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ChatGPT for Bibliometrics: A comprehensive corpus of applications

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Abstract

This paper explores the transformative role of ChatGPT in enhancing bibliometric research methodologies across various stages of academic study. It discusses the application of ChatGPT in bibliometric studies across five core research stages: preparation and consultation, data processing, data analysis, results interpretation, and scientific writing. Highlighting ChatGPT's versatility, the paper showcases its utility in streamlining data handling, enhancing analytical depth, and facilitating scholarly communication. With capabilities ranging from querying external APIs to customising responses for specific research needs, ChatGPT may aid the efficiency and efficacy of bibliometric research. Ethical considerations are also discussed, advocating for the integration of ChatGPT to uphold high ethical standards and improve research integrity.

Keywords

ChatGPT, bibliometric studies, academic research, data analysis, AI ethics

44 1. INTRODUCTION

45 1.1. Features and functionalities of ChatGPT for research

46 ChatGPT is a generative text system that leverages machine learning to produce text that
47 closely mimics human writing. The current versions, 3.5 and 4, each offer capabilities for a
48 wide range of potential applications. Interaction with ChatGPT is primarily through one or
49 more user prompts, enabling tailored responses to queries. ChatGPT 4 can also analyse multiple
50 file types, including images, Excel spreadsheets, and PDF documents, enriching its interaction
51 capabilities. In addition to these functionalities, ChatGPT can query external APIs and establish
52 connections with third-party services, offering integration with external data and tools.

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54 ChatGPT users have various options to tailor their own GPT bots for specific tasks or
55 knowledge bases, including flexible API access to integrate ChatGPT into precise analysis
56 processes and workflows. Beyond these capabilities, ChatGPT incorporates ethical safeguards,
57 such as mechanisms to prevent the generation of harmful content. Its theoretical potential for
58 facilitating academic writing, data analysis, and even conducting complex research activities
59 suggests that it may play a role in advancing academic research.

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61 1.2. Previous discussions of the potential of ChatGPT for research

62 The potential of ChatGPT for research has been discussed by UNESCO, suggesting that it can
63 help the processes of design, data collection, data analysis, and the subsequent publication stage
64 (United Nations Educational, Scientific and Cultural Organization, 2023). Discussions
65 centering on various health fields have also tended to emphasise the potential of ChatGPT. For
66 example, a review of biomedical studies about ChatGPT found that its benefits were mentioned
67 in 51 of the 60 studies analysed (85%), and these included: (1) improvements in scientific
68 writing (see also: Graf & Bernardi, 2023) and an increase in the equity and versatility of
69 research; (2) the efficient analysis of datasets, code generation, and literature reviews (Sallam,
70 2023). Additionally, various experiments have been conducted, simulating patient populations
71 in biomedical data and testing its effectiveness in drafting papers. (Macdonald et al., 2023).
72 These uses have led to discussions about co-authorship with ChatGPT in scientific articles
73 (Stokel-Walker, 2023).

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75 Generative AI also raises ethical and copyright issues, such as who owns the rights to the
76 generated text since it is partly derived from the uncredited authors of the texts used to train the
77 models (Lund et al., 2023). In addition, it can be difficult to detect ChatGPT-authored text
78 within academic papers, which is a problem for journals and conferences that ban it (Guillaume
79 Cabanac (here and elsewhere) [@gcabanac], 2024b, Guillaume Cabanac (here and elsewhere)
80 [@gcabanac], 2024a). In this regard, to avoid plagiarism, it has been proposed that the detection
81 of ChatGPT and similar technologies should be integrated into academic platforms to catch
82 plagiarism and safeguard the rights of researchers and writers (Qasem, 2023)

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84 The increased use of generative AI may also cause a decrease in critical thinking and
85 challenges with effectively evaluating the generated text (Rahman & Watanobe, 2023),
86 including the detection of hallucinations. This problem might be reduced or exacerbated by
87 custom GPTs, such as the Dimensions GPT for scientific information search.

88

89 1.3. Objectives

90 The objective of this paper is to discuss potential applications of ChatGPT for bibliometric
91 studies, both articles or reports. These have been split into five core task blocks: preparation

92 and consultation, data processing, data analysis, results interpretation, and writing. Each block
 93 includes a series of tasks (Table 1). This paper will elaborate on each block and present
 94 examples to demonstrate potential ChatGPT applications.

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Table 1. Tasks where ChatGPT could be used in bibliometrics.

Project stage	Detailed activities
Preparation and consultation <i>Establishing bibliometric goals and consulting relevant literature</i>	Review of manifestos and ethical and methodological guidelines.
	Design and preparation of contextualised case studies.
Data processing <i>Retrieving, cleaning, and combining bibliometric data for accurate analysis</i>	Identification and selection of relevant data sources.
	Extraction and downloading of data from multiple sources.
	Data cleaning, transformation, and normalisation.
	Guidance on database structuring.
	Data capture through APIs and process automation.
	Documentation and metadata description of datasets.
Data analysis <i>Analysing bibliometric data to identify trends and patterns</i>	Conducting descriptive and exploratory data analysis.
	Application of advanced statistical techniques.
	Development of data visualizations for interpretation.
	Calculation of bibliometric indicators and impact metrics.
	Consultation on the selection and application of indicators.
	Implementation of Topic Modeling and content analysis.
Results interpretation <i>Interpreting data to understand bibliometric impacts and relationships</i>	Critical interpretation of the obtained results.
	Validation of results through statistical methods.
Writing <i>Drafting the report summarising bibliometric findings and conclusions</i>	Critical review and editing of scientific texts.
	Writing of reports, articles, and presentations.
	Making recommendations based on the bibliometric results, if applicable.
	Summarising the limitations of the bibliometric approach used.
	Translation of scientific documents into multiple languages.

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100 **2. APPLICATIONS AND EXAMPLES**

101 2.1. Preparation and consultation

102 Table 2 highlights three ways in which ChatGPT could help in the preparatory phases of
103 bibliometric analyses.

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105 *Table 2. Utilising ChatGPT in preparation and consultation: tasks, descriptions, and real-case scenarios.*


Task	Description	Example
Review of ethical and methodological guidelines	Assists in analysing and summarising key points from relevant documents to ensure adherence to best practices.	ChatGPT facilitates the examination and summary of the DORA declaration and COAR recommendations, enabling researchers to integrate these considerations into their publication strategies and repository selections.
Design and preparation of contextualised case studies	Provides support in structuring and drafting case studies that reflect specific research contexts.	ChatGPT assists in designing a methodology for evaluating 50 scientists in accordance with evaluative principles, detailing the steps such as criteria selection, data collection methods, and analysis techniques for objective assessment.

106

107 To give a practical example, we used ChatGPT in the initial consultation phase of a bibliometric
108 study into the impact of open access policies (Figure 1) and then asked for help with the
109 recommended software (Figure 2). Whilst the first example output might be plausible to a non-
110 expert, the recommended strategy is too general to be valid and recommends the widely
111 discredited h-index. Similarly, whilst the second output seems helpful, it would be risky to rely
112 on it rather than the official software documentation in case ChatGPT has guessed incorrectly.

113

114 *Figure 1. In the following example, a prompt is shown requesting guidance for a bibliometric study, and the
115 output is displayed in table format.*

<p>1 Suggested prompt to receive a bibliometric study suggestion in a specific format</p> <p><i>I need a table that summarizes the methodology and peer review process for a bibliometric analysis project, including evaluation criteria with specified weights, data collection methods mentioning specific databases and metrics, detailed analysis techniques identifying the software used, and a structured peer review process with defined steps and their importance. Please ensure the table provides a clear and comprehensive overview suitable for academic and research purposes.</i></p> <p style="text-align: center;"></p>	<p>2 Table generated by ChatGPT outlining the various elements of the study</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Section</th> <th style="text-align: left;">Details</th> </tr> </thead> <tbody> <tr> <td>Evaluation Criteria</td> <td>1. Publication Output (30%): Number of peer-reviewed articles. 2. Citation Impact (40%): Citations and h-index. 3. Collaboration Networks (20%): Strength and diversity of co-authorships. 4. Policy Contributions (10%): Influence on policy-making documents.</td> </tr> <tr> <td>Data Collection Methods</td> <td>Utilizing Scopus for breadth of academic journals and Web of Science for robust citation data. Metrics include publication counts, citation numbers, and h-index. Data extraction facilitated through API access when available, ensuring the most current and comprehensive dataset.</td> </tr> <tr> <td>Analysis Techniques</td> <td>1. Citation Analysis: Using VOSviewer for citation mapping and impact assessment. 2. Social Network Analysis: Employing Gephi for visualizing collaboration networks, identifying key nodes and clusters. 3. Content Analysis for Policy Contributions: Applying NVivo to qualitatively assess the inclusion of scientific work in policy documents.</td> </tr> <tr> <td>Importance of Peer Review</td> <td>1. Indicator Verification (30%): Peer consultation for validating bibliometric indicators. 2. Report Analysis (40%): In-depth review by subject matter experts to ensure accuracy. 3. Candidate Scoring (30%): Objective scoring by peers, based on detailed reports and adherence to evaluation criteria.</td> </tr> </tbody> </table>	Section	Details	Evaluation Criteria	1. Publication Output (30%) : Number of peer-reviewed articles. 2. Citation Impact (40%) : Citations and h-index. 3. Collaboration Networks (20%) : Strength and diversity of co-authorships. 4. Policy Contributions (10%) : Influence on policy-making documents.	Data Collection Methods	Utilizing Scopus for breadth of academic journals and Web of Science for robust citation data. Metrics include publication counts, citation numbers, and h-index. Data extraction facilitated through API access when available, ensuring the most current and comprehensive dataset.	Analysis Techniques	1. Citation Analysis : Using VOSviewer for citation mapping and impact assessment. 2. Social Network Analysis : Employing Gephi for visualizing collaboration networks, identifying key nodes and clusters. 3. Content Analysis for Policy Contributions : Applying NVivo to qualitatively assess the inclusion of scientific work in policy documents.	Importance of Peer Review	1. Indicator Verification (30%) : Peer consultation for validating bibliometric indicators. 2. Report Analysis (40%) : In-depth review by subject matter experts to ensure accuracy. 3. Candidate Scoring (30%) : Objective scoring by peers, based on detailed reports and adherence to evaluation criteria.
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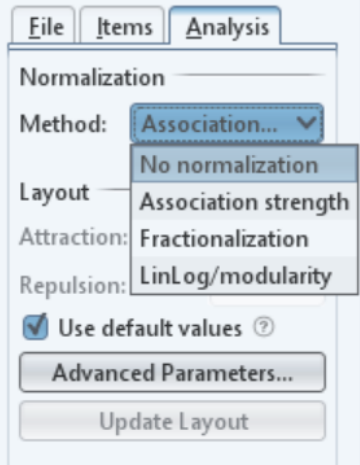



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Figure 2. Ask ChatGPT with a VOSviewer image to define the indicators and help us understand them.

	<p>1 In this instance, you were working with the VOSviewer software, and I want to know specific details about the functionalities and concrete indicators from the menu, particularly regarding normalisation aspects. I'm asking ChatGPT to describe them for me, and I'm attaching a small screenshot of the menu in the prompt.</p> <div style="text-align: center;">  </div> <div style="border: 1px solid gray; border-radius: 15px; padding: 10px; display: flex; align-items: center; justify-content: space-between;">  <div style="flex-grow: 1;"> <p>Can you help me understand this menu from the VOSviewer software, especially the normalisation methods it includes? Could you briefly summarize them for me?</p> </div>  </div>
<p>2 In the response, we see how ChatGPT can identify the different indicators included in the menu image and enlighten us on their use.</p> <div style="border: 1px solid gray; padding: 5px; margin-top: 10px;"> <p>ChatGPT</p> <p>In the VOSviewer software, normalisation is a critical feature for adjusting raw data to account for size-related differences among items, making comparisons more meaningful. The normalisation methods included in the menu are likely as follows:</p> <ol style="list-style-type: none"> 1. No normalization: This option means that the raw data will be used without any adjustments. It's a straightforward approach that may be suitable when all items are of similar size or when size differences are not expected to distort the analysis. 2. Association strength: This normalization method adjusts the data based on the strength of the association between items. It's often used in co-citation or co-authorship analysis, where it's important to understand how strongly items (such as documents, authors, or journals) are related, relative to the overall network structure. 3. Fractionalization: This method typically divides the count for each instance by the number of all instances that share a characteristic. It's used, for instance, in collaboration networks, where a publication co-authored by multiple authors may have its 'weight' divided equally among them to avoid over-representation of collaborative works. 4. LinLog/modularity: This might refer to a specific combination of linear and logarithmic normalization or to a modularity-based approach often used in community detection within networks. It helps to fine-tune the visualization by focusing on the modularity of the network, which can highlight the strength of clusters within the data. <p><small>These normalization methods help users perform bibliometric analysis by adjusting data to reveal underlying patterns that raw counts might obscure. The choice of method will depend on the research question and the characteristics of the dataset.</small></p> </div>	<p>In the VOSviewer software, normalisation is a critical feature for adjusting raw data to account for size-related differences among items, making comparisons more meaningful. The normalisation methods included in the menu are likely as follows:</p> <ul style="list-style-type: none"> • No normalisation: This option means that the raw data will be used without any adjustments. It's a straightforward approach that may be suitable when all items are of similar size or when size differences are not expected to distort the analysis. • Association strength: This normalisation method adjusts the data based on the strength of the association between items. It's often used in co-citation or co-authorship analysis, where it's important to understand how strongly items (such as documents, authors, or journals) are related, relative to the overall network structure. • Fractionalization: This method typically divides the count for each instance by the number of all instances that share a characteristic. It's used, for instance, in collaboration networks, where a publication co-authored by multiple authors may have its 'weight' divided equally among them to avoid over-representation of collaborative works. • LinLog/modularity: This might refer to a specific combination of linear and logarithmic normalisation or to a modularity-based approach often used in community detection within networks. It helps to fine-tune the visualisation by focusing on the modularity of the network, which can highlight the strength of clusters within the data. <p>These normalisation methods help users perform bibliometric analysis by adjusting data to reveal underlying patterns that raw counts might obscure. The choice of method will depend on the research question and the characteristics of the dataset.</p>

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133 2.2. Data processing

134 ChatGPT may help with at least six data processing tasks (Table 3). All of these are sensitive
 135 actions in the sense that errors could invalidate a study and so expert oversight would be needed
 136 to check the results. To help with this, ChatGPT might be prompted for explicit reasons for its
 137 choices or supporting information (Figure 3). It is not clear whether the ChatGPT outputs
 138 would tend to be a helpful timesaver or a problematic distraction for these tasks.

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140 *Table 3. Utilising ChatGPT in bibliometric data processing: tasks, descriptions, and real-case scenarios.*

Task	Description	Example
<i>Identification and selection of relevant data sources</i>	Suggests databases, journals, and platforms for data collection.	Asking ChatGPT to identify the most appropriate database for a study on social sciences in Spanish might lead to the suggestion of Scopus or Web of Science due to their extensive coverage and language support.
<i>Extraction and downloading of data from multiple sources</i>	Automates the process of retrieving data from identified sources.	Using ChatGPT to automate the extraction of data from PubMed and arXiv for a review on neurodegenerative diseases.
<i>Data cleaning, transformation, and normalisation</i>	Refines raw data into a usable format, addressing inconsistencies and preparing for analysis.	ChatGPT could assist in scripting for data cleaning routines, such as standardising author names and affiliations from different citation styles.
<i>Guidance on database structuring</i>	Advice on organising data in a structured manner conducive to analysis.	ChatGPT offers insights on how to structure a relational database for storing bibliometric data, emphasising the relationships between authors, publications, and citations.
<i>Data capture through APIs and process automation</i>	Uses APIs for efficient data retrieval and employs automation for repetitive tasks.	ChatGPT aids in creating scripts to query the Crossref API for real-time citation data, enhancing the dataset's currency and accuracy.
<i>Documentation and metadata description of datasets</i>	Creating detailed records about the dataset, ensuring clarity and reusability.	ChatGPT helps draft comprehensive documentation for a dataset, outlining its scope, methodology, and potential limitations, ensuring future researchers can understand and utilise the data effectively.

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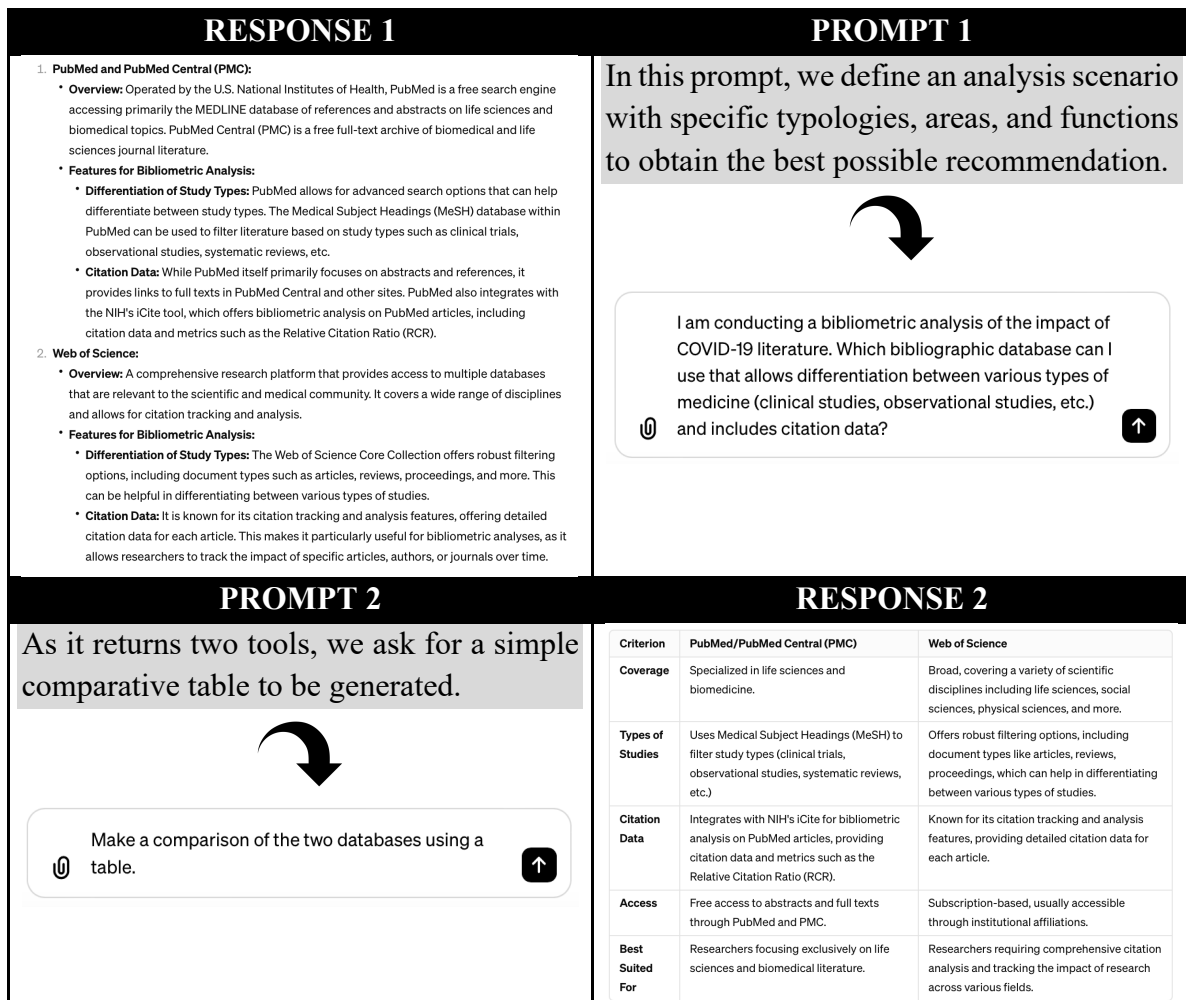
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Figure 3. Example of assistance for choosing a bibliographic database and comparison.

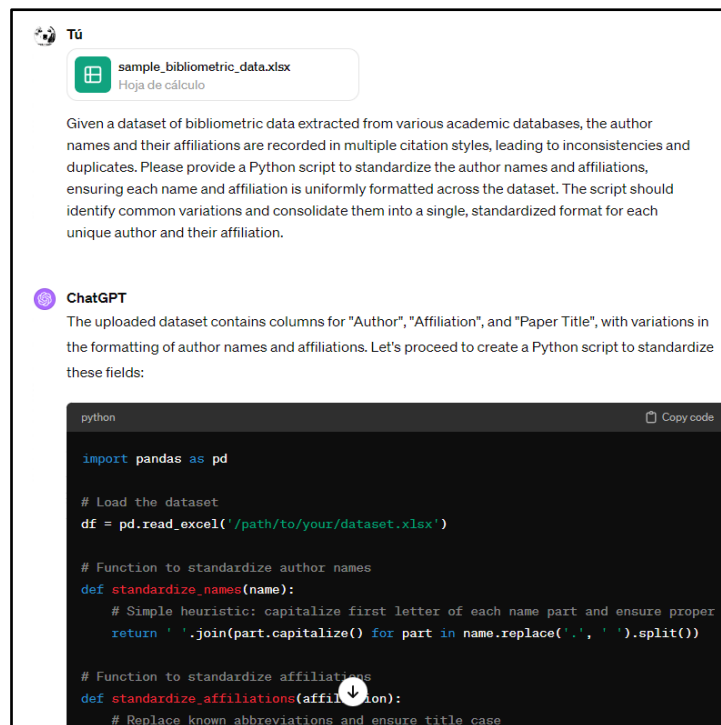


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ChatGPT may be particularly useful for programming tasks if the bibliometrician is not an experienced programmer. This might include constructing API queries. Figure 4 provides an example where ChatGPT constructs a Python program to normalise author names as part of the data preparation phase. The script employed regular expressions to identify and standardise common variations in author names (e.g., "J. Doe" vs. "John Doe") and affiliations (e.g., "Univ. of Example" vs. "University of Example"). It also included a function to match and merge records that, after processing, were identified as belonging to the same individual or institution, despite the initial discrepancies in how their names were presented. The application of this script significantly improved the quality of the dataset, enabling more accurate analyses of publication patterns, collaborations, and institutional affiliations within the field of study. An competent Python coder should be able to check that the code works, saving considerable time in comparison to identifying the appropriate functions to write the code themselves (Figure 4).

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Figure 4. Example of a prompt in ChatGPT to request a Python routine that allows for the normalisation of author names and institutions in a dataset.



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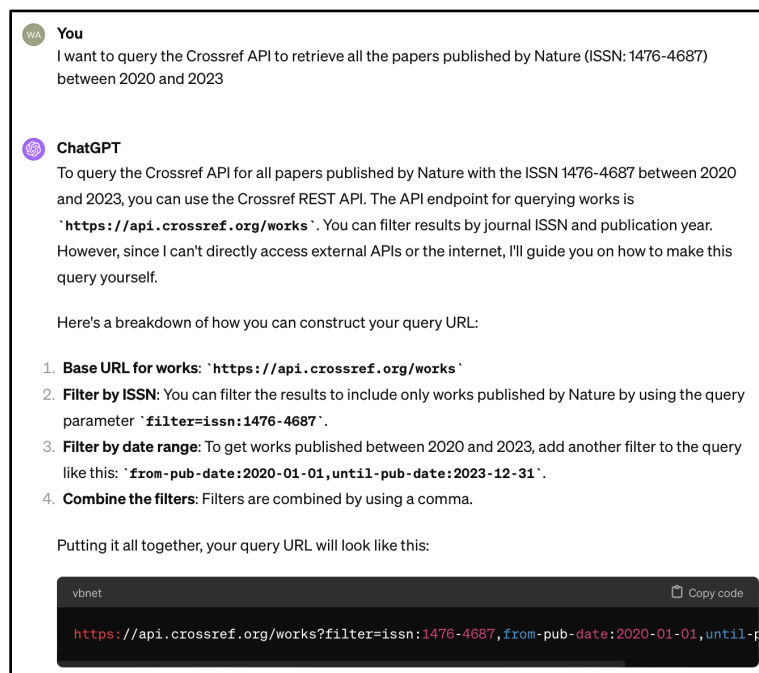
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176 Similarly to the above example, Figure 5, on the other hand, showcases ChatGPT's ability to
 177 show how to construct a specific format of API query, with an explanation that can be checked.
 178 This can save the programmer the time to look up all the components of the query in the API
 179 documentation.

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Figure 5. Example of a prompt for constructing a query to the Crossref API.



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183 2.3. Data analysis

184 ChatGPT could be used to analyse data (e.g., uploaded in a spreadsheet), suggest a data analysis
 185 strategy or write code for a particular analysis (Table 4). Relying on ChatGPT to process the
 186 data is particularly problematic because the researcher then no longer has the oversight to check
 187 that the processing steps are correct. Since bibliometric processing often has many steps and
 188 some require expert input, relying on ChatGPT's guesses is problematic.

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Table 4. Using ChatGPT in data analysis: tasks, descriptions, and real-case scenarios.

Task	Description	Example
Conducting descriptive and exploratory data analysis	Involves summarising the main characteristics of a dataset to uncover patterns or anomalies.	ChatGPT aids in scripting preliminary data analyses, guiding researchers through the process of identifying trends within their bibliometric data.
Application of advanced statistical techniques	Utilises complex statistical methods to interpret data and draw conclusions.	ChatGPT suggests appropriate statistical methods for complex datasets, such as regression analysis or factor analysis, to uncover deeper insights in bibliometric studies.
Development of data visualisations for interpretation	Creates visual representations of data to facilitate understanding and communication of findings.	ChatGPT assists in selecting the most effective data visualisation tools and techniques for showcasing bibliometric findings, such as network graphs or heatmaps.
Calculation of bibliometric indicators and impact metrics	Computes measures to assess the impact and quality of research outputs.	ChatGPT helps outline the steps for calculating key bibliometric indicators like the impact factor, ensuring accurate assessment of research impact.
Consultation on the selection and application of indicators	Advises on the most suitable metrics for specific research evaluation needs.	ChatGPT provides insights on the pros and cons of various bibliometric indicators, helping researchers choose the most relevant metrics for their analysis.
Implementation of Topic Modeling and content analysis	Employs algorithms to discover the thematic structure of a large corpus of text.	ChatGPT guides the setup and interpretation of Topic Modeling, facilitating the exploration of predominant themes in scholarly publications.

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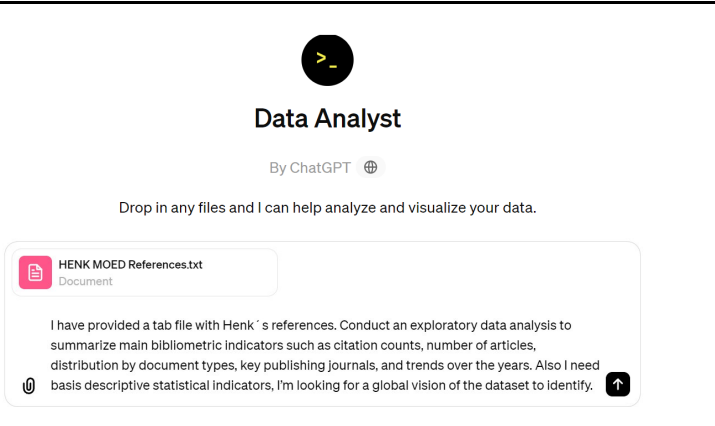
192 To illustrate descriptive and exploratory data analysis, we provided ChatGPT with a tabulated
 193 file with bibliographic records (Figure 6). The GPT Data Analyst is an AI-driven feature,
 194 equipped to handle, interpret, and provide insights from datasets by executing various statistical
 195 analyses, identifying trends, generating visualisations, and summarising key findings.
 196 Furthermore, Figure 7 illustrates the ability of ChatGPT to create visualisations directly from
 197 data files, such as those downloaded from the Journal Citation Reports (JCR), but there is no
 198 guarantee that the visualisations are correct and do not contain hallucinations.

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Figure 6. Example of an exploratory analysis of an author's file downloaded from Web of Science and analysed with the GPT "Data Analyst".

1 The image displays a specialized GPT model designed by OpenAI specifically for data analysis. We can see that a file containing Henk Moed's references has been attached. The prompt instructs the model to carry out some basic calculations. Although the tasks set out here are fundamental, the GPT Data Analyst has the capability to perform much more complex analyses.



2 In the following image, we see the response provided, which promptly delivers an overarching view.

Based on the exploratory data analysis of the dataset provided, here are the summaries of the main bibliometric indicators:

- **Total Number of Articles:** The dataset contains a total of 179 entries.
- **Distribution by Document Types:**
 - Articles: 78
 - Article; Book Chapter: 28
 - Editorial Material: 18
 - Proceedings Paper: 15
 - Article; Proceedings Paper: 15
 - (Others include Letter, Editorial Material; Book Chapter, Meeting Abstract, Correction, Review, Biographical-Item, Book, Book Review, Note)
- **Key Publishing Journals (Top 10):**
 - Scientometrics: 54 publications
 - Citation Analysis in Research Evaluation: 30 publications
 - Journal of Informetrics: 12 publications
 - Nature: 7 publications
 - Research Evaluation: 7 publications
 - Research Policy: 6 publications
- **Citation Counts Summary:**
 - Mean: 43.88 citations per document
 - Standard Deviation: 77.93
 - Min: 0 citations
 - 25th Percentile: 1 citation
 - Median (50th Percentile): 10 citations
 - 75th Percentile: 48.5 citations
 - Max: 410 citations
- **Trends Over the Years:** Publications span from 1985 to 2022, with varying numbers of publications per year. The year 2005 saw the highest number of publications in the dataset (36 publications).

3 Next, we see how we can ask all kinds of exploratory questions about the dataset.

Could you briefly indicate Moed's three main research lines, provide a very brief description of each, and the terms's frequency associated with that line?

1. **Citation Analysis and Impact:** Moed investigates the significance of citations (38 mentions) to understand the impact (36 mentions) and reach of research (56 mentions). This area focuses on how citations can reflect the value and influence of scientific works, aiming to unravel the narrative behind citation patterns and their role in academic recognition.
2. **Bibliometrics and Scientometrics:** Through bibliometric (25 mentions) techniques, Moed analyzes scientific (34 mentions) publications to quantify the dynamics of science (30 mentions). This research examines publication trends, collaboration networks, and the distribution of knowledge across fields, offering insights into the structural aspects of scientific activity and its measurement.
3. **Journal and Research Performance Indicators:** Moed's work on evaluating journals (25 mentions) through performance indicators (18 mentions) aims to assess the quality and impact of scholarly outputs. This involves developing and applying metrics that accurately reflect the contributions of journals and research articles to the scientific community, aiding in the strategic decisions of academia and policy.

Can you tell me the names and institutions of his main collaborators in Spain?

Let's proceed with identifying these collaborators and their institutions.
Based on the data, Henk Moed's main collaborators in Spain and their institutions include:

1. **Vicente P. Guerrero-Bote:**
 - Institution: Universidad de Extremadura, Department of Information and Communication, Badajoz, Spain.
2. **Felix de Moya-Anegón:**
 - Institution: SClmago Group, Madrid, Spain; also associated with CSIC (Spanish National Research Council), Madrid, Spain.
3. **Carmen Lopez-Illescas:**
 - Institutions: Universidad Complutense Madrid, Department of Library and Information Science, Madrid, Spain; also mentioned in connection with the University of Granada, Granada, Spain.

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Figure 7. Example of creating visualisations with ChatGPT from a file directly downloaded from the JCR.

DanielTorres-Salinas_JCR_...
 Hoja de cálculo

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With this collection of one hundred scientific journals and their corresponding Journal Citation Reports (JCR) indicators, I require the creation of four distinct visualizations (such as a heatmap to display data density, a cluster diagram organized by indicator values, a bivariate map for comparative analysis, and a fourth visualization of your choosing) that will facilitate a deeper insight into the patterns and relationships within the indicator data.

1 In the following example, we provide a basic prompt and a file containing six bibliometric indicators, then request ChatGPT to create various visualisations.

[File with original data](#)

2 Before generating the graphics, ChatGPT explains, on one hand, the methodology it will follow, the programming language, and libraries (2a), and then briefly describes the four graphics that it will produce (2b)

2a

To proceed with creating these visualizations, the first step involves parsing the data into a structured format suitable for analysis, such as a pandas DataFrame in Python. This structured format will enable the efficient manipulation and visualization of the data using libraries like matplotlib and seaborn for the heatmaps, cluster diagrams, and scatter plots, alongside other suitable tools for the bivariate map. Let's begin by parsing the data. [\[↩\]](#)

2b

Here is a summary of the visualizations we will develop:

- Heatmap to Display Data Density:** This will visualize the distribution of journals across selected indicators, helping identify areas of high density where many journals share similar metric values.
- Cluster Diagram (Dendrogram):** By grouping journals based on the similarity of their indicator values, this visualization will reveal natural clusters, helping to identify journals with similar performance metrics.
- Bivariate Map for Comparative Analysis:** This plot will compare two indicators against each other for each journal, allowing us to observe correlations between different metrics directly.
- Scatter Plot Matrix (SPLOM):** This comprehensive visualization will showcase pairwise relationships between all indicators, providing an overview of how these metrics interrelate across the dataset.

3 Finally, here we have an image of the visualisations generated directly through ChatGPT ↻

Heatmap

Cluster

Bivariate

Scatter

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214 2.4. Results interpretation

215 ChatGPT may be used to help interpret and validate results through statistical methods (Table
 216 5). It may help by suggesting conclusions and by finding ways of framing these insights within
 217 the context of prior research, which may be checked.

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219 *Table 5. Utilising ChatGPT in results and interpretation: tasks, descriptions, and real-case scenarios.*

Task	Description	Example
Critical interpretation of the obtained results	Engages in-depth analysis to understand the significance and implications of research findings.	ChatGPT facilitates a discussion on interpreting complex bibliometric data, assisting in drawing meaningful conclusions about research trends and patterns.
Validation of results through statistical methods	Uses statistical techniques to confirm the reliability and accuracy of the study's conclusions.	ChatGPT advice on selecting and applying robust statistical tests to validate bibliometric findings, ensuring their credibility and contributing to scholarly discourse.

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220 In the realm of validating results, ChatGPT provides guidance on employing statistical methods
 221 to ensure the accuracy and reliability of the research conclusions. It advises on the selection
 222 and application of appropriate statistical tests, such as chi-square tests for categorical data or t-
 223 tests for comparing means, which might be useful suggestions if they can be checked by the
 224 researcher. For example, ChatGPT might guide a researcher through the process of validating
 225 a hypothesis about the correlation between the number of citations and the impact factor of
 226 journals, but statistical expertise would be needed to check that the correct type of correlation
 227 was used (e.g., Spearman or Pearson).

228 229 2.5. Writing

230 ChatGPT may be most useful for scientific writing, especially for people who are not fluent in
 231 academic English (or whichever language the paper is written in) (Table 6). It can help by
 232 improving grammar and may also help to refine manuscripts by improving structure, enhancing
 233 argumentation, and clarifying ambiguous sections. It may also help with the creation of related
 234 scientific communication materials, such as presentations, by converting papers into slides that
 235 are appropriately restructured for the new medium. Additionally, ChatGPT supports the
 236 translation of scientific documents into multiple languages.

237
238 *Table 6. Utilising ChatGPT in writing: tasks, descriptions, and real-case scenarios.*

Task	Description	Example
<i>Critical review and editing of scientific texts.</i>	Involves the evaluation and refinement of scholarly manuscripts to improve clarity and accuracy.	ChatGPT assists in reviewing a draft article, suggesting improvements in structure and argumentation, and identifying sections that require further clarification.
<i>Writing of reports, articles, and presentations.</i>	Facilitates the creation of various scientific communication materials.	ChatGPT aids in drafting a conference presentation, structuring the content to convey research findings effectively and engagingly.
<i>Making recommendations based on the bibliometric results, if applicable</i>	Analyses bibliometric data to derive actionable insights and recommendations that can guide future research directions, policy-making, or academic discourse.	ChatGPT aids researchers in identifying significant trends within publication data, suggesting potential areas for further research or areas needing more substantial funding. For example, after analysing data on renewable energy research outputs, ChatGPT could recommend a greater focus on emerging but under-researched technologies like biofuels, providing strategic insights useful for shaping research agendas and funding policies.
<i>Summarising the limitations of the bibliometric approach used</i>	Critically assesses the bibliometric methods used to identify potential biases or limitations in data collection, analysis, or interpretation.	ChatGPT assists in drafting sections of research papers that outline the limitations of bibliometric analyses, such as emphasising the predominance of English-language sources in the dataset. This summary helps maintain the credibility of the research by transparently addressing its methodological constraints and the potential impact on the understanding of global research trends.
<i>Translation of scientific documents into multiple languages</i>	Enables the broader dissemination of research by translating texts into different languages.	ChatGPT supports the translation of a research paper from English to Spanish, ensuring the technical terminology is accurately conveyed.

240 **3. LIMITATIONS, ETHICAL, AND LEGAL CONSIDERATIONS**

241

242 *Table 7. Limitations and risks in the main tasks where ChatGPT could intervene or be utilised in bibliometrics.*

Project stage	Detailed activities	Limitations and critical points
Preparation and consultation	Review of manifestos and ethical and methodological guidelines	Potential for misinterpretation or non-compliance due to limited understanding of guidelines
	Design and preparation of contextualised case studies	Risk of bias or lack of representativeness in case selection
Data processing	Identification, comparison, and selection of relevant data sources	Limited availability of relevant data sources
	Extraction and downloading of data from multiple sources	Technical errors or data format inconsistencies may occur
	Data cleaning, transformation, and normalisation	Risks of errors or biases during data cleaning
	Guidance on database structuring	Inadequate database structure may hinder analysis
	Data capture through APIs and process automation	Dependency on APIs may entail risks of non-compliance or discontinuation
	Documentation and metadata description of datasets	Inaccurate or insufficient metadata may hinder data interpretation
Data analysis	Conducting descriptive and exploratory data analysis	Risk of overlooking important patterns due to overreliance on descriptive statistics
	Application of advanced statistical techniques	Risks of misapplication leading to erroneous conclusions
	Development of data visualisations for interpretation	Ineffective visualisations may mislead interpretations
	Calculation of bibliometric indicators and impact metrics	Risks of oversimplification in calculations leading to misinterpretation
	Consultation on the selection and application of indicators	Inappropriate indicators may misrepresent research impact
	Implementation of Topic Modeling and content analysis	Results may be influenced by subjective choices or biases
Results interpretation	Critical interpretation of the obtained results	Risks of biased interpretations
	Validation of results through statistical methods	Statistical validation may not capture the full complexity of the data
Bibliometric reporting	Critical review and editing of scientific texts	Inadequate reporting may compromise transparency and reproducibility
	Writing of reports, articles, and presentations	Poor communication may lead to misunderstandings
	Making recommendations based on the bibliometric results, if applicable	Recommendations may be limited by analysis scope or quality
	Summarising the limitations of the bibliometric approach used	Failure to acknowledge limitations may undermine credibility

243

244 The deployment of AI, such as ChatGPT, in bibliometric analysis introduces a complex array
245 of ethical issues that stem from the inherent limitations and critical points highlighted in various
246 project stages (Table 7). One of the fundamental ethical challenges arises from the potential
247 for misinterpretation or non-compliance with ethical and methodological guidelines during the
248 preparation and consultation phase. This can lead to ethical dilemmas when AI systems, despite

249 being designed to operate within certain ethical frameworks, inadvertently reinforce biases or
250 lack representativeness in case selection due to an inadequate understanding of the guidelines.
251 Moreover, the reliance on AI for data processing and analysis, including data cleaning and the
252 application of advanced statistical techniques, introduces risks of perpetuating or even
253 exacerbating existing biases. These biases may not only affect the accuracy of the bibliometric
254 analysis but also raise ethical concerns regarding fairness and equality in scientific research
255 dissemination. Additionally, the ethical responsibility of ensuring accurate and sufficient
256 metadata description, along with the critical interpretation of obtained results, underscores the
257 need for transparency and accountability in AI-assisted bibliometric research. As AI
258 technologies continue to evolve, addressing these ethical issues necessitates ongoing dialogue
259 among researchers, ethicists, and technologists to develop and adhere to comprehensive ethical
260 standards that safeguard against potential harms.

261
262 On the legal front, the utilisation of AI like ChatGPT in bibliometric analysis brings to the fore
263 significant legal considerations, particularly concerning data privacy, intellectual property, and
264 compliance with regulatory frameworks. The collection, extraction, and processing of data
265 from multiple sources involve navigating complex legal landscapes to ensure adherence to data
266 protection laws, such as GDPR in Europe, which impose strict requirements on data handling
267 and privacy. Moreover, the dependency on APIs for data capture and process automation
268 presents legal risks related to the terms of service and copyright laws, which may limit the
269 scope of permissible uses of data. Intellectual property rights also pose a legal challenge, as the
270 creation and use of bibliometric databases and analyses must respect the copyright and
271 ownership of original research materials. In addition, the automation of data analysis and report
272 generation by AI systems necessitates a careful consideration of the legal implications of
273 automated decisions, especially when they influence research funding, publication, and
274 reputation. Ensuring compliance with these diverse legal requirements demands a thorough
275 understanding of both domestic and international laws and underscores the need for legal
276 expertise in the design and implementation of bibliometric projects. Addressing these legal
277 challenges is crucial for maintaining the integrity and credibility of bibliometric analysis and
278 for fostering trust in AI-assisted research methodologies.

279

280 **AI STATEMENT**

281 ChatGPT was used in this manuscript for text revision and fluency enhancement, handling
282 basic grammatical corrections and sentence restructuring to improve clarity and coherence.

283 **CONTRIBUTORSHIP STATEMENT**

284 DTS – Conceptualization, Formal Analysis, Investigation, Methodology, Project
285 administration, Resources, Software, Visualization, Writing – original draft.

286 MT – Investigation, Methodology, Supervision, Validation, Writing – review & editing.

287 WAM – Formal Analysis, Investigation, Methodology, Software, Visualization, Writing –
288 original draft.

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 305 #ChatGPT wrote the first sentence of this @ElsevierConnect article. Any other parts
 306 of the article too? How come none of the coauthors, Editor-in-Chief, reviewers,
 307 typesetters noticed? How can this happen with regular peer-review?
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