A Bibliometric Analysis of Fuel Subsidy: A Call for Action

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Abstract - **Fuel subsidies play a vital role in mitigating inflation and lowering fuel production expenses, particularly during periods of surging global crude oil prices. The study's objectives involve a comprehensive assessment, mapping research studies to understand current trends, publication impact, research productivity in fuel subsidy studies, and identifying the most influential countries, institutions, and authors in this field. This research conducts a bibliometric analysis of fuel subsidies and their trends, utilizing data and academic literature from the Scopus database retrieved on October 4, 2022, with the keywords "fuel" and "subsidy" in the title string. Examining 168 articles spanning 1978 to 2022, quantitative data analysis employed Microsoft Excel, VOSviewer, and Harzing's Publish or Perish. Results reveal a rising trend in article publication since 2014, peaking at 23 articles in 2017. The United States (USA), the United Kingdom (UK), and China emerge as the most productive countries in fuel subsidy studies, with the USA playing a crucial role in international collaboration. The most cited paper garnered 164 citations. Future research is encouraged to explore broader areas, linking fuel subsidies with low carbon societies, environmental policy, renewable energy, or the blue economy, given their global significance. The study's findings aim to guide researchers in planning future investigations, offering relevant literature and critical issues to address, ultimately enhancing the quality of knowledge in this domain.**

Keywords *- Bibliometric Analysis, Fuel Subsidy, Environment, Fiscal Policy, Harzing's Publish or Perish, VOSviewer*

I.   Introduction

A fuel subsidy has an important economic implication, as it involves a significant amount of government spending and places a fiscal burden on the economy, especially when there is a large disparity between international oil prices and subsidised domestic retail price of fuel. In economic terms, a subsidy decreases the prices of consumers' pay and pushes the producers' price. Nevertheless, subsidies are useful for inflation and moderation of supply and demand. On average, firms with subsidies are 61.3% more productive than firms without subsidies. Within the sub-sample of firms that received subsidies, a significantly positive subsidy effect was found on the productivity at the mean, although the effect varies across firms (Li et al., 2022).

Fuel subsidies are key fiscal measure and avenue access to energy sources for the poor. Initially, subsidies are used to bolster the welfare of society. In Malaysia, fuels subsidized include RON 95 petrol and diesel fuels, and liquefied petroleum gas (LPG). Fuel subsidies account for 45% of the allocation in 2021, followed by education (12.5%), welfare (9.6%), agriculture (6.9%), transport (6.8%), and basic necessities (4.4%). Most road fuel subsidies are distributed on a blanket basis resulting in the unwanted regressive distributional outcome. It is argued that road fuel subsidy often excludes the intended receipt i.e. the poorest segment of the community (Peltovouri, 2017). Theoretically, the benefits of blanket subsidies tend to cater more to higher income groups.

In terms of distributional effects, the top 20% of the richer household do enjoy twice as much of the subsidy benefits as the bottom 20% households (Soile & Mu, 2015; and Dennis, 2016). The distribution of petrol subsidy is extremely concentrated and typically benefits the richer households. Furthermore, fuel subsidies contribute to an increase in greenhouse gas (GHG) emissions by incentivising the use of more vehicles that emit carbon dioxide gas through fuel combustion on roads. Additionally, subsidies also may hinder innovation by reducing producers' reliance on innovation as a way of generating more profit. Producers or growers may become "subsidy-dependent" in the long run while there is also the risk of corrupt practices such as siphoning off financial support to those who don't need the subsidies.

Thus, eliminating or reducing the subsidy would lead to higher fuel prices that could have a ripple effect on other sectors of the economy, particularly those who rely heavily on fuel. A removal of fuel subsidy has been known to hike petrol and electricity prices as the country's tax authority hikes excise taxes in an inflation adjustment plan. Advocates for the removal of fuel subsidies argue that it has become imminent to do so, as the government needs to allocate the revenue generated from crude oil towards other meaningful projects

How does the removal of a subsidy promote greater efficiency? Removal of the subsidy will reduce government expenditure and, considering all other things being equal, will lead to an increase in the budget surplus or reduce the budget deficit. However, while removing the subsidy, the government may decide to allocate funds to help society in other ways, such as assist workers who lose their jobs to be retrained and find new jobs in other industries. Other sectors that need to be focused by the government by providing additional budgets are – food security and food sustainability; health; education; public transportation improvisation or environmentally friendly public transport which can considerably lower emission rates, and sustainable transport e.g. electric vehicles, e-bikes etc; and develop more renewable energy.

Recently, the distribution of fuel subsidies was revised by the Malaysian government under the leadership of the Finance Minister and the Prime Minister, Datuk Seri Anwar Ibrahim in the revised Budget 2023. A targeted fuel subsidy mechanism was proposed to address the issue that have been raised on numerous occasions over the years. This new mechanism aims to ensure that subsidies are provided to those who truly need them, rather than being distributed on a broad basis. Hence, the authorities should consider systems and means-testing to ensure that subsidies will be distributed to those who truly need to receive them.

Despite the various programmes and government planning in place, enhancing people awareness and attitudes are significant and important factors to be developed among the public. The awareness and attitude towards eco-friendly vehicles, and the options of using public transport, and other concerns to reduce the detrimental effects to the environment from utilising more fuel should be developed. The purpose of subsidies should be highlighted to encourage consumers to use more green products and increase consumers' environmental awareness (Kadir et al., 2022). Thus, the objectives of the study is to make an assessment by mapping the full range of research studies, excluding any information prior to the year 1978. Therefore, the significant contribution of this paper will benefit researchers and propose new directions on fuel subsidies literature. The study gives a significant contribution theoretically, among academics, since the publications on fuel subsidies have been covered in many areas of studies, which include science and social science.

Consequently, this paper seeks to answer the following research questions: (1) what are the current trends, impact of publications, as well as, productivity of research in fuel subsidy studies?, (2) which are the most productive countries, institutions and authorships on fuel subsidy studies?, (3) what are the most prevalent themes of fuel subsidy research among scholars?, and (4) which articles have had the most significant influence on fuel subsidy studies? The remainder of the paper is divided into three (3) sections: Section 2 covers methodology used in the current study. Section 3 is on findings and discussion, and Section 4 explains the conclusion and recommendations of the study.

II. Literature Review

While fuel subsidies contribute to societal well-being and economic growth, the current perspective presents a somewhat unclear picture regarding their environmental impact. The provision of fuel subsidies appears to contribute significantly to environmental degradation, resulting in elevated carbon (CO2) emissions due to excessive consumption (Rentschler & Bazilian, 2017). This finding aligns with Coady et al.'s (2017) discovery that fuel subsidies foster wasteful fuel consumption, hindering clean energy investments and exacerbating local pollution through increased CO2 emissions. Lower fuel prices incentivize individuals to opt for private vehicles over energy-efficient ones, compounding environmental consequences (Bárány & Grigonytė, 2015; Mustapa &

Bekhet, 2016; Rentschler & Bazilian, 2017). Furthermore, this trend makes fuel investments more appealing than investments in cleaner alternatives like renewable energy or electric vehicles (Kuehl et al., 2021).

The escalating carbon emissions issue is particularly concerning in Malaysia, where a growing dependency on private vehicles is observed. Ramli et al. (2021) emphasize the connection between fuel subsidy distribution and the surge in CO_2 emissions, attributing the increase to higher fuel consumption driven by lower fuel prices. This underscores the need for a closer examination of the environmental impact of fuel subsidies, especially in the context of rising private vehicle dependence in Malaysia.

III.Methodology

In order to assess the current trends in academic research on fuel subsidies, this study employs the bibliometric analysis method. . The bibliometric indicators and network visualization are used to present the results of the study. This method is widely used in measuring the properties of various types of documents, including journal articles, conference proceedings, and books and measuring scientific research productivity in any specific field of research (Zyoud et al., 2017).

Bibliometric Analysis

The bibliometric research refers to a quantitative method that uses statistics to measure text and information and enables an analysis of published documents (Hall, 2011). A bibliometric study gains popularity as an established tool to measure scientific research productivity in any specific field of research (Zyoud et al, 2017) and it is one of the methods in revealing the trend and pattern of studies (Ahmi & Mohammad, 2019). Furthermore, it can be used to evaluate the quantity and quality of the published materials to monitor the trends or pattern of a specific research area (Sweileh et al., 2017). According to Ho (2007), the bibliometric analysis can provide descriptive patterns of publications completed based on a domain, field, country, period, amongst other factors. Moreover, a methodical approach in executing a bibliometric analysis could discover more detailed information related to the publications, including authors, frequency of keywords and citations (Rusly et al., 2019). "Common bibliometric indicators include publication outlet, type of publication, authorship, affiliation, country, and h-index (Ahmi & Mohammad, 2019)." These indicators are some of the descriptive analysis gathered based on the data sets supplied from the chosen databases. Some of the studies will also investigate the impact of the publications based on the citations, such as citation counts, citation per publication, impact per publications, the impact factor, and co-citation.

With the current accessibility and richness of data available for academic publications, there are various tools being developed to analyse these bibliometric data. The trend in bibliometric research has shifted towards visualising bibliometric networks. VOSviewer, for example, offers a freely available tool for constructing and visualising the networks as well as offering text mining features for constructing and visualising the co-occurrence networks of crucial terms extracted from 'www.vosviewer.com'. Another tool, Harzing's Publish and Perish, which is an established software program, retrieves and analyses academic citations, enabling researchers to showcase the impact of their research even with a limited number of citations. It is proposed to use this tool that can be found at 'Harzing.com" to showcase academic research impact to its best advantage, even if the researcher has limited citations. The VOSviewer and Publish and Perish can be used to further examine the impact of publications based on citation counts, impact per publication, and citations per publication.

Source and Data Collection

The bibliometric analysis is done in this study by utilizing the Scopus database as a source in searching and extracting relevant and necessary literature according to the research questions. According to Sweileh et al., 2018, the Scopus is able to provide bibliometric indicators directly and in a very simple manner. As the Scopus is currently a prominent literature database and includes approximately 1741 titles (Anuar et al., 2021), it is decidedly it is the best primary source for this study as regards data collection. A thorough identification was done using key terms such as 'fuel subsidy', and 168 related articles were found indicating a topical scope where the majority focused on subsidy in various subject areas. The authors followed a Systematic Reviews and Meta-Analyses known as Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) which is used to search, filter and select the articles as presented in Figure 1. The identification was done using the following keyword string: (TITLE ("fuel" AND "subsidy")). The searches were conducted on Oct 4, 2022 and 201 documents were successfully retrieved.

Next for the screening process, the filtrations were done using the list of 201 documents. The authors removed the subject area which are not related to the scope of the study and then included the applicable fields, such as environmental science; social sciences; economics, econometrics and finance; energy; business, management and accounting; and multidisciplinary and this led a total of 174 documents. To ensure a high-quality review, the articles chosen for the analysis should be written in English to minimise misunderstanding of the concepts and issues discussed.

Furthermore, types of documents used included articles, book chapters, and conference papers. Other types of publications such as business articles, editorials, reviews, notes, letters, erratum, and short surveys were not considered for the review process. The analysis was done by excluding 6 of them, which then provided the remaining 168 articles for abstract analysis.
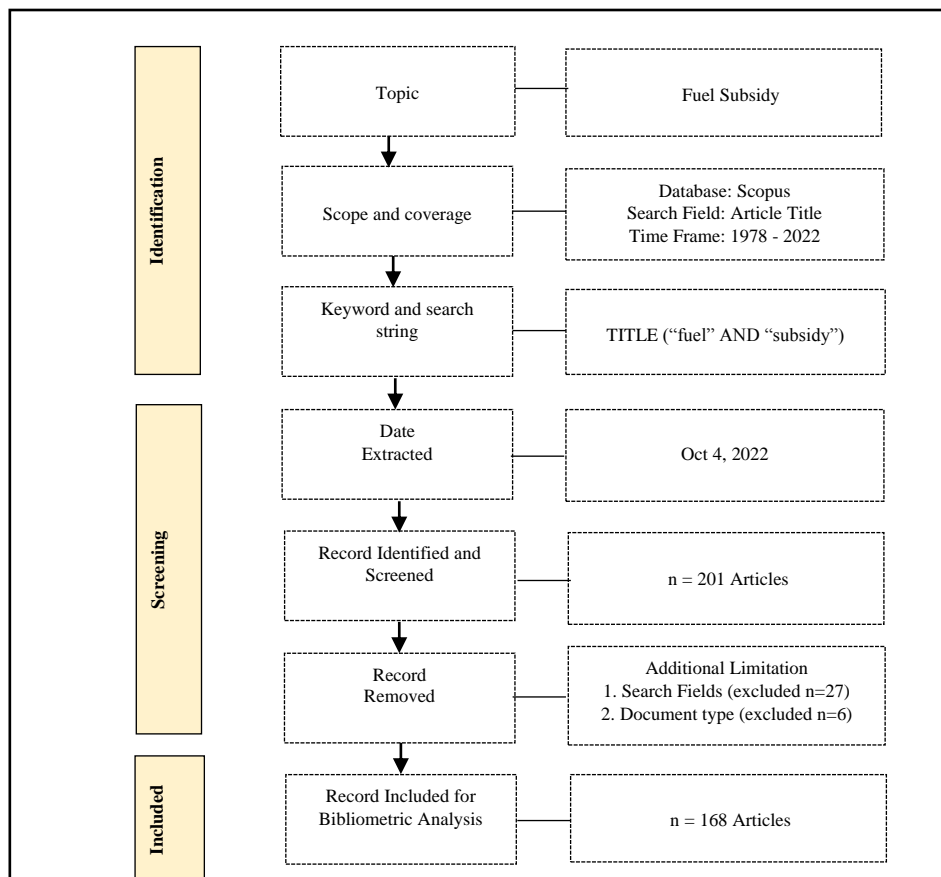

Figure 1. PRISMA Flow diagram of the search strategy
Source: Adapted from Moher et al. (2009)

IV. Findings and Discussions

This part analyses the extracted academic articles obtained from the bibliometric analysis to answer the research questions raised in the current paper. At the outset, this paper addresses the first research question regarding the current trends, impact of publications and productivity of research in fuel subsidy studies. The attributes which were used in the analysis to discuss the current trend and impact of fuel subsidies publication studies are:- document and source type, document languages, annual growth of publications, subject areas, and the most active source titles on subsidies.

Document and source types

The published documents on fuel subsidy have been classified into three types of documents as summarised in Table 1. Articles constitute the highest type of publications with 86.9 percent, followed by book chapters (11.31 percent), and conference papers (1.79 percent).

Table 1. Document Type

Document Type	TP	%
Article	146	86.90%
Book Chapter	19	11.31%
Conference Paper	3	1.79%

Note: TP refers to total publications

Similarly, the published documents in this study are divided into four major sources. Journal articles reflect the highest with 147 documents (87.5 percent) and followed by 18 books (10.71 percent), 2 conference proceedings (1.19 percent) and one book series (0.6 percent) as summarised in Table 2.

Table 2. Source Type

Source Type	TP	%
Journal	147	87.50%
Book	18	10.71%
Conference Proceeding	2	1.19%
Book Series	1	0.60%

Languages of Documents

As shown in Figure 3, the only language chosen is English as it was the primary language of the total number of publications of the fuel subsidy as stated in Table 3.

Table 3. Languages

Language	TP	%
English	168	100.00%

Annual Growth of Publications

Productivity of research in fuel subsidy studies is investigated based on the total documents published annually, which is from 1978 to 2022, being the period under the focus of this paper. The annual growth data presented in this part include their frequency and percentage. According to Ahmi & Mohamad (2019), publication year examination of the documents empowers the researcher to comprehend the pattern of the chosen topic over time. Table 4 shows the research on subsidies was firstly published in 1978. There was a significant gap in the publication of articles from 1979 to 1995, during which time no articles were published on the topic. However, starting in 2010, periodic publication of articles resumed. . Apart from that, the publications seem consistent from the year 2012 with a total of 9 publications. Subsequently, the trend of article publications shows an increase in its flow. The year 2017 recorded the highest number of publications with 23 articles showing a contribution of 13.69 percent in the study period.

Table 4. Growth of Publication by Year

Year	TP	%	Year	TP	%
2022	18	10.71%	2011	2	1.19%
2021	14	8.33%	2010	2	1.19%
2020	15	8.93%	2008	2	1.19%
2019	10	5.95%	2007	2	1.19%
2018	17	10.12%	2005	1	0.60%
2017	23	13.69%	2003	1	0.60%
2016	11	6.55%	2001	1	0.60%
2015	12	7.14%	1996	3	1.79%
2014	16	9.52%	1995	1	0.60%
2013	6	3.57%	1979	1	0.60%
2012	9	5.36%	1978	1	0.60%

Subject Area

Table 5 presents the subject area. In general, the distribution shows that the literature on fuel subsidy contributes in various fields of interest. The highest are from environmental science (47.02 percent); social sciences (41.07 percent); economics, econometrics and finance (39.29 percent); energy (33.93 percent) and followed by business, management and accounting (10.21 percent, while, the rest are fields which comprise less than 10 percent of the overall publications as depicted in Table 5.

Table 5. Subject Area

Subject Area	TP	%	Subject Area	TP	%
Agricultural and Biological Sciences	8	4.76%	Engineering	18	10.71%
Arts and Humanities	4	2.38%	Environmental Science	79	47.02%
Biochemistry, Genetics and Molecular Biology	1	0.60%	Materials Science	1	0.60%
Business, Management and Accounting	17	10.12%	Mathematics	4	2.38%
Chemical Engineering	1	0.60%	Medicine	2	1.19%
Computer Science	1	0.60%	Multidisciplinary	4	2.38%
Decision Sciences	3	1.79%	Pharmacology, Toxicology and Pharmaceutics	1	0.60%
Earth and Planetary Sciences	13	7.74%	Physics and Astronomy	2	1.19%
Economics, Econometrics and Finance	66	39.29%	Psychology	1	0.60%
Energy	57	33.93%	Social Sciences	69	41.07%

Most Active Source Titles

This section addresses the most active source titles on fuel subsidies. The research on subsidies is published in various source types such as journals, proceedings and books. Based on Table 6, it is interesting to note that the Energy Policy hosts the largest number of total publications with 19 publications (11.31 percent). The second and third highest are energy economics, and energy fields with 8 (4.76 percent) and 6 publications (3.57 percent) respectively. From here the top three fields are related to energy which indicates the importance of energy- and fuel-related subsidies. The remaining source titles can be seen directly from the table below.

Table 6. Most Active Source Title

Source Title	TP	%	Source Title	TP	%
Energy Policy	19	11.31%	Extractive Industries And Society	2	1.19%
Energy Economics	8	4.76%	International Journal Of Hydrogen Energy	2	1.19%
Energy	6	3.57%	Jurnal Ekonomi Malaysia	2	1.19%
International Environmental Agreements Politics Law And Economics	5	2.98%	Marine Policy	2	1.19%
World Trade Review	5	2.98%	Sustainability Switzerland	2	1.19%
Applied Energy	3	1.79%	Transportation Research Part A Policy And Practice	2	1.19%
Environmental And Resource Economics	3	1.79%	2010 IEEE Conference On Innovative Technologies For An Efficient And Reliable Electricity Supply Citres 2010	1	0.60%
Fuel Taxes And The Poor The Distributional Effects Of Gasoline Taxation And Their Implications For Climate Policy	3	1.79%	Africa Development	1	0.60%
International Journal Of Energy Economics And Policy	3	1.79%	American Economic Review	1	0.60%

World Development	3	1.79%	Annual Review Of Energy And The Environment	1	0.60%
Climate Policy	2	1.19%	Asia Pacific Journal Of Environmental Law	1	0.60%
Climatic Change	2	1.19%	Asian Development Review	1	0.60%
Economist United Kingdom	2	1.19%	Asian Journal Of Scientific Research	1	0.60%
Energies	2	1.19%	Asian Social Science	1	0.60%
Energy Research And Social Science	2	1.19%	Bulletin Of Indonesian Economic Studies	1	0.60%
Environmental Security In The Asia Pacific	2	1.19%	Carbon Pricing Growth And The Environment	1	0.60%

The first research question has been successfully discussed and addressed the current trends and impact of subsidies publication studies. It also recognised the most active source titles on subsidies. The second research question pertains to the most productive countries, institutions and authorships on fuel subsidy studies. This section will discuss on the most productive countries in terms of geographical distribution of publications, the most influential institutions and authorship analysis.

Most Active Countries

Publications by country are described in Table 7. This section focuses on collaborator country trends. Scholars from 39 countries have published the articles related to fuel subsidy. The country that most actively contributed to the publication was the United States with 50 publications (29.76 percent); United Kingdom ranked second with 18 publications (10.71 percent); followed by China with 17 publications (10.12 percent). On the other hand, Germany, Indonesia and Malaysia contributed 15, 14 and 13 articles (8.93 – 7.74 percent) respectively. Other countries constituted the lowest percent (< 7.74 percent) of the entire number of published articles related to fuel subsidy.

Table 7. Most Active Countries

Country	TP	%	Country	TP	%	Country	TP	%
United States	50	29.76%	Netherlands	6	3.57%	Fiji	1	0.60%
United Kingdom	18	10.71%	Austria	4	2.38%	Greece	1	0.60%
China	17	10.12%	India	4	2.38%	Hong Kong	1	0.60%
Germany	15	8.93%	Norway	4	2.38%	Hungary	1	0.60%
Indonesia	14	8.33%	South Korea	4	2.38%	Iran	1	0.60%
Malaysia	13	7.74%	Finland	3	1.79%	Kenya	1	0.60%
Canada	10	5.95%	Spain	3	1.79%	Oman	1	0.60%
Nigeria	10	5.95%	Turkey	3	1.79%	Samoa	1	0.60%
Sweden	9	5.36%	Argentina	2	1.19%	Singapore	1	0.60%
France	8	4.76%	Brazil	2	1.19%	Sudan	1	0.60%
Italy	8	4.76%	Ecuador	2	1.19%	Thailand	1	0.60%
Belgium	7	4.17%	Ethiopia	2	1.19%	Tunisia	1	0.60%
Switzerland	7	4.17%	Ghana	2	1.19%	Undefined	3	1.79%
Australia	6	3.57%	Japan	2	1.19%			

Most Influential Institutions

Table 8 presents the most influential institutions that contributed to the publications. The Xiamen University is the top university in publishing articles on the subject of fuel subsidies with 7 publications (4.17 percent). This

was followed by Universiti Utara Malaysia, University College London, and Colombia University which came in tied for second place with 6 publications (3.57 percent). The group comprising of Universiteit Utrecht, Stockholm Environment Institute, Copernicus Institute of Sustainable Development, Institut International du développement Durable, Minjiang University and The World Bank, USA were placed third in terms of total publications collectively with 4 articles (2.38 percent). The rest of the institutions, numbering 8 in total published 3 articles (1.79 percent), while 14 other institutions had only 2 publications (1.19 percent).

Table 8. Most Influential Institutions

Institution	TP	%	Institution	TP	%
Xiamen University	7	4.17%	Itä-Suomen yliopisto	3	1.79%
Universiti Utara Malaysia	6	3.57%	The Oxford Institute for Energy Studies	3	1.79%
University College London	6	3.57%	Earth Track, Inc.	2	1.19%
Columbia University	6	3.57%	School of Government and Public Policy SGPP	2	1.19%
Universiteit Utrecht	4	2.38%	International Food Policy Research Institute	2	1.19%
Stockholm Environment Institute	4	2.38%	HEC Montréal	2	1.19%
Copernicus Institute of Sustainable Development	4	2.38%	The Australian National University	2	1.19%
Institut International du développement Durable	4	2.38%	Purdue University	2	1.19%
Minjiang University	4	2.38%	L'Organisation de Coopération et de Développement Economiques	2	1.19%
The World Bank, USA	4	2.38%	Multimedia University	2	1.19%
The Royal Institute of Technology KTH	3	1.79%	Christian-Albrechts-Universität zu Kiel	2	1.19%
Queen's University	3	1.79%	Universität Zürich	2	1.19%
International Monetary Fund	3	1.79%	Hunan Normal University	2	1.19%
Lunds Universitet	3	1.79%	Universität Duisburg-Essen	2	1.19%
Universitas Indonesia	3	1.79%	University of California, Davis	2	1.19%
The University of Nottingham Malaysia Campus	3	1.79%	Peking University	2	1.19%

Authorship Analysis

The present research uses VOSviewer for co-author analysis to further analyse the author's collaboration. The analysis is based on the fact that influential authors that have a minimum of at least one citation. These are calculated using fractional counting. Based on the network visualization in Figure 2, the strength of the author's connection is based on the colour of the connecting line, the size of the circle, the font size and the thickness. Connected authors that are shown in the same colour are usually grouped together as shown in the figure which is proposed by C. Bertram. Authors who work closely together and frequently perform research together were also analysed. Additionally, it also illustrates a group of authors identified in red color that J. Emmerling and D. Vanvuuren have collaborated with.
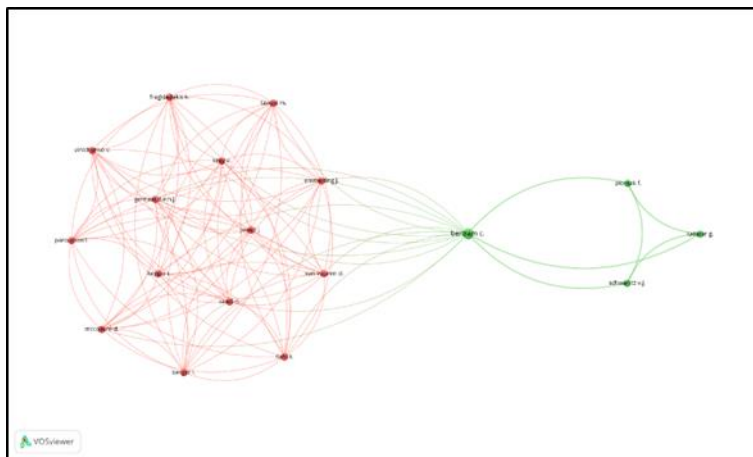
Figure 2. Co-authorship based on authors that have a minimum of one
number of citations.

Figure 3 shows the network visualisation of the authors' country or region. The analysis only includes countries that have cited more than three articles and have received more than five citations using fractional counting.
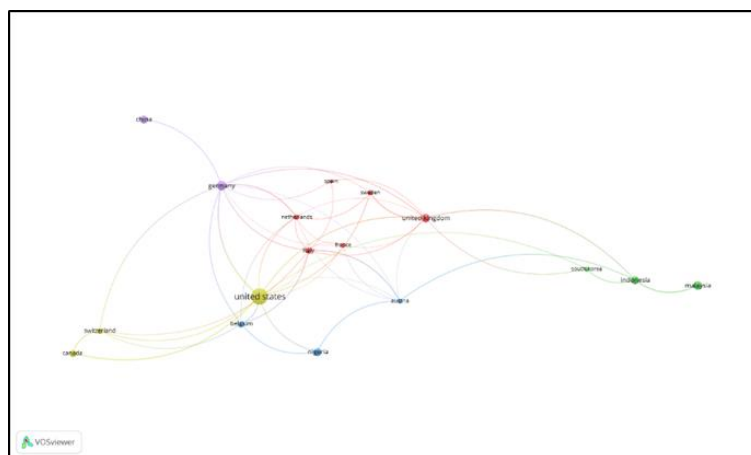

Figure 3. Co-authorship based on countries that have a minimum of five
number of citations and three number of documents.

Based on the score counting method, the findings indicate that the USA plays a very important role in cooperation with other countries, followed by the United Kingdom and Germany. After addressing the second research question, this analysis continues further to answer the third research question regarding the most prevalent themes of fuel subsidy among scholars. This section will discuss on the keywords and citations analysis.

Keywords Analysis

The basic principle of keyword analysis is that the authors' keywords are sufficient to reflect the content of articles (Comerio & Strozzi, 2019). When two keywords occur in the article simultaneously, the keywords co-occur, indicating a relationship between the two concepts. In this study, we use keyword and co-occurrence analysis in the VOSviewer software as illustrated in Figure 4.
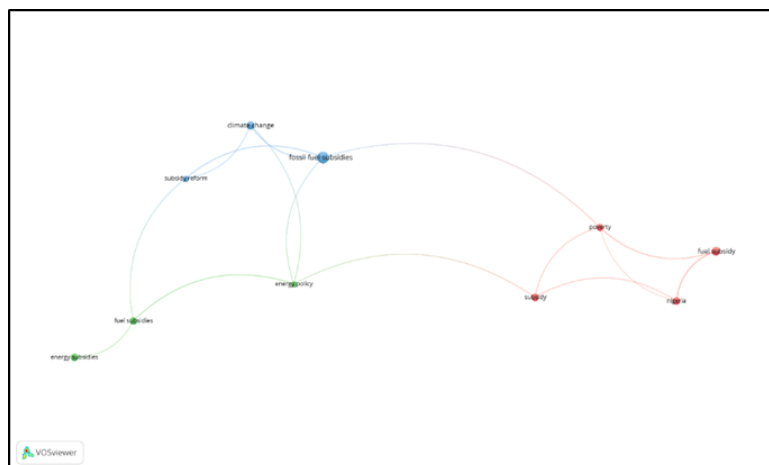
Figure 4. Network visualisation map of the author keywords

Figure 4 illustrates a map visualisation of the authors' keywords which displays the strength of the connections among keywords through colour, the size of the circles, font and thickness of the connecting lines. Based on the analysis, fossil fuel subsidies and climate change impacts, which are coloured in blue, are closely connected and frequently appear together. A citation analysis was then conducted to further understand the related prevalent themes.

Citations Analysis

Table 9 provides a summary of the citation metrics for the documents collected from October 4, 2022. To find the citation metric, we utilised the Harzing's Publish or Perish software. The short description contains the statistics comprising of number of citations per year, citations per paper and citations per author. The citations metrics table shows that during the 44 years, from year 1978 to 2022, a total of 2,720 citations were cited for 168 published articles, with an average of 61.82 citations/year. The total h-index for all the publications was 32 and the g-index was 47.

Table 9. Citations

Metrics	Data
Papers	168
Citations	2720
Years	44
Citations/Year	61.82
Citations/Paper	16.19
Citations/Author	1362.75
Papers/Author	90.29
Authors/Paper	2.46
h_index	32
g_index	47

After addressing the third research question, this analysis went forward to answer the fourth research question as regards the most influential articles on fuel subsidy studies. We analyzed the entire collection of 168 articles for the total number of citations for each document.

Highly Cited Articles

Although there are several ways to measure the effect of research publications, citation analysis is the most common tool (Ding and Cronin, 2011). Table 10 displays the most highly cited articles based on data obtained from the Scopus database, ranked according to the total number of citations received for each document.

Table 10. Highly Cited Articles

	Authors	Title	Year	Source	Total Citation	Cites Per Year
1	D. Coady, I. Parry, L. Sears, B. Shang	How Large Are Global Fossil Fuel Subsidies?	2017	World Development	164	32.8
2	F.J. Arze del Granado, D. Coady, R. Gillingham	The Unequal Benefits of Fuel Subsidies: A Review of Evidence for Developing Countries	2012	World Development	149	14.9
3	U.R. Sumaila, L. Teh, R. Watson, P. Tyedmers, D. Pauly	Fuel price increase, subsidies, overcapacity, and resource sustainability	2008	ICES Journal of Marine Science	136	9.71
4	S. Gangopadhyay, B. Ramaswami, W. Wadhwa	Reducing subsidies on household fuels in India: How will it affect the poor?	2005	Energy Policy	85	5
5	B. Lin, X. Ouyang	A revisit of fossil-fuel subsidies in China: Challenges and opportunities for energy price reform	2014	Energy Conversion and Management	84	10.5
6	Y. Li, Q. Zhang, B. Liu, B. McLellan, Y. Gao, Y. Tang	Substitution effect of New-Energy Vehicle Credit Program and Corporate Average Fuel Consumption Regulation for Green-car Subsidy	2018	Energy	82	20.5
7	T. Dartanto	Reducing fuel subsidies and the implication on fiscal balance and poverty in Indonesia: A simulation analysis	2013	Energy Policy	72	8
8	B. Gardner	Fuel ethanol subsidies and farm price support	2007	Journal of Agricultural and Food Industrial Organization	71	4.73
9	J. Jewell, D. McCollum, J. Emmerling, C. Bertram, D.E.H.J. Gernaat, V. Krey, L. Paroussos, L. Berger, K. Fragkiadakis, I. Keppo, N. Saadi, M. Tavoni, D. Van Vuuren, V. Vinichenko, K. Riahi	Limited emission reductions from fuel subsidy removal except in energy-exporting regions.	2018	Nature	69	17.3
10	B. Lin, A. Li	Impacts of removing fossil fuel subsidies on China: How large and how to mitigate?	2012	Energy	62	6.2

Coady, Parry, Sears and Shang was ranked first in the article titled "How Large Are Global Fossil Fuel Subsidies?", with a total number of citations of 164 and an average of 32.8 citations per year. This was followed by Arze del Granado, Coady and Gillingham with the article entitled "The Unequal Benefits of Fuel Subsidies:

A Review of Evidence for Developing Countries" and then Sumaila, Teh, Watson, Tyedmers and Paulywith the title "Fuel Price Increase, Subsidies, Overcapacity, and Resource Sustainability" which had 149 citations and 136 citations respectively.

Figure 5 illustrates a map visualisation of the citation based on the minimum number of ten citations of a document generated by VOSviewer. It displays the connection among authors in different colours.
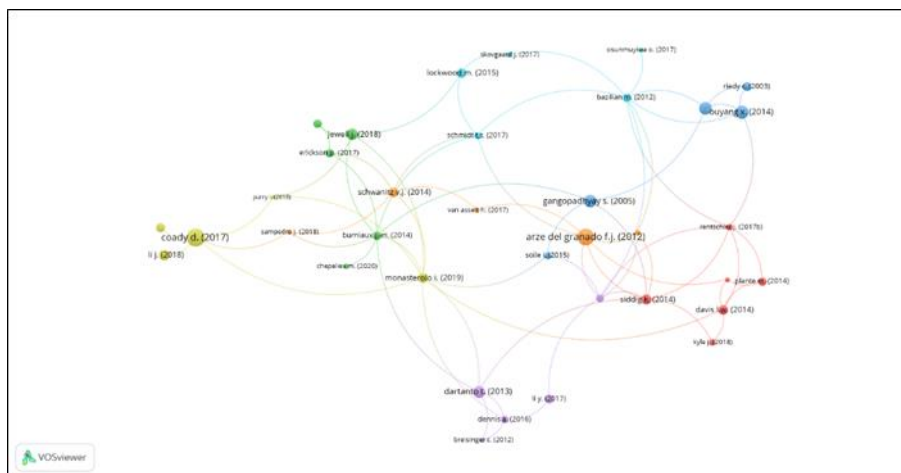

Figure 5. Citation based on minimum number of ten citations of a document

Based on the analysis, the result suggests that Coady, Parry, Sears and Shang and Arze del Granado, Coady and Gillingham whom are coloured in yellow and orange have the highest and the most cited articles. Figure 6 illustrates a map visualisation of the citation based on countries that have a minimum of one number of document of a country and ten number of citations of a country.
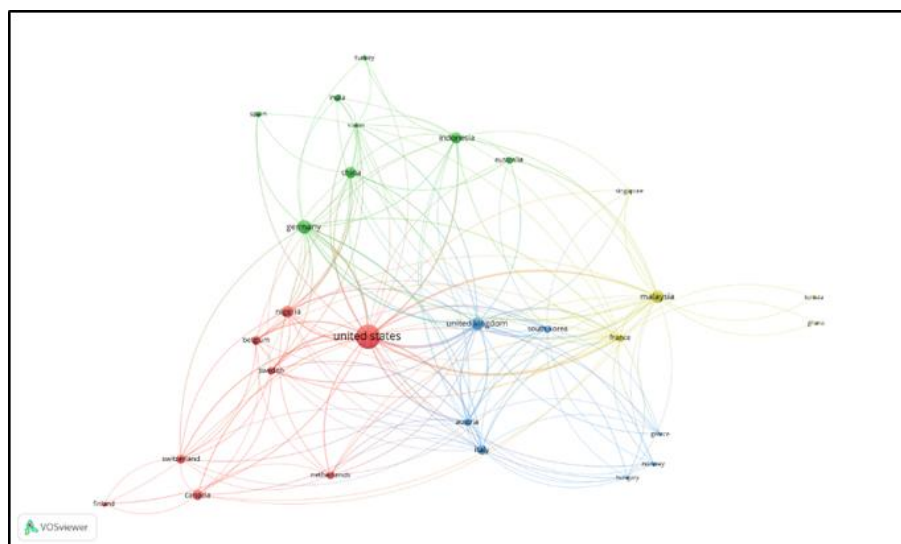

Figure 6. Citation based on countries that have a minimum of one number of document
of a country and ten number of citations of a country

It displays the connection amongst countries in various different colours. Based on the analysis, the result that the United States which is in red has the highest number of cited articles.

V.   Conclusion and Recommendation

A research related to fuel subsidies is indeed an interesting and intriguing field, particularly in countries that rely heavily on natural resources such as coal and fuel. The growth of the country is stimulated by the policy implementation such as fiscal stimulus to enhance the economic performance and people welfare. The allocation provided for subsidies by the government is huge and to some extent it needs to be improved to reduce fiscal

deficit. Meanwhile, it can alleviate welfare loss by increasing the expenditure on education, health and other main service sectors including food security. Research has proven that reducing subsidies on fuel has plundered the environment. Many countries worldwide have taken numerous and varied actions to help save the environment as it is a global sustainability agenda to reduce GHG emissions. Therefore, it is critical for practitioners and policy makers to plan for the improvement of health and the environment.

In summary, the bibliometric analysis was conducted on the topic of fuel subsidies in different aspects as highlighted in the various research questions. In general, subsidies have been heavily discussed in all the literature reviewed and in varied subject areas, making it an interesting exercise to analyse the multi-faceted aspects by applying the bibliometric method. Basically, this study provides an analysis of research trends related to web accessibility, specifically to summarise the trends in the fuel subsidy from 1978 to 2022. Based on the findings, the total of 168 documents selected were considered for the analysis. It was found that the majority of documents were published in journal form, while the rest were published in proceeding papers and all publications were written in English.

Due to the significance of this issue and the research gap, this paper provides an overview and analysis on fuel subsidies publications. It can be concluded that: (1) In relation to subject areas, environmental science was listed as the top choice of the publishing field, while energy was in the fourth place after social sciences and economics, econometrics, and finance; (2) Energy Policy, Energy Economics, and Energy are among the top journals published in respect to the fuel subsidies topic; (3) The United States is the leading country, with regards to contributing for the most number of publications, followed by the United Kingdom, China and Germany; (4) The Xiamen University is the top university in terms of publishing on the topic of fuel subsidies with 7 publications; (5) Fossil fuel subsidies and climate change are related keywords which are closely connected. The trend analysis provided in this study is expected to provide significant insight to the present and future scholars. In addition, this study will offer potential direction and promising opportunities for future researches.

As Sweileh et al., (2017) noted, there is no search query that is 100 percent ideal and false positive and negative outcomes should be expected. This study exclusively extracted the data from the most comprehensive database, i.e. Scopus, as the primary source. However, Scopus does not cover all published sources easily (Sweileh et al., 2017; Ahmi & Mohamad, 2019). Therefore, in future research, Web of Science, Google Scholar and other databases could be used. Integrating all these databases may help to add exciting and valued results. Despite other limitations, the current research adds to global knowledge by providing current research trends on fuel subsidies. This research also contributes to expand the knowledge of fuel subsidies literature by applying the bibliometric analysis.

The research carries wide-ranging implications (1) fuel subsidies play a pivotal role in boosting economic growth, particularly in resource-dependent nations. However, the challenge lies in balancing this stimulation with fiscal responsibility. Policymakers must explore alternative approaches to maintain economic performance while addressing fiscal deficits, (2) redirecting resources from fuel subsidies to essential services like education, health, and food security can alleviate welfare loss, contributing to overall societal well-being and sustainable development, (3) the study underscores that reducing fuel subsidies can have adverse environmental effects. Policymakers must carefully navigate subsidy reductions to align with global sustainability goals, balancing economic considerations with environmental protection, (4) identifying leading countries and institutions in fuel subsidy research emphasizes the importance of global collaboration. Policymakers and practitioners can use this information to foster international partnerships, share best practices, and collectively address challenges related to fuel subsidies, (5) analysis of subject areas and journals reveals insights into the interdisciplinary nature of fuel subsidy research. Policymakers and scholars can leverage this information to prioritize research areas and disseminate findings through influential publications, (6) recognizing closely connected keywords, such as "fossil fuel subsidies" and "climate change," highlights the intricate relationship between fuel subsidies and broader environmental concerns. This understanding informs policymakers and researchers on the interconnectedness of energy policies and climate change mitigation strategies.

Although the study provides valuable insights, it also has some limitations which makes it incumbent for readers to clearly understand this article and the potentialities of future researches. It is to be noted that firstly, this study employed only the Scopus database; and second, the authors limited the results of the search procedure to scholarly works focused only on the fuel subsidy; third, the search query results used the title as a catchword which may focus on search words in the abstract or the keyword field. The study's trend analysis provides a valuable resource for current and future scholars, offering a comprehensive overview of the fuel subsidy research

landscape. It serves as guidance to inspire exploration of emerging topics, address literature gaps, and contribute to ongoing discussions on fuel subsidies, environmental sustainability, and economic development.

Conflict of Interest Statement

The authors declare that they have no competing interests.

Author's Contribution

All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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