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**Green Taxonomy Standards across Jurisdictions:
A systematic literature review approach**

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Abstract

Since adopting the Paris Agreement in 1995, green financing and investment have broadly developed and made green taxonomy an essential foundation of a sustainable financial system. This study uses the systematic literature review approach to analyze and classify extant research on green taxonomy across jurisdictions. For the literature review, this study reviews 527 academic articles published between 2015 and 2022 from the Scopus databases and finds there are two pioneers in developing green taxonomy, they are the European Union and China, with their different approach. This study confirms that green taxonomy standards is crucial for effective interoperability among taxonomies across countries.

Keywords: green taxonomy; sustainable finance; green investment; systematic literature review

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1.0 Introduction

Rapid global warming has forced all sectors of society, including the financial sector, to take responsibility for environmental sustainability. The Global Commission on Economy and Climate estimated a need for \$90 trillion for sustainable infrastructure over the next 15 years. Financial support is essential for sustainable agriculture and deforestation prevention derived from public and private sectors through various instruments. To mitigate the issue, the People's Bank of China (PBOC) issued the Green Bond Endorsed Project Catalogue for financial institutions and companies that will issue green bonds. The document became a guidance for financial institutions to meet specific environmental targets, which became known as the green taxonomy. In addition to China, other countries have also issued their green taxonomies.

This study analyzes and classifies extant research on green taxonomy across jurisdictions in the world. Using a systematic literature review (SLR) methodology, this study aims to examine the development of green taxonomy and determine how green taxonomy implemented across jurisdictions in global countries. The findings of this study are helpful for countries that are in developing a taxonomy for environmental sustainability.

The paper examines the green taxonomy implementation in China and the European Union, as both regions are recognized as leaders in this domain. Additionally, the study emphasizes the significance of establishing a green taxonomy to enhance green financing. The paper consists of several sections: Section I is the introduction as the background, Section II describes the importance and development of green taxonomy, Section III illustrates the research model and methodology, Section IV outlines the findings, Section V interprets the results, and Section VI concludes the research.

2.0 Literature Review

Green taxonomy is a system for classifying activities that advance environmental objectives (ICMA, 2021). A taxonomy for sustainable finance provides criteria for evaluating financial assets aligned with sustainability goals (Ehlers et al., 2021). Its purpose is to categorize sectors to guide investments labelled as "green." Investments are classified into three categories based on their environmental impact. Green taxonomy promotes projects that foster sustainable economic development and meet environmental objectives including climate change, water, and biodiversity (OECD, 2020).

The disclosure of environmental information specified by the taxonomy can enhance the knowledge of private sector and motivate them to shift toward low-carbon production. Multiple researchers have investigated the impact of (mandated or optional) disclosure of non-financial environmental information. Downar et al. (2019) find that mandated emissions disclosure in the UK led to significant reductions in greenhouse gas emissions without harming financial returns. Voluntary carbon emissions disclosures correlate with company value when accounting for company self-assessment.

Many studies have assessed the positive link between ESG sustainability performance and stock returns, also ESG and corporate financial outcomes. Although there is no clear consensus, most research suggests a positive relationship between environmental and financial performance, often linked to the efficient resource utilization of greener firms.

Several global financial authorities have established green taxonomies for their jurisdictions. The existence of green taxonomies globally signifies a commitment to the Paris Agreement. Several countries such as China and Mongolia, have implemented green taxonomies for sustainable finance. Additionally, the EU and ASEAN regions have also adopted green taxonomies. Meanwhile, nations like the UK, Vietnam, and several others remain in the developmental phase of their taxonomies (CBI, 2022).

3.0 Methodology

3.1 Review protocol

An SLR is identifying, evaluating, and interpreting all available study material to answer specific research questions. It helps to capture information from various sources in a structured manner (Acerbi & Taisch, 2020), and also provides a comprehensive overview of the available scientific evidence regarding a particular study. This study employs a three-stage SLR process. The stages are planning, implementation, and reporting and dissemination. Figure 1 illustrates the analysis procedure of this study.

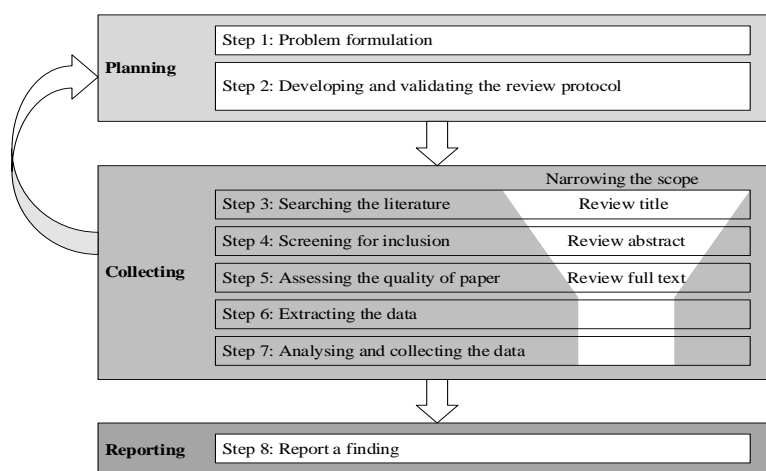


Fig. 1: The SLR Steps
(Source:) Researchers (2022)

As shown in Figure 1, the first stage of the SLR is planning by identifying research questions, research objectives, inclusion criteria, search strategies, quality assessment criteria, and screening procedures, also strategies for data extraction, synthesis, and reporting; this stage drives the entire literature review process. The second stage is collecting the literature by screening them using inclusion and exclusion criteria, quality assessment, data extraction, analysis, and data merging. The last stage is reporting phase by writing the SLR results based on the previous stages, then drawing conclusions about them.

3.2 Searching strategy

This study provides an overview of green taxonomy across G20 countries. The researchers utilize the Scopus database for its comprehensive indexing of academic literature. The database recognized for indexing scientific journals, books, and conference proceedings utilized by various stakeholders.

A combination of Boolean searches and bibliometric networks are employed to explore terms related to green taxonomy. The SLR methodology necessitates pre-defined keywords to narrow the research focus. The search string utilized includes terms such as "taxonom*" OR "indicator*" AND "green" AND "economy*" OR "sustain*" AND "financ*" for filtering relevant literature.

Inclusion and exclusion criteria are applied in filtering the literature based on publication date, language, article status, and document type. Only articles published between 2015 and 2022 were considered or after the green taxonomy launched by China in 2015. Additional criteria included the requirement for the articles to be in English or Indonesian, finalized, and to consist of journal articles or books. Figure 2 illustrates the methodological steps undertaken in this study.

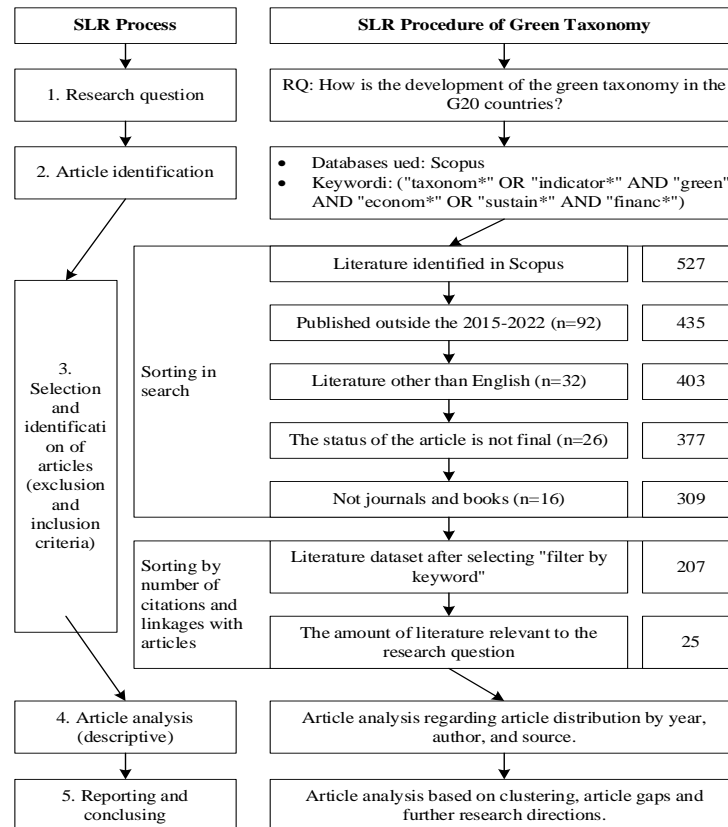


Fig. 2: The SLR Processes
(Source:) Researchers (2022)

The search yielded 527 articles, is shown in Figure 2. Eligibility criteria were further applied to refine the literature sample for relevance to research question of the study. The first screening based on year of publication resulted 435 articles. The second screening based on language screening generated 403 articles, and the next - publication status screening provided 377 articles, and finally, the document type screening resulted 309 articles. Subsequent sorting of the keyword-filtered results led to the selection of 207 articles which generated by manual screening against predetermined criteria focusing on green taxonomy, resulting in the exclusion of 25 articles. Article samples demonstrate a moderate increase from 2016 to 2022, with minor declines observed in 2018 and 2021 (Figure 3). The most notable growth is recorded in 2022, marking a 150% increase relative to 2021.

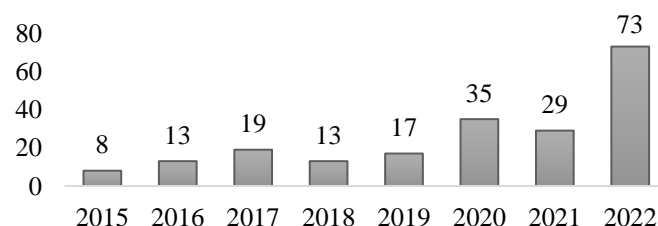


Fig. 3: Number of Publications

(Source:) Researchers (2022)

Descriptive statistics from the samples used in this study show that 25 countries have published articles on green taxonomy. Figure 4 shows that of the 25 countries, China is the country that has conducted the most research in this field, with a total of 102 articles, while Indonesia is in the 22nd position with a total of eight articles. The reasonably large gap between China and Indonesia shows there is a lack of research and awareness to develop research on this subject in Indonesia.

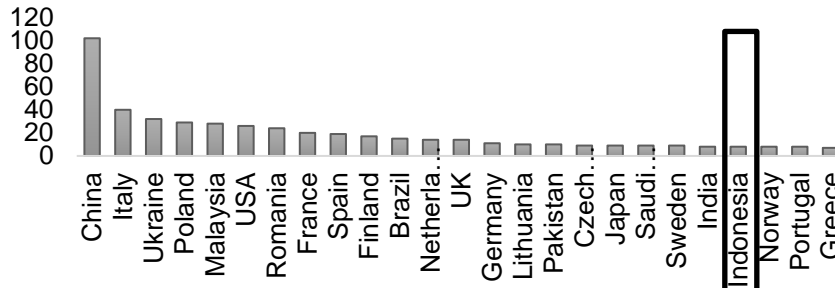


Fig. 4: Samples Based on Country
(Source:) Researchers (2022)

This study only examines publications in the form of journals and books (Figure 5), with journal articles comprising 88% of the sample publications because journals and books have fairly high accuracy and objectivity compared to other types of publications. In addition to being initial references, journals and books are frequently utilized by readers in carrying out research and for references in policy making.

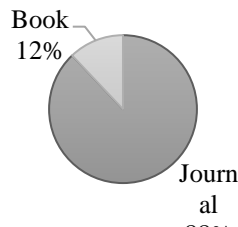


Fig. 5: Publication Types
(Source:) Researchers (2022)

Table 1 shows 20 subjects covered among the articles selected for SLR analysis in this study. Most of the articles come from environmental journals, describing that green taxonomy not only discussed in economic journals but also in environmental journals. This finding also proved that green taxonomy is closely related to a broad range of environmental aspects, especially in the scientific field of setting thresholds for green taxonomy.

Article Subjects	Number of Articles
Environmental	91
Business, Management, and Accounting	62
Economics, Econometrics, and Finance	60
Engineering	60
Social	53
Energy	52
Computer	25
Mathematics	16
Agricultural and Biological	9
Earth and Planetary	9
Chemical Engineering	4
Decision	4
Materials	4
Arts and Humanities	2
Multidisciplinary	2
Physics and Astronomy	2
Biochemistry, Genetics, and Molecular Biology	1
Chemistry	1
Medicine	1
Psychology	1

(Source:) Researchers (2022)

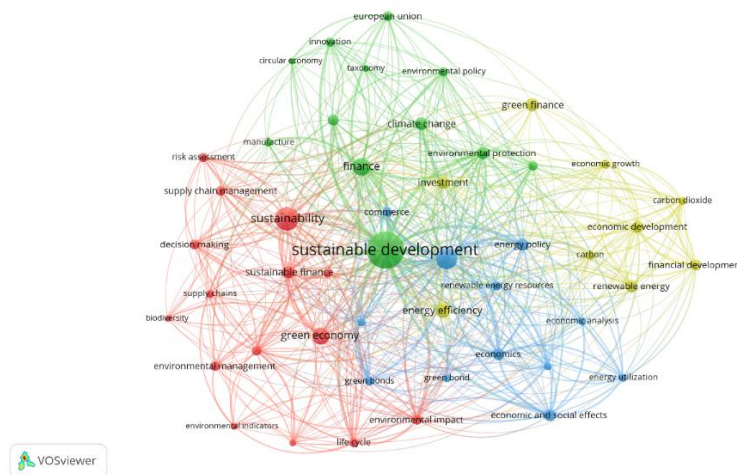


Fig. 8: Co-occurrence Network of Green Taxonomy
(Source:) Researchers (2022)

Figure 8 shows the four large clusters obtained from the results of data mapping with the SLR. These clusters indicate the existence of four significant variables related to green taxonomy that frequently discussed in the Scopus database. Cluster 1 shows green taxonomy literature linked with supply chain management (Centobelli et al., 2022), life cycle (Becchetti et al., 2022), and risk assessment (Bingler & Colesanti Senni, 2022).

Cluster 2 illustrates that green taxonomy is closely related to a circular economy (Molocchi, 2021), innovation (Marecki et al., 2022), and finance (Edenhofer et al., 2022). Cluster 3 shows that some literature links green taxonomy with energy policy (Careri et al., 2022) and green bonds (Liberadzki et al., 2021). Cluster 4 shows that green taxonomy has links with green finance (Steuer & Tröger, 2022).

5. Discussion

5.1 The most influential countries in green taxonomy

Countries which significantly influenced green taxonomies in the past decade, are China and the EU (ICMA, 2021). The Future of Sustainable Data Alliance found that several countries are developing a green taxonomy referenced the EU (Gondijan & Merle, 2022). This situation underscores the authority of Chinese and EU taxonomies and their high global standards. Bangladesh's central bank and South Africa National Treasury have adopted taxonomies aligned with the EU's "do no significant harm" (DNSH) and "make a significant contribution" principles, albeit at a lower threshold (Larsen, 2022). In 2019, Financial Stability Commission of Mongolia released a taxonomy mirroring China's 2015 green bond taxonomy.

As signatories of the Paris Agreement, the EU and China must ensure their green taxonomies address climate change challenges in alignment with the Agreement. They must avoid incorporating interests that conflict with the Agreement's objectives. In February 2022, the European Commission controversially included nuclear power and natural gas in transitional activities for climate change mitigation within the EU taxonomy. Hairabedian (2022) indicates this inclusion stimulates private investment in these sectors for the green transition. However, Anlar (2022) suggests this decision may have been influenced by the Russia-Ukraine conflict, potentially aiding in reducing the EU's reliance on Russian fossil fuels.

The decision of European Commission can be precedent for other countries developing taxonomies referencing the EU framework. Some economic stakeholders question the European classification system. Integrating of natural gas and nuclear power as "transitional activities" is risking the goal of Paris Agreement in limiting global temperature rise to 1.5 degrees Celsius.

5.2 The policy pioneer based on its top-down policymaking model

China is a leader in taxonomic development through a top-down policymaking model. Jun (2020) notes that China has aggressively pursued a green financial system despite its initial limitations. This advancement is supported by a political consensus from the government. Economic governance approach of China allows for active state guidance of the economy which is reflected in green finance and bolstered by key components such as (a) a defined green taxonomy; (b) mandatory environmental disclosures; (c) established rules for green financial products; and (d) incentives for relevant entities.

The rationale for this top-down policy stems from market inefficiencies and neglect of environmental externalities and information asymmetry, which hinder effective regulation and material production (Jun, 2020). Without a standardized taxonomy, financial institutions would create competing and inconsistent standard and definitions.

Top-down taxonomy policy of China is described as compilation of a taxonomy that specifies eligible projects rather than defining environmental objectives. Consequently, currently there are no established principles or requirements for classifying projects within the

Chinese taxonomy. The taxonomy lacks specific carbon emission criteria, relying instead on qualitative standards for determining green project eligibility.

While top-down approach of China has positioned it as a pioneer in green taxonomy development, market constraints can impede progress of the system. Thus, it is essential for the Chinese government and regulators need to integrate top-down and bottom-up strategies, ensuring a guiding role in mobilizing investments for green finance and enhancing the green taxonomy framework.

5.3. The standard setter based on its bottom-up model

Green financial policies are gaining traction globally with distinct roles played by China and the EU. While China initiated new policies in 2015, the EU has been formulating standards since 2018.

The EU taxonomy is rapidly emerging as a global standard. Initial rules of China are now being adopted worldwide following with EU standards, indicating the EU's influence on China's green finance policies. Following the establishment of EU standards, nations have begun implementing taxonomic policies, either voluntarily or mandatorily. China is also aligning with EU practices, considering clean coal and introducing stress testing (Larsen, 2022).

EU sustainable finance practices are poised to set global standards due to their democratic foundation and broad industrial engagement, which enhances legitimacy compared to centralized approach of China. Although the process is become more slower, the increasing environmental awareness in the private sector may render this approach effective over time.

The EU further enhances its influence by integrating various aspects of green finance and promoting their adoption globally, exemplified by the Sustainable Finance Disclosure Regulation (SFDR). The EU taxonomy underpins green bond standards and disclosure mandates. Consequently, when asset managers request global compliance with the EU taxonomy, organizations become acquainted with it and are likely to adopt it as a benchmark for green initiatives (Rasche, 2021). Compliance with EU standards caused lower transaction fees compared to the implementation for multiple standards concurrently.

5.4. The need of green taxonomy standards

The finding emphasizes the current deficiency in the harmonization of green taxonomy (Larsen, 2022; Lee, 2020; Zetzsche & Anker-Sørensen, 2022). Furthermore, Zhang (2020) argues that China's establishment of the taxonomy is justified due to its significant domestic market. Nonetheless, the suitability of China's green standards for international markets remains uncertain, primarily as the green bond market seeks to attract global investors. Presently, green taxonomy is evolving across various jurisdictions worldwide. However, there are concerns among global green finance stakeholders that differing taxonomies may hinder cross-border capital flows.

Additionally, high transaction costs and the potential for greenwashing are risks associated with the emergence of inconsistent taxonomies (Jun, 2020). Thus, it is imperative to harmonize green taxonomy standards to facilitate interoperability among diverse national frameworks. Currently, China and the EU are collaborating on taxonomy harmonization via the International Platform on Sustainable Finance. In November 2021, they introduced their Common Ground Taxonomy – Climate Change Mitigation, which aims to delineate commonalities and discrepancies between their taxonomies. The framework is anticipated to serve as a foundation for establishing harmonized global standards.

Harmonization is critical for fostering responsible and sustainable investment through standardized practices, and it requires enhanced coordination among regulators and policymakers to ensure uniformity in green labelling and information transparency. The urgency of harmonization stems from its essential role in achieving responsible and sustainable investment. As China and the EU is leading on the green standards, it is their responsibility to ensure effective taxonomy harmonization. If these parties synergize their efforts, the global expansion of green finance could accelerate significantly. Recognizing the impactful roles of China and the EU enables both entities to concentrate their initiatives on the most effective areas. Consequently, the taxonomy harmonization process must be reviewed by all relevant stakeholders.

6. Conclusions

This study systematically articulates qualitative and quantitative green taxonomy derived from 25 articles. Four findings emerge: 1) China and the EU are the dominant nations; 2) China is the policy pioneer due to its top-down approach; 3) The EU serves as the standard setter through its bottom-up strategy; and 4) Developing of green taxonomy standards is necessary.

Finding 1: Global green taxonomy is significantly influenced by China and the EU with countries like Bangladesh and South Africa modeling their taxonomies refers to the EU's, and Mongolia's taxonomy reflecting China's principles. The EU and China's taxonomies are benchmarks for other nations, making their policy developments vital for global taxonomy evolution. Stakeholders must monitor these implementations to ensure alignment with climate change objectives outlined in the Paris Agreement.

Findings 2 and 3: China leads as the policy pioneer through a top-down model, while the EU functions as the standard setter with a bottom-up approach. The contrasting methodologies of China and the EU can facilitate the advancement of their respective taxonomies and the global green taxonomy. The EU's taxonomy development inspired by China's innovative policies, which significantly enhanced the EU's green finance ambitions. Conversely, China adopted specific EU policies, indicating that divergent approaches can foster policy advancement through distinct contributions.

Finding 4: Global green taxonomy standards require development. Concerns arise regarding potential barriers to capital flows if national taxonomies differ. In 2021, China and the EU aligned their taxonomies to promote interoperability. As leaders at taxonomy harmonization, both must ensure effective collaboration, which could catalyze global green finance expansion, necessitating oversight of their harmonization efforts to inspire other nations.

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Paper Contribution to Related Field of Study

Currently, only few comprehensive and comparative studies in global market discuss about green taxonomy. This paper provides a concise and comprehensive understanding of the differences between each taxonomy across jurisdictions in the world and will fill the gap of the limitations on green taxonomy literature.

Recommendation for Further Study

There is limitation in this study which the papers screened in this literature review do not sufficiently explain the development of taxonomies in countries or regions other than the EU and China. The limitation can be explored more broadly in the next study, as time by time, other countries develop their taxonomies to provide relevant taxonomy with their green economy and finance.

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