros/- 0.9% in 2023, interrupting the growth cycle that had been taking place.	S2: In 2023, the growth trend observed throughout the four-year period [2020–2023] continued, particularly in current expenditure. This growth was most noticeable in two specific years: • **2021**, due to measures to combat the pandemic, which required a significant increase in current transfers and subsidies; • **2023**, where the increase was generalized, but with greater emphasis on personnel expenses. When comparing the extreme years of this four-year period (2020 and 2023), current expenditure increased by around **132.4 million euros (+21.36%)**, with growth in all the categories that comprise it. Especially noteworthy are: • **Staff expenditure**, which increased by approximately **45.5 million euros (+17.9%)**. In addition, current debt burdens, after several years of continuous reduction, increased in 2023. This increase results from the rise in indexes and the start of interest payments for some instalments of loans contracted. As for **capital expenditure**, there was an increase of around **41.7 million euros** between 2020 and 2023. However, there was no consistent growth over the period or among the various items that make up this type of expenditure. In particular, expenditure on the acquisition of capital goods, although with a reduced share in the budget, suffered a reduction of around **1.8 million euros (−0.9%)** in 2023, interrupting the growth cycle that had been recorded in previous years. This analysis reflects the evolution of expenditure over the four-year period, highlighting the main changes and factors that influenced budget execution.

(*Continued*)

Appendix I. Continued.

Original excerpt	Modified excerpt
S3: The expenditure included in the Plan of Activities, as detailed in point IV of this report, totalled ≈609.7 million euros in 2023 (≈+19.5 million euros/+3.3% compared to the same period of the previous year), representing ≈60.0% of the total execution of the budget of the Municipality of Lisbon. Expenditure on the operation of services totalled ≈406.7 million euros and increased by ≈17.9 million euros (+4.6%), when compared to 2022. This increase is the result of the increase in personnel expenses (≈+22.6 million euros), current debt charges (≈+5.6 million euros) and acquisition of services (≈+5.2 million euros), combined with the decrease in financial liabilities (≈−12.8 million euros) and other current expenses (≈−2.5 million euros).	S3: In 2023, the expenditure included in the Activity Plan totalled around **609.7 million euros**, representing **60.0% of the total execution of the budget of the Municipality of Lisbon**. This figure reflects an increase of approximately **19.5 million euros (+3.3%)** compared to the same period in 2022. Expenditure related to the operation of services reached around **406.7 million euros**, which corresponds to a growth of around **17.9 million euros (+4.6%)** compared to the previous year. This increase was driven by the following factors: • An increase of **22.6 million euros** in personnel expenses; • An increase of **5.6 million euros** in current debt charges; • A growth of **5.2 million euros** in the acquisition of services. On the other hand, some items recorded reductions: • Financial liabilities decreased by around **12.8 million euros**; • Other current expenses showed a reduction of approximately **2.5 million euros**. These data reflect the main changes in the functioning of municipal services, detailed in point IV of this report.
S4: Non-current assets increased by ≈405.6 million euros, which is almost entirely explained by the increase in tangible fixed assets by ≈379.8 million euros (13%), which highlights the value of ≈211.8 million euros in public domain assets, historical, cultural and artistic heritage. This increase is essentially justified by the Infrastructure item (#4303) due to the new values attributed to sanitation infrastructures, as well as the registration of assets in use, but which were not registered, based on a study carried out by the National Laboratory of Civil Engineering (LNEC), in order to update the register to 2020 values, in the amount of ≈276, 3 million euros (as part of the transition to SNC-AP).	S4: In 2023, non-current assets increased by around **405.6 million euros**, explained almost entirely by the growth in **property, plant and equipment**, which rose by approximately **379.8 million euros (+13%)**. Within this heading, the increase of around **211.8 million euros** related to assets in the public domain, including historical, cultural and artistic heritage, stands out. This increase is mainly due to: • The revaluation of the infrastructure item **(#4303),** with emphasis on the new values attributed to sanitation infrastructures; • The registration of assets in use that were not yet registered. This process was based on a study carried out by the **National Laboratory of Civil Engineering (LNEC),** which updated the register to reflect the 2020 values. This adjustment resulted in the incorporation of around **276.3 million euros**, as part of the transition to the **Accounting Standardization System for Public Administrations (SNC-AP).** These changes reinforce the appreciation of public assets and the adequacy of heritage records to the financial reality of the municipality.
S5: In the current presentation of the values on the Balance Sheet, in which the items are very aggregated and are presented by net value, the variations that occurred are not visible, but some more significant movements are highlighted, still in the item of tangible fixed assets. In land and natural resources, there was an increase of ≈12.1 million euros, where ≈17.3 million euros stand out, referring to shipments of goods that were in use and were not registered, and there was no knowledge of the acquisition values, they were registered in the VPT – Taxable Patrimonial Value. Of these, Rua José Cardoso Pires worth 4.8 million euros, Avenida Carlos Paredes worth ≈4.0 million euros and Alto do Lumiar worth 3.0 million euros stand out. In expropriations, the increase of ≈2.7 million euros, namely in Beco do Belo and Beco das Taipas. Conversely, there are exchanges worth ≈7.1 million euros, and disposals of ≈2.3 million euros, where Rua José Cardoso Pires and Avenida Carlos Paredes stand out for both situations. The item housing and buildings for services increased by ≈33.3 million euros, mainly justified by ongoing investment transfers. Namely, in Alto do Lumiar, in the amount of ≈8.5 million euros, Schools and nurseries, in a total of ≈4.4 million euros, Avenida da República, in the amount of ≈3.3 million euros, in Rua do Rio Douro, in ≈1.2 million euros.	S5: The current presentation of the values in the Balance Sheet, with very aggregated items and presented by net value, does not allow us to directly observe the variations that have occurred. However, the following most relevant movements within the item **fixed assets** stand out • **Land and natural resources:** There was an increase of around **12.1 million euros**, the main reason being the registration of assets in use that were not previously registered. These assets, whose acquisition has not been documented, were recorded based on the **Taxable Patrimonial Value (VPT),** for a total of approximately **17.3 million euros**. Among the highlights are: ○ Rua José Cardoso Pires: **4.8 million euros**; ○ Avenida Carlos Paredes: **4.0 million euros**; ○ Alto do Lumiar: **3.0 million euros**. On the other hand, there were: ○ **Increases due to expropriations**: about **2.7 million euros**, mainly in Beco do Belo and Beco das Taipas; ○ **Reductions for** exchanges: approximately **EUR 7.1 million**; ○ **Disposals**: around **2.3 million euros**, with emphasis again on Rua José Cardoso Pires and Avenida Carlos Paredes in both situations. • **Housing and buildings for services:** This item registered an increase of about **33.3 million euros**, mainly due to ongoing investment transfers. The main contributions were: ○ Alto do Lumiar: **8.5 million euros**; ○ Schools and nurseries: **4.4 million euros**; ○ Avenida da República: **3.3 million euros**; ○ Rua do Rio Douro: **1.2 million euros**. These variations show the impact of cadastral updates, expropriations, exchanges and ongoing investments on the total value of the municipality's tangible fixed assets.

(*Continued*)

Appendix I. Continued.

Original excerpt	Modified excerpt
S6: Financial investments show an increase of ≈23.1 million euros, due to the application of the MEP – Equity Method to municipal companies, which are 100% owned by the Municipality, and also to other participations in entities, when it is greater than 20%. The most significant impact was recorded at Carris, with an increase of ≈19.3 million euros, and there was also an increase at Lisboa Ocidental, SRU and EMEL, in the amount of ≈1.9 million euros and ≈653.3 thousand euros, respectively. The affiliated entities that are subject to the application of the MEP are Associação Parque Junqueira and Valorsul, S.A.. Regarding these two entities, the impact on the Municipality's accounts was an increase of ≈885.7 thousand euros and ≈592.5 thousand euros, respectively, in the item Financial investments, taking into account the percentage of the Municipality's participation in these entities.	S6: In 2023, **financial investments** increased by around **23.1 million euros**, due to the application of the **Equity Method (MEP).** This method was applied to municipal companies fully owned by the Municipality (100%) and also to other entities where the Municipality's participation is greater than 20%. The main highlights of this increase are: • **Carris**: increase of around **19.3 million euros**; • **Western Lisbon, SRU:** increase of approximately **1.9 million euros**; • **EMEL:** increase of about **653.3 thousand euros**. In addition, the following entities participated by the Municipality were also subject to the MEP: • **Parque Junqueira Association**: impact of **885.7 thousand euros**; • **Valorsul, S.A.**: impact of **592.5 thousand euros**. The increases recorded in these entities were reflected in the item of financial investments, according to the percentages of participation of the Municipality. These variations reinforce the valuation of municipal participations and the impact of the management of the entities in which the Municipality has participated in the overall financial statement.