Comparative Study of Carbon Emission Disclosure in High-Profile Companies at Developing Countries

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Abstract. This research aims to determine whether there are differences in the Carbon Emissions Disclosure (CED) among developing countries. The content analysis assesses the information in the sustainability and annual reports. The research sample based on purposive sampling consisted of 41 companies in China, 36 in India, and 29 in Indonesia. The test results support the research hypothesis, indicating differences in corporate carbon emission disclosure practices among developing countries. The different nature of regulations has led to different CED practices in China, India, and Indonesia. Voluntary emission disclosure regulations impact the incomplete information presented by companies in China and Indonesia. On the contrary, mandatory disclosure accompanied by reporting standards affects the higher quality of CED for companies in India that are more qualified and accountable.

Keywords: Carbon emission disclosure, developing countries.

1 Introduction

Climate change is claimed to be an environmental problem the global economy faces [1]. This was caused by carbon emissions, which have increased significantly since 1990 [2]. Rapid economic growth without a renewable energy mix leads to increased emissions [3]. According to [4], the Carbon Emission Disclosure (CED) is an essential step to achieving carbon emission reductions and addressing climate change. Currently, CED does not have established standards [5]. However, to ensure consistency and comparability of CED in sustainability reporting, a standard framework is needed [6]

Emissions in large quantities cause climate change, which has implications for companies [7]. The impact of climate change on companies includes disruptions to production activities and severe implications for the supply chain [8]. In addition, negative stigma by consumers, suppliers, staff, and shareholders towards the resulting emissions can be a reputational risk a company faces [9]. Therefore, companies need to address the dangers of climate change by adopting low-carbon strategies and proactively disclosing information [10].

Apart from companies, most countries are concerned about climate change and are trying to find ways to reduce carbon emissions [11]. This is reflected in the Paris Agreement of 2015, which replaced the 1997 Kyoto Protocol. The consensus in the agreement is the importance of reducing carbon emissions in economic activity and adopting a balanced long-term

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perspective between the economy and the environment [12]. Besides that, if the Kyoto Protocol only requires developed countries to reduce emissions, the Paris Agreement calls on all countries to set emission targets [13].

Even though it has become an international legal obligation, the agreement in the Paris Agreement is laissez-faire in that domestic policies are left to each government [14]. [15] States that this creates regulatory differences between developed and developing countries. Developed countries must reduce global emission levels so that there are mandatory requirements to disclose carbon emissions, or Carbon Emission Disclosure (CED) [16]. In contrast, CED does not yet have a standard and is voluntary in developing countries [5]. Developing countries, or what is known as the non-Annex group, are not required to reduce carbon emissions but only report their emission status [2].

China, India, and Indonesia are developing countries where CED is a new issue, and only a few companies make disclosures [15]. Evensee though these three countries are the top ten contributors to carbon emissions globally (See Figure 1), As the world's largest developing country, China is still in the industrialization and urbanization phases, and there is an urgency for economic and social development [17]. The rapid growth of industrialization, not accompanied by a mix of renewable energy and low efficiency, has increased emissions and energy consumption [3]. Apart from China, India is one of the countries with the fastest-growing economies in the world [18]. This causes many carbon emissions into the atmosphere due to production activities [19]. The same thing also happened in Indonesia. Based on data from the World Development Indicators for 2023, Indonesia's Gross Domestic Product (GDP) has experienced an increasing trend from 2015 to 2019, with an average growth of 5.03%. The energy sources used in Indonesia are primarily coal, which produces more emissions than natural gas [20].

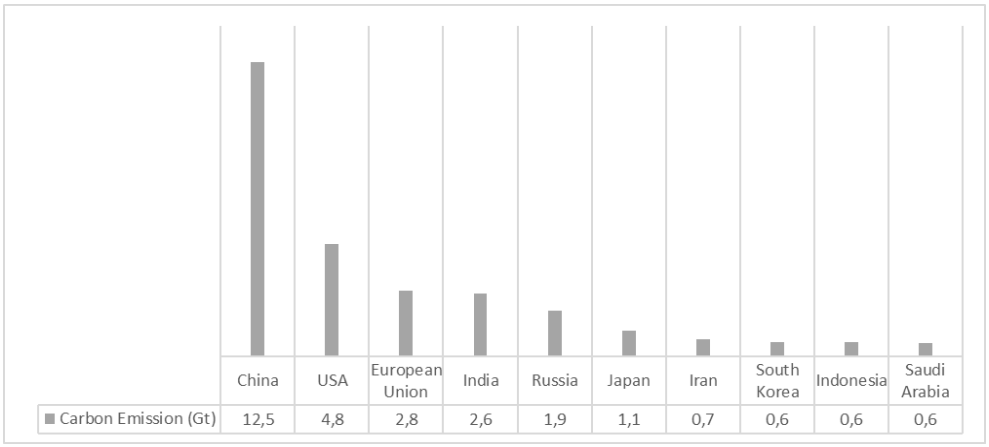

Fig. 1. Highest carbon emissions emitter in 2021
Source: Crippa et al., 2021

The limited resources owned by developing countries cause a lack of commitment to carrying out CED [15]. According to [21], CED is one component of the overall climate change strategy that requires a lot of financial, human, and technological resources. Therefore, only a few companies make disclosures related to carbon emissions.

Disclosure of non-financial information on companies with environmental risks can support the company's operational activities based on community values [22]. This aligns with legitimacy theory, explaining that organizations disclose environmental information voluntarily to regain or maintain legitimacy [23]. Because the community controls the factors of production, the existence of the company depends on the approval of the community [24]. Environmental disclosure is used as a communication strategy and assures the public that the company is in good faith in its environmental responsibility [25]. Therefore, this study uses legitimacy theory to explain the importance of conducting CED even though it is not mandatory.

There are still a few previous studies that discuss CED comparative studies among developing countries. Research by [26] analyzes the differences in corporate carbon disclosure between developed countries. In contrast, research by [27] compared the CED of developed countries with that of developing countries. In addition, the CED variable in previous studies was only measured using a weight of zero to one [27–29]. This study measured the CED variable using a scale of zero to three. The measurement of this scale aims to capture the quality and depth of the information.

Based on this background, this study aims to determine differences in the disclosure of carbon emissions in China, India, and Indonesia. This study has a theoretical contribution to the use of legitimacy theory in explaining the relationship between the disclosure of carbon emissions and regulatory differences in developing countries. The research findings can serve as a valuable resource for assessing the accuracy and comprehensiveness of carbon emission disclosures. In addition, the research can be utilized as a foundation for developing effective government policies to reduce carbon emissions and mitigate the adverse impacts of climate change.

2 Literature Review

CED comparative studies still need to be widely carried out, especially among developing countries. Research by [26] analyzes the differences in corporate carbon disclosure among developed countries, including the European Union, Japan, and Canada. The results of this study show significantly lower disclosures of carbon emissions by companies from the European Union than companies from Japan and Canada. Research conducted by [27] and [21] compared the CED of developed countries with that of developing countries. The study by [27] showed that companies in Japan make the highest disclosures, followed by China and India; meanwhile, [21] found a tendency for CED to correlate with resource availability. Limited financial, human, and technological resources cause a lack of commitment to mitigation and CED in developing countries compared to developed countries. Based on the description above, this research contributes to the topic of CED in developing countries.

CED conducted by companies is in line with the theory of legitimacy, namely, to obtain public approval. Based on legitimacy theory, a company can still exist if it operates within the limits and values accepted by society [30]. Along with increasing world carbon emissions, companies are expected to be able to provide environmental awareness and transparency to the public [31]. The corporate sector that generates a lot of carbon emissions, such as mining and energy, carries out carbon disclosures accompanied by efforts related to reducing carbon

emissions [2]. This is done to gain legitimacy. In line with the opinion of [32], carbon-intensive industries use carbon disclosure as a legitimate strategy.

There are four criteria of organizational legitimacy: regulatory, pragmatic, moral, and cultural-cognitive [33, 34]. However, only regulatory and moral legitimacy are relevant in this study. Regulatory legitimacy refers to the perception that organizations comply with government regulations to avoid legal or financial penalties. While moral legitimacy views corporate actions as following ethical and moral principles, This is done by demonstrating a commitment to ethical behavior and social responsibility.

Good legitimacy is expected to reduce conflict between the two parties [35]. If the company's legitimacy is threatened, several parties in society, such as employees, consumers, investors, the government, and other parties, may refuse to deal with the company [36]. At the same time, the community's approval is essential because the company's sustainability depends on production factors controlled by the community [24]. One way to gain or maintain legitimacy is by issuing a sustainability report to show the company's environmental and social concerns. With social responsibility accompanied by business ethics, the company's reputation can be good in the eyes of stakeholders [37].

Not only companies but also the state created various regulations as a form of commitment to protecting the environment, mainly due to carbon emissions. China, India, and Indonesia are included in the top ten carbon-emitting countries in the world in 2021 [38]. The Chinese government has developed low-carbon strategies and policies to achieve the stated commitments [39]. Several national and regional policies lead to cleaner production and lower carbon emissions [40].

Over the past two decades, the government of India has introduced environmental laws such as environmental protection and B3 waste management regulations, as well as other regulations [41]. The Government of India has also established a climate program to mitigate carbon emissions, including an integrated energy policy program and a national action plan [5]. In Indonesia, the Paris Agreement is spelled out in Law Number 16 of 2016 [42]. The law aims to reduce carbon emissions independently or through international partnerships.

Based on the description above, there is still no international standard related to carbon emission policy. In India and other developing countries, disclosure of carbon emissions is still early [43]. Even though corporate activities contribute significantly to the country's total carbon emissions, there is still a gap in the regulatory framework to regulate the number of carbon emissions and their disclosure [5]. In addition, CED practices in several countries are still voluntary [44, 45]. Based on the description above, the research hypothesis is formulated as follows:

Ha: There are differences in the disclosure of carbon emissions in China, India, and Indonesia.

3 Methods

3.1. Sample Selection

The population in this study are high-profile companies in China, India, and Indonesia registered with the Carbon Disclosure Project (CDP) for the climate change program in 2021. A high-profile company is highly sensitive to the environment due to its production process, which generates high levels of emissions [28, 46]. Companies in the oil and mining, chemical, paper, automotive, aviation, agribusiness, cigarette, food and beverage, energy, engineering, and transportation sectors were selected because they are high-profile industrial sectors. The year 2021 was chosen because there was a significant increase in carbon emissions from the previous year [47]. The sampling technique used was purposive sampling. The sample criteria in this study are:

a. Listed on each country's stock exchange
b. Publishing Annual Report (AR) and Sustainability Report (SR) in English

The results of the research sample calculation based on purposive sampling are presented in Table 1.

Table 1. Total population and research sample

	China	**India**	**Indonesia**
Total population	200	71	32
Not listed on each country's stock exchange	[32]	0	[3]
Not publishing AR and SR	[96]	[35]	
AR and SR are not in English	[31]		
Total Sample	41	36	29
		106	

Source: Research data, 2023

3.2. Data Collection

The data used in this study is secondary data. Data collection in this study was carried out through documentation techniques. Documentation techniques are used to collect data and information in the form of documents in the format of AR and SR, which are accessed through the websites of each company and stock exchanges in each country. Content analysis is used to assess the information contained in the report.

3.3. Data Measurement

The CED variable is measured by the Carbon Disclosure Project [CDP] index developed by [46]. CDP has become the primary reference for CED globally [21, 48]. The CDP index consists of five relevant climate change and carbon emissions categories. The eighteen items in the index are measured using a score with a weight of zero to three. The weighting is based on the type, nature, and quality of disclosure adapted from [49]. Zero scores are given if there is no disclosure, one if the disclosure is only qualitative, two if the disclosure is made quantitatively, and three if the disclosure is monetary. Thus, this assessment can capture the

quality of the information disclosed by the company [27]. The CED checklist can be seen in Table 2 below.

Table 2. Carbon Emissions Disclosure Checklist

Category	Code	Item
Climate Change [CC]	CC1	Assessment and action to address risks and opportunities
	CC2	Business implications
Greenhouse Gas [GHG]	GHG1	Calculation methodology
	GHG2	External verification
	GHG3	Number of emissions
	GHG4	Disclosure based on the scope
	GHG5	Disclosure by source
	GHG6	Disclosure by facility or segment
	GHG7	Historical comparison of emissions
Energy Consumption [EC]	EC1	Total energy consumed
	EC2	Disclosure of consumption from renewable sources
	EC3	Disclosure by type, facility, or segment
Reduction and Cost [RC]	RC1	GHG emission reduction plan
	RC2	GHG emission targets
	RC3	Achieved Savings
	RC4	Future emission costs are factored into capital expenditure planning
Accountability [ACC]	ACC1	An indication of the board's responsibility for climate change
	ACC2	Council mechanism for reviewing climate change

Source: Choi et al. (2013

3.4. Reliability Test

Content analysis is the process of analyzing and interpreting the meaning contained in a text. If the content analysis is only carried out by one rater, then there is a possibility that the analysis results are subjective [50]. Therefore, it is necessary to do an inter-rater to ensure the validity and reliability of research data. The statistic that is commonly used to assess agreement between two raters is Cohen's Kappa [51]. According to [52], the classification of the results of Cohen's Kappa is a score of 0.8–1 indicating almost perfect agreement, 0.6–0.8 substantial, 0.4–0.6 moderate, 0.2–0.4 is fair, 0–0.2 is slight, and < 0 there is no agreement. Cohen's Kappa results in this study obtained a score of 0.81, classifying it as almost perfect agreement. Thus, the data in this study indicated that it was valid, reliable, and not subjective.

4 Results and Discussions

4.1. Descriptive Statistics

The average CED in the sample companies has yet to reach 50% (see Table 3). This is due to the weighting of the assessment by type of disclosure. Disclosure using specific numerical or quantitative measures is indicated to have higher quality because it is more objective and informative for stakeholders [53]. Meanwhile, qualitative disclosures only focus on describing

the company's functions and roles, which results in limitations in understanding company performance from the perspective of social costs and benefits [social cost-benefit] [54]. Thus, although most disclosures are carried out quantitatively, the percentage of companies that do not make disclosures and the minor monetary disclosures impact the mean CED score (see Figure 1).

The percentage of disclosure in monetary terms is the lowest compared to other types of disclosure. Disclosures presented in financial terms include the company's efforts to plan investments in capital expenditures and cost savings. According to [55], company actions to invest in renewable energy to reduce emissions are included in mitigation. The availability of resources is critical to overcoming problems related to climate change mitigation [29]. This causes low monetary disclosure. In line with the research of [21], companies in developing countries are relatively inactive in terms of their tendency to disclose information about their carbon mitigation activities.

The minimum value in China is Brilliance China Automotive Holdings Ltd. The company only disclosed 8 out of 18 CED items. Meanwhile, SINOPEC Shanghai Petrochemical Co. Ltd., which gets the maximum score, announces all items, with 11 quantitatively. Unlike Brilliance China Automotive, which has issued SRs since 2016, SINOPEC has issued SRs earlier, namely since 2014.

Indraprastha Gas Ltd. gets the minimum score in India by disclosing 11 CED items. The company only issued SR in 2021. On the other hand, Vedanta Ltd. receives the maximum value by disclosing all CED items and most of them quantitatively. Vedanta Company Ltd. has also published SR since 2008.

A construction company in Indonesia, PT Waskita Karya [Persero] Tbk, obtained a minimum score. The reason is that the company only discloses half of all items and is more dominant in qualitative disclosure. Meanwhile, PT Bumi Resources Tbk discloses all items with a quantitative majority to get the maximum value.

Table 3. Descriptive Statistics Results

	Mean	**Min**	**Max**	**Std. Dev**
China	0,416	0,222	0,574	0,083
India	0,481	0,315	0,648	0,090
Indonesia	0,412	0,241	0,537	0,080

Source: Research data, 2023

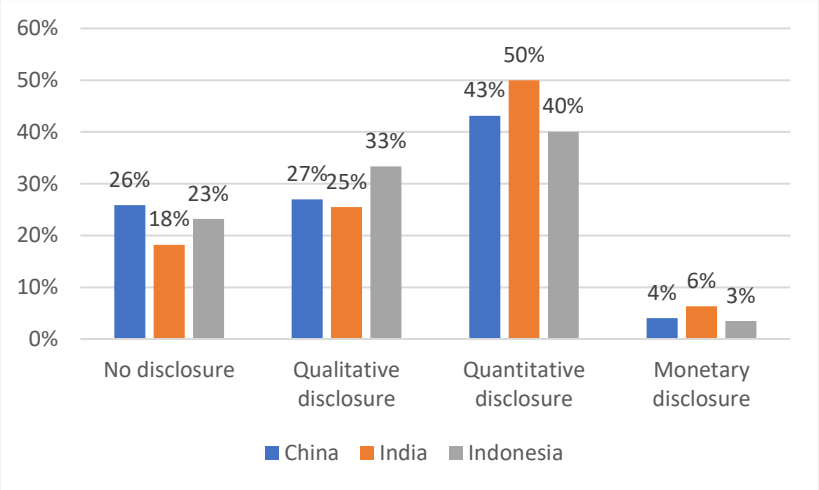

Fig. 1. Percentage of Disclosures by Companies Based on Rating Weight

(Source: Research data, 2023)

4.2. Result

Table 4 shows that the significance value of Anova is 0.001. This value is less than 0.05, indicating differences in the disclosure of carbon emissions in China, India, and Indonesia. Thus, the alternative hypothesis in this study is accepted. Then a post-hoc test was carried out to determine the differences in CED between one country and another. Based on a significance value of less than 0.05 on the Tukey test, it can be interpreted that there is a difference in CED between China and India (see Table 4). In addition, the CED between India and Indonesia also has differences. Meanwhile, there is no difference in CED between Indonesia and China because the significance value is greater than 0.05.

Table 4. Analysis of Variance and Post-Hoc Test Results

Test	Value
Anova	0,001
Post Hoc [Tukey test]	
China-India	0,003
China-Indonesia	0,978
India-Indonesia	0,004

Source: Research data, 2023

From the 18 CED items, the companies' main focus in China, India, and Indonesia is item RC1 (see Table 5). Most of these items are disclosed in the environmental performance and corporate sustainability principles sections. All the companies studied have a mission to reduce emissions resulting from the impact of their operations. The efforts include transitioning towards using clean and renewable energy and reducing emissions from company operations. This effort is related to item CC1, which aims to address risks due to climate change.

Climate change has various negative impacts on business operations. To overcome this impact, the company undertook multiple initiatives, which were reflected in the high level of disclosure of CC1 items. In addition, almost all of the company's board of directors have commitments conveyed to the SR regarding responsibility for climate change. Generally, the board of directors communicates ACC1 items in the speech and sustainability governance sections.

The item that was disclosed the least in three countries, namely GHG6, Most companies reveal the amount of emissions produced as a single business entity. Only a few research samples show the emissions by business unit or subsidiary.

Table 5. Percentage of Each Item Disclosed by the Company

Code	Item	China	India	Indonesia
CC1	Assessment and action to address risks and opportunities	90%	100%	100%
CC2	Business implications	63%	69%	45%
GHG1	Calculation methodology	68%	56%	69%
GHG2	External verification	29%	81%	48%
GHG3	Number of emissions	100%	97%	97%
GHG4	Disclosure based on the scope	85%	97%	86%
GHG5	Disclosure by source	66%	67%	100%
GHG6	Disclosure by facility or segment	27%	33%	45%
GHG7	Historical comparison of emissions	88%	89%	90%
EC1	Total energy consumed	93%	97%	100%
EC2	Disclosure of consumption from renewable sources	59%	100%	93%
EC3	Disclosure by type, facility, or segment	90%	81%	79%
RC1	GHG emission reduction plan	100%	100%	100%
RC2	GHG emission targets	76%	81%	45%
RC3	Achieved Savings	66%	81%	62%
Code	**Item**	**China**	**India**	**Indonesia**
RC4	Future emission costs are factored into capital expenditure planning	61%	75%	62%
ACC1	An indication of the board's responsibility for climate change	98%	100%	100%
ACC2	Council mechanism for reviewing climate change	73%	69%	62%
	Mean	**74%**	**82%**	**77%**

Source: Research data, 2023

4.3 Discussion

Although several international agreements have been made, Carbon Emission Disclosure [CED] still needs a regulatory standard. In addition, CED is still voluntary in developing countries. The study results indicate differences in the disclosure of carbon emissions in China, India, and Indonesia.

Lower disclosure in China could be due to several factors. The Chinese government issued various regulations related to handling carbon emissions as described by [56], namely carbon taxes and carbon emission rights trading. However, there still needs to be comprehensive

regulation regarding mandatory CED [57]. According to the research results of [57], regulations regarding CED, including the Environmental Protection Law [EPL] and Measures for the Disclosure of Environmental Information [MDEI], are optional requirements and weak in ensuring accountability. This is reflected in the EPL articles 13 and 53, revised in 2014, below.

> Article 13 states:
>
> The environmental impact statement for a construction project must assess the pollution that the project may produce and its impact on the environment and stipulate preventive and curative actions. The statement is submitted with specific procedures to the appropriate Department of Environmental Protection Administration for approval following the initial inspection by the construction project official.
>
> Article 53 states:
>
> Citizens, legal entities, and other organizations have the right to obtain environmental information, participate in and supervise environmental protection activities by the law Competent environmental protection of government at various levels and other departments with environmental oversight responsibilities should disclose environmental information by law, enhance public participation procedures, and facilitate citizens, legal entities, and other organizations to oversee the protection work environment.

Based on the description of the article, disclosure only focuses on the company's construction projects that have an impact on the environment. In addition, regulations guarantee the right to environmental information to the public but focus more on information disclosed by the government, not companies. Thus, EPL does not oblige but only encourages governments and companies to disclose environmental information. The same thing is reflected in MDEI 2014 article 10, which states:

> Companies voluntarily disclose environmental information. This action can be carried out by announcing ecological information to the public online or disclosing the company's annual environmental report.

The average CED score in India is the highest compared to China and Indonesia. The Ministry of Corporate Affairs of the Government of India [MCA] issued a regulation, 'National Voluntary Guidelines on Social, Environmental, and Economic Responsibilities of Business,' 2011 to increase social and environmental disclosure [58]. Even though there is the word 'voluntary,' the regulation is mandatory for registered companies to issue Business Responsibility Reports [BRR]. This is regulated by a law administered by the Securities and Exchange Board of India [SEBI] in 2012, which confirms that:

> According to the aforementioned Guidelines, it has been determined to mandate the inclusion of a Business Responsibility Report in the Annual Report for listed companies, given the increased significance of public disclosure about the actions taken by registered entities in terms of environmental, social, and governance.

Mandatory disclosure of environmental and social information to BRR was to improve disclosure quality [59]. In 2012, the top one hundred companies on the stock exchange were required to issue BRR [59]. The number of companies needed to issue BRR has gradually increased to a thousand within ten years [60]. Increasing pressure from investors, governments, communities, and civil organizations for corporate transparency and accountability has made regulations mandatory [61, 62].

Besides being mandatory, regulations by the Government of India are universally designed for all business sectors. Nine principles cover the triple bottom line to align financial, environmental, and corporate social performance [63]. Thus, the disclosure of information by companies is more transparent and accountable [64]. However, the absence of sanctions for non-compliance is a weakness of the regulations that have been issued [58].

Regulations related to the disclosure of emissions in Indonesia are similar to those in China, but Indonesia has the lowest average CED score compared to India and China (see Table 3). Government Regulation [PP] number 47 of 2012 follows up on the Limited Liability Company Law [UUPT]. UUPT requires companies with business activities that impact the environment to carry out social and environmental responsibility activities. At the same time, PP No. 47 of 2012 is a policy that regulates companies disclosing social and environmental activities in their annual reports. However, PP No. 47 of 2012 has weaknesses, namely that no sanctions are given to companies that do not make social and environmental disclosures and do not have standards regarding procedures for reporting environmental problems [65]. This can be seen in Article 7 PP No. 47 of 2012, which states:

> Companies referred to in Article 3 that do not carry out social and environmental responsibilities are subject to sanctions under the provisions of the law.

The description of the article above indicates that there are no sanctions for companies that do not disclose social-environmental information. In addition to PP No. 47 of 2012, the Indonesian government also issued national and regional policies developed by the National Development Planning Agency [BAPPENAS] in 2013: Action Monitoring, Evaluation, and Reporting [MER]. However, this policy is more focused on serving as a reference for ministries and other agencies in implementing the National Action Plan for Reducing GHG Emissions [RAN-GRK] [20]. These sectors are four main ones, including marine and coastal, water, agriculture, and health, accompanied by related ministries, agencies, and agencies [66]. Thus, weak regulations and the absence of reporting standards for companies in Indonesia make CED practices inadequate.

The results of this study are consistent with the research of [67], which states that voluntary disclosures are less complete compared to mandatory disclosure requirements, which are considered to result in high-quality reporting. The content analysis results support this statement. The average percentage of items companies disclose in China is 74%, and in Indonesia, it is 77% (see Table 5). Meanwhile, countries with mandatory disclosures, namely India, have a higher average score of 82%.

Although CED regulations have a limited scope and are not mandatory requirements, companies in China voluntarily disclose additional information to demonstrate commitment and responsibility for environmental protection due to the impact of company operations [57].

The same situation also occurs in Indonesia. The percentage of reported carbon emissions has increased significantly, even though there is no reporting standard [65]. This can be seen in several CED items that have a maximum score that is close to the maximum (> 90%) [see Table 5].

The results of this study support the legitimacy theory, which states that companies try to gain or improve legitimacy by using social and environmental reporting [23]. The voluntary practice of CED in China and Indonesia is in line with research by [22, 68, 69], who argue that environmental disclosure is used as a legitimate tool based on different national circumstances. Moreover, CED voluntarily refers to a type of moral legitimacy. Moral legitimacy refers to the perception that the company's actions and behavior are based on ethics and morals [34]. Social and environmental disclosure indicates the ethical concern of the company and serves to maintain legitimacy and demonstrate accountability [70]. Based on the description above, CEDs in China and Indonesia are considered to have moral legitimacy.

Unlike in China and Indonesia, CED practice in India is mandatory. In line with previous research, mandatory regulations cause companies to disclose more relevant and accurate information than voluntary disclosure [71]. In addition, the results of a study by [72] state that mandatory carbon reporting positively impacts CED. Thus, mandatory CED correlates with regulatory legitimacy. Regulatory legitimacy is the conception that companies comply with laws, regulations, and standards issued by the government or regulatory agencies [73].

5 Conclusions

This study aims to determine whether there are differences in the disclosure of carbon emissions in developing countries, namely China, India, and Indonesia. The study's results indicated that companies' CED practices in India differed from those in China and Indonesia. However, no differences were found between China and Indonesia. Differences in regulations lead to differences in CED practices between countries. Regulations related to voluntary disclosure of emissions impact the incomplete information presented by companies in China and Indonesia. On the other hand, disclosures are mandatory and carried out in stages, which affects disclosures in companies in India that are more qualified and accountable.

The step that developing countries should take is to increase their disclosure and reporting practices. Policymakers should tighten regulations regarding scope, sanctions, and reporting standards. By expanding the regulatory area, CED practice in China is expected to focus on construction projects, the government, and companies. The Government of India should tighten regulations, considering there are still no sanctions for non-compliance with emission disclosures. The Indonesian government should stipulate strict sanctions against companies that commit violations. In addition, reporting standards are needed to increase comparability between companies.

The content analysis results show that the company's plans to reduce carbon emissions and the responsibility of the committee's board on climate change are the most disclosed CED items. However, there are some areas for improvement in CED practice in developing countries. The government is urged to require external or independent party verification to assess information on reporting carbon emissions and environmental performance. Given the relatively low score

of external party verification disclosure items, it is necessary to increase the reliability of CED information so that it is not subjective.

This study has limitations related to the observation period and the number of research subjects. Because it is cross-sectional, the research results cannot provide an overview of trends in CED practice in other years. In addition, the subjects in this study were limited to three developing countries. Thus, future research can use a longitudinal study and add research subjects to provide a better picture of trends in carbon emission disclosure.

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