

Analysis of Research on Artificial Intelligence in Public Administration: Literature Review and Textual Analysis

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ABSTRACT

Purpose: This study aims to investigate how analysing academic research through digital tools can improve our understanding of the applications, functions, and challenges related to the use of advanced artificial technologies (AI) in public administration.

Methodology: The applied methodology relies on the use of digital tools, specifically Voyant-Tools and Chat Generative Pre-Trained Transformer (GPT-4), for text analysis in conjunction with a selection of scientific literature on artificial intelligence and public administration.

Findings: The results of our study show that researchers equally report advantages and disadvantages of using AI in public administration. Moreover, the research highlights the benefits of using artificial intelligence while emphasising the importance of the ethical and appropriate regulation thereof.

Practical implications: Our innovative approach of developing and using a combined methodology involving specialised digital tools to analyse scientific literature introduces a new dimension to the examination of scientific texts and has the potential to shape public policy in the field of public administration.

Originality: The existing body of research on public administration and artificial intelligence is limited. Our study expands the scientific field by delving into the use of artificial intelligence in public administration.

Keywords: digital tools, artificial intelligence, GPT-4, public administration, regulation

JEL: Z18

1 Introduction

In the age of quickly developing artificial intelligence (AI), it is imperative that the progress of science in this field is accompanied by the progress of AI in the domain of public administration. Xu et al. (2019) defined AI as the simulation of human intelligence with a specific system or machines with the aim of mimicking human thinking and behaviour. AI subareas defined by Vijayakumar and Sheshadri (2019) include expert systems, natural language processing, pattern recognition, robotics, and machine learning, among others.

Ahn (2023) explained that the essence of AI lies in large language models (LLMs). LLMs are machine-learning models trained on vast text collections and operate by predicting the most likely word to follow a given sequence of text. With their help, processing similar to natural language can be performed, which includes tasks such as translation, analysis, summarization, and proof-reading. LLMs analyse and comprehend the connections between words and concepts, enabling them to follow a logical sequence of ideas. Moshirfar et al. (2023) noted that Chat Generative Pre-Trained Transformer (ChatGPT) is among the most well-known natural language processing (NLP) models that is trained on large language databases. The latest available version of ChatGPT is Version 4 (ChatGPT-4), which has shown great efficiency and accuracy of results compared to previous versions, even from the perspective of understanding the context of analysed texts.

However, software applications available prior to ChatGPT also can perform a general analysis of texts. One such program is Voyant Tools. Alhudithi (2021) explained that Voyant Tools uses computer algorithms to obtain the required information from the text. The areas of use for the Voyant Tools program were defined by Gregory et al. (2022) as the identification of terms that most frequently appear in the text, the occurrence of other terms in connection with the most commonly used terms, visualization of results, and the occurrence of terms that connote positively or negatively.¹ With certain fine adjustments, we can also customize the obtained results.

Gesk and Leyer (2022) noted the growing interest in utilizing AI-based software in the public sector, as well. However, research findings from the private sector cannot be directly applied to the public sector due to disparities in citizens' perception of services. AI holds significant potential for enhancing public services, primarily in terms of efficiency and service quality, but concerns regarding its growth and application remain a significant obstacle to its adoption. Similarly, Androniceanu (2023) found that digitalization and the use of AI can visibly improve managerial and economic efficiency in public administration. Štefanišinová et al. (2021) added that individual AI tools are still in the development phase but already offer substantial advantages in providing public services that will further improve in the future. However, in the use of

¹ "Generally words can be used for positive or negative connotations depending on the contextual situation. The usage of words may be good or bad sense, impression, experience, feeling, etc. For example, politicians and advertisers may prefer words with positive connotations in view of expressing their message attractively. In case of unpleasant feeling, a word with negative connotations may be used to describe them" (Rao, 2017).

advanced analytics, Simonofski et al. (2022) emphasized the importance of respecting the protection of personal data and human verification of decisions made by AI technologies.

The primary objective of the current study was to understand how analysing academic research through digital tools may improve our view into the applications, functions, and issues related to the use of advanced artificial technologies in public administration.

We next provide a literature review of the analysed articles. Thereafter, we discuss the selection and advantages of our employed methodology and explain the analytical procedures we used. In the following Results section, we cover the outcomes of literature identification and selection as well as graphical and visual representations of the findings. We then further elaborate upon and compare these results with the outcomes of other comparable studies in the Discussion section. Finally, we provide brief conclusions into essential insights into the broader applicability of the results obtained, highlight the weaknesses of our research, and show opportunities for further development of the study.

2 Literature Review of Selected Articles

In our brief review of the scientific literature, we primarily focused on the scientific contributions that were discussed and analysed in our research. A brief literature review is a collaborative work of the authors with ChatGPT-4, in which the authors sought a deeper meaning of the analyzed text in accordance with the goals of our research. This may, to a certain extent, differ from the intentions of the original authors of the analyzed texts. ChatGPT-4 can hallucinate, i.e., cosmetically re-interpret the actual state – a result that must be considered in further interpretations of literature summaries. For one, Wirtz and Müller (2019) discussed the use of AI in public administration through a conceptual study. In their research, they developed an integrated AI framework for public management that encompassed all crucial aspects (regulation, and ethical and political guidelines), goal of using AI is achieving greater efficiency in public management. Subsequently, Wirtz et al. (2021) conducted a systematic review of the literature in the field of AI in the public sector. Utilizing qualitative and quantitative approaches, they analysed 189 articles. They further performed a methodological classification of articles and analysed the risks and benefits of using AI in the public sector. They discovered an extremely heterogeneous research area that is methodologically unbalanced and thus proposed more empirical and in-depth studies on the use of AI in the public sector, they anticipate a larger number of empirical data and proposed more in-depth studies of the use of AI in public sector. Previously, Wirtz et al. (2020) had proposed an integrated AI governance framework by considering the interactions of AI challenges, previous regulations and public administration. We can conclude that when balancing risks with the benefits of AI regulation, all stakeholders' viewpoints should be taken into account for optimal results for the society. Wirtz and Müller (2023) further expanded

their research by questioning the development of modelling smart cities and technological interactions of its stakeholders and the use of technologies. They used a literature review, which was rather complex. In the study, they noted that technological city governance can improve efficiency in resource use and enhance the quality of life for citizens. However, they also noted that despite technological progress, traditional governance mechanisms will not become redundant and will be important to balance the weaknesses of smart technological governance. Moreover, Wirtz et al. (2019) explored the use of AI in the public sector and defined the possibilities and challenges in using AI. They conducted a literature review with a selection of keywords that defined the use of AI and challenges in the public sector. Their results identified 10 AI application areas in the public sector and defined four main dimensions of challenges in using AI, the primary of which were how to ensure regulation of AI, how to use it in an ethically acceptable way, and what the impact of AI on a society as a whole will be.

In the specialized field of the public sector, namely in the provision of health and social services, Štefanišinová et al. (2021) investigated the use of AI. Utilizing a comparative approach and case analysis, they acquired a realistic assessment of current AI technologies and anticipated levels of AI. They emphasized that using AI could both improve and challenge the way healthcare and social services are provided, but the main goal should be to make life better for people. Among the principal challenges of using AI are the utilization of data and the potential reduction of jobs due to task optimization.

Simonofski et al. (2022) also scrutinized the legal requirements of data protection in public administration in the area of fraud analytics with advanced technologies. They examined two case studies and summarized 15 different governance practices in this field. They accentuated the complexity of the integration a legal requirements that would be in line with advanced analytics. A further challenge in employing AI technologies represents the protection of personal data and the application of administrative law.

Furthermore, Busuioac (2021) researched the use of AI algorithms in the public sector in connection with ensuring accountability for decisions. The author employed conceptual analysis to diagnose and analyse the challenges and responsibilities associated with the use of AI (accountability) in the public sector and underscored the importance of interpretable and transparent AI models.

Additionally, McDonald et al. (2022) addressed the area of research and the future of research in public administration. They reflected on the state of public administration research and analysed the methodology used in that field. They noted that technology could significantly impact how governments respond to emerging changes, which could represent a further potential area of research.

Vogl et al. (2020) also explored the use of smart technologies at the local level of public administration. In their study, they used questionnaires and interviews with employees in local public administration. They found that the use

of smart technologies in local public administration was on the rise. Smart technologies are becoming part of the process in providing public services, which may result in certain changes.

Moreover, Terzidou (2022) investigated the use of AI in the judiciary. Specifically, she examined the transition from the use of information and communication technologies (ICT) to the use of AI. Although she emphasized that the use of AI may present certain benefits, especially in terms of improved efficiency and better accessibility of judicial services, she also mentioned disadvantages that need to be addressed with the implantation of regulatory rules. The key risks are primarily related to the independence and impartiality of the courts.

In another study, Bodó and Janssen (2022) explored the impact of private technological systems in the public sector on citizens' trust in the government. They conducted a critical assessment and analysis of various aspects of technology and trust in the public sector. They found that when technology fails, it can significantly influence citizens' trust in the state. In their study, AI was mainly understood in connection with the use of technology.

Furthermore, Hartmann and Wenzelburger (2021) investigated the application of algorithms and computer models to support decision-making processes within the U.S. public administration – criminal justice. They conducted a case study based on the review of primary sources and interviews with experts. The results of the study showed that decision-making with the help of algorithmic methods was popular mainly because of the prior uncertainty of outcomes, the consequent dispersion of responsibility for negative consequences of decisions, because of the help of algorithmic methods, it is not such an important factor. Thus, the careful consideration of legal, social, and ethical aspects is important when using AI systems.

Grimmelikhuijsen (2021) also explored the effect of algorithms on perceived trust in automated decision-making. Experimental testing of two scenarios showed that explainability of algorithmic decision-making is more important for trust. Similarly, Wenzelburger et al. (2022) examined how people accept algorithms used in the public sector and issue of context. They conducted two case studies with surveys completed by over 2,600 people from Germany. Their research results also indicated that people accept algorithms more if they are solving a problem of personal importance and if they trust the organization using them.

Moreover, Giest and Klievink (2022) analysed two cases and explored the influence of AI on bureaucrats roles within public administration in different organizational contexts by focusing mainly on the impact of AI on innovation in the public sector. They found that there was pronounced administrative-process innovation, in other words, a change in the organizational structure and tasks of employees. In one case, there was also conceptual innovation because the AI system handled a specific task faster, more accurately, and more efficiently than a human could have.

The interaction between humans and AI in decision-making in the public sector was also studied by Alon-Barkat and Busuioc (2023) in three experimental studies. Their research primarily dealt with the aspect of automating bias and selective adherence to decisions and advice from AI or algorithms when they align with group stereotypes. They emphasised understanding the functioning of algorithmic shortcomings when used to assist decision-making for already vulnerable and disadvantaged citizens in the public sector.

Additionally, Pencheva et al. (2020), through a review of scientific literature in the field of public administration, investigated the transformational impact of big data and AI on governance around the world. They observed a benefits of big data and AI on policy cycle, especially in terms of increasing accuracy, efficiency, and speed of the policy-making process due to Big Data – AI usage.

Similarly, Castelnovo and Sorrentino (2021) addressed the impacts of big data and AI on government role in their research, which used a conceptual approach. They noted that big data can help to achieve significant improvements in policymaking and the provision of public services. However, we think that governments need to be careful and plan ahead when dealing with the issues of Big Data and AI.

With this critical evaluation of existing literature, we can improve our understanding of the gaps and shortcomings in this subject.

3 Methods

We methodologically designed this study as an identification and selection of scientific literature in the field of AI in public administration, a literature review of analysed articles with an emphasis on the research area under investigation (presented in the literature overview of selected articles), a determination of the most frequently used terms in the corpus of articles, and an identification of the positive and negative connotations of the article's texts.

We focused on using the Web of Science (WoS) database because our aim was to demonstrate the utility of digital tools in analysing a limited set of scientific articles indexed in one of the major databases. We also decided to limit the data to the last 5 years, which enabled us to analyse the latest research trends and developments in the selected period. This approach ensured the relevance and timeliness of the acquired data while also allowing for the effective use of digital tools for analysis and interpretation of the gathered information. Articles that met all the criteria below (applied to the WoS database) and were freely accessible (accessed through the Educational Research Institute network) in the WoS database or from the publisher were used for further text analysis:

- Keywords: artificial intelligence and public administration in all WoS databases (ALL);
- Publication years: 2018–2022;

- Languages: English;
- Countries/regions: EU;
- Document types: Article or review article;
- WoS categories: Public administration.

There are various digital tools available for analyzing scientific texts, including fairly traditional ones such as VOSviewer (VOSviewer, 2023) and those used for classic quantitative bibliographic analysis. Our objective was to visualize text with a deep understanding of semantics and content analysis, so we sought tools that were generally accessible, free of charge, user friendly, and required less technical expertise compared to, for example, NVivo and Biblioshiny. Consequently, we determined Voyant Tools (Voyant Tools, 2023) and ChatGPT-4 (OpenAI, 2023b) to be suitable choices.

The 19 scientific articles, which were freely accessible, were analysed using Voyant Tools. Voyant Tools is a freely accessible, web-based program for textual analysis of text. With Voyant Tools, it is possible to analyse documents in different languages because it supports analysis in any language because it operates on character sequences (Voyant Tools, 2023). Our analysis encompassed the entire content of each article. We first identified 25 terms that appeared most frequently across the entirety of the article corpus, namely, the keywords. During the analysis, we excluded irrelevant words, and, among the first 25 terms, we tried to combine words with the same roots. We also determined the frequency of occurrence of the first 25 individual terms that denoted positive and negative connotations. The frequency of occurrence of positive and negative connotations was determined using the word base of Voyant Tools. Determining the positive and negative connotations in texts is important because it can help identify the authors' and the scientific community's perspectives on a specific topic, for example, perception and potential receptiveness to AI technologies.

In ChatGPT-4, using the appropriate and available PDF plugin (Ai PDF), we analysed-interact with 19 freely accessible scientific articles. Furthermore, we created and used prompts² following the principles outlined in "Best Practices for Prompt Engineering with OpenAI API" (OpenAI, 2023a). According to these guidelines, prompts should be concise, precise, and elaborative. The analysis using prompts was divided into two steps:

1. Searching for the most frequent terms in the corpus of scientific articles. Example prompt: Analyse the entire content of the provided scientific articles in PDF format and identify the five most frequently occurring terms, focusing on key terminology. Please ensure that the results are based solely on the actual content of the articles, without conjecture or fabrication of data.
2. Using prompts that focused on determining the general connotation of the entire corpus of text. Example prompt: Determine the general text

² As Reynolds and McDonnell (2021) pointed out, a prompt is an instruction to the GPT chat on how to perform a specific task.

connotation of the entire content of the provided scientific articles in PDF format, analysing the overall tone, sentiment, and thematic elements. Ensure that the interpretation is based strictly on the content provided, without any conjecture or fabricated results.

4 Results

4.1 Results of Literature Identification and Selection

Only 22 scientific articles met the search criteria in WoS, and they are presented in Table 1. In terms of WoS categories, all 22 of the articles fell within the category of public administration. Six were also categorized under political science, two under management, and one under social sciences interdisciplinary. In relation to research areas, all 22 articles related to public administration, six to government law, two to business economics, and one to social sciences other topics. From the subsequent textual analysis, we excluded three scientific articles due to lack of public accessibility, leaving a total of 19 articles for textual analysis.

Table 1. Results of Literature Identification and Selection

Authors	Article Title	Source Title	Publication Year	Early Access Date
Wirtz, B. W., & Müller, W. M.	An Integrated Artificial Intelligence Framework for Public Management	<i>Public Management Review</i>	2019	
Wirtz, B. W., Weyerer, J. C., & Sturm, B. J.	The Dark Sides of Artificial Intelligence: An Integrated AI Governance Framework for Public Administration	<i>International Journal of Public Administration</i>	2020	
Stefanisino, N., Muthova, N. J., Strangfeldova, J., & Sulajova, K.	Implementation and Application of Artificial Intelligence in Selected Public Services	<i>Croatian and Comparative Public Administration</i>	2021	
Wirtz, B. W., Langer, P. F., & Fenner, C.	Artificial Intelligence in the Public Sector - A Research Agenda	<i>International Journal of Public Administration</i>	2021	8/2021
Wirtz, B. W., Weyerer, J. C., & Geyer, C.	Artificial Intelligence and the Public Sector- Applications and Challenges	<i>International Journal of Public Administration</i>	2019	
Simonofski, A., Tombal, T., De Terwangne, C., Willem, P., Frenay, B., & Janssen, M.	Balancing Fraud Analytics With Legal Requirements: Governance Practices and Trade-Offs in Public Administrations	<i>Data & Policy</i>	2022	
Busuioc, M.	Accountable Artificial Intelligence: Holding Algorithms to Account	<i>Public Administration Review</i>	2021	11/2020
McDonald, B. D., Hall, J. L., O'Flynn, J., & Thiel, S.	The Future of Public Administration Research: An Editor's Perspective	<i>Public Administration</i>	2022	1/2022
Vogl, T. M., Seidelin, C., Ganesh, B., & Bright, J.	Smart Technology and the Emergence of Algorithmic Bureaucracy: Artificial Intelligence in UK Local Authorities	<i>Public Administration Review</i>	2020	
Terzidou, K.	The Use of Artificial Intelligence in the Judiciary and Its Compliance with the Right to a Fair Trial	<i>Journal of Judicial Administration</i>	2022	
Bodo, B., & Janssen, H.	Maintaining Trust in a Technologized Public Sector	<i>Policy and Society</i>	2022	5/2022
Hoffman, I., & Karpiuk, M.	E-Administration in Polish and Hungarian Municipalities - A Comparative Analysis of the Regulatory Issues	<i>Lex Localis-Journal of Local Self-Government</i>	2022	

Authors	Article Title	Source Title	Publication Year	Early Access Date
Hartmann, K., & Wenzelburger, G.	Uncertainty, Risk and the Use of Algorithms in Policy Decisions: A Case Study on Criminal Justice in the USA	<i>Policy Sciences</i>	2021	1/2021
Giest, S. N., & Klievink, B.	More Than a Digital System: How AI Is Changing the Role of Bureaucrats in Different Organizational Contexts	<i>Public Management Review</i>	2022	7/2022
Alon-Barkat, S., & Busuioc, M.	Human-AI Interactions in Public Sector Decision Making: Automation Bias and Selective Adherence to Algorithmic Advice	<i>Journal of Public Administration Research and Theory</i>	2023	2/2022
Wenzelburger, G., König, P. D., Felfeli, J., & Achitziger, A.	Algorithms in the Public Sector. Why Context Matters	<i>Public Administration</i>	2022	12/2022
Pencheva, I., Esteve, M., & Mikhaylov, S. J.	Big Data and AI - A Transformational Shift for Government: So, What Next for Research?	<i>Public Policy and Administration</i>	2020	
Kim, S., Andersen, K. N., & Lee, J. W.	Platform Government in the Era of Smart Technology	<i>Public Administration Review</i>	2022	8/2021
Castelnuovo, W., & Sorrentino, M.	The Nodality Disconnect of Data-Driven Government	<i>Administration & Society</i>	2021	3/2021
Grimmelikhuisen, S.	Explaining Why the Computer Says No: Algorithmic Transparency Affects the Perceived Trustworthiness of Automated Decision-Making	<i>Public Administration Review</i>	2023	6/2022
Wirtz, B. W., & Müller, W. M.	An Integrative Collaborative Ecosystem for Smart Cities - A Framework for Organizational Governance	<i>International Journal of Public Administration</i>	2023	3/2022
Compton, M. E., Young, M. M., Bullock, J. B., & Greer, R.	Administrative Errors and Race: Can Technology Mitigate Inequitable Administrative Outcomes?	<i>Journal of Public Administration Research and Theory</i>	2023	9/2022

Source: Table was produced via WoS, 2023

4.2 Results of the Textual Data Analysis Using Voyant Tools

In Table 2 below, we have identified the first 25 terms that most frequently appeared in the entire corpus of article texts. The terms “public” and “AI” were the most common, which is expected given the research theme. The word “AI” was the second most frequently used term in the analysed articles, but the terms “artificial” and “intelligence” were also listed separately. Therefore, these terms can be combined differently, for example, as “artificial neural network,” “artificial discretion,” “intelligence technologies,” or “intelligence techniques.” The term “algorithms” also appeared as “algorithm” and was combined into a unified form “algorithms” for the purpose of analysis, ranking as the fourth most frequently used term in the analysed text.

Table 2. First 25 Terms That Most Frequently Appeared in the Corpus of Article Texts

Term	Count	Term	Count
public	2,099	policy	509
ai	1,776	risk	497
data	1,479	algorithmic	483
algorithms	805	government	482
administration	701	making	443
decision	686	technology	431
research	640	information	419
intelligence	604	social	417
use	563	review	413
human	545	big	398
artificial	540	governance	396
systems	533	services	338
sector	514		

Source: Own

4.3 Frequency of Words with a Positive Connotation

In the corpus of scientific articles, the terms “intelligence” ($n = 604$) and “trust” ($n = 275$) were most frequently used as terms with a positive connotation (Table 3). “Trust,” “ethical,” and “trustworthiness” also appeared on this list. Although these terms themselves carry positive connotations, the context in which they are used in texts is also crucial. For instance, when discussing a lack of trust or ethical issues in trustworthiness, words can convey a negative meaning in a text even though the Voyant Tools word database would classify these words as positively connotated.

Table 3. First 25 Terms with a Positive Connotation

Term	Count	Term	Count
intelligence	604	advanced	75
trust	275	integrated	73
smart	250	better	71
well	228	creative	68
work	203	like	67
important	173	trustworthiness	62
support	157	regard	62
available	124	fairness	62
innovation	120	protection	58
ethical	117	improve	58
benefits	110	selective	55
right	106	fair	52
significant	77		

Source: Own

4.4 Frequency of Words with a Negative Connotation

In the corpus of scientific articles, the terms “risk” ($n = 497$) and “bias” ($n = 265$) were most frequently used as terms with a negative connotation (Table 4). The word “issue” also appeared in the form “issues,” so we combined them into a unified form “issue.” Similarly, the term “bias” appeared in the forms “biases” and “biased,” so in the analysis, we combined them into a unified form “bias.” Unlike the list of terms with a positive connotation, in this list, it is harder to attribute an opposite positive meaning to the terms.

Table 4. First 25 Terms with a Negative Connotation

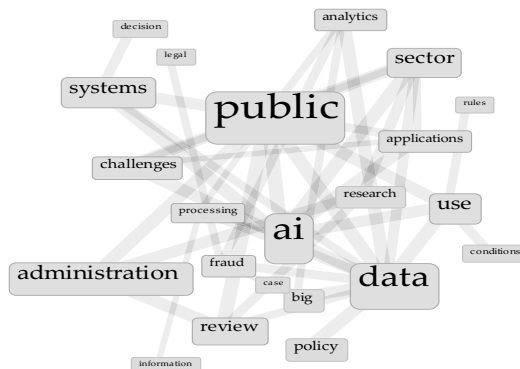
Term	Count	Term	Count
risk	497	discrimination	46
bias	265	scandal	45
fraud	234	limitations	44
problem	151	cancer	44
issues	147	concern	36
criminal	90	regression	27
complex	71	vice	25
lack	71	manipulation	25
limited	57	crime	24
concerns	54	discriminatory	22
negative	50	error	21
critical	50	limitation	20
blame	47		

Source: Own

4.5 Collocates Graph

Figure 1 below shows the networking of word connections. The central part displays some of the keywords while the co-occurring terms are marked in orange and show the occurrences of terms in the context of the keywords. In our analysis, we noted that when using the term “use,” the terms “rules” and “conditions” often co-occurred, indicating that they were important when defining conditions and rules for the use of AI.

Figure 1. Collocates Graph of Word Connections



Source: Figure was produced via Voyant Tools.

4.6 Analysis of the Article Corpus with ChatGPT-4 Dated August 21, 2023

ChatGPT-4 identified the five most frequently used words in the corpus of articles as the following (response on key-word prompt):

- Artificial
- Intelligence
- Technology
- Public
- Management

ChatGPT-4 then responded to the given connotation prompt. Specifically, ChatGPT-4 identified that the texts in all 19 articles exhibited a diversity of topics and connotations. The scientific texts concentrated on various areas such as AI, technology, management, societal and ethical aspects, and challenges associated with them. The connotations of the texts were a blend of positive and negative aspects, reflecting diverse perspectives addressed within the corpus. ChatGPT-4 also noted that positive connotations were evident in descriptions of intelligent systems, technological advancements, trust in technology, and good work and approaches to management. Conversely, ChatGPT-4 established that negative connotations related to risks, bias, fraud, problems, and challenges encountered in the implementation of these solutions. The ChatGPT-4 analysis concluded that the overall picture of the analysed documents was balanced because the corpus of articles engaged with both positive and potentially negative aspects of the use of AI and technology in management and society at large.

4.7 Analysis of the Content of Selected Articles

Our brief review of the literature, as presented in the literature overview of selected articles, revealed a very broad scope of AI application in public administration. We found that researchers focused on both the advantages of using AI and the potential problems and threats associated with its use. Particularly, researchers emphasized aspects of simplifying work processes and thereby optimizing operational workflows as well as ethical considerations and the protection of personal data. Overall, the researchers seemed to present a balanced view of all aspects of AI usage.

5 Discussion

Both research tools we used employ algorithms in their analyses, but, as Alhuthi (2021) pointed out, Voyant Tools focuses primarily on the frequency of occurrence of certain terms and the further visualization of them. In contrast, ChatGPT-4 is an advanced language model intended for natural language processing, which also understands the meaning, content, and context of the analysed text (Moshirfar et al., 2023).

For our analysis of the entire content of selected scientific articles, we used both Voyant Tools and ChatGPT-4. We deepened the analysis by preparing short reviews of the articles' content in collaboration with ChatGPT-4, reviews integrated an important human factor into the analysis. Thus, our analysis of the texts' connotations via ChatGPT-4 plus our human analysis could offer the full meaning of the texts, which is important for a thorough analysis. On the contrary, Voyant Tools lacks this option. Voyant Tools searches for the occurrence of individual terms in the texts that have a positive or negative connotation but does not understand the broader meaning of the entire text.

Voyant Tools identified the terms "public," "AI," "data," "algorithms," and "administration" as the most frequently used in the corpus of articles. Consequently, it is evident that thorough understanding of these terms is vital when dealing with the use of AI in public administration. In our analysis of terms that often co-occurred with the keywords, we found the terms "use," "rules," and "conditions" often co-occurred. This result likely indicates that researchers often research and write about setting rules and conditions (i.e., regulations) when talking about the use of AI. Indeed, this is a very frequent topic in the scientific literature. For one, Wirtz et al. (2019) emphasized that regulation is one of the main challenges in the use of AI. Furthermore, in June 2023, the EU Parliament adopted the negotiating positions for regulating AI in the EU. The regulation would ensure transparent operation of AI and provide privacy and security for users as well as human oversight of AI operations (European Parliament, 2023).

Positive connotations generally occur when describing intelligent systems and technological advancements, and negative connotations when dealing with words related to risks and bias. In the literature review, we noted that the term "trust" was used mainly from the perspective of questioning the trustworthiness of AI. However, Voyant Tools marked it as a word that denotes a positive connotation even though the actual meaning in the text was more negative. Also, among words with negative connotations, the terms "issue" and "bias" often appeared. This finding connects with research from Alon-Barkat and Busuioc (2023) who warned about the issues of automating bias and selective adherence to decisions and advice from AI or algorithms when they align with group stereotypes. Therefore, human control of decisions made with AI is important, and the type of texts on which AI learns is also crucial.

We noted that the analysis of texts in terms of positive and negative connotations reflected a very complex and diverse field of AI use in the public sector. Moreover, our literature review found similar observations to those in the connotation analysis with ChatGPT-4, specifically, that researchers deal with both positive and negative consequences of the use and implementation of AI in the public sector. As Giest and Klievink (2022) stated, the execution of certain tasks can be faster and more efficient with AI, but the use of AI is always linked to the use of technology (Bodó & Janssen, 2022), so it is important to also consider risks such as the protection of personal data (Simonofski et al., 2022) and ethics in using AI (Wirtz et al., 2019).

Through a review of the literature, we also recognized the need for establishing rules and regulations in the field of AI, but we are aware that it is difficult to halt the progress of technology, and, in our opinion, halting the development of technology and AI would even be inappropriate. For example, the use of algorithms in connection with AI is significant in the field of medical science. Indeed, Wenzelburger et al. (2022) noted that algorithms are used in predicting skin cancer. Furthermore, AI technology allows detailed text analyses, as evident in our research. The results of using intelligent tools for analysis can provide different and broader insights into the subject matter, which can contribute to increased quality of life and development of science.

In analysing the results, we also noticed that Voyant Tools and ChatGPT-4 classified keywords differently to a certain extent. Such differences may be the result of the different algorithms each analysis tool uses. For instance, ChatGPT-4 takes semantics into account, understands the context of terms, and considers various linguistic nuances of the text. The actual prompts can also influence outcomes with ChatGPT-4 depending on how the program understands an instruction. For example, instructions determine whether it searches for words in the text that are identical or for words that have a similar meaning. Moreover, PDF plugins for use with ChatGPT-4 can segment and analyse the text in parts, or they can just summarize it to a certain extent (ChatGPT-4 has important limitations in the amount of data processed). One of the negative aspects of the literature review made in collaboration with ChatGPT-4 is the possibility of hallucination, i.e., the cosmetic reinterpretation of the actual state - the result of the analyzed scientific articles. This should be pointed out to the readers of our article, and readers should consider this in the final interpretation of the literature summary and highlight this issue. Similarly, technological advancements in the use of digital tools could influence the accuracy of our results. For example, we noticed that during the article review period, OpenAI (the provider of ChatGPT-4) offered updated and more advanced chat features, such as advanced data analysis, browse with Bing, and Dalle-E 3 (photo generation). Finally, the way each tool is used can influence the results. For instance, when we excluded meaningless words and combined words with the same root via Voyant Tools, we affected the results of the analysis.

All the mentioned shortcomings of digital tools could have significantly impacted the results of our analysis. For a more detailed explanation, we would need to examine the background functioning of the algorithms of both tools.

6 Conclusions

Analysis and research of texts with so-called digital smart tools can help us understand the deeper meaning of a text and can emphasize individual elements that are significant in addressing a particular subject matter. These analyses could influence the overall advancement of society and the development of science.

Textual analysis emphasizes individual keywords that are important in the subject being discussed and the general connotation of the text, which may indicate factors for or against the use of AI technology in the field of public administration. Terms that co-occur with keywords can express certain additional views that need to be considered in the analysis. In our case, the terms “rules” and “conditions” were connected with the key word “use,” which may indicate a strong necessity for the regulation of the AI field and perhaps an indication and incentive for regulators in shaping policies for the use of AI in public administration.

However, the weaknesses of this study were the limited number of scientific articles we analysed, possible hallucination of ChatGPT-4 and the overrepresentation of certain authors among those articles. Moreover, we included the entire text of each article in our analysis; for further research, we suggest removing individual parts of the article, such as references. This modification can change the determination of keywords and the general connotations of the text. Further research could also expand the selection of analysed research articles by using other databases of scientific literature and comparing research among individual countries.

In sum, for the broader field of public administration, the simultaneous use of both text-analysis tools—ChatGPT-4 and Voyant Tools—is appropriate. Only in this way can we obtain results that are more broadly applicable and that can help us shape policy in the field of public administration.

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