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Bibliometric Review and Content Analysis on the Relationship Between Foreign Direct Investment, Environmental Degradation, and Income Inequality

Rahmat Arsyad[1], Basri Hasanuddin[2], Agussalim[3], Sanusi Fattah[4]
[1]Wira Bhakti University, Makassar, South Sulawesi 90222, Indonesia
[2,3,4]Hasanuddin University, Makassar, South Sulawesi 90245, Indonesia
Email: rahmat.arsyad0330@gmail.com

Abstract
This study aims to examine the complex relationship between foreign direct investment (FDI), environmental degradation, and income inequality using bibliometric methods and content analysis. Utilizing the Scopus database from 2005 to 2025, it identified 289 relevant articles and filtered them based on specific inclusion criteria. Bibliometric analysis was used to track publication trends, author productivity, journals, countries, and patterns of scientific collaboration. Meanwhile, content analysis explored substantive issues from the clustered literature. The results indicate that this topic has experienced substantial growth in publications over the past decade, with the most significant contributions coming from China and the United States. Nine main themes were identified: FDI's role in economic growth and trade openness, carbon pricing, corruption and governance, climate change, globalization, the relationship between environmental degradation and health, and renewable energy as a potential solution. Key findings suggest that while FDI can promote economic growth and income equality in specific contexts, it often worsens environmental harm and increases social inequalities, particularly in developing countries. This study emphasizes the importance of selective, inclusive, and sustainability-focused policies to ensure that FDI benefits are distributed fairly while reducing ecological impacts. Its contribution enriches existing academic literature and offers practical recommendations for policymakers to develop sustainable investment strategies in the era of globalization.
Keywords: *foreign direct investment, environmental degradation, income inequality, bibliometric analysis, sustainable policies*

INTRODUCTION

In the current era of globalization, foreign investment (FDI) has become a key element in developing and enhancing national economies worldwide. The LDC not only supplies financial resources but also offers opportunities for the host country regarding job creation, knowledge transfer, and infrastructure improvements. This phenomenon has shifted the strategies of developing countries in designing their economic growth policies, making FDI a crucial tool for economic development.t for economic development. (Alam Iqbal. 2006).

As countries worldwide compete to attract foreign direct investment (FDI) to boost economic growth, addressing their environmental and social impacts remains a key concern. Despite the significant financial benefits, the rise in FDI also leads to various adverse effects related to environmental damage, particularly in developing countries. (Furtuna & Atis, 2024; Nasir et al., 2019; Opoku & Boachie, 2020; Philip et al., 2021) Sectors that attract foreign investment, such as heavy industries, mining, and plantations, substantially impact local ecosystems and global environmental sustainability. The FDI fueling the growth of these sectors often results in increased pollution, resource depletion, and considerable loss of biodiversity. (Latief et al., 2021)

Amid the debate, there is also an argument that FDI does not always harm the environment. In some cases, FDI can spark the adoption of green technologies in host countries. (Hao et al.. 2020)This technology improves efficiency and reduces the environmental footprint of economic activities, which significantly promotes green economic growth and reduces CO2 emissions in developing countries. (Pradhan et al.. 2021; Xiao et al.. 2023)However, while some foreign investors may have high standards regarding environmental practices, the reality on the ground is more complex. In general, environmentally friendly FDI is still rare because it requires significant capital and high levels of technology. As a result, developing countries often face a dilemma between collecting as much foreign investment as possible to finance domestic economic development and being selective and limiting incoming foreign investment to preserve the environment.

The most obvious consequence of the increase in FDI is the increase in industrial activity, which in some countries results in air, water, and soil pollution. (Zeng & Zhou. 2021) Many sectors that attract foreign investment, such as manufacturing facilities, petrochemicals, and other heavy industries, result in considerable greenhouse gas emissions. In addition, the vast mining, plantation, and agricultural sectors that attract foreign investment also significantly impact the environment. (Schmitz et al.. 2015). Excessive exploitation of natural resources, especially in the tropics, results in considerable deforestation (Ordway et al.. 2017). The clearing of land for mining operations or the establishment of large-scale plantations and agriculture, such as oil palm and rubber, destroys the natural habitats of various flora and fauna that depend on these ecosystems. Deforestation also contributes to increased carbon dioxide emissions, as trees that serve as carbon sinks are cut down based on economic interests. This process reduces biodiversity and damages the ability of the natural environment to absorb carbon dioxide, thereby exacerbating climate change. (Fuss et al.. 2020).

The environmental damage associated with foreign direct investment adversely affects the ecosystem and the livelihoods of residents. (Ssekibaala & Kasule. 2023). Nevertheless, the environmental impact of these foreign direct investment flows differs significantly according to the circumstances of the host country. Foreign Investment (FDI) inflows to low- and middle-income countries (LMCs) generally damage the environment. In contrast, FDI inflows to high-income countries (HICs) tend to be more beneficial to the environment. (Doytch & Uctum. 2016)Communities that depend on natural resources to meet the needs of life, which are characteristic of LMC, are disproportionately affected by climate change caused by foreign investment that is not environmentally friendly, thus causing social and economic injustices. (Antoci et al.. 2020).

WDI, environmental degradation, and income inequality are intricately and significantly interconnected. FDI affects ecological factors and exacerbates the income gap between the group that invests and those who are negatively affected by environmental consequences. Although FDI can substantially improve a country's economy, its distribution of benefits is often uneven, and the negative impacts of environmental degradation disproportionately affect marginalized populations, especially those who depend on natural resources for their livelihoods. (Marques & Caetano, 2020).

Income inequality becomes increasingly evident as variations in the capacity to adapt to changes caused by FDI and environmental degradation result in disparities in the quality of life. (Popovich et al.. 2024)Marginalized communities that are most affected by environmental degradation cannot often address these issues, both in terms of mitigation technology and the resources to obtain compensation, making them increasingly marginalized. (Anuar. 2012). In addition, they usually do not have enough political influence to influence policies or decisions that companies or governments make regarding natural resource management. As a result, they have to bear the impact of a deteriorating environment without adequate compensation.

FDI is an essential instrument expected to stimulate the economy and overcome social problems such as income inequality, especially in developing countries. Several previous studies confirm this. They show that FDI can be a solution for countries in their efforts to reduce income inequality. (Khan & Khan. 2023). To make this happen, a more comprehensive strategy is needed to formulate and implement investment policies. The government must ensure that foreign investment generates profits for companies and local elites while providing fair benefits to small communities affected by environmental degradation. One way to achieve this is to create adequate compensation programs for communities affected by the degradation. (Rosa et al.. 2004). In addition, local communities should be empowered to participate in decision-making processes related to using natural resources, ensuring that their voices are heard and their interests are protected. (Oanh & Ha. 2023).

Developing policies that incentivize companies receiving FDI to prioritize environmental sustainability is critical. (Liu et al.. 2017; Tsoy & Heshmati. 2024). Governments can incentivize companies to adopt environmentally friendly practices and comply with strict environmental regulations. Thus, the FDA will generate economic benefits and encourage more sustainable and equitable development. (Kutlu Furtuna & Atis. 2024). Effective implementation of such regulations can reduce the adverse impact of FDI on income inequality, ensuring that its benefits are distributed to all walks of life, not just limited to those with access to resources and investment returns.

Although many studies have investigated the impact of the FDA on environmental degradation and income inequality, the existing literature lacks a comprehensive understanding of the interactions between these three elements. Most studies have focused on two variables—FDI and income inequality or FDI and environmental degradation—while making limited efforts to integrate those three factors into a

cohesive analytical framework. This study addresses this gap by thoroughly synthesizing the interaction between PMAs and environmental degradation. Moreover, while assessing trends and methodologies used in the current literature, income inequality aims to improve the understanding of these issues.
This study seeks to evaluate the relationship between FDI, environmental degradation, and economic inequality through an integrated approach that combines bibliometric analysis and content analysis to generate new insights into the dynamics of the three variables. This study aimed to look at significant trends in the global literature regarding the impact of FDI on environmental quality and income distribution and to assess whether FDI acts as a catalyst or a mitigation of socio-economic inequalities in recipient countries. The study uses bibliometric analysis to describe current research trends, evaluate previous research's methodological strengths and limitations, and recommend areas that require further investigation. The expected implications of this study are to improve the academic literature and provide practical insights for policymakers, practitioners, and stakeholders in developing more effective and sustainable policies related to FDI, environmental degradation, and income distribution.

Research Methods

This study uses a mixed-method approach that combines bibliometric analysis and content analysis. (Chountalas & Lagodimos. 2024; Gao et al.. 2020; Tamasiga et al.. 2023). Bibliometric analysis is used to identify patterns, trends, and knowledge networks related to the relationship between FDI, environmental degradation, and income inequality in the global literature. (Donthu et al.. 2021). Meanwhile, content analysis is applied to explore and understand the context and specific issues discussed in the previous study. (White & Marsh. 2006; Williamson et al.. 2013).
The first step in this study was collecting relevant scientific articles from the Scopus database. Scopus was selected because it is one of the most comprehensive and reputable indexing services, covering peer-reviewed journals across disciplines. Its global scope, regular updates, and bibliometric features make it highly suitable for analyzing research trends and patterns on the topic under investigation.
The inclusion criteria required that selected articles explicitly address the relationship between foreign direct investment (FDI), environmental degradation, and income inequality regarding causes or impacts. Only articles written in English and published between 2005 and 2025 were considered, ensuring global accessibility, thematic comparability, and research novelty. Studies focusing on only one of the variables (FDI, environment, or inequality) without linking them to the others, or those lacking a clear connection between FDI and inequality through environmental impacts, were excluded.
To identify relevant documents, a specific search string was applied in Scopus using keywords such as "foreign direct investment," "environmental degradation," "pollution," "carbon emissions," and "income inequality." The search was limited to journal articles published in their final stage and indexed in Scopus. Conducted on June 5, 2025, the search yielded 289 articles that met the established criteria.
To determine publication trends. The author conducted a descriptive analysis of the remaining 289 documents that had passed screening based on predetermined criteria. We investigated the most cited articles, the most cited authors, the most cited journals, influential countries and institutions, and the publication period.
Bibliometrics is an interdisciplinary study that utilizes mathematics, statistics, and bibliography to analyze academic literature quantitatively. (Xiang et al., 2022). In this study, bibliometric analysis was used to identify the trends of the most prolific authors and the most frequently discussed topics, as well as to create a network graphical representation of the bibliometric linkages between authors, institutions, and countries as well as the co-emergence of keywords that resulted in cluster analyses in the literature relevant to FDI, environmental damage and income inequality. This substantial bibliometric analysis stage consists of three analyses, including general performance analysis, in-depth citation analysis, and network analysis, as exemplified by (Tumewang et al., 2025). This process uses Microsoft Excel to create tables and VOSviewer to generate network visualizations based on co-emergence or collaboration. VOSviewer was developed at Leiden University in the Netherlands and is used to create association maps. (Jeong & Koo, 2016)VOSviewer is software designed for creating and exploring maps derived from network data, primarily for analyzing academic records. (Arruda et al., 2022)
This process involves identifying the main themes that emerge from the literature groups that have been grouped based on bibliometric analysis and visualization using VOSviewer. Once these literature groups have been identified, the next step is to dig deeper into the content of the literature in each group to reveal the dominant topics.

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The literature analysis in this study is important in providing in-depth insights to formulate effective policy recommendations to policymakers and stakeholders on the steps that need to be taken to address the negative impact of FDI on environmental damage and income inequality, especially in developing countries.

RESULTS AND DISCUSSION

Publication screening based on keywords used in the Scopus database in this study resulted in 289 articles. Figure 1 shows global research trends based on publications and citations in the last two decades related to FDI, environmental damage, and income inequality. In 2005, attention to this topic was minimal, with only two publications. Even in 2009 and 2010, not a single publication was produced. However, over time, interest in this topic continues to increase significantly until it reaches its peak in 2024, with 45 publications. Despite the annual fluctuations in the number of publications, the trend has generally continued to increase, reflecting the growing interest in understanding the relationship between FDI, environmental damage, and income inequality. The number of publications in the last decade shows a very significant increase in publications when compared to the previous decade. This increasing publication trend indicates an awareness of the importance of looking at the issue of income inequality from two sides, namely the economy and the environment.

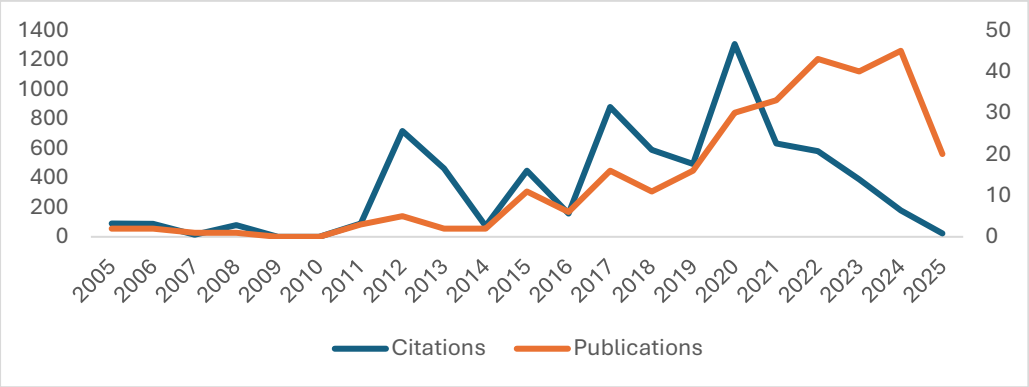

Figure 1. Trends in publications and citations from 2005 to 2025

Publication Trends by Country Affiliation

Figure 2 shows the distribution of publications from the ten countries with the highest productivity related to FDI, environmental damage, and income inequality. China topped the list with 66 documents, followed by the United States with 48 documents and the United Kingdom with 27 papers. Countries like Indonesia, Germany, Canada, Vietnam, France, Italy, and Pakistan have between 12 and 16 documents. Based on these data, it can be seen that the composition of countries in the top ten related to research productivity with this topic shows an almost balanced proportion between developed and developing countries, with China and the United States as the main contributors. This indicates that these issues affect nearly all countries. Although developing countries have limited resources, they are increasingly actively researching the impact of FDI on the environment and income inequality.

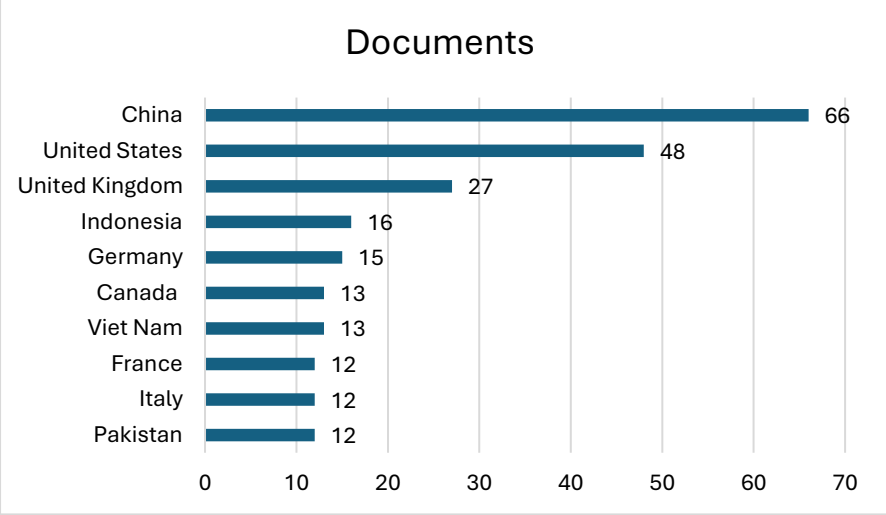

Figure 2. Publication Trends Based on Author's Country Affiliation (top 10)

In-Depth Citation Analysis

Table 1 shows that Energy Economics is among the journals with a few publications but has the highest number of citations per paper at around 70.83. In contrast, Sustainability Switzerland, which has the highest number of publications at 25, recorded the second lowest number of citations per paper at only about 10.68.

Table 1. The most relevant and most productive journals on the topic of FDI, Environmental Damage, and Income Inequality

No.	Source Title	Article	Number of Citations	Citations per Paper	Cite Score
1	Sustainability Switzerland	25	267	10,68	07.07
2	Plos One	11	228	20,73	05.04
3	International Journal Of Environmental Research And Public Health	7	82	11,71	08.05
4	Environmental Science And Pollution Research	6	100	16,67	10.06
5	Energy Economics	6	425	70,83	21.07
6	Environmental Research Letters	6	94	15,67	11.01
7	Heliyon	5	104	20,80	04.01
8	Energies	5	21	4,20	07.03
9	Ecological Economics	5	156	31,20	13.00
10	Environment International	4	234	58,50	19.07

Most Cited Journal Articles

The most cited articles and the impact of their citations (calculated as citations/number of years since publication). Between 2005 and 2025, were 7,321 citations from all articles used in this study. The highest number of citations occurred in 2020, 1,306, and the lowest was in 2009 and 2010, with no citations. This is because there were no publications that year, as shown in Figure 1. The article with the highest citation in this study is one of the 2013 articles entitled "Rising income inequality: Technology, or trade and financial globalization?". This article has 464 citations. However, the article with the highest number of citations per year (46 citations per year) is a journal titled "Feasible alternatives to green growth" in 2020.

Table 2. Articles with the highest citations (top 10) related to FDI, Environmental Degradation, and Income Inequality

No.	Title	Authors	Source	Year	Citations	Citations per Year
1	Rising income inequality: Technology, or trade and financial globalization?	Jaumotte, F., Lall, S., Papageorgiou, C.	IMF Economic Review	2013	464	39
2	Income inequality and carbon dioxide emissions: The case of Chinese urban households	Golley, J., Meng, X.	Energy Economics	2012	254	19
3	What makes growth sustained?	Berg, A., Ostry, J.D., Zettelmeyer, J.	Journal of Development Economics	2012	249	19

4	Feasible alternatives to green growth	D'Alessandro, S., Cieplinski, A., Distefano, T., Dittmer, K.	Nature Sustainability	2020	232	46
5	Trade-offs between social and environmental Sustainable Development Goals	Scherer, L., Behrens, P., de Koning, A., ... Sprecher, B., Tukker, A.	Environmental Science and Policy	2018	200	28
6	A study of intracity variation of temperature-related mortality and socioeconomic status among the Chinese population in Hong Kong	Chan, E.Y.Y., Goggins, W.B., Kim, J.J., Griffiths, S.M.	Journal of Epidemiology and Community Health	2012	182	14
7	Billions in Misspent EU Agricultural Subsidies Could Support the Sustainable Development Goals	Scown, M.W., Nicholas, K.A., Brady, M.V.	One Earth	2020	163	33
8	Birth outcome racial disparities: A result of intersecting social and environmental factors	Burris, H.H., Hacker, M.R.	Seminars in Perinatology	2017	163	20
9	The effects of globalization on Ecological Footprints: an empirical analysis	Figge, L., Oebels, K., Offermans, A.	Environment Development and Sustainability	2017	152	19
10	Estimated effects of future atmospheric CO2 concentrations on protein intake and the risk of protein deficiency by country and region	Medek, D.E., Schwartz, J., Myers, S.S.	Environmental Health Perspectives	2017	149	19

Author Based on Productivity and Impact.

Table 3 shows the most prolific authors related to FDI, environmental damage, and income inequality. The H-index score here is a metric for the author's scientific output that considers the number of publications and the number of times each publication is cited. (Moffatt et al., 2022). (Dhiaf et al., 2021)

Table 3. Top Ten Writers Based on Productivity and Impact.

No.	Author	Number of Publications	H-Index	M-Index	Citations	Publication Year Start
1	Jorgenson, A.K.	3	50	2.273	173	2003
2	Asongu, S.A.	3	66	4.714	86	2011
3	Ridzuan, A.R.	3	17	1.308	74	2012
4	Tung, L.T.	3	13	1.300	15	2015
5	Amar, S.	3	8	1.333	2	2019
6	Distefano, T.	2	9	1.125	246	2017
7	Sovacool, B.K.	2	114	5.700	184	2005
8	Schwartz, J.	2	186	6.414	162	1996
9	Downey, L.	2	21	0.700	147	1995
10	Khan, S.	2	10	2.500	132	2021

Network Analysis

In this section of network analysis, the author uses the VOSviewer software. The software offers three visualizations: networking, overlays, and density. In this study, researchers only used network visualization because it helps group data, such as the simultaneous occurrence of words, writing collaborations, or countries of origin, that show the relationship between keywords and published topics. In addition, color coding is applied based on the level of popularity and similarity of the research. The lines connecting the words also have different contrasts; If the word is used frequently in varied studies, it will look brighter. (Tamala et al.. 2022).

Bibliometric Coupling of Documents

The authors set a minimum parameter of 25 citations for a paper to be included in this analysis. As a result, out of 289 papers in the database, 74 were identified with a minimum of 25 citations and classified into nine clusters. The results of this bibliography can be seen in Figure 3, which shows that Joumatte (2013) is the author with the largest circle size, which indicates that Joumatte (2013) is the most influential author on this topic with the highest number of citations. This is also shown in Table 2 of the in-depth citation analysis section. The next most influential writer is Golley (2012), followed by Berg (2012), D'Alessandro (2020), and Scherer (2018).

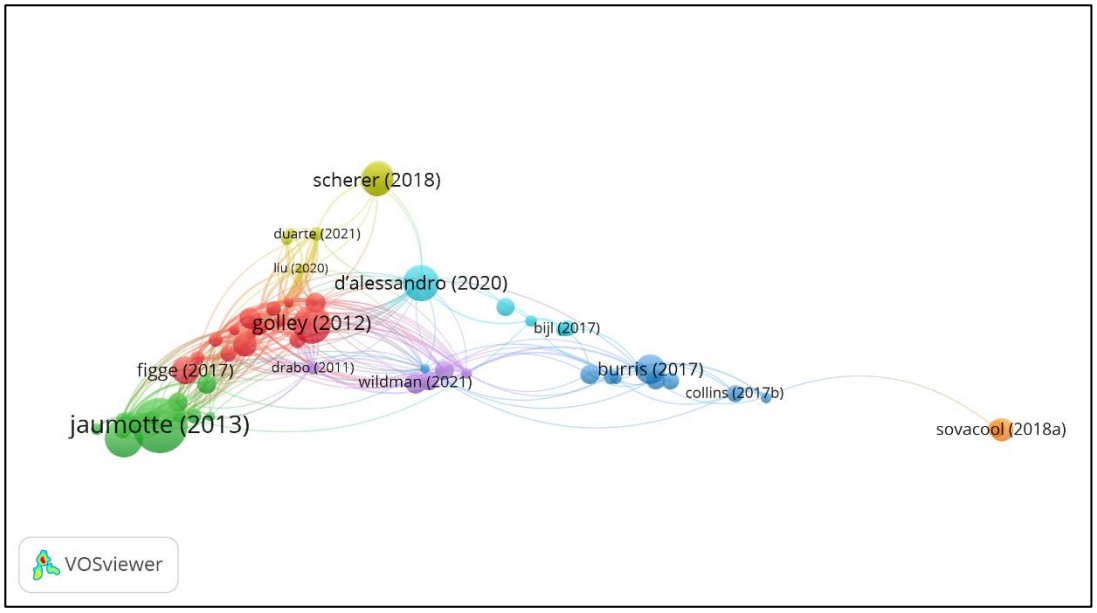

Figure 3. Bibliographical Coupling of FDI, Environmental Degradation, and Income Inequality Articles

Meanwhile, the most productive journals are seen in Figure 4, which shows that Sustainability Switzerland, Plos One, International Journal of Environmental Research and Public Health, Environmental Science and Pollution Research, and Energy Economics are the top five most productive

journals from the number of articles produced. In addition, it can also be seen that there is a reasonable proximity among journals that publish this topic, except for some journals such as Oryx, Nutrients, and several other journals. This shows a close relationship in papers that address the topics of FDI, environmental damage, and income inequality.

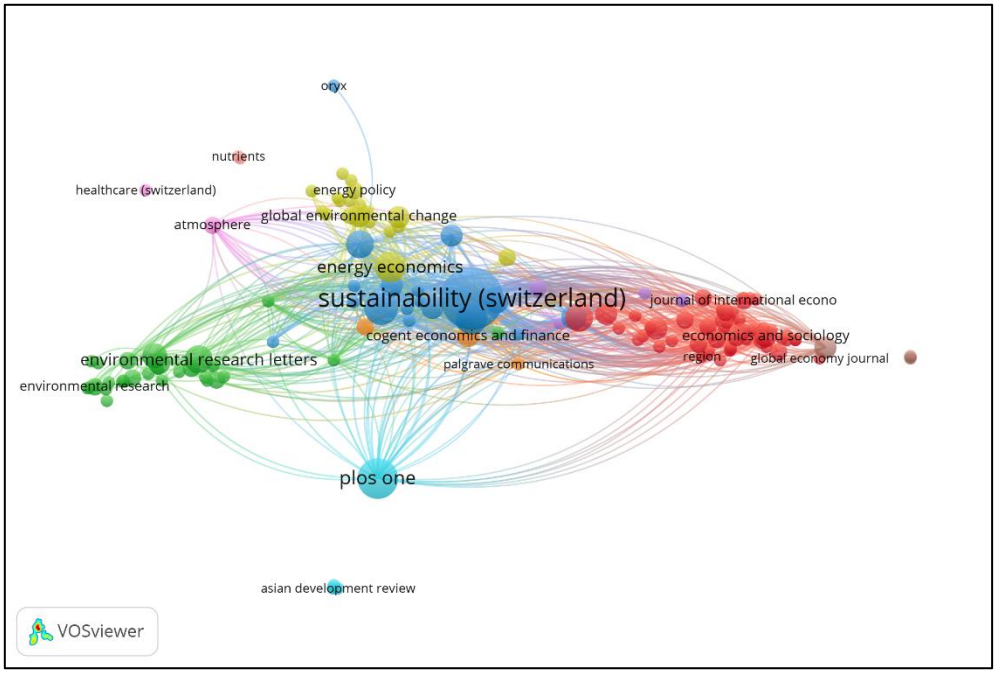

Figure 4. The Most Productive Journal Combined Bibliometrics

Next, we conducted a joint authorship analysis by country. With the complete calculation method, the author sets the minimum number of documents and citations to "1" so that a more comprehensive analysis of the origin of the document source can be carried out. As a result, we identified and classified 73 countries into 8 clusters. Collaboration between countries in studies related to the relationship between FDI, environmental degradation, and income inequality can be seen in Figure 3. Based on the figure, it is clear that the highest productivity measured by the number of documents produced in this case is in China, followed by the United States.

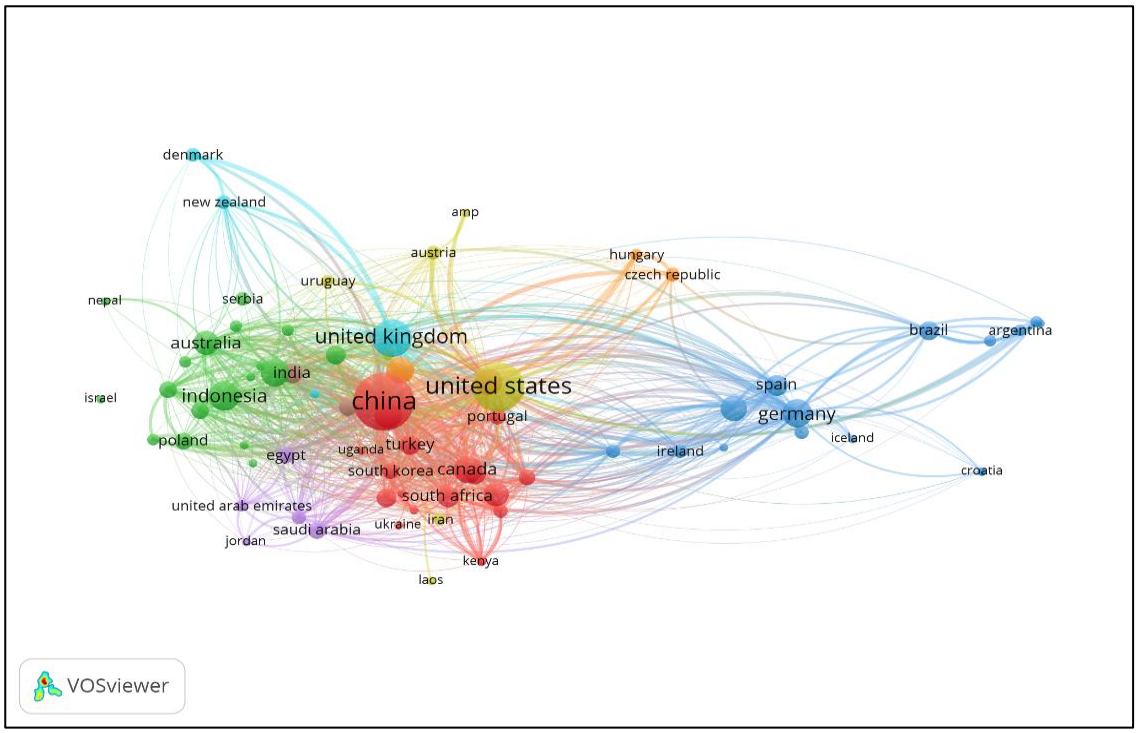

Figure 5: VOSViewer map showing geographic distribution

In conducting the analysis, the author chose author keywords as the unit of analysis and set 3 citations as the minimum limit. As a result, there were 68 papers identified and classified into nine clusters as shown in Figure 6 below:

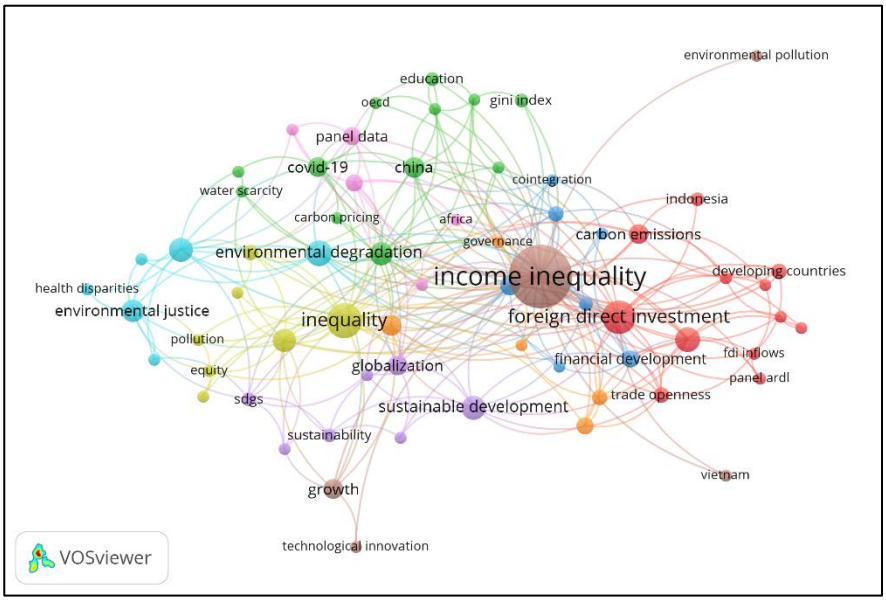

Figure 6. Co-Occurrence of Keywords

Table 4: Keywords for research topics, clusters, and themes

Cluster	Keywords	Emerging Theme
1 (n = 12)	Carbon emissions, developed countries, developing countries, economic growth, FDI inflows, foreign direct investment, Indonesia, panel ARDL, poverty reduction, quantile regression, trade openness	The impact of FDI, economic growth, and trade openness on carbon emissions and income inequality in developed and developing countries
2 (n = 12)	Carbon pricing, China, COVID-19, economic development, education, food security, Gini index, OECD, poverty, socioeconomic factors, urbanization, water scarcity	The relationship between carbon pricing, food security, urbanization, education, and income inequality
3 (n = 7)	Carbon dioxide emissions, cointegration, corruption, democracy, FDI, financial development, Sub-Saharan Africa	Corruption, financial development, and democracy as determinants of environmental degradation and income inequality
4 (n = 7)	Air quality, climate change, Environmental Kuznets Curve, equity, inequality, political economy, pollution	Climate change and social inequality in the context of political economy
5 (n = 7)	Ecological footprint, environment, globalization, SDGs, spillover effect, sustainability, sustainable development	The impact of globalization on the environment and income inequality in efforts to achieve sustainable development goals in developing countries
6 (n = 6)	Air pollution, environmental degradation, environmental inequality, environmental justice, health disparities, socio-economic disparities	Environmental degradation and socio-economic inequality, and their implications for health

7 (n = 5)	CO2 emissions, energy consumption, governance, income distribution, and renewable energy	The reciprocal relationship between renewable energy and income inequality as a solution to environmental degradation
8 (n = 5)	Environmental pollution, growth, income inequality, technological innovation, Vietnam	The impact of income inequality on environmental pollution
9 (n = 5)	Africa, foreign direct investment, income redistribution, panel data, trade	The role of foreign direct investment in income redistribution

Content Analysis

Our primary focus in this study is analyzing bibliometric data on FDI, environmental damage, and income inequality in developing countries from 2005 to 2025. As a result of combining bibliometrics and descriptive analysis in 289 articles, there are several clusters classified into nine main themes as follows:

The influence of FDI, economic growth, trade openness, and carbon emissions on income inequality in developing and developed countries.

Income inequality is a complex issue that arises from a variety of interrelated factors, including economic, social, political, and environmental dimensions. FDI and economic openness are part of the economic factors that have contributed to increasing income inequality in various countries in the Asian region, both developed and developing countries (Hossain et al., 2022). However, the impact of FDI on income inequality differs in developed and developing countries. According to the findings (Nguyen, 2023), FDI increases income inequality in 30 developed countries but reduces it in 35 developing countries. It is undeniable that FDI plays a big role in encouraging economic growth; therefore, many countries are trying to present FDI as a stimulus for domestic economic growth. The combination of FDI and trade openness plays an important role in efforts to reduce inequality, especially among developing countries. (Tabash et al., 2024)By creating a system that supports these two factors, countries can achieve more inclusive economic growth, which is expected to improve society's overall well-being.

If appropriately managed, economic growth has the potential to reduce income inequality. However, the tug-of-war between economic growth and income inequality often occurs, especially in developing countries. (Fazaalloh, 2019)Environmental factors also indirectly impact income inequality. The increasing efficiency of carbon emission reduction efforts in China has fueled regional income inequality, where high-tech labor is a key connecting factor. (Cui et al., 2021).

The relationship between carbon pricing, food security, urbanization, education, and income inequality.

Implementing carbon pricing is a policy that can reduce CO2 emissions in the household sector. These policies can provide economic incentives to reduce fossil-based energy consumption, encourage changes in consumer behavior, and create space for more environmentally friendly technological innovation. However, efforts to reduce emissions require high transition costs, increased production costs, disruption in specific sectors, and changes in consumption and investment patterns, slowing down Gross Domestic Product growth, especially in the short term. (Sheng et al., 2020). However, if the revenue from carbon pricing is effectively paid back to households, it can help reduce income inequality or create a more equitable income level. (Cunha Montenegro et al., 2019).

Changes in skill levels and urbanization increase food prices and improve income inequality in the country. However, this has led to an increase in people consuming more than 2,500 calories per day, which has triggered an increase in the risk of environmental impacts from the agricultural sector. With urbanization, the net income benefits for people experiencing poverty from higher food prices may not last long. Therefore, addressing demographic change is the key to addressing the impacts of food inequality and climate change and encouraging sustainable food production. (Kuiper et al., 2020)

Corruption, financial development, and democracy determine environmental damage and income inequality.

Today's evolving financial system must consider environmental risks in investment decision-making. Uncertainty related to climate change and environmental damage can affect long-term economic stability.

Therefore, financial institutions need to integrate environmental risk analysis in their investment strategies to avoid losses caused by ecological disasters or stricter regulations in the future. Research conducted by Bui (2020) Found that the development of the financial system has increased energy demand and consequently increased pollutant emissions. On the other hand, poor governance, such as rampant corrupt practices, tends to erode the effectiveness of environmental and development policies, as reflected in the failure to distribute development results. (Wang et al., 2021). Several studies have confirmed the phenomenon in several countries, such as Africa and Russia. Over the years, corrupt practices in Sub-Saharan Africa have degraded social well-being and weakened institutional effectiveness. (Osuma & Nzimande, 2025). Meanwhile, in Russia, positive shocks in corruption increase environmental degradation, both in the long and short term. (Burakov & Bass, 2019).

Climate change and social inequality in the context of political economy

Income inequality is not only an economic problem, but also a profoundly political issue. When income is unevenly distributed, it affects social relations, political power, and state stability. Therefore, income inequality is often the primary reference in explaining various political achievements. (Fails, 2012). Research with a political economy approach conducted by I. M. A. Ali (2022) states that the economic development policies adopted in Egypt over the past four decades have created widening income inequality and, in the long run, have hurt the environment. Environmental issues are an increasingly pressing global issue. However, each country, even among developed countries with greater economic resources and low levels of social inequality, has very different political conditions and institutions in handling this issue. (Cho, 2021)These differences reflect the diversity of approaches, priorities, and challenges each country faces in protecting the environment and addressing the impacts of climate change.

The impact of globalization on the environment and income inequality in achieving sustainable development goals in developing countries

Globalization is a phenomenon that has significantly impacted various aspects of life, ranging from economic and human development to various other dimensions such as environmental performance, mortality, gender equality, and physical integrity rights. However, growing globalization has also created a widening income gap in developing countries. (Figge et al., 2017). However, some articles related to this theme present the opposite fact. In the context of Mexico, globalization does not increase income inequality. On the contrary, globalization in this country can increase household income distribution. States that are more connected to the global economy provide more job opportunities for low-skilled women than for women with higher education levels. (Borraz & Lopez-Cordova, 2007).

Income inequality, poverty, and environmental issues are key challenges for sustainable development that are interconnected and mutually reinforcing. Rising income inequality, especially in developing countries in Asia, has a detrimental and harmful environmental impact. (S. Khan et al., 2022). This can certainly help achieve the Sustainable Development Goals (SDGs).

Environmental degradation and socio-economic disparities, and their implications for health

Environmental degradation, notably air pollution, and income inequality are interrelated and reinforce each other. (Karimi et al., 2024), creating serious challenges to socio-economic inequality that can disrupt public health. The socio-economic gap is particularly noticeable, especially with increased exposure to industries that produce high pollution, and among groups with low levels of education. (Wu et al., 2025)Air pollution, often generated by industry and vehicles in urban areas, affects low-income communities that live near polluting sources, increasing the risk of respiratory diseases and other health problems. In some provinces in China, environmental damage and income inequality significantly contribute to the death rate. (Shao & Dou, 2023).(Ssekibaala & Kasule, 2023)(Ansari Samani et al., 2024)Therefore, a holistic policy is needed to simultaneously address environmental degradation and socio-economic disparities and create a more just and sustainable future.

The reciprocal relationship between renewable energy and income inequality is a solution to the problem of environmental degradation.

The reciprocal relationship between renewable energy and income inequality plays an important role in addressing environmental degradation, especially as it relates to CO2 emissions. Synergies between income distribution and environmental governance must exist to ensure sustainable and thoughtful

economic development. (Yang et al., 2022). Studies conducted (Mehmood et al., 2022) show that reduced income distribution inequality contributes to increased renewable energy consumption. In contrast, CO2 emissions have a positive correlation with renewable energy. Reducing emissions through renewable energy not only improves air quality and public health but also opens up new economic opportunities through job creation in the energy sector.

With the right approach, the transition to renewable energy can create mutually beneficial solutions for the environment and the economy, support sustainable development, and reduce income inequality. Most of the research addressing this theme recommends that the government implement environmentally friendly policies and increase the consumption of renewable energy to reduce environmental pollution. Research conducted (M. Ali et al., 2025) Underlines the need for specific policies designed to encourage the use of renewable energy, especially in countries experiencing significant levels of inequality and CO2 emissions. However, the challenge is that many countries rely on fossil fuels to pursue economic growth.

The impact of income inequality on environmental pollution

The unequal distribution of wealth can affect various aspects of life, including its environmental impact. One of the studies on this theme confirms that areas with greater income inequality result in more environmental pollution. (Liu et al., 2020). In the literature, income inequality often creates situations where low-income groups live in areas more exposed to pollution. (Rodrigues et al., 2017). This can be because they do not have the power to reject industrial projects that damage the environment. As a result, they are more susceptible to the adverse effects of environmental pollution. However, the impact of income inequality on environmental pollution varies for each sector. Research from (Alataş & Akın, 2022) Indicates that a 1% increase in the Gini index will increase environmental pollution in the form of emissions by 1.4% from the electricity and building sectors. On the other hand, the increase also has a positive effect on the environment in the transportation sector and other sectors, with different amounts.

Studies on this theme also discuss the relationship between income inequality and environmental pollution, referring to the "inverted U" model, which states that income inequality increases initially at the individual level. Then, after reaching its peak, environmental pollution decreases. (Li & Xiao, 2021)The study also discusses the relationship between income inequality and environmental pollution in this inverted U context. (Xiao et al., 2022), where per capita income is the connecting variable between the two variables, namely, environmental pollution increases first and then decreases Along with the increase in people's per capita income, the conditions that support the "inverted U-model" also occur in some Asian countries. For example, there is a negative relationship between income inequality and environmental damage in the long term, but in the short term, it shows a positive relationship. This finding also poses a dilemma: income redistribution can cause environmental pollution. This dilemma can affect policies encouraging income redistribution, particularly in countries. (Ghazouani & Beldi, 2022).

The role of foreign direct investment in income equity.

Research examines the role of FDI in creating income equity. In theory, FDI has great potential to support income equity by increasing the productivity of factors of production, such as labor and capital, in FDI recipient countries. (Misztal, 2020). However, although FDI flows significantly positively influence job creation and wages, the impact cannot be ascertained in the context of income equity. (Peric & Filipovic, 2021).

The impact of FDI on income inequality can vary depending on the sector in which the investment is made. In general, FDI in the manufacturing sector can create many jobs, especially for skilled workers. However, if these investments are focused on high technology, it could be that only a handful of individuals have the skills needed. However, investment in the manufacturing sector is more likely to be associated with more egalitarian outcomes, especially in developing countries with large numbers of low-skilled workers. (Bogliaccini & Egan, 2017). In addition, improved infrastructure and trade openness through FDI can create income equity, especially in developing countries. In addition to sector-based studies, other studies on this theme also highlight that the impact of FDI on income inequality can also differ depending on the level of education and institutions in the FDI destination area. The results of this study imply that, to ensure the realization of income equity through the role of FDI, the policies taken must focus on efforts to improve the quality of economic governance and administrative reform of local governments at both the provincial and district levels. (Le et al., 2021).(Tung, 2022)(Preepremmote,

2024) In his research in one of the developing countries in Southeast Asia, he emphasized the need for a strategy to attract FDI because there are specific points where FDI can boost the economy and reduce poverty and inequality in society.

Table 5: Gap Analysis and Future Research Directions

No	Theme	Research Gaps (Short)	Future Research (Short)
1	FDI, trade openness, carbon emissions, and inequality	Sectoral impacts unclear; limited study on trade–environment–inequality link	Sector-specific FDI studies; trade–emission effects on inequality; integrated policy frameworks
2	Carbon pricing, urbanization, food & education inequality	Limited empirical evidence in developing countries; unclear urbanization impact	Long-term effects of carbon pricing: urbanization–food–education nexus
3	Corruption, finance, democracy, and inequality/environment	Focus on corruption–environment, less on income inequality; democracy effects unclear	Direct link corruption–inequality; role of financial systems in reducing inequality & environment
4	Climate change & socio-economic inequality	Climate–inequality link still vague; limited political economy research	Explore political economy policies; inclusive climate justice frameworks
5	Globalization, environment & inequality	Mixed evidence on inequality; weak analysis of environmental impact	Long-term globalization effects: policy adaptation in developing countries
6	Environmental degradation, inequality & health	Few links between socio-economic inequality and health access	Study inequality–environment–health; health costs of pollution; policy solutions
7	Renewable energy & inequality	Few local/sectoral studies; unclear role in reducing inequality	Access & equity in renewables; job creation effects; supportive policy frameworks
8	Income inequality & pollution	Few direct/long-term studies; limited redistribution focus	Role of redistribution policies; sectoral & locational analysis
9	FDI & income distribution	FDI's role in equity unclear; institutional quality impact understudied	Directing FDI to equitable growth; institutional effects; inclusive sectoral FDI policies

CONCLUSIONS AND RECOMMENDATIONS

Foreign Investment (FDI) significantly impacts environmental damage, especially in developing countries. Sectors attracting FDI, such as heavy industry, mining, and plantations, often contribute to pollution, deforestation, and biodiversity decline. However, some foreign investment can trigger the application of environmentally friendly technologies that can reduce CO2 emissions. In addition, FDI also has the potential to reduce income inequality in developing countries if appropriately managed. However, unequal distribution of benefits often exacerbates social inequality, with marginalized groups being the most disadvantaged. Therefore, more selective policies in receiving FDI and ensuring social and environmental sustainability are important to reduce the gap.

FDI, environmental damage, and income inequality are complexly intertwined. FDI that drives economic growth often hurts communities that depend on natural resources. This income inequality resulting from FDI affects more people who do not have the resources to adapt to changes caused by environmental degradation. Some developed countries show the positive impact of FDI on reducing income inequality and environmental sustainability, while developing countries often face dilemmas in managing both aspects.

Policy recommendations emphasize the need for host countries to formulate more inclusive frameworks, ensuring that FDI benefits not only large corporations but also local communities affected by environmental impacts. Governments should promote environmentally friendly investments by incentivizing companies that adhere to strict environmental standards. Furthermore, a holistic approach is required to address social and economic inequality, particularly by integrating social policies into every foreign investment plan to ensure sustainable and equitable development outcomes.

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