BIBLIOMETRIC ANALYSIS OF CARBON TAX LITERATURE: FUTURE RESEARCH FOR INDONESIA

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Abstract

In recent years, the carbon tax has become a popular discussion among countries. After careful consideration, Indonesia plans to implement carbon tax policies in 2022. As a result, there will be beneficial and on the other hand, negative influences. As a new player in implementing carbon tax policies, Indonesia could learn from the country that implemented it first. Using bibliometric analysis, this study is expected to give insight to the next researcher and concerned party for the future research direction on carbon tax policy and its impact on the related parties. This research assesses the most prolific authors, source institutions, and nations, as well as the most cited papers and the most popular keywords using the Scopus database. Indonesia has a big chance to do research related to the carbon tax. We recommend that Indonesian scholars focus on the economic and business level in their future research related to the carbon tax.

1. INTRODUCTION

The Indonesian government will collect carbon tax, limited to coal power plants. Previously, the carbon tax's scheduled implementation had been delayed twice, in April and July 2022. Nevertheless, the carbon tax will continue to apply in 2022 (Kompas, 2022). It will be subject to the carbon-emitting activity. In fact, the carbon tax is not something new. The OECD adopted The Pollution-Pays Principles (PPP) in 1972, which stated that the polluter must bear the cost of environmental preservation. Gradually, this carbon tax will expand to the other sector in 2025.

The main reason for implementing this policy is that Indonesia is very vulnerable to climate change (Kemenkeu., 2021). Running carbon policies causes several results. The main goal is its impact on the environment, which supports emission reduction as an action to fight global warming (Kemenkeu., 2022) since it is associated with greenhouse gas, including carbon emissions (Bhat & Mishra, 2020; Datta, 2017). On the other hand, it can also change the behavior to be a green economy. The environmental goals align with the Paris Agreement and the 2030 Agenda for Sustainable Development Goals (SDGs).

On the other hand, the effect will expand the economy nationally. The additional national income will be gathered to increase development funds, environmentally friendly investments, and support low-income communities through social assistance (Kemenkeu., 2021). Practicing carbon tax is expected to have a positive impact nationally, both environmentally and economically.

On the opposite side, it may cause pressure on the firm. The carbon tax shocks the firms, especially those that will implement this

regulation. This tax will shift the firms' earnings and revenues (Luo & Tang, 2014), also its supply chain (Fahimnia et al., 2015). On the other hand, the firms also have to shift their technology and invest in environmentally friendly technology to reduce emissions (Datta, 2017). Since carbon tax policies will affect the price mechanism, consumers will also feel the impact (Liu et al., 2022). The growing news about climate change, its effects, and what needs to be done to cut carbon emissions will gain more attention from corporate responsibilities for the customers (Wang et al., 2014). Not only will the customers be influenced, but the other stakeholders, such as investors, will. It is crucial to see do or not work the implementation by seeing the response of the firms, customers and investors.

Since carbon tax became a popular topic several decades, previous studies have been conducted by many scholars globally before. There are many studies about the effect of the policy on the energy transition (Liu & Xu, 2022; Ravigné et al., 2022; Wang et al., 2022) and on the economy, such as the gross domestic product and investment (Datta, 2017; Luo & Tang, 2014; Wang et al., 2022). On the other hand, there are studies about the firm response to the carbon price (Bumpus, 2015), the carbon tax on financial performance (Lee et al., 2015; Wang et al., 2014), the GHG emission on return on sales (Rokhmawati et al., 2017) and also the financial behavior through a carbon tax (Zhu et al., 2020). However, none of the previous studies did the mapping by bibliometric analysis. This study will focus on mapping the carbon tax as well as its impact on the economy and business level.

The structure of this article is as follows: Section two provides a concise summary of the bibliometric methodology and indicators. The third section provides the main findings of this article. Section four concludes the paper with a summary of the principal findings and conclusions.

2. METHODOLOGY

This study uses the bibliometric model as the method. Bibliometrics offers a comprehensive quantitative, objective, and methodical analysis of the current state of research, as well as the research hotspots and future development patterns (Xue et al., 2022). Bibliometric techniques are highly effective for providing an overview of academic research in a topic or journal by identifying the most prominent trends in publications, citations, authors, keywords, and institutions (Martínez-López et al., 2018). This study gains the data from the Scopus database and uses Publish or Perish (PoP) 8 software and VOSViewer software. We select Scopus as Scopus has the best reputation and most trusted source for scholars worldwide.

We begin by identifying the article title, abstract, and keyword by "carbon tax" or "carbon tax policy" on the Scopus database. The results show there are 4.299 documents. Next, we filter some criteria, such as limiting the year from 2012 to 2022, choosing document type as article, the source type is a journal, English is the language, and we also limit the subject area. We filter by limiting the subject area of: (1) Economics, Econometrics and Finance, (2) Business, Management, and Accounting, (3) Social Sciences, (4) Decision Sciences, (5) Computer Sciences, and (6) Multidisciplinary, as we want to focus the literature on the economic and business scope. After considering all the criteria, we have 351 documents to be analyzed. We focus on analyzing the factors that come up most often: the author, the journal, the article, the country and the keyword. In the end, we conduct a graphical visualization to generate future directions.

3. RESULT AND DISCUSSION

A. General Information

The summary of the selected paper is presented in table 1. In the last ten years, there have been 351 papers that discussed carbon tax in the economic and business fields. Surprisingly, the documents are cited 5.857 times, with an average of 586 (585,7) cites per year. On average, one paper is cited 17 (16,69) times. The metric shows that carbon tax is an active topic and has become popular this decade.

Table 1. Citation Metrics

Description	Data
Publication Years	10
Citation Years	10 (2012-2022)
Papers	351
Citations	5857
Cites/Year	585.70

Cites/Paper	16.69
Authors/Paper	2.47
h_index	39
g_index	63

To more deeply analyze, the annual evolution of the published paper and citations is indicated in figure 1. In 2012, there were 19 publications; it was the minimum number of published papers over ten years. On average, the paper published about a carbon tax is not more than 45 publications per year, by 2021 is the most productive year for publication. As 2022 is not over yet, we expect the publication to increase. On the other hand, the highest citation was in 2014, with more than one thousand citations. On average, the citation per year is relatively high on this topic.
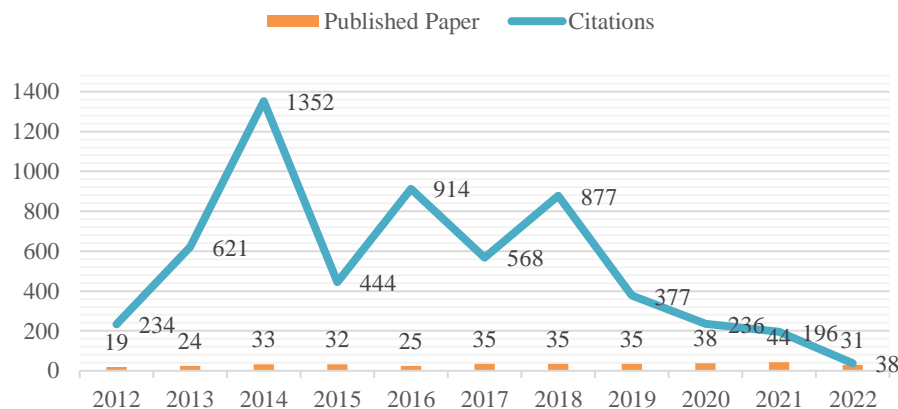

Figure 1. Publications and citations per year

B. Leading Authors

This section provides an overview of the leading authors who obtained higher publications on the Scopus database, presented in Table 2. We rank ten leading authors by total publications (TP). The most productive author is Van Der Ploeg F., with six papers from 2012 to 2022, followed by Zhang J. and Withagen C., each having five total publications, respectively. On the other hand, the highest total citations (TC) and citations per year (C/P) is owned by Lemoine D., with 174 citations and 58 citations per year. That made Lemoine D. the most influential author. On the other hand, William R.C. has the highest strength in a collaborative relationship, with 12 total link strengths. We highlight that even though all the top-ten leading authors have no more than six publications in the Scopus database, they have a relatively high number to be cited by other scholars.

Table 2. Leading authors in carbon tax literature

No	Author	TP	TC	C/P	LS
1	Van Der Ploeg F.	6	166	27,67	7
2	Zhang J.	5	173	34,6	7
3	Withagen C.	5	155	31	7
4	Li J.	4	93	23,25	7
5	Meng S.	4	34	8,5	5
6	Lemoine D.	3	174	58	3
7	Williams R.C.	3	96	32	12
8	Zhang Y.	3	93	31	4
9	Mattauch L.	3	75	25	6
10	Wang Z.	3	57	19	7
Notes: TP=Total Publications, TC=Total Citations, C/P=Average Citations per Publications, LS=Total Link Strength					

C. Leading Sources

The summary of ten leading journals is presented in Table 3. Overall, Resource And Energy Economics leads all the criteria: the total publications, total citations and total link strength. This journal published 17 papers about carbon tax from 2012 to 2022, with 409 total citations and 795 total link strengths. Overall, most of the top-ten journals are from Elsevier B.V. publisher.

Table 3. Leading journals of carbon tax literature

No.	Journal Name	TP	TC	LS	Publisher
1	Resource And Energy Economics	17	409	795	Elsevier B.V.
2	Journal Of Public Economics	11	381	476	Elsevier B.V.
3	National Tax Journal	11	126	239	University of Chicago Press
4	Annals Of Operations Research	10	92	292	Springer
5	European Economic Review	9	158	623	Elsevier B.V.
6	Transport Policy	7	231	94	Elsevier Ltd
7	American Economic Journal: Economic Policy	6	265	310	American Economic Association
8	Economic Modelling	6	91	194	Elsevier B.V.
9	Economic Analysis And Policy	5	62	147	Elsevier B.V.
10	Applied Economics	5	22	267	Routledge
Notes: TP=Total Publications, TC=Total Citations, LS=Total Link Strength					

Figure 2 displays the annual evolution of the top-ten journals. In 2012, only two journals published about carbon tax were from Resources And Energy Economics and Economics Analysis And Policy, each with one paper. As the leader, Resources And Energy Economics published the highest number of carbon tax topics in 2014. On the other hand, the highest number of published carbon tax topics is in 2022 by Annals Of Operation Research, Springer Publisher.
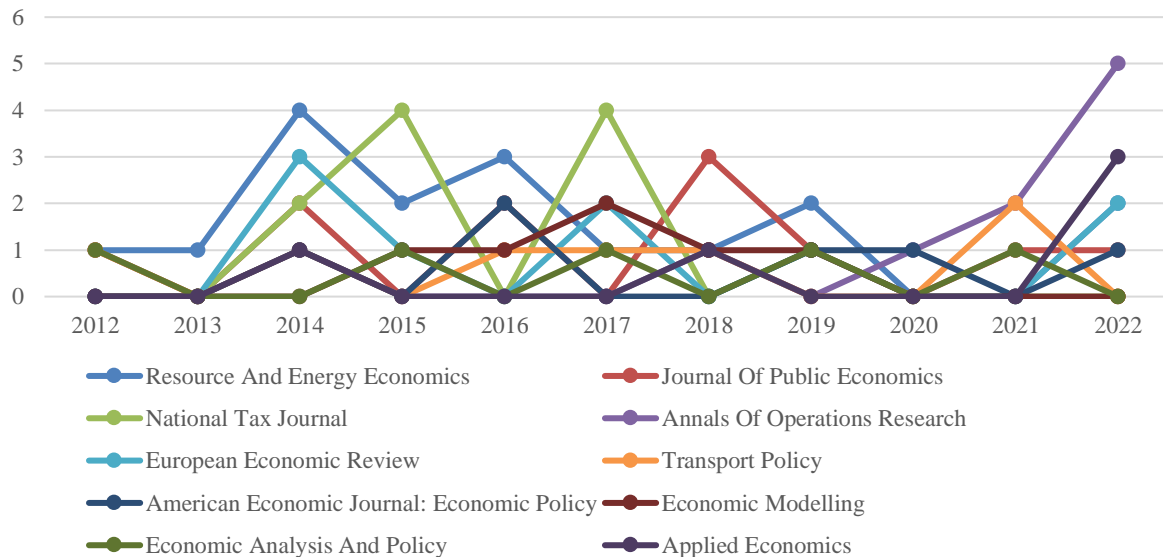

Figure 2. Annual frequently journals

D. Leading Countries

This section assesses the most productive countries for the carbon tax literature. Fifty-two countries contributed from 2012 to 2022. We highlight the top-ten countries. The leading countries are from America, Asia, Australia and Europe region. The top country by the total publications is the United States, with 115 papers, followed by China and Australia, with 51 and 45 papers, respectively. This indicates that the United States authors have been more interested in carbon tax in the last decade. While the United States also leads the total citations among countries, the United Kingdom leads the average of citations per publication. Most of the leading countries are developed countries. Only one developing country contributes more to the top-ten leaders. This indicates that carbon tax literature from the developing countries is still

low in the Scopus Database. We also highlight that there is no country from the ASEAN region has become the top-ten leading country.

Table 4. Leading countries of carbon tax literature

No	Country	TP	TC	C/P	LS
1	United States	115	2665	23,17	63
2	China	51	845	16,57	20
3	Australia	45	618	13,73	20
4	United Kingdom	35	1021	29,17	44
5	Canada	22	309	14,05	12
6	Germany	19	375	19,74	25
7	Netherlands	19	351	18,47	25
8	India	19	140	7,37	9
9	France	17	439	25,82	15
10	Japan	13	195	15	9
Notes: TP=Total Publications, TC=Total Citations, C/P=Average Citations per Publications, LS=Total Link Strength					

E. Popular Articles

To better understand the most popular articles, we evaluate the articles by the citations. The article entitled "Optimal Taxes on Fossil Fuel in General Equilibrium" by Golosov et al. (2014) has the highest number of citations, with 281 citations, respectively. Moreover, the number of citations of top-ten articles is more than a hundred. On the other hand, the highest average of citations per year is entitled "Retailer-driven carbon emission abatement with consumer environmental awareness and carbon tax: Revenue-sharing versus Cost-sharing" by Yang & Chen (2018), with an average of 45 citations, respectively. A relatively high number of citations indicates that scholars are engaging with the topic of firm-level and its relationship with the customer.

Table 5. Popular articles

No	Authors	Title	Year	TC	C/P	LS
1	M. Golosov, J. Hassler, P. Krusell, A. Tsyvinski	Optimal Taxes on Fossil Fuel in General Equilibrium	2014	281	35,13	18
2	P. Aghion, A. Dechezleprêtre, D. Hémous, R. Martin, J. van Reenen	Carbon taxes, path dependency, and directed technical change: Evidence from the auto industry	2016	268	44,67	7
3	D. Acemoglu, U. Akcigit, D. Hanley, W. Kerr	Transition to clean technology	2016	211	35,17	7
4	H. Yang, W. Chen	Retailer-driven carbon emission abatement with consumer environmental awareness and carbon tax: Revenue-sharing versus Cost-sharing	2018	179	44,75	3
5	G.P. Cachon	Retail store density and the cost of greenhouse gas emissions	2014	162	20,25	3
6	D. Lemoine, C. Traeger	Watch your step: Optimal policy in a tipping climate	2014	128	16	9
7	G. Santos	Road transport and CO2 emissions: What are the challenges?	2017	124	24,8	0
8	H. Allcott, S. Mullainathan, D. Taubinsky	Energy policy with externalities and internalities	2014	113	14,13	2
9	R. Martin, L.B. de Preux, U.J. Wagner	The impact of a carbon tax on manufacturing: Evidence from microdata	2014	106	13,25	5
10	M. Kalkuhl, O. Edenhofer, K. Lessmann	Renewable energy subsidies: Second-best policy or fatal aberration for mitigation?	2013	103	11,44	1
Notes: TC=Total Citations, C/P=Average Citations per Publications, LS=Total Link Strength						

F. Related Keywords and Network Analysis

To see the popular keywords in this topic, we use co-occurrence analysis. Seventy-three meet the threshold by using a minimal number of occurrence keywords. Furthermore, we still filter the exact meaning of the keyword. In the end, we have 44 keywords. We examine the top-ten most popular keywords. The summary is presented in table 6. The "carbon tax" keyword leads to 123 occurrences and 185 total link strength. Overall, the keywords show that the scholars are interested in: (1) the policy points such as carbon tax, environmental policy, taxation and climate policy; (2) the environmental point, such as climate change, carbon emission, emission control and global warming; (3) the economy-related environmental and (4) the costs. On the other hand, business-level keywords are not popular this decade. This is an excellent opportunity to research the business level related performance and innovation.

Table 6. The most popular keywords

No	Keyword	Occurrences	LS
1	Carbon tax	123	185
2	Climate change	66	162
3	Carbon emission	46	154
4	Emission control	39	139
5	Environmental economics	38	148
6	Environmental policy	32	127
7	Costs	14	53
8	Global warming	14	38
9	Taxation	14	38
10	Climate policy	13	60
Notes: LS=Total Link Strength			

To make a deep analysis, we create graphical mapping visualization. Figure 3 presents the results. Five clusters are shown in the figure. The red, green, blue, yellow and purple clusters each consist of seventeen, ten, eight, eight and one keywords. The popular keyword in the red area is "environmental policy", "carbon tax" in the green, "carbon emission" in the blue and "climate change" in the yellow area. On the other hand, there is only one keyword in the purple area: "developing new world". We highlight that the most popular keywords in every cluster are related to macro points, such as policy and environmental. In this map, we also find that the keywords related to firm-level are still limited.
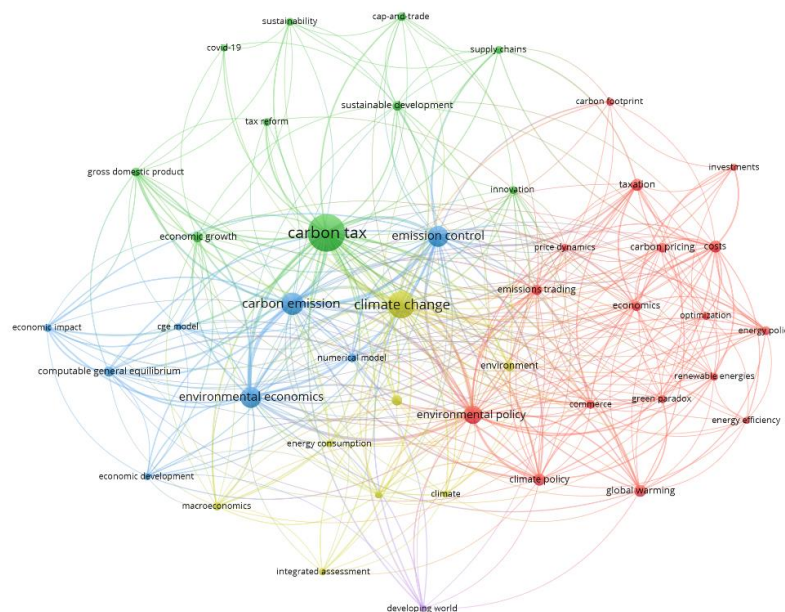

Figure 3. Mapping the co-occurrence keywords

We also create the visualization by the time horizon in figure 4. The lighter color shows the newer keywords related to the literature. We highlight that the newest keywords are "investments", "optimization", "economic development", "gross domestic product" and "covid-19". These keywords shifted to the more specific field like "investments" and "covid-19".
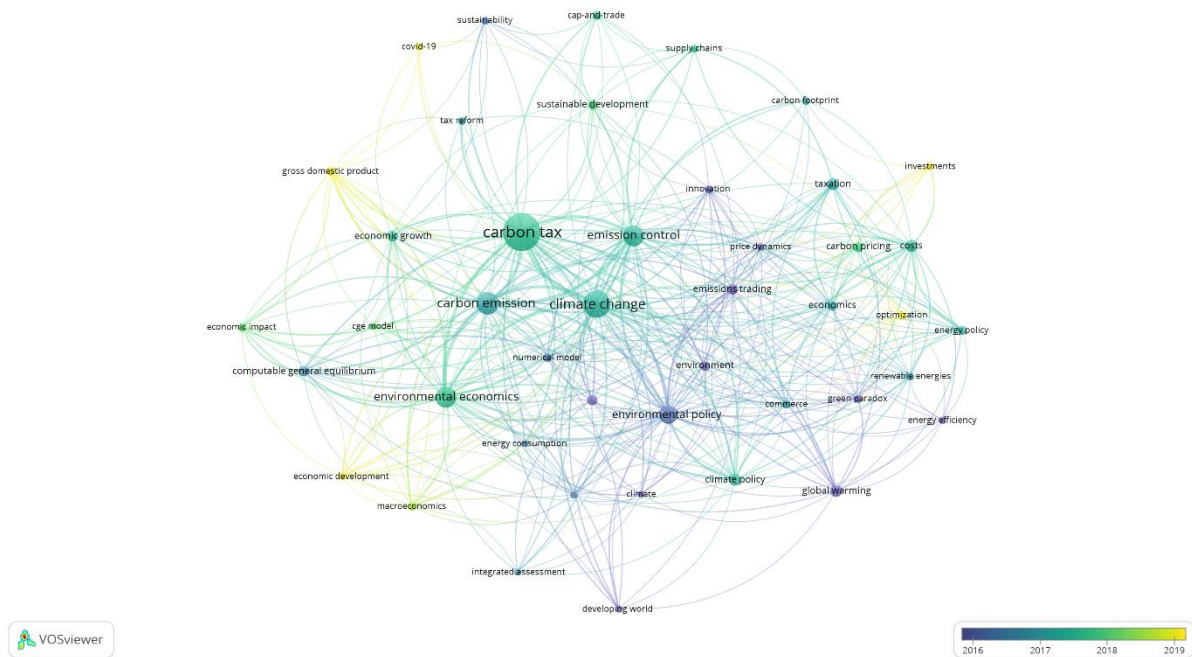

Figure 4. Overlay visualization

G. Carbon Tax and Impact on The Economy and Business

Referring to the data of bibliometric analysis, an essential subject of worldwide carbon tax literature is its impact on economic and business areas. From an economic view, this policy is expected to gain additional income for the country. Even in 2022, the policy will only be limited to the coal business, through the fact that the carbon tax will be implemented for the other sectors in 2025 will have a beneficial impact on the national income in the future. On the other hand, it is still debatable to the scholars that it also has positive influences and, on the other hand, negative effects on the gross domestic product (GDP) through aggregate consumption, economic growth, investment horizon and employment. We must underline that every country has different policies and implementation of the carbon tax. As a result, researching the model and the impact of the carbon tax on the Indonesian economy is a chance.

Overall, the problem is ensuring that macro policy is coordinated with a knowledge of how carbon policies and finance influence actual firm responses (Bumpus, 2015). In terms of the micro area, the literatures about the impact on firms are still limited, as reflected in figure 3 and figure 4. Since the firm has to keep running the business, it would need to start competing not only on costs but also on the environmental image, notably emission intensity, to manage the demand and increase its profitability (Hammami et al., 2018). Therefore, the focus topic in this area will be how the companies manage their costs, innovation, profitability and performance through various proxies. It is also crucial to observe the firms' responses, those that will implement this legislation soon and those that may in the future. Due to the lack of relevant previous research, it will be a valuable experience for academics to conduct the study in firm-related fields.

4. CONCLUSIONS

The carbon tax has stolen scholars' interest over several decades. To see the trend, we use a bibliometric overview from 2012 to 2022. This study finds that carbon tax in this decade is a prevalent topic to be cited. We discover that even though all of the leading authors in the top ten have a few articles, they have a relatively high number of articles that other researchers have referenced. We also find that having the highest number of publications of the author does not make he has the highest number of

citations by the other scholars and its average citations per year. On the other hand, the leading journal of the carbon tax literature is Resource And Energy Economics by Elsevier B.V. We also find that the most productive country is the United States, with a significant difference with the publications from China in the second place. Overall, the majority of productive countries are developed countries. This study highlights that "Optimal Taxes on Fossil Fuel in General Equilibrium" by Golosov et al. (2014) is the most cited article.

Based on current trends, the most popular keyword is related to the macro points, such as policy and environmental entity. The economic point, especially at the firm level, is still limited to be discussed in the context of the carbon tax. Beside there are only limited articles, we recommend that the scholars could perform the research in Indonesia. Since Indonesia becomes a new player in implementing the carbon tax, scholars can also focus on the economic and firm-level effects, such as the effect of the carbon tax on investment, market return, firm performance, and further consumer reaction.

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