https://doi.org/10.51408/issi2025_161

The Interaction between Scientific Research and Policy in The Field of Supply Chain: An Empirical Analysis Based on Overton Data

Li Jiangbo[1], Li Jiake[2], Mu Yingyu[3], Li Jian[4]

[1]*jiangbosky@sina.com*
Business College, Qingdao University, Qingdao 266100 (China)
Research Institute for Science and Technology System and Institutional Innovation of Qingdao, Qingdao 266100 (China)

[2] *lijiake@qdu.edu.cn,* [3] *muyingyu@qdu.edu.cn,* [4]*lj13181433265@163.com*
Business College, Qingdao University, Qingdao 266100 (China)

Abstract

Against the backdrop of accelerating global economic integration and digital transformation, the complexity of supply chain management has continuously escalated, with a significant increase in policy dependency. This necessitates a systematic investigation into the interaction between academic research and policy-making to enhance the scientific rigor and effectiveness of decision-making.This study integrates data from the Overton policy database (covering policy documents from 1991 to 2025) and the Web of Science (WOS) academic database (including research articles from 1978 to 2024) by matching Digital Object Identifiers (DOIs) and policy IDs. A total of 116,193 supply chain-related academic papers (including 4,379 papers cited by policy documents) and 237,849 policy documents (including 8,556 documents citing academic papers) were identified. Empirical analysis was conducted using the Mann-Whitney U test and Spearman correlation analysis.The findings reveal that academic papers cited by policy documents (n = 4,379) had an average citation count of 110.8 in the WOS Core Collection, which is significantly higher than the average citation count of 29.8 for non-cited papers (n = 111,814), representing a 3.7-fold difference. Similarly, policy documents citing academic papers (n = 8,556) had an average citation count of 8.7 in the policy domain, which is 4.3 times higher than that of non-citing documents (n = 229,293).Correlation analysis indicates a weak positive association between academic citation impact and policy citation frequency suggesting that policy documents tend to reference research with high immediate relevance, whereas academic influence requires long-term accumulation.The study underscores a bidirectional synergy between academia and policy-making in the supply chain domain: policy documents enhance their scientific validity and authority by citing high-impact academic research, while policy needs drive academic research toward practical issues. This study quantitatively assesses the reciprocal citation relationship between science and policy in the supply chain field, providing empirical evidence for the policy translation of academic research findings.

Introduction

In modern enterprise management, as global economic integration and market competition intensify, enterprises no longer compete independently but as part of a supply chain comprising multiple businesses and relationship networks. The American Supply Chain Management Association (APICS/SCC) defines the supply chain as a value-added business network centered on a core enterprise, encompassing material acquisition, processing, and product delivery. It operates through the control of information, logistics, and capital flows, forming a logistics chain, information chain, and capital chain.

In globalization, supply chain management (SCM) has become a key academic focus. The supply chain revolves around a core enterprise, controlling information, logistics, and capital flows from raw material procurement to product manufacturing and final delivery through a sales network. It forms a functional network linking suppliers, manufacturers, distributors, retailers, and consumers. Emphasizing cross-organizational and cross-regional resource coordination, it optimizes logistics, information, and capital flows to reduce costs, enhance efficiency, and mitigate risks. Since the 1990s, supply chain research has advanced in theory and practice, expanding into areas like collaboration, finance, risk management, and sustainability, bringing significant economic and social benefits. With the rise of information technology and big data, it has integrated multidisciplinary foundations, including management science, economics, and sociology, while leveraging emerging technologies such as blockchain, IoT, AI, and cloud computing to enhance flexibility, intelligence, and transparency. Recent global crises, including pandemics, geopolitical conflicts, and natural disasters, have exposed supply chain vulnerabilities, driving research on resilience and sustainability. Scholars explore risk identification, early warning, and response strategies to mitigate disruptions and balance public interests with corporate profits (Chowdhury et al., 2021). As a result, supply chain research now extends beyond operations and costs to encompass environmental sustainability, social responsibility, resilience, and risk management.

In summary, supply chain research is vital for enterprise management, global economic efficiency, and sustainable development. As economic globalization and digital transformation accelerate, supply chain operations will grow more complex and increasingly interconnected with macro policies. Policy factors—such as tariffs, trade agreements, industrial support, regulations, and risk management—profoundly impact supply chain stability, efficiency, and sustainability. With environmental and carbon neutrality goals, policies have become key external influences. Green supply chain theory highlights how regulations (e.g., carbon emission controls, environmental standards) shape corporate sustainability (Ji et al., 2024b). This policy-driven pressure reshapes business models, driving new supply chain strategies

that integrate social responsibility. Effective policies optimize resource allocation, foster sustainability, enhance resilience, and promote fair competition and social welfare.

To navigate the evolving global supply chain landscape, academia and policymakers must strengthen interdisciplinary and technological collaboration to develop a sustainable, inclusive policy system. Analyzing the supply chain-policy interaction can yield innovative frameworks and tools to enhance efficiency, achieve sustainability goals, and address future uncertainties, fostering global economic prosperity and social welfare. For researchers, systematically examining policy impacts on supply chains is crucial for informing scientific policy-making and optimizing corporate strategies. The link between policy and science is key: policies cite high-quality research to guide institutions and allocate resources, while academic findings support supply chain optimization and transformation. This synergy enhances efficiency, resilience, and sustainability at both technical and institutional levels, driving balanced economic and social development.

In recent years, policymakers have placed increasing emphasis on the use of research evidence in policymaking (Hui et al.,2020; Obuku et al., 2018). At the same time, in academia, researchers are thinking about how to conduct research in such a way as to better provide evidence for policy-making. Amid accelerating globalization and digitalization, exploring the policy-science connection has become crucial for advancing supply chain research. However, previous studies faced challenges due to the lack of a reliable global data source for analyzing this relationship. In 2019, the Overton policy document database was introduced, compiling policy documents and their citations of academic papers. This study leverages Overton, which includes records from government agencies, think tanks, and intergovernmental organizations, to examine the interaction between scientific research and policy in the supply chain field. The influence of academic findings may be reflected in policy document citations.

literature review

Overview of studies on the connection between science and policy

In recent years, the phenomenon of cross-domain knowledge diffusion from science to policy has become increasingly evident (Nay & Barré-Sinoussi, 2022). This refers to the process of introducing scientific research results into policy formulation and implementation to solve specific problems and challenges (Hodges et al., 2022). In this process, scientific research results need to be translated into specific policies and practical measures to meet the needs of policymakers and implementers (Watson, 2005). Research institutions (e.g., universities), as well as researchers, are working

to ensure that their research is considered in the policy-making process (Ray et al., 2021). However, in previous studies, the disconnect between science and policy is a long-standing problem, in which policymakers may miss important scientific insights and erroneous scientific advice may affect decision-making.

Yin et al. (2021) pointed out that the reason for the limited systematic understanding of the connection between science and policy is the lack of reliable data worldwide, making it difficult to reliably track the co-evolution of policy and science on a global scale. As a result, there was relatively little early research on the science-policy interface. For example, Haunschild et al. (2016) explored the feasibility of policy documents as a source for measuring the social impact of scientific research by examining the frequency of references to climate change-related scientific research in policy-related documents. Using data from Altmetric.com, Haunschild and Bornmann (2017) investigated the extent to which articles indexed by the Web of Science (WOS) are mentioned in policy documents. They found that less than 0.5% of articles are mentioned at least once in relevant policy documents. Vilkins and Grant (2017) conducted a study using documents from policy-focused Australian government departments. They found that the majority of citations were peer-reviewed journal articles, federal government reports, and Australian business information. The study also suggests that 'the chances of being cited may increase if the academic research is open access.' Additionally, Newson et al. (2018) explored the current status of research citations in policy documents on childhood obesity in New South Wales, Australia, and its feasibility as an indicator of research impact by analyzing policy documents from 2000 to 2015, revealing how scientific research is adopted by policy and its practical impact on policy development.

But in 2019, the new OVERTON policy document database was released, which includes links to research papers cited in policy documents (Overton,2020). Yang et al. (2020) define policy documents in this context as carriers of policy. The OVERTON database provides a channel for policy science researchers to study the main content of policies, policy-making processes, and policy tools.Policy documents are an important data source to investigate the social impact of research (Drongstrup et al., 2020; Yu et al., 2020).Since then, research on the science-policy nexus has gradually increased.Drongstrup et al. (2020) found that economics articles published in high-level journals were more likely to be cited in policy documents than those published in low-level journals.Yin and Gao used Overton data to analyze the connection between science and policy regarding COVID-19.They found that "many policy documents on the COVID-19 pandemic substantially cite the latest, peer-reviewed, high-impact science. Policy documents that cite science are particularly highly cited in the policy field. At the same time, there are differences in the use of science by different decision-making bodies. The tendency of policy

documents to cite science seems to be mainly concentrated in intergovernmental organizations (IGOs) such as the World Health Organization (WHO), but very few in national governments, because they mainly cite science indirectly through IGOs.Cheng et al. (2021) studied the co-evolutionary relationship between scientific research and policy making in China during the early stages of the COVID-19 epidemic, and proposed a science-policy coevolution model (CEM) to explain the dynamic interaction in public health emergencies. Bornmann et al. (2022) discussed the question of how climate change research is connected to policy. They pointed out that intergovernmental organizations and think tanks pay more attention to climate change and have issued more climate change policy documents than expected. The authors found that climate change papers cited in climate change policy documents were cited much more often on average than climate change papers not cited in these documents. Both scientific papers and policy documents focus on similar areas of climate change research: biology, earth sciences, engineering, and disease science.

In addition to this, there are other studies that examine the relationship between science and policy from different perspectives. Fang et al. (2020) focused on hot research topics reflected in papers cited in policy documents. Brandts-Longtin et al. (2022) explored the potential impact of predatory journal articles on policy and guidance documents, analyzed how these low-quality scientific studies infiltrated policy areas through a cross-sectional study design, and evaluated their possible consequences for public decision-making. Cristofoletti, Evandro Coggo, et al. (2023) revealed the interactive relationship between scientific research and policy making by analyzing the citations of research related to projects funded by the Sao Paulo Research Foundation (FAPESP) in policy documents, and proposed a new methodological framework to evaluate the policy impact of research. Yoshida et al. (2024) explored the importance of gray literature in the scientific policy process and applied research, especially in supplementing the evidence and knowledge of peer-reviewed literature. Llewellyn et al. (2023) explored the translation path of scientific research results in health policy, and proposed an evaluation framework that links translational research publications with policy literature through innovative bibliometric methods. Van Elsland et al. (2024) analyzed the policy impact of the research of the Imperial College COVID-19 Response Team (ICCRT) during the epidemic, and explored how its research results influenced global and British policy decisions through different dissemination channels. Ma and Cheng (2024) describe the citation of Public Administration and Policy (PAP) academic papers within policy documents and find that the three dimensions of collaborative teams, interdisciplinary interactions, and disruptive paradigms are all influential factors that increase the citation rate of academic papers in this field within policy documents,

but the relationship between them is not linear. Using publication data on COVID-19 topics, Hu et al.(2024b) found a positive correlation between the interdisciplinarity of scientific publications and the attention given to them in policy documents in almost all fields.

Overview of studies on Overton

In previous studies, data on policy documents and policy citations could only be obtained from databases of companies such as Altmetric and PlumX. In 2019, the Overton database emerged to change this situation, aiming to become the largest policy document and citation database. In the OVERTON database, policy documents are defined as "documents written very broadly primarily for or by policymakers". Overton includes documents from governments, think tanks (i.e. research institutions that conduct research and advocacy on climate change), non-governmental organizations (NGOs), and intergovernmental organizations (IGOs, i.e. organizations composed of countries). The database includes not only various bibliographic information of policy documents (such as titles and appearances), but also citation links between policies and science and between policy documents in the database itself. The Overton database uses text mining methods to identify citation relationships.

Yin and Gao studied the reliability of science policy citations in the Overton database by comparing them with the citation links provided by the Microsoft Academic Graph database. The results showed that "although the two datasets were collected for different purposes using different methods and techniques, independent measurements on the two datasets showed significant consistency."

Since then, there has been a gradual increase in the number of studies based on overton databases. Cabral and Salles-Filho (2024) analyzed the evolution of global artificial intelligence (AI) policy documents and their scientific basis through the Overton policy document database. The study found that the number of AI policy documents has increased significantly since 2018, and the United States, the European Union and international organizations have played a leading role in policy making. Fourough Rahimi, F., & Danesh, F. (2024) conducted a scientometric analysis of 2,493 political documents related to open government data in the Overton database from 2007 to 2023 based on scientometric indicators and content analysis. The study found that the Organization for Economic Cooperation and Development (OECD) and the Guardian News Agency performed outstandingly in terms of the number of citations, and there was a significant positive correlation between GDP and the number of open government data policy documents at the national level. Haunschild, R et al. (2023, April) used the OVERTON database to explore the extent to which public policy and administrative research has influenced policy

departments. By analyzing the citations of public policy and administrative research in policy documents, it was revealed which research contributed the most to policy reports and decisions, and which policy institutions used research literature more frequently to support their policy decisions. Szomszor and Adie (2022) explored the citation of academic literature in policy making by analyzing the Overton policy document database. Ren and Yang (2023) used the OVERTON database to explore the characteristics of the diffusion of scientific knowledge into the policy field and found that the intensity and breadth of the diffusion conformed to the power law distribution, while the diffusion speed conformed to the log-normal distribution. Huang et al. (2022) used data from the Overton database to study the association between scientific collaboration and its policy impact in the field of library and information science (LIS). Through quantitative analysis of policy citations in LIS research, the important role of international collaboration in enhancing the impact of research policies was revealed. Xu and Zong (2023) used overton data to test the effect of international research cooperation on policy impact through PSM method, and the results of the study showed that international research cooperation has a significant positive effect on the policy impact of scientific research.

Other scholars have studied overton by combining it with other data sources. Dorta-González et al. (2024b) used Altmetrics and the Overton database to explore how scientific research results affect policy making and analyzed the citations of nearly 125,000 articles from 434 public policy journals. The study found that news and blog mentions, social media participation, and open access publications can significantly increase the likelihood of research articles being cited in policy documents, while non- open source articles have a lower chance of being cited in policies. Pinheiro et al. (2021b) used publication data from the Framework Programs for Research and Technological Development (FPs) to investigate the relationship between interdisciplinarity at the paper level and policy impact measured by policy citation data from the Overton database. The results show that measuring the use of policy-related literature based on the OVERTON database can benefit research. The OVERTON database can capture the interaction between science and policy and the contribution of these interactions to the larger decision-making process. Jonker and Vanlee (2024) reveal for the first time the media mentions and policy citations of all active scholars at Dutch-speaking universities in Belgium by linking data from FRIS, BelgaPress and Overton.

In summary, the Overton platform brings together a large number of academic documents, policy documents, patents, etc., and can track and analyze the citations and application backgrounds of scientific research results in the policy field. The database provides a valuable analytical tool for the interaction between research papers and policy documents, especially in measuring the impact of academic

research on policy making. For researchers, it can help them understand how their research has aroused public attention and ultimately turned into policy actions; for policymakers, it provides a reference channel to help them formulate more scientific and effective policies based on the latest academic research. Through Overton, researchers and policymakers can clearly see how academic results affect policy documents and actual decisions. In general, the Overton database has played a positive role in promoting interaction and communication between academic research and policy and enhancing the social influence of scientific research results.

Research Objectives and Research Questions

Given the increasing need for science-policy interaction in the supply chain domain and the existing research gaps, this study aims to systematically examine the relationship between academic research and policy-making. By integrating empirical data from the Overton policy database and the Web of Science (WOS) academic database, this study pursues three key objectives. First, it seeks to quantify policy citation preferences by investigating whether supply chain policy documents tend to cite high-impact academic papers and assessing the difference in academic influence between cited and non-cited papers. Second, it examines the correlation between policy influence and the citation of academic research, analyzing whether policy documents referencing academic studies receive greater recognition within the policy domain. Lastly, the study explores the broader interaction between science and policy by identifying statistical associations between academic citations and policy citations, thereby evaluating the extent to which academic influence affects policy adoption.

To achieve these objectives, this study addresses the following research questions:

RQ1: Do academic papers cited in supply chain policy documents exhibit significantly higher academic influence (e.g., citation counts) than those that are not cited?

RQ2: Do supply chain policy documents that reference academic papers have greater policy influence (e.g., citation frequency by other policy documents) than those that do not?

RQ3: Is there a significant correlation between the academic influence of a paper and its likelihood of being cited in policy documents?

Data Acquisition

Data Source

In order to explore the science and policy in the field of supply chain, in this study, we chose the Overton database as our data source for obtaining policy documents

and the academic papers they cited. Overton defines policy documents as "studies, briefs, reviews, or reports " written with the purpose of influencing or changing policy, and provides scientific and policy citations in each document. For each policy document, the Overton database has a unique policy ID code to match it. The Overton database contains links to academic papers through digital object identifiers (DOIs), and "academic" papers in Overton have a unique DOI. As for the source of academic papers related to the supply chain field, we chose the Web of Science academic paper database as the source of academic papers.

Data processing

In order to find the most relevant scientific research results for supply chain policy, we searched for relevant academic research papers using the keyword "Supply Chain" in the " Search Academic Papers" search window in the Overton database. According to our search results on January 10, 2025, a total of 6,442 relevant academic papers were obtained, with publication dates ranging from 1978 to 2024. In our subsequent research, we used these 6,442 academic papers as a paper subset to represent all academic papers in the field of supply chain that have been cited in policy documents.

After obtaining 6442 academic papers related to supply chain policies, we then used the Overton database to obtain the policy collection that cited these 6442 academic papers in the policy library. As of January 10, 2025, a total of 12692 policy documents that cited the above academic papers were obtained. Since our main focus is policy documents, we follow Overton's advice and further filter the file type, using only "publications" (accounting for 90.5% of the total number of documents) and removing other types such as "working papers". Finally, 11485 policy documents that cited these academic papers were obtained. Subsequently, the data were analyzed and processed by a computer program, which detected and removed duplicate records from the data, removing a total of 554 duplicates, thereby effectively reducing data noise. As a result of the above processing, 10,931 policy documents in the field of supply chain with the document type of “Publication” were obtained. For each policy document, we have its title, original URL, publication date, document type, policy source and subject classification, as well as a unique policy ID code, the number of times it was cited by other policies (including the average number of policy citations after removing the citations from the policy source agency itself and the average number of policy citations without removing the citations from the policy source agency itself). The distribution of publication years and source types of these 10,931 policy documents are shown in Figures 1, 2 respectively.

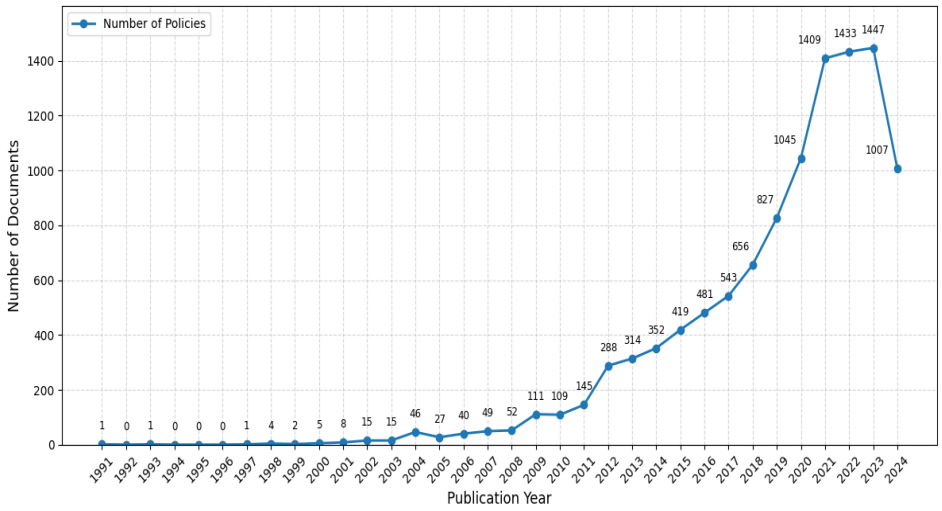

Figure 1. Distribution of the release years of the 10,931 policy documents.

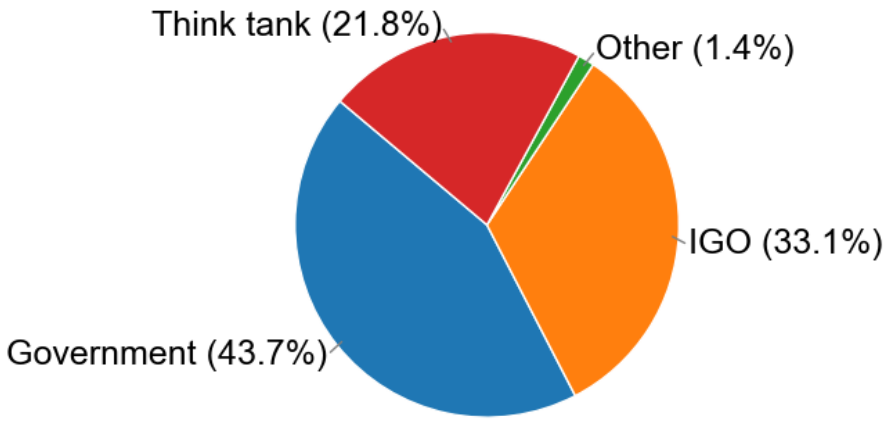

Figure 2. Distribution of source types of 10,931 policy documents.

In order to obtain more policy documents related to the supply chain field (regardless of whether they cite academic papers), we searched for documents using the exact phrase "Supply Chain" in the "Search Policy Documents" window in the Overton database. Similar to the above, we only selected policy documents with the file type "Publication". As of our search time on January 10, 2025, we retrieved a total of 264,759 relevant policy documents. In order to be consistent with the publication time of the previous 10,931 policy documents, we again limited the time and only retained the supply chain field policy documents with the type of "Publication" published from 1991 to 2025. Subsequently, the data were processed by a computer program to detect and remove duplicates. This process resulted in the deletion of a

total of 12,972 duplicate records, thereby effectively removing data noise. Consequently, 237,849 policy documents in the domain of supply chain management with the document type of "Publication" were obtained. Similarly, for each policy document, we have its title, original URL, publication date, document type, policy source and subject classification, as well as unique policy ID code, number of citations by other policies, and other information. The distribution of the year of release, and the source type of these 237,849 policy documents are shown in Figures 3, 4, respectively.

This study finds that both sets of supply chain policy releases show a similar evolutionary trajectory in the time dimension: firstly, the number of annual policies remains very low from the early 1990s to around 2005; then, from around 2006 onwards, there is a gentle rise in the data and an accelerated climb after 2010, signalling a growing interest in supply chain issues. Between 2015 and 2020, both sets of data show rapid growth and reach relative peaks around 2020, respectively, suggesting a concentrated burst of policy interest during this period. After reaching their peaks, the number of releases dropped off in 2023 and 2024, although they are still well above the levels of the earlier years. This downward trend may be related to factors such as data not yet being fully collected, a change in policy focus, or the period of concentrated policy releases having passed.

Overall, the chart reflects the explosive growth of policies in the supply chain sector from few to many over the last decade or so, with a peak followed by a phase of relative decline but still a high base. Meanwhile, the comparison of the pie charts shows that the distribution of source types has changed somewhat as the size of the data has increased, with government sources accounting for a relatively higher proportion of the second set of data, and other types (igo, think tank, etc.) accounting for a relatively lower proportion. This may be due to the fact that policy documents from the government are less likely to be cited in academic papers. Previous scholars have come to similar conclusions. (Yin et al., 2021b) After our inspection, 8,556 of the 10,921 policy documents initially obtained were included in these 237,849 policy documents. In subsequent research, we decided to use these 8,556 policy documents to represent the set of policy documents in the field of supply chain that cited academic papers.

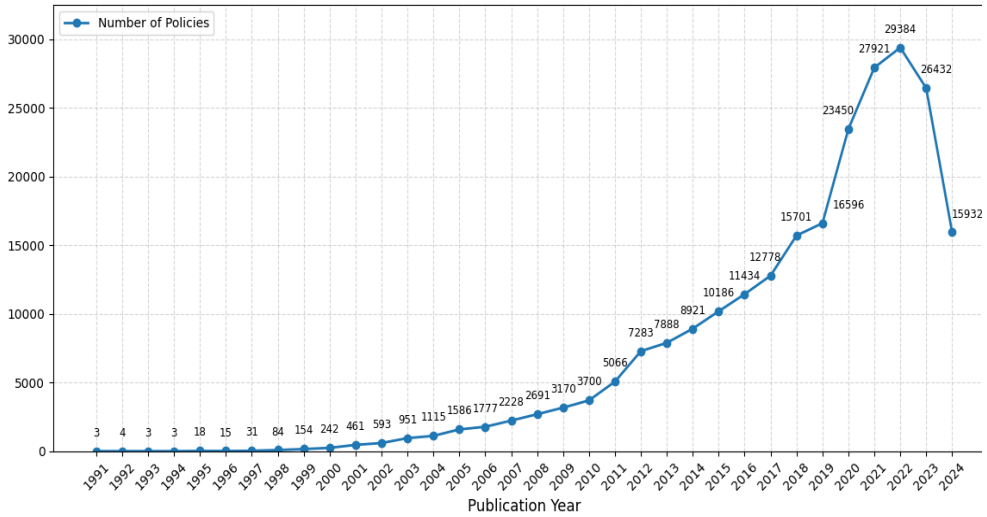

Figure 3. Distribution of the release years of the 237,849 policy documents.

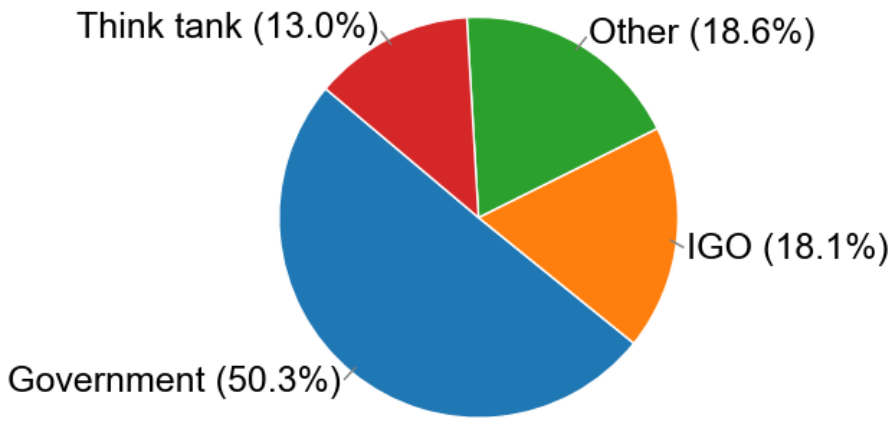

Figure 4. Distribution of source types of 237,849 policy documents.

In order to obtain more academic papers related to the supply chain field (regardless of whether these academic papers have been cited in policy documents), we chose the Web of Science academic paper database as the source of academic papers. We searched all databases of WOS using the keyword "Supply Chain". Since our research object is mainly academic papers, we retained the results of the document types "paper" and "review paper". In order to be consistent with the academic papers obtained from the Overton database above, we limited the publication time of the search results to 1978 to 2024. Finally, 146,558 supply chain-related academic papers were retrieved. After removing 21,273 data without DOI numbers (about 14.5% of the total data) and 9,092 duplicate data (about 7.2% of the total data), we

finally obtained 116,193 academic papers. For each paper, we will obtain information about its title, author list, publication date, file type, DOI number , abstract , and number of citations (including the number of citations in the Web of science core database and the number of citations in all Web of science databases).Match the academic papers cited by Overton with those obtained from the Web of science database through DOI numbers. The matching results show that 4379 of the 6442 academic papers obtained from the Overton database are also included in the Web of science. Therefore, we can obtain the citations of these academic papers by other papers in the Web of science database.

In this study, we use the number of times an academic paper is cited by other papers to measure the quality of an academic paper. The more times a paper is cited, the higher its academic influence, that is, the higher its quality. Similarly, we use the number of times a policy document is cited by other policies in the Overton database to measure the quality of the policy. The more times a policy is cited by other policies, the more influence it has, that is, the higher its quality.

As shown above, in our study, we have two sets of academic papers and two sets of policy documents. We regard 8556 policy documents that exist in both policy sets as policy documents that cite academic papers, and 4379 academic papers that exist in both academic paper sets as academic papers cited by policies. For comparison, we remove the 8556 policy documents from the 237849 policy documents and the remaining 229293 policy documents as policy documents that do not cite academic papers, and remove 4379 academic papers from the 116193 academic papers obtained from Web of science. The 111814 papers represent academic papers that are not cited by policies. In the following research, we hope to measure the quality of the two sets of policies or academic papers by the citations they receive, and ultimately find out the mutual influence of academic papers and policy documents in the field of supply chain.

Results

Correlation analysis between the number of academic citations and the number of policy citations of academic papers

In the study of communication and policy impact, the number of citations of academic papers can be one of the important indicators of their impact. Based on the 4379 academic papers cited by policy obtained above, we analyse the correlation between the number of citations of these papers in the academic field (divided into the number of citations in the core database and the number of citations in all databases, provided by the Web of Science core database) and the number of

citations in the policy field (provided by the Overton database), in order to explore the correlation between the academic influence and the policy influence.

Our dataset contains the following three columns of key fields:1. DOI: the unique identifier of each academic paper, which is used to distinguish different papers;2. the number of times a paper has been cited by core databases: i.e. the number of academic citations, reflecting the influence of the paper in academia;3. the number of citations by policies: i.e. the number of policy citations, reflecting the influence of the papers in policy making.

Preliminary checking of the data shows that there are no missing values in these fields, indicating that the data are complete and can be used directly for analysis. For correlation measures, we use the Spearman Correlation Coefficient as a correlation measure. Spearman Correlation Coefficient is suitable for non-linear or non-normally distributed data, and can measure the monotonic relationship between two variables. By calculating the Spearman Correlation Coefficient between the number of citations in core databases and the number of citations in policies, we can find out the strength of the correlation between the two.

By calculating the correlation coefficients between the number of citations in WOS core database and the number of citations in all WOS databases on the number of citations of academic papers by policy, the following results are obtained: the Spearman's correlation coefficients between the number of citations in two kinds of WOS and the number of citations of academic papers by policy are all 0.25. The two sets of results are shown in Fig. 5 and Fig. 6 in the following figures. This result shows that there is a weak positive correlation between the number of citations in core databases and the number of policy citations, and a weak positive correlation between the number of citations in all databases and the number of policy citations. There is also a weak positive correlation between ‘number of citations in all databases’ and ‘number of citations in policy’, i.e., papers with more academic citations are more likely to be cited in policy documents to a certain extent. The weak correlation may be partly due to differences in citation motivation: academic citations are mainly motivated by research background and theoretical support, while policy citations are more driven by practical needs and social issues. There may be a difference in emphasis between the two. In addition, temporal factors may also play a role: academic citations usually take a long time to accumulate, whereas policy citations may be closely related to unexpected events, leading to differences in the temporal distribution of citation patterns.

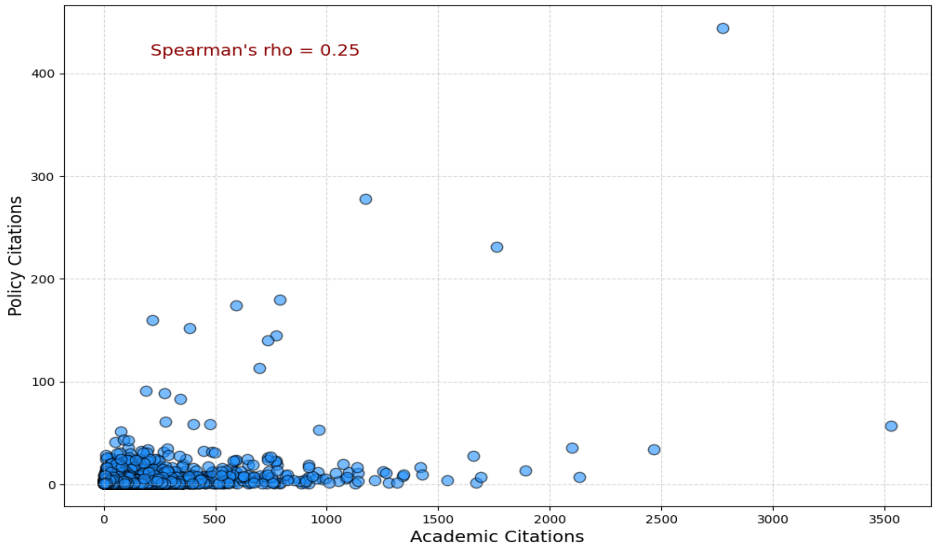

Figure 5. Scatterplot of the correlation analysis between the number of citations of academic papers by the WOS core database and the number of citations by policy.

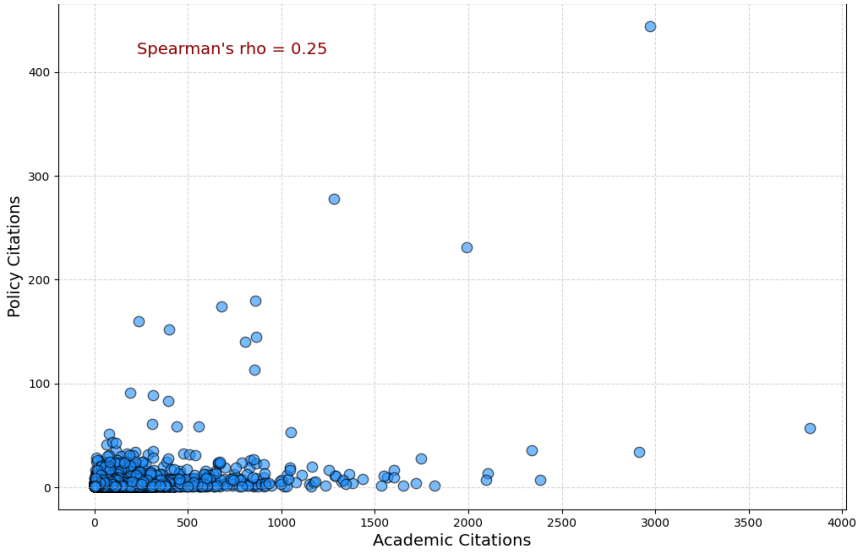

Figure 6. Scatterplot of the correlation analysis between the number of citations of academic papers by all WOS databases and the number of citations by policy.

Difference in the number of citations to other papers between academic papers cited by the policy and those not cited by the policy

Based on the above, two collections of policy documents and a collection of academic papers are compared in terms of the number of citations

respectively.Processing the acquired paper data, it can be obtained that the 4379 academic papers cited by the policy that exist in both paper collections have an average of 110.822 citations by papers in the Web of science core database and 122.574 citations by papers in all databases of Web of science. And the remaining 111,814 academic papers out of 116,193 academic papers have an average of 29.787 citations in Web of science core database and 32.755 citations in Web of science all databases. The average number of citations in Web of science core databases and the average number of citations in Web of science all databases of academic papers cited by the policy are 3.720 times and 3.742 times higher than that of academic papers that are not cited by the policy, respectively. As shown in Figure 7, Figure 8 below.
At the same time, we do Mann-Whitney U-test on the number of citations in WOS core database and WOS all databases for academic papers cited by the policy and academic papers not cited by the policy, and the results are shown in Fig. 9 and Fig. 10 below. Separate results, in the Mann-Whitney U test for the number of citations in the WOS core database, the U-Statistic is 378287334.5 with a p-value of 0.0. $p < 0.05$, indicating that there is a significant difference in the distribution of the number of citations to the two groups of academic papers cited by the policy and those not cited by the policy in the WOS core database, i.e. whether or not being cited by the policy has a significant effect on the number of citations of papers in the core database.
The box plot shows that the median number of citations of policy-cited papers is significantly higher than that of uncited papers, and the distribution is wider. While the number of citations for papers not cited by the policy is lower. And there are similar results in the Mann-Whitney U-test of the number of citations in all WOS databases. the U-Statistic is 378163246.0, and the P-value is 0.0. $p < 0.05$, indicating that there is a significant difference in the distribution of the number of citations to the two groups of policy-cited and non-policy-cited academic papers in all the databases of WOS. That is, whether or not they are cited by the policy has a significant effect on the number of citations of papers in the core databases. Observation of the box-and-line plot shows that the median number of citations in WOS all databases for policy-cited papers is significantly higher than that for uncited papers, and the distribution of citations is wider and contains more high citation values.The results of Yin,Gao's study suggest that policy documents about the COVID-19 pandemic substantially cite high-impact scientific results (Yin et al., 2021c). Although the data in our study are not as significant as in Yin, Gao's study, we still believe that our results also illustrate that policy documents in the supply chain field actually cite high-impact academic papers in the supply chain field.

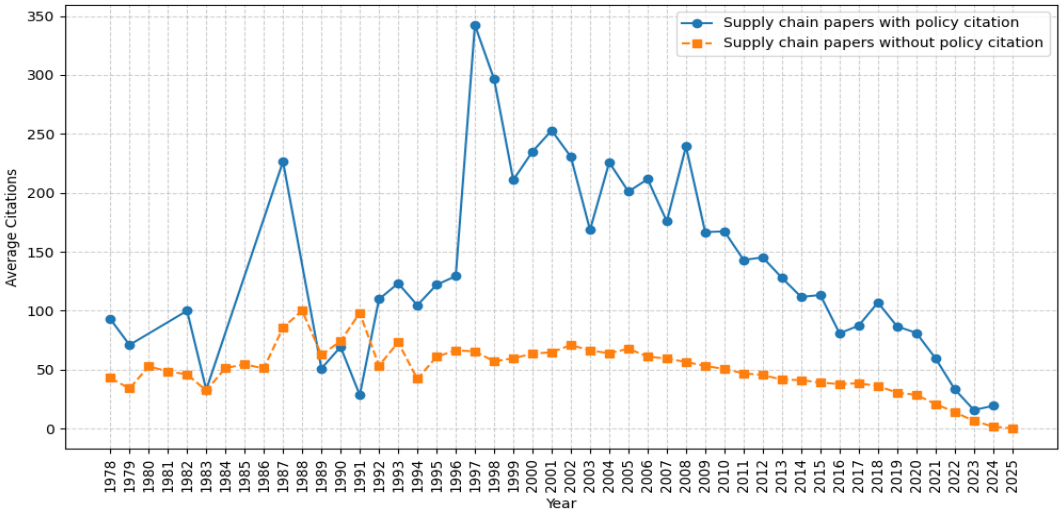

Figure 7. Difference in the number of core database citations between academic papers cited by the policy and those not cited by the policy.

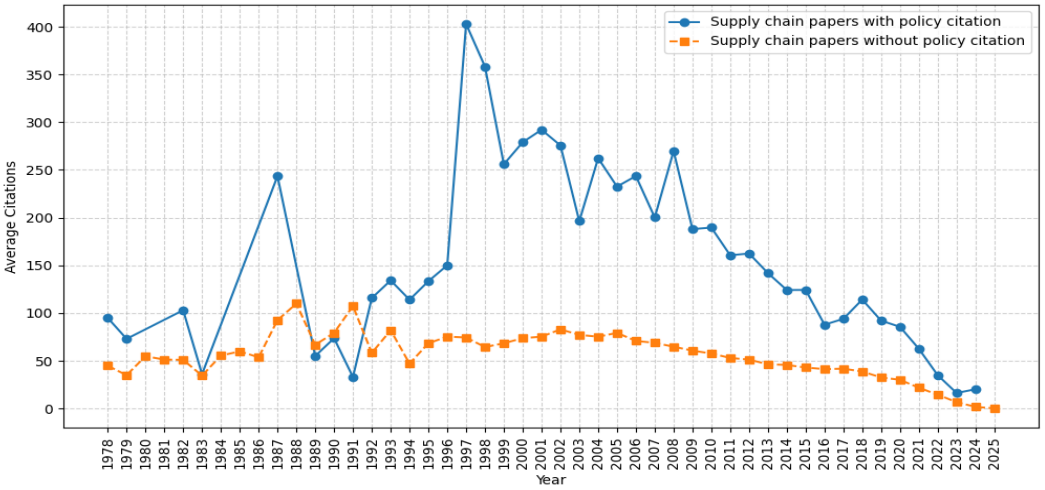

Figure 8. Difference in the number of citations in all databases between academic papers cited by the policy and those not cited by the policy.

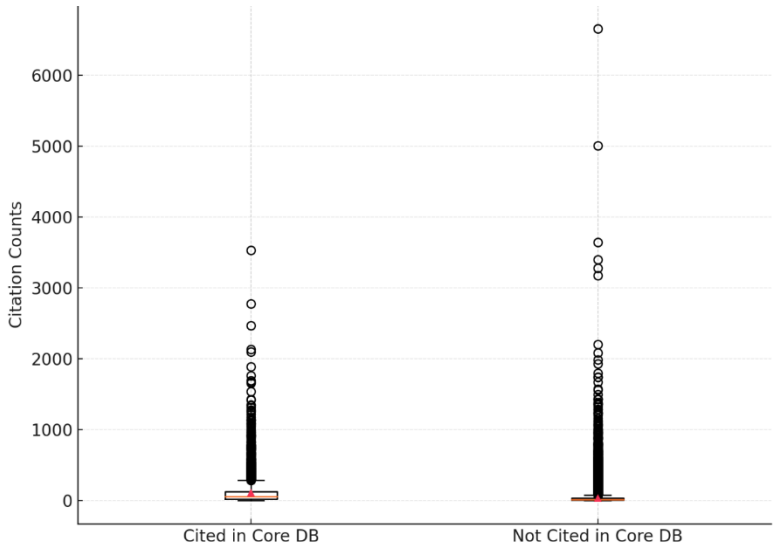

Figure 9. Comparison of the number of citations of policy-cited and non-policy-cited papers in the WOS core database.

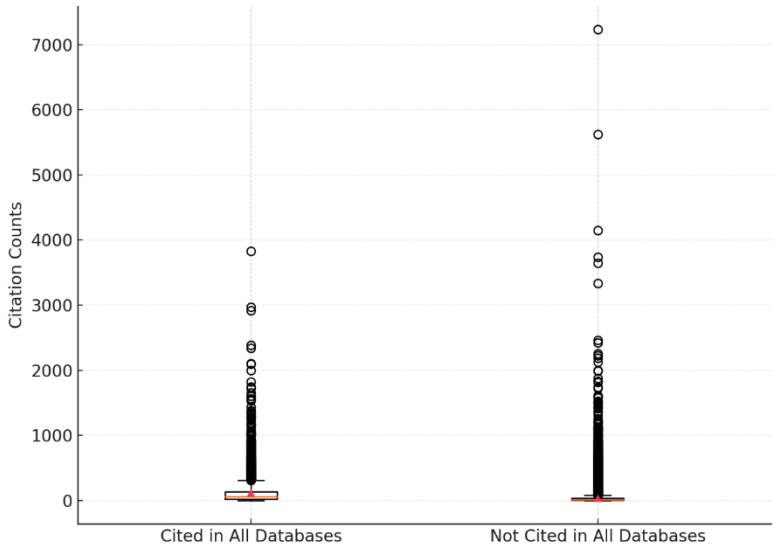

Figure 10. Comparison of the number of citations of policy-cited and non-policy-cited papers in the WOS all database.

Similarly, processing the acquired policy document data yields that the 8556 policy documents citing academic papers that are present in both policy collections have an average number of citations by policy after removing citations from their own policy source institutions of 8.667 citations, while the average number of citations by policy

that include citations from their own policy source institutions is 11.711 citations. The average number of policy citations for the remaining 229,293 policy documents out of 237,849 is 1.999 after removing citations from the same source, and the average number of policy citations for those that include citations from the same source is 3.158. (The number of policy citations we obtained from the Overtons database is divided into two categories, including citations from other policy documents from the policy document's own source institution and removing citations from other policy documents that are cited by the same source. source). The average number of policy citations after removing same-source citations and the average number of policy citations including same-source citations for policy documents that cite academic papers are 4.335 and 3.708 times higher than the average number of policy citations for policy documents that do not cite academic papers, respectively. Our findings also illustrate that supply chain policy papers that cite science also have higher citation levels in the supply chain policy domain. Therefore, we conclude that in the supply chain field, academic papers cited by policy papers are high level research papers in their own field, and policy papers that cite academic papers become high impact policies in their own field.

Conclusion

As mentioned earlier, the use of research results and recommendations of supply chain academic papers may be reflected in the citations of supply chain academic papers in policy documents. This study focuses on exploring the connection between scientific research and policy in the field of supply chain based on data from the Overton database and the Web of Science database, including policy documents and their citations to academic research papers, as well as the citations of policy documents and papers in their respective fields.

We can draw the conclusion that academic research improves the scientific nature of policies from the two-way interactive relationship between scientific research and policy making. Scientific research provides a rigorous theoretical basis and methodological tools for policy making. Academic research in the field of supply chain can provide a scientific basis for policy making by providing theoretical frameworks, data analysis and cutting-edge technological achievements. Policies that cite scientific research papers are more scientific in comparison. The high-level research papers cited in policy documents make these policies more authoritative in the field of supply chain, so they will be cited by more other policies and have a higher influence. By conducting quantitative analysis on academic research cited in policy documents, we can evaluate the actual impact of these studies on policy making and implementation, and then provide feedback for academic research in the field of supply chain and promote further optimization of research results. The new

results of academic research will once again promote the development of policies and maintain a good ecology of scientific research and policy making. In addition, some policy documents may refer to ideas, data or research findings in academic papers in their content, but these academic papers are not explicitly cited as sources in the text. This situation may be due to differences in the writing habits, length limitations or citation requirements of the policy documents.

The conclusions of this study point to the fact that improving the scientific quality and transparency of academic citations in policy documents, i.e., policymakers clearly citing the sources and rationale of academic research in policy documents, can improve the scientific quality and number of citations of policies, and increase the impact of policies. Publicly cited academic results in policy documents, when seen by academic researchers, can also promote understanding and support for the policy context within the academic community, again facilitating the synchronisation of scientific research and policy formulation.

At the same time, policy documents that cite academic research provide academic circles with cases where research results have been implemented, thus enhancing the practical application value of academic research. This shows that policies can also provide feedback to promote the deepening of academic research. In addition to policies assisting the implementation of academic research results, the focus on practical issues during the policy-making process will also drive the direction of academic research. For example, changes in prevention and control policies during the COVID-19 pandemic have promoted research on the stability of global supply chains, while regional economic development policies have promoted research on the localization and regionalization of supply chains. The citation of policy documents not only provides application scenarios for academic research, but also arouses researchers' attention to emerging issues and forms new theoretical and practical explorations. The academic community should encourage academic research to pay attention to policy needs, enhance sensitivity to policy needs, and pay attention to practical issues in policy making. In response to the current trend of globalization and regionalization of supply chains, relevant academic research should be carried out to provide timely support for policy adjustments.

In future research, a cooperation mechanism between academic research and policy making should be established. Policy-making departments and academic institutions should strengthen cooperation to achieve an effective combination of research and policy through joint research, policy consulting, etc. Future supply chain research needs to be more closely integrated with supply chain-related scientific research to enhance the wide applicability and policy influence of research results.

In summary, in the field of supply chain, a close two-way interactive relationship has been formed between high-level academic research and high-impact policy

documents. Academic papers cited by policy documents are high-level research papers in their own fields, and policy documents that cite academic papers have also become high-impact policies in their own fields. Academic research provides a scientific basis for policy making by providing theoretical foundations and technical support; policy documents enhance their authority by citing academic achievements, while promoting academic research to focus on practical problems. This virtuous circle not only enhances the scientificity and practicality of supply chain management, but also provides a guarantee for the effectiveness of policy making and implementation. In the future, by strengthening the cooperation mechanism between academia and policy, promoting the quantitative research of policy citations of scientific research, and exploring new directions for the integration of supply chain policy making and scientific research, we will make greater contributions to the sustainable development of the global economy and society.

Acknowledgments

This paper is one of the research outcomes of the National Social Science Fund of China project "Evaluation of Humanities and Social Sciences Academic Monographs Based on Scientometric Big Data" (Project No. 21BTQ104).

References

Ali Abd Al-Hameed, K. (2022). Spearman's correlation coefficient in statistical analysis. *International Journal of Nonlinear Analysis and Applications*, 13(1), 3249-3255.

Bornmann, L., Haunschild, R., Boyack, K., Marx, W., & Minx, J. C. (2022). How relevant is climate change research for climate change policy? An empirical analysis based on Overton data. PloS one, 17(9), e0274693.

Brandts-Longtin, O., Lalu, M. M., Adie, E. A., Albert, M. A., Almoli, E., Almoli, F.,.. & Cobey, K. D. (2022). Assessing the impact of predatory journals on policy and guidance documents: a cross-sectional study protocol. BMJ open, 12(4), e059445.

Cabral, B., & Salles-Filho, S. (2024). Mapping science in artificial intelligence policy development: formulation, trends, and influences. Science and Public Policy, 51(6), 1104-1116.

Cheng, X., Tang, L., Zhou, M., & Wang, G. (2021). Coevolution of COVID-19 research and China's policies. Health research policy and systems, 19, 1-16.

Chowdhury, P., Paul, S. K., Kaisar, S., & Moktadir, M. A. (2021). COVID-19 pandemic related supply chain studies: A systematic review. Transportation Research Part E: Logistics and Transportation Review, 148, 102271.

Cristofoletti, E. C., Salles-Filho, S., Hollanda, S., Juk, Y., Pinto, K. E., Toledo, C. G.,.. & Campgnolli, E. (2023, April). The use of research in policy documents: exploring

methodological potentialities. In 27th International Conference on Science, Technology and Innovation Indicators (STI 2023). International Conference on Science, Technology and Innovation Indicators.

Dorta-González, P., Rodríguez-Caro, A., & Dorta-González, M. I. (2024). Societal and scientific impact of policy research: A large-scale empirical study of some explanatory factors using Altmetric and Overton. Journal of Informetrics, 18(3), 101530.

Drongstrup, D., Malik, S., Aljohani, N. R., Alelyani, S., Safder, I., & Hassan, S. U. (2020). Can social media usage of scientific literature predict journal indices of AJG, SNIP and JCR? An altmetric study of economics. Scientometrics, 125, 1541-1558.

Fang, Z., Costas, R., Tian, W., Wang, X., & Wouters, P. (2020). An extensive analysis of the presence of altmetric data for Web of Science publications across subject fields and research topics. Scientometrics, 124(3), 2519-2549.

Haunschild, R., & Bornmann, L. (2017). How many scientific papers are mentioned in policy-related documents? An empirical investigation using Web of Science and Altmetric data. Scientometrics, 110, 1209-1216.

Haunschild, R., Williams, K., & Bornmann, L. (2023, April). How relevant is public policy and administration research for the policy sector? An empirical analysis based on Overton data. In 27th International Conference on Science, Technology and Innovation Indicators (STI 2023). International Conference on Science, Technology and Innovation Indicators.

Hodges, R., Caperchione, E., Van Helden, J., Reichard, C., & Sorrentino, D. (2022). The role of scientific expertise in COVID-19 policy-making: evidence from four European countries. Public Organization Review, 22(2), 249-267.

Hu, L., Huang, W. B., & Bu, Y. (2024). Interdisciplinary research attracts greater attention from policy documents: Evidence from COVID-19. *Humanities and Social Sciences Communications*, *11*(1), 1-10.

Huang, Z., Zong, Q., & Ji, X. (2022). The associations between scientific collaborations of LIS research and its policy impact. Scientometrics, 127(11), 6453-6470.

Hui, A., Rains, L. S., Todd, A., Boaz, A., & Johnson, S. (2020). The accuracy and accessibility of cited evidence: a study examining mental health policy documents. Social psychiatry and psychiatric epidemiology, 55, 111-121.

Ji, C. Y., Tan, Z. K., Chen, B. J., Zhou, D. C., & Qian, W. Y. (2024). The impact of environmental policies on renewable energy investment decisions in the power supply chain. Energy Policy, 186, 113987.

Jonker, H., & Vanlee, F. (2024). Linking science with media and policy: The case of academics in Flanders, Belgium. Quantitative Science Studies, 5(3), 556-572.

Llewellyn, N. M., Weber, A. A., Pelfrey, C. M., DiazGranados, D., & Nehl, E. J. (2023). Translating scientific discovery into health policy impact: innovative bibliometrics bridge translational research publications to policy literature. Academic Medicine, 98(8), 896-903.

Ma, J., & Cheng, Y. (2024). Why do some academic articles receive more citations from policy communities? Public Administration Review.

Marx, W., Haunschild, R., Thor, A., & Bornmann, L. (2017). Which early works are cited most frequently in climate change research literature? A bibliometric approach based on reference publication year spectroscopy. Scientometrics, 110, 335-353.

Nay, O., & Barré-Sinoussi, F. (2022). Bridging the gap between science and policy in global health governance. The Lancet Global Health, 10(3), e322-e323.

Newson, R., Rychetnik, L., King, L., Milat, A., & Bauman, A. (2018). Does citation matter? Research citation in policy documents as an indicator of research impact–an Australian obesity policy case-study. Health Research Policy and Systems, 16, 1-12.

Obuku, E. A., Sewankambo, N. K., Mafigiri, D. K., Sengooba, F., Karamagi, C., & Lavis, J. N. (2018). Use of post-graduate students' research in evidence informed health policies: a case study of Makerere University College of Health Sciences, Uganda. Health research policy and systems, 16, 1-13.

Overton (2020). Overton Help Center: Advice and answers from the Overton Team, Retrieved December 7, 2024 from: http://help.overton.io/en/ .

Pinheiro, H., Vignola-Gagné, E., & Campbell, D. (2021). A large-scale validation of the relationship between cross-disciplinary research and its uptake in policy-related documents, using the novel Overton altmetrics database. Quantitative Science Studies, 2(2), 616-642.

Rahimi, F., & Danesh, F. (2024). Scientometric Analysis of Political Documents of Overton: Open Government Data Case Study. Caspian Journal of Scientometrics, 11(2), 1-13.

Ren, C., & Yang, M. (2023). Study on the Characteristics of Cross-Domain Knowledge Diffusion from Science to Policy: Evidence from Overton Data. Proceedings of the Association for Information Science and Technology, 60(1), 368-378.

Schnake-Mahl, A. S., Jahn, J. L., Purtle, J., & Bilal, U. (2022). Considering multiple governance levels in epidemiologic analysis of public policies. Social Science & Medicine, 314, 115444.

Szomszor, M., & Adie, E. (2022). Overton: A bibliometric database of policy document citations. Quantitative science studies, 3(3), 624-650.

Van Elsland, S. L., O'Hare, R. M., McCabe, R., Laydon, D. J., Ferguson, N. M., Cori, A., & Christen, P. (2024). Policy impact of the Imperial College COVID-19 Response Team: global perspective and United Kingdom case study. Health Research Policy and Systems, 22(1), 153.

Vilkins, S., & Grant, W. J. (2017). Types of evidence cited in Australian Government publications. Scientometrics, 113(3), 1681-1695.

Watson, R. T. (2005). Turning science into policy: challenges and experiences from the science–policy interface. Philosophical Transactions of the Royal Society B: Biological Sciences, 360(1454), 471-477.

Xu, C., & Zong, Q. (2023). The effects of international research collaboration on the policy impact of research: A causal inference drawing on the journal Lancet. Journal of Information Science, 01655515231174381.

Yang, C., Huang, C., & Su, J. (2020). A bibliometrics-based research framework for exploring policy evolution: A case study of China's information technology policies. Technological Forecasting and Social Change, 157, 120116.

Yin, Y., Gao, J., Jones, B. F., & Wang, D. (2021). Coevolution of policy and science during the pandemic. Science, 371(6525), 128-130.

Yoshida, Y., Sitas, N., Mannetti, L., O'Farrell, P., Arroyo-Robles, G., Berbés-Blázquez, M.,.. & Harmáčková, Z. V. (2024). Beyond academia: a case for reviews of gray literature for science-policy processes and applied research. Environmental Science & Policy, 162, 103882.

Yu, H., Cao, X., Xiao, T., & Yang, Z. (2020). How accurate are policy document mentions? A first look at the role of altmetrics database. Scientometrics, 125, 1517-1540.