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Diverging Pathways of Inclusive Green Growth: Evidence From China and India

Binta Zulfia [1]*, Inayati Nuraini Dwiputri [1], Etty Soesilowati [1], Wen-Chi Huang [2]
[1]Faculty of Economics and Business, State University of Malang, Indonesia
[2]College of Management, National Pingtung University of Science and Technology, Taiwan

**Corresponding Author:bintazlf@gmail.com*

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ABSTRACT

Global discussions on sustainable development are increasingly emphasizing inclusive green growth (IGG), which integrates economic performance, social equity, and environmental sustainability. Among developing countries, China and India are the two main growth drivers in the BRICS grouping, but their development trajectories exhibit different patterns in balancing expansion with sustainability. China's rapid industrialization and technological advancement were accompanied by significant environmental pressures in the pre-pandemic era, while India's growth was relatively more gradual and balanced, with social challenges and lower per capita emissions. Comparative literature on inclusive green growth between China and India using a multidimensional framework is still limited. Therefore, this study constructs and compares the Inclusive Green Growth Index (IGGI) for China and India, incorporating indicators across three pillars: economic performance, social inclusion, and environmental sustainability. The Balanced Inclusive Green Growth Index (BIGGI) is also used to evaluate equivalence across pillars. Robustness tests are conducted using Shannon entropy. This study provides empirical insights into the comparative dynamics of inclusive green growth and highlights structural differences in the development trajectories between the two countries.

Keywords: Inclusive Green Growth, BRICS, Sustainable Development, Public Policy

INTRODUCTION

The introduction should include the background, from general to specific issues, the rationale for the chosen object, previous research related to the problem to be studied, the author's proposed solution, contributions such as research gaps (novelty, pioneering, original),

the proposed method, and the expected objectives. Everything the author chooses should explain the rationale without leaving any questions for the reader. All pages should be full with no blank or leftover space.

The referencing system used is *References, Citations & Bibliography* , a tool available for Microsoft Word. However, Mendeley or Zetero can also be used. Please cite using paraphrases, as direct quotations will be detected as plagiarism. Each citation must have a valid reference source, with priority given to sources from scientific journals.

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The Sustainable Development Goals (SDGs) agenda adopted by the United Nations represents a major change in the global development landscape. The SDGs highlight a shared understanding of the opportunities and challenges that will come with countries working toward a more balanced, socially robust, inclusive, and environmentally sustainable growth while maintaining intergenerational stability (Guterrres, 2017). In this context, sustainable development no longer focuses solely on increasing national income, but also include a broader human perspective: lifting people out of poverty, protecting the planet for future generations, and fostering a peaceful, inclusive society are vital for ensuring sustainability for all humans (Gupta & Vegelin, 2016).

The COVID-19 outbreak in early 2020 profoundly transformed the global economic and social landscape. As one of the most widespread public health emergencies in recent history, it has created dual pressures on supply and demand, destabilized financial systems, disrupted international value chains, and heightened macroeconomic uncertainty (Caggiano et al., 2020; Hu et al., 2022; OECD, 2020). Besides its health impact, the pandemic has revealed the fragile structures of many nations—especially those with high inequality, weak social safety nets, and limited environmental resilience (Achim et al., 2022; Topcu & Gulal, 2020). Therefore, recovering from the pandemic requires rethinking growth strategies to focus on resilience, inclusion, and ecological sustainability as key elements of economic renewal (Rosenbloom & Markard, 2020).

Against this background, Inclusive Green Growth (IGG) has become an essential framework that combines the three main aspects of sustainable development—economic prosperity, social equity, and environmental protection. This approach treats marginalized groups as active participants in development, rather than just beneficiaries, through strategies that increase economic opportunities while preserving ecological sustainability. Therefore, IGG acts as a way to promote social justice, boost economic resilience, improve the competitiveness of green industries, and lower long-term environmental risks (Bouma & Berkhout, 2015; Chapman & Shigetomi, 2018; Kourula et al., 2017).

For developing countries, this agenda presents a double challenge: how to balance economic growth and efforts to reduce social inequality without worsening ecological

pressures. The balance among these three pillars—economic, social, and environmental—is the key factor in determining whether growth can truly be called inclusive and sustainable.

The 21st century is often called the "Asian Century," driven by the rise of two major economic powers: China and India. Together, they account for more than one-third of the world's population and play a key role in global economic growth. Although India has not yet experienced the same rapid economic expansion as China, its economy has undergone significant transformation since it began its own economic reform program in 1991. Despite their different socio-political systems, India and China shared one common goal until the late 1970s: prioritizing economic planning to boost growth and maintaining an ideological focus on fairly distributing the benefits of that growth (Taneja, 2020).

Although the political and social systems of the two countries differ greatly—with China adopting a centralized state model and India implementing a parliamentary democracy—both share similar ideological roots in their early development: a focus on strong economic planning and efforts to distribute the benefits of growth evenly. During early industrialization, China built an egalitarian society by prohibiting private ownership and placing economic activities under state control. In contrast, India adopted a mixed economic system, combining the roles of the public and private sectors in a social context still influenced by tradition and hierarchy (Rao, 2011).

However, both China and India face similar challenges in achieving rapid enough economic growth to meet their social aspirations and improve their people's welfare. Although both nations have shown progress, their growth rates are not as fast as those of other East Asian countries such as Japan, South Korea, and Taiwan during the same period. The protectionist policies they implemented early on played an important role in building domestic industrial capacity, which later became the foundation for more competitive development strategies in the subsequent reform era (Bosworth & Collins, 2008; Rao, 2011; Taneja, 2020)

Many previous studies have explored the relationship between economic growth and the environment using the Environmental Kuznets Curve (EKC) framework and research on green growth in BRICS countries (Zulfia, Dwiputri, et al., 2025). However, most of these studies focus on single quantitative analyses or regional groups (e.g. Kamah et al., 2021; Mu'min et al., 2024; Zulfia et al., 2025), and comparative approaches between countries, especially between China and India, are rarely documented in academic literature. To bridge this gap, this study aims to develop the Inclusive Green Growth Index (IGGI) and the Balanced Inclusive Green Growth Index (BIGGI) as a multidimensional evaluation framework, along with a robustness test using the Shannon Entropy approach to assess balance. The IGGI is designed to assess development performance based on three main pillars—economic, social, and environmental—while the BIGGI measures the balance among these pillars, reflecting the extent to which progress in one dimension does not come at the expense of others.

RESEARCH METHOD

Metode penelitian yang digunakan dalam penelitian ini untuk memechkan permasalahan termasuk metode analisis. Metode yang digunakan dalam penelitian dituliskan di bagian ini.

The Inclusive Green Growth Index categorizes the main variables of the study into three dimensions. First, the economic dimension, assessed through indicators such as the GDP growth rate, international trade, and the dependency ratio. Second, the social dimension, which includes employment rate, life expectancy, labor force participation, mortality rate, electricity access, and school enrollment. Third, the environmental dimension, represented by indicators such as carbon emissions, forest area, and greenhouse gas emissions. The following steps outline how the IGGI was compiled, as referenced in the Asian Development Bank (2018) dan Mu'min et al. (2024).

Normalize each indicator's data using the max-min method.

- Normalization for indicators has a positive effect on the preparation of the IGGI.

$$Z = 5\ x \frac{country\ score - minimum\ value}{maximum\ value - minimum\ value} + 1 \quad (1)$$

- Normalization for indicators that have a negative effect on the preparation of the IGGI

$$Z = -5\ x \frac{country\ score - minimum\ value}{maximum\ value - minimum\ value} + 6 \quad (2)$$

After normalization, compute the average of each indicator within each pillar to establish the economic, social, and environmental pillar values. The pillar values are then aggregated to determine the IGGI using the following formula.

$$IGGI = \frac{1}{3}(average\ economic\ pillar) + \frac{1}{3}(average\ social\ equity\ pillar) + \frac{1}{3}(average\ environtmental\ pillar) \quad (3)$$

In addition to calculating the IGGI value, additional calculations are necessary, specifically the IGGI Balance, to determine whether the three pillars perform equally, following these steps:

Calculate the total absolute gap

$$Total\ absolute\ gap = economic\ pillar - social\ equity\ pillar| + |social\ equity\ pillar\ environmental\ pillar| + |environmental\ pillar - economic\ pillar| \quad (4)$$

Normalization of absolute total values

$$CPBi = -5\ x\frac{total\ gap\ score - minimum\ value\ (gap)}{maximum\ value\ (gap) - minimum\ value\ (gap)} + 6 \quad (5)$$

Finally, calculate the BIGGI value using the equation

$$BIGGI = \frac{3}{4}(IGGI) + \frac{1}{4}(CPB) \quad (6)$$

In addition, a robustness test is required to determine whether the three pillars—economic, social, and environmental—are also balanced in other measurements. In this case, Shannon Entropy is used to test this.

Entropy is a measure of uncertainty based on the explanatory power of a continuous or discrete variable (Luo et al., 2018). In this study, the Shannon Entropy measure will be normalized using the following formula, as cited in Busu & Busu (2018),

$$H(X) = -\frac{1}{ln(n)}\sum_{i=1}^{n} p_i Ln(p_i) \quad (7)$$

To produce an output value between 0 and 1. The closer the value is to 1, the more balanced and the better the country's level of green inclusivity.

Table 1. Components of Inclusive Green Growth

Indicator	Source	Unit	Direction
Economics			
GDP per capita growth (annual %)	WDI	annual %	(+)
GDP per capita (constant 2015 US$)	WDI	Per-capita	(+)
Inverse CV of GDP per capita growth	WDI	Intensity	(+)
Trade (% of GDP)	WDI	% of GDP	(+)
HH Market Concentration Index	WITS (World Integrated Trade Solution	Index	(+)
Age dependency ratio	WDI	% of working-age population	(+)
Adjusted savings: net national savings	WDI	% of GNI	(+)
General government gross debt	IMF	% of GDP	(+)
Social			
Employment to population ratio, 15+, total (%) (modeled ILO estimate)	WDI	% of population	(+)
Primary enrollment gender gap	WDI	years	(-)
Life expectancy gender gap	WDI	years	(-)
Labor force participation gender gap	WDI	years	(-)
Life expectancy at birth, total	WDI	years	(+)
Mortality rate, infant	WDI	per 1,000 live births	(+)
People using safely managed sanitation services	WDI	% of population	(+)
Access to electricity	WDI	% of population	(+)
Political Participation Index	Global Change Data Lab	Index	(+)
Environmental			
Total natural resources rents	WDI	% of GDP	(-)
Renewable internal freshwater resources per capita	WDI	Cubic meters/capita	(+)
Water productivity, total	WDI	constant 2015 US$ GDP per cubic meter of total freshwater withdrawal	
CO2 per GDP	WDI	Ton/capita	(-)
Energy intensity level of primary energy	WDI	MJ/$2021 PPP GDP	(-)
Renewable energy consumption	WDI	% of total final energy consumption	(+)

RESULT AND DISCUSSION

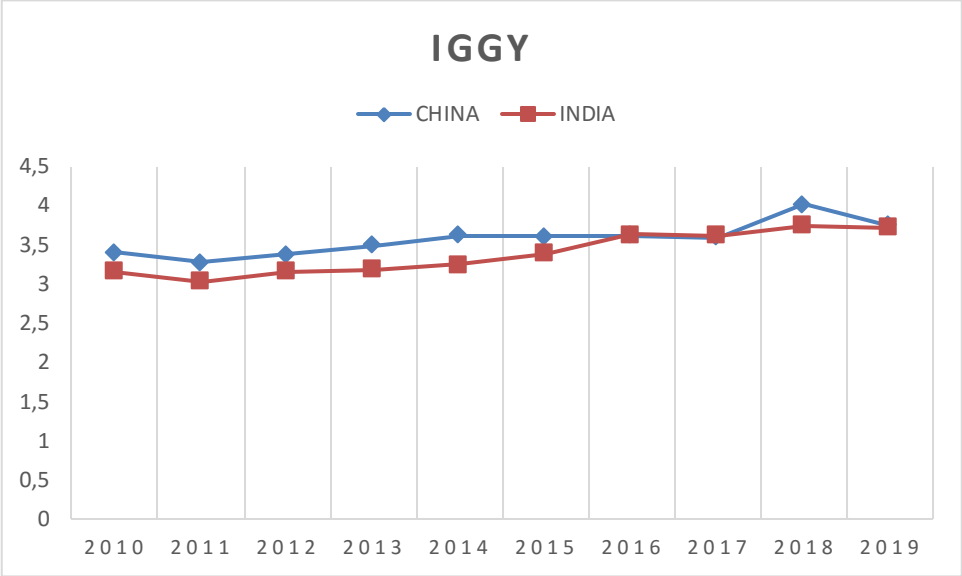


Figure 1. Trends in China and India's Inclusive Green Growth Index from 2010 to 2019 (Pre-Pandemic Covid-19)

Source: Calculated by the authors

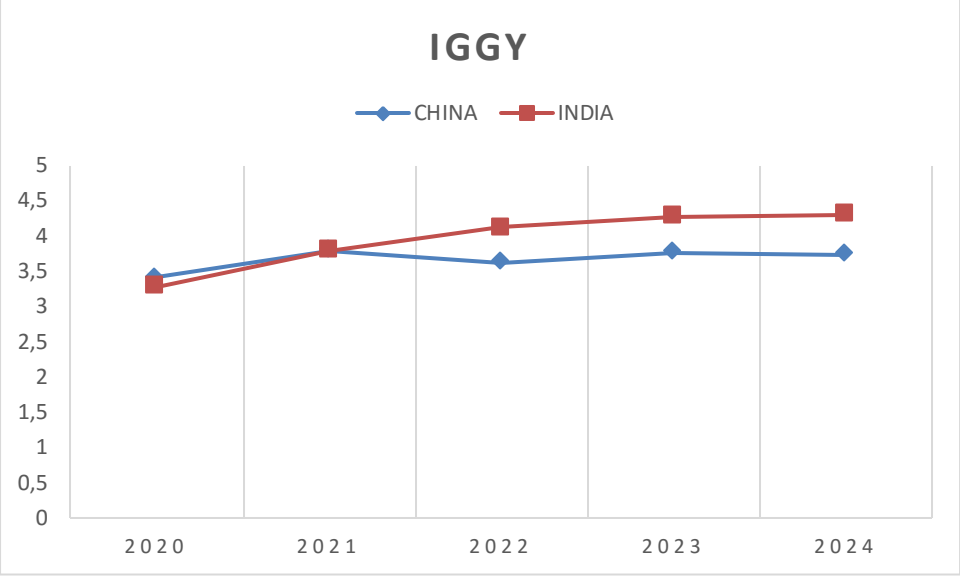


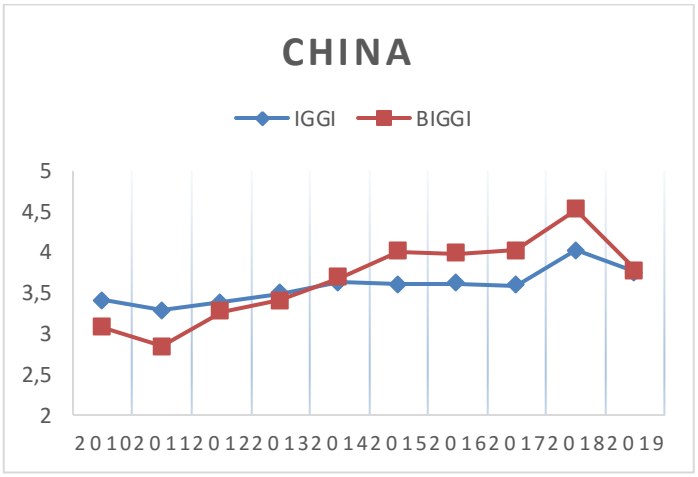
Figure 2. Trends in China and India's Inclusive Green Growth Index from 2020 to 2024 (Pasca-Pandemic Covid-19)

Source: Calculated by the authors

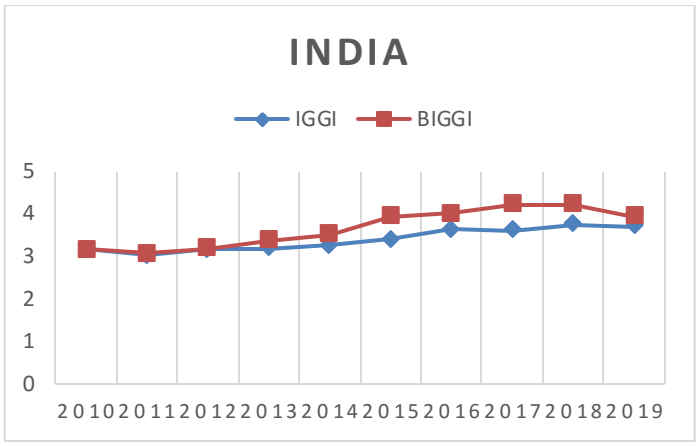
Measurements of inclusive green growth for China and India from 2020 to 2024 show a trend of convergence toward inclusive and sustainable development. Over this five-year

period, China's IGGI has tended to show a slowdown. Meanwhile, India's IGGI has shown a growth trend, indicating a transition toward inclusive green growth. Although China maintained a higher absolute IGGI level throughout the pre-pandemic period (2010 to 2019), reflecting a stronger initial capacity for green growth, India's faster rate of improvement demonstrates that its approach is highly adaptive and integrated across all aspects of development.

The following analysis compares the IGGI and the Balanced Inclusive Green Growth Index (BIGGI) (see Figures 3 and 4). This comparison is particularly important, as trends in the IGGI and BIGGI serve as barometers of balanced economic growth that encompass social and environmental factors. When viewed by country, China's BIGGI rose from 3.07 to 3.76 in the pre-pandemic period, indicating that while there has been steady progress, the balance among the three pillars remains fairly moderate—suggesting that some areas (likely the environmental pillar) may be lagging behind economic growth.



(a)



(b)

Figure 3. Comparison of IGGI and BIGGI Trends in China and India Pre-Pandemic
Source: Calculated by the authors

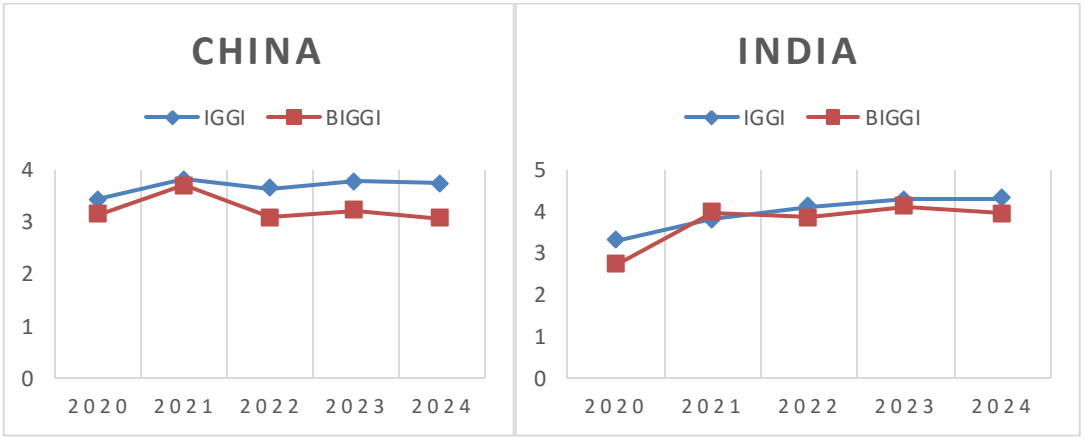


Figure 4. Comparison of IGGI and BIGGI Trends in China and IndiaPasca-Pandemic
Source: Calculated by the authors

Meanwhile, India's BIGGI score rose steadily from 3.1 to 3.9 before eventually declining during the COVID-19 pandemic. This pattern indicates that India continues to strive to improve its overall green growth performance, while achieving more balanced progress across the economic, social, and environmental pillars.

In a direct comparison, China consistently maintained a higher absolute IGGI value throughout most of the pandemic period, indicating a stronger initial capacity for green growth. Meanwhile, India's steady and balanced rise in both IGGI and BIGGI through 2019 signaled a qualitative shift toward more holistic and sustainable development. This convergence pattern suggests that India's inclusive policy framework may have begun to

yield tangible structural results, particularly in the pre-pandemic era, while China, with its robust economy, faces the challenge of improving the environmental aspects of its growth without losing economic momentum.

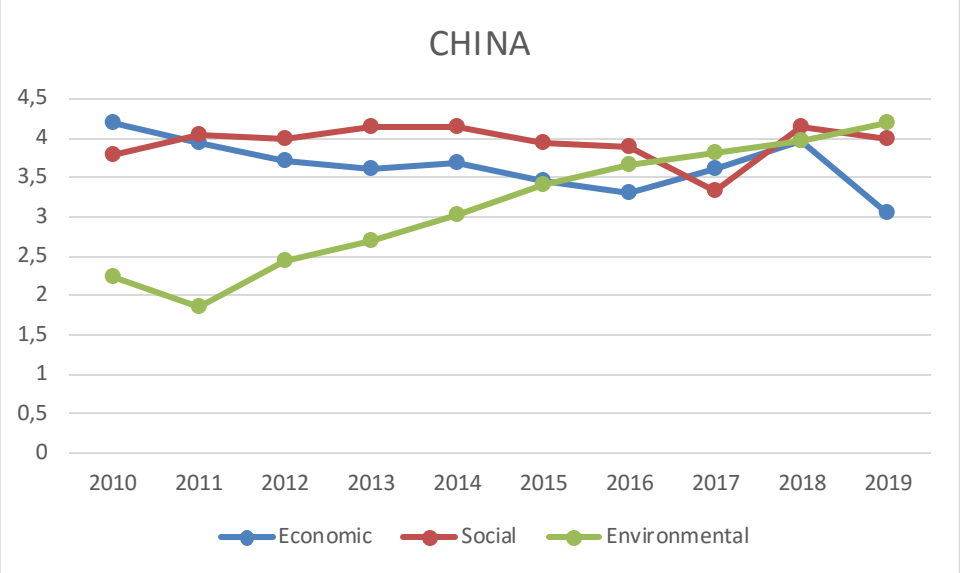


Figure 5. Trends in China's Inclusive Green Growth Index based on each pillar (Pre-Pandemic)

Source: Calculated by the authors

Furthermore, this study breaks down the Inclusive Green Growth Index (IGGI) into its three pillars—economic, social, and environmental—for both China and India. Figure 5 shows that China has experienced fluctuating growth across the economic and social pillars. In this regard, China outperforms India in indicators such as GDP growth, trade share, and life expectancy. However, significant imbalances are evident in the environmental pillar, highlighting the gap between economic progress and environmental sustainability. A considerable gap is visible in the early 2010s.

In China, the dominance of a rapid growth model characterized by high consumption, high emissions, and substantial pollution is at odds with the concept of inclusive green growth. While this model has driven rapid industrial expansion, it has also led to significant wealth disparities, social injustice, and environmental degradation. For example, China's total economy grew from 368 billion yuan in 1978 to 101.6 trillion yuan in 2020, with an average annual growth rate of 9%. However, this success has come with serious environmental and social costs. China's Gini coefficient fell from 0.479 in 2003 to 0.465 in 2019, but it remains above the international warning level of 0.4, indicating enormous income inequality. Moreover, China accounted for 16.34% of global GDP in 2019 while contributing over 27% of worldwide carbon emissions. The cost of environmental pollution is estimated to exceed 8% of the nation's GDP, reaching up to 10% in the economically advanced eastern coastal region (Cooper et al., 2020; Kumar, 2017; Sun et al., 2022).

In response to these challenges, China has committed to peaking carbon emissions by 2030 and reaching carbon neutrality by 2060 (Zhao et al., 2023). This ambitious goal marks a strategic shift toward a low-carbon development path in the post-pandemic era. The move to a green recovery is not only a domestic need but also a geopolitical tool to boost China's role in global sustainability governance (Liu et al., 2022).

Zhao et al. (2023) note that Chinese provinces have integrated green transformation objectives into the "Proposal for Formulating the Fourteenth Five-Year Plan for National Economic and Social Development and the Vision for 2035." These plans emphasize low-carbon development, renewable energy expansion, and green recovery initiatives across various sectors. Notably, the National Development and Reform Commission (NDRC) issued the "Opinions on Accelerating the Establishment of a Green Production and Consumption Regulatory and Policy System" on March 11, 2020. This document outlines a comprehensive framework to foster environmentally sustainable production and consumption practices.

Second, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council jointly issued the " "Guiding Opinions on Building a Modern Environmental Governance System" This directive outlines the institutional framework for environmental governance in China, clarifies the roles and responsibilities of various stakeholders, and reinforces the government's commitment to a multi-stakeholder approach to environmental management.

Third, the People's Bank of China helped introduce the " Green Finance Performance Evaluation Plan for Depository Financial Institutions in the Banking Industry" (July 21, 2020) to standardize green credit assessments and promote sustainable investment. It also collaborated with the China Securities Regulatory Commission and the National Development and Reform Commission to revise the "Green Bond Support Project Catalog," aligning with international green finance standards and expanding support for sustainable industries. The results of these various policy initiatives and collaborative efforts are reflected in the increase in the environmental pillar in the post-COVID-19 era compared to the other two pillars (see Figure 6).

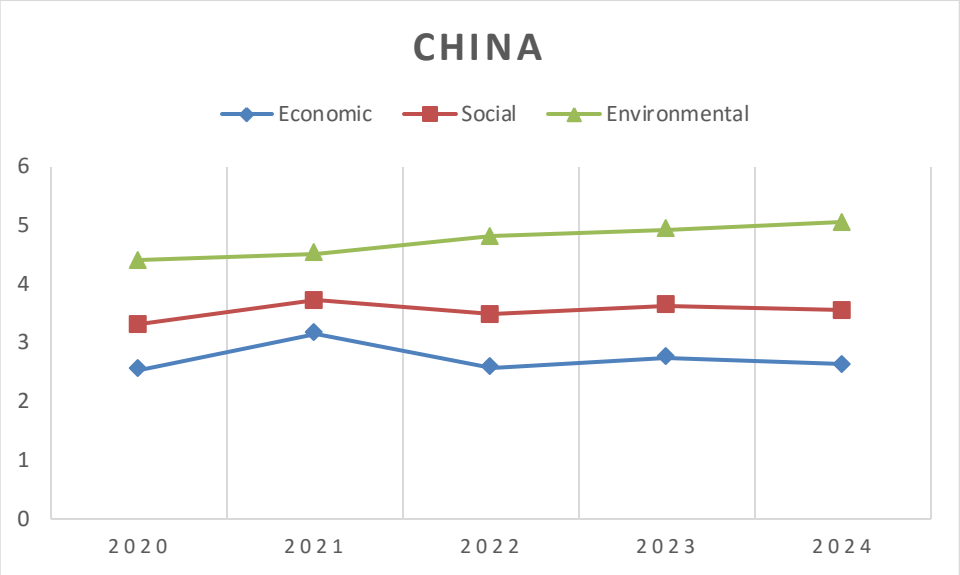


Figure 6. Trends in China's Inclusive Green Growth Index based on each pillar (Pasca-Pandemic)

Source: Calculated by the authors

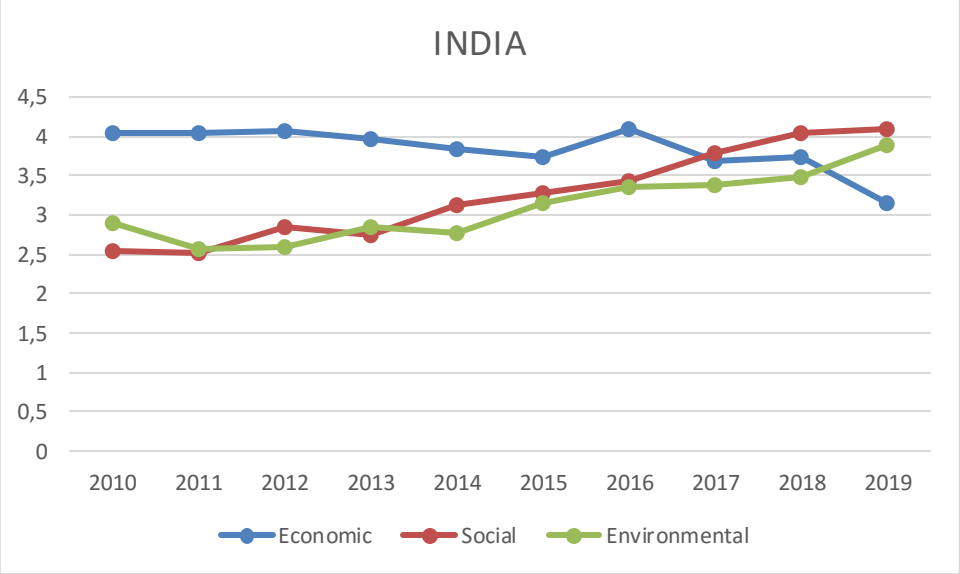


Figure 7. Trends in India's Inclusive Green Growth Index based on each pillar (Pre-Pandemic)

Source: Calculated by the authors

Unlike China, prior to the pandemic, India demonstrated relatively more balanced growth performance in the environmental pillar of the Inclusive Green Growth Index (IGGI). This result may be partly due to the index's standardization scale (1–6), which accounts for

differences between countries. Nevertheless, this finding remains valid upon substantive analysis—India's per capita environmental impact is indeed lower than China's due to its slower industrialization and greater reliance on less carbon-intensive sectors such as agriculture and small-scale industry, with most growth concentrated in services. However, India experienced a decline in the economic pillar through the post-pandemic period (see Figure 8), indicating ongoing structural challenges to its inclusive development.

There was a decline in the economic pillar's value from 2010 to 2019. This may be due to challenges India still faces in poverty alleviation and the distribution of prosperity. Less developed states account for more than 60% of the population living below the poverty line, and the pace of poverty reduction has slowed since the reforms, even though the national average GDP per capita has grown faster. Socially and economically disadvantaged groups—including Scheduled Castes, Scheduled Tribes, Other Backward Classes, minorities, women, and children—have gained the least from economic growth and rising national wealth.

Although India's recent rapid growth has helped lift tens of millions of people out of poverty, its track record in this area is not as impressive as China's. India still faces various internal challenges surrounding class, caste, and identity. While structural barriers to inclusive growth in China are connected to its political system, in India the country's social structure remains the biggest structural barrier (Rao, 2011).

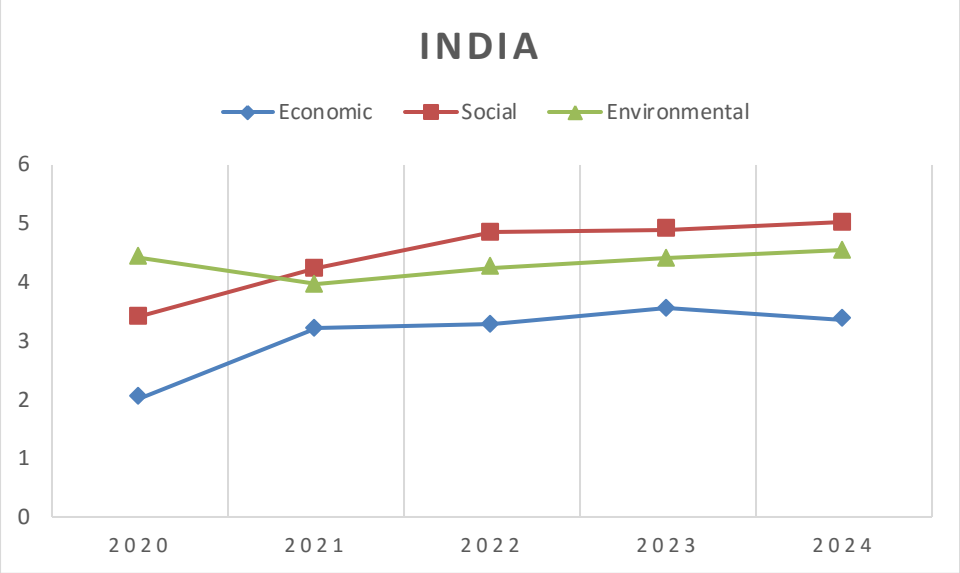


Figure 8. Trends in India's Inclusive Green Growth Index based on each pillar (Pasca-Pandemic)

Source: Calculated by the authors

Inequality in India is very high, especially in terms of wealth and income distribution. According to Dev (2024), the richest 10% of India's population controls 77% of the country's wealth. Meanwhile, in 2017, 73% of newly generated wealth flowed to the top 1% of the population. Additionally, India's 670 million people—who make up half of the poorest

population—only experienced a 1% increase in wealth. India has undergone an economic transformation from agriculture to industry and services in terms of output composition and employment (Bosworth & Collins, 2008; Dev, 2024). However, structural transformation in the Indian labor market has further worsened this inequality. According to Dev (2024), employment-related structural change has indeed taken place, but the decline in the agricultural sector has been largely absorbed by the informal sector, which has relatively low productivity—especially in construction and informal services like trade, hotels, and restaurants. India has a very large informal sector where output and employment are concentrated in small enterprises (Bosworth & Collins, 2008), rather than in high-value manufacturing or technology-intensive industries. India's large informal economy, where micro and small enterprises still dominate output and employment, has the potential to hinder inclusive growth. Despite progress in non-agricultural employment, the quality of job creation remains low.

Robustness Test

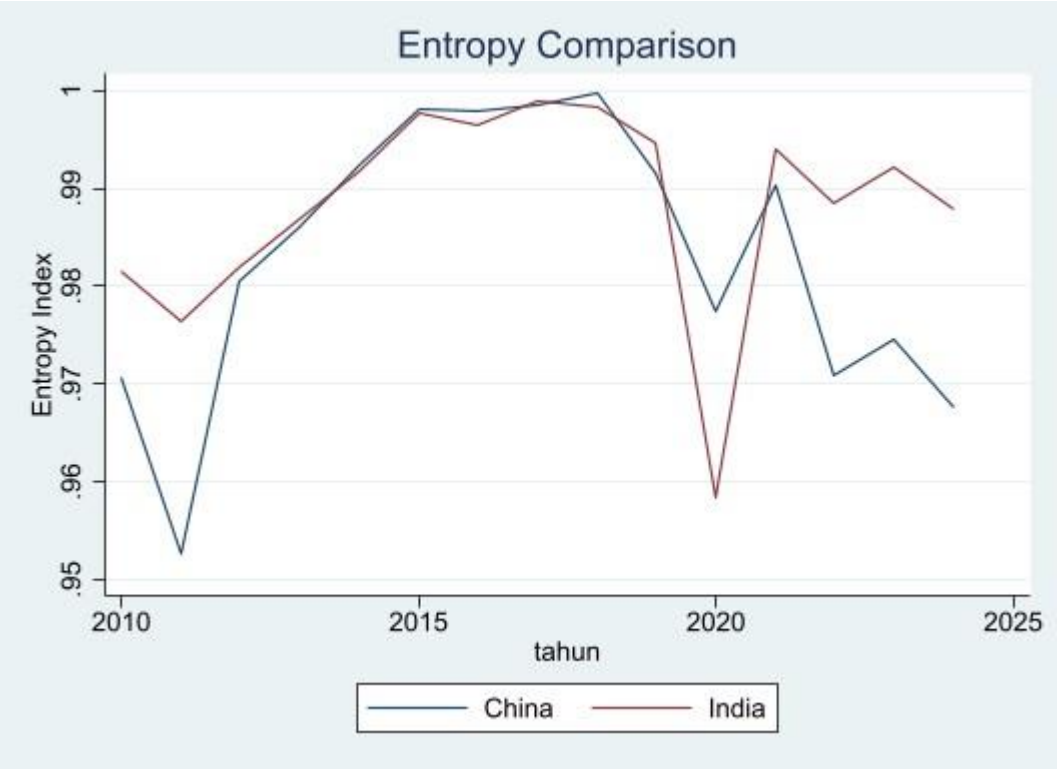


Figure 9. Trends in China and India's Inclusive Green Growth Index measured by Shannon Entropy

Source: Calculated by the authors

The results of the Shannon Entropy calculation show that both China and India have relatively high levels of development balance throughout the 2010–2024 period, with index values approaching 1. This indicates that the distribution of development across the three pillars—economic, social, and environmental—tends to be even in both countries.

However, there are several important dynamics that reflect differences in development characteristics between the two countries. In the early period (2010–2014), India exhibited a relatively more stable level of balance compared to China. This is reflected in China's greater entropy fluctuations, particularly at the beginning of the period, indicating an imbalance among the pillars—likely due to the dominance of economic growth that had not yet been fully offset by the social and environmental dimensions.

Then, during the middle period (2015–2018), both countries experienced a significant increase in entropy values, approaching a maximum point. This indicates a process of convergence toward more balanced development, where economic progress began to be accompanied by improvements in social and environmental aspects. This phase can be interpreted as an optimal period for the integration of inclusive and sustainable development.

Furthermore, during the COVID-19 pandemic (around 2020), a sharp decline was observed in both countries, particularly in India, which experienced the most significant contraction. This decline reflects a major disruption to the balance of development, in which economic and social pressures were not proportionally offset by the capacity of existing systems. Finally, in the post-pandemic period (2021–2024), India demonstrated a relatively faster and more stable recovery in maintaining the balance among the pillars. Conversely, China experienced greater fluctuations and tended to show a gradual decline after 2021. This indicates that although China possesses strong economic capacity, there is a potential trade-off among the pillars—particularly between economic growth and environmental quality or social aspects. Overall, these results are not significantly different from BIGGI measurements, suggesting that IGGI results are robust enough to serve as a measure of green inclusive growth, albeit with different weightings—BIGGI using CPB and Shannon Entropy results.

A comparison of the Inclusive Green Growth (IGG) trajectories between China and India reveals two distinct development paths, yet both share the same goal: sustainable transformation. China's growth pattern follows an institution-driven top-down approach, characterized by state-led coordination, high industrial capacity, and strong regulatory control (Taneja, 2020). However, this has also resulted in environmental costs due to rapid industrialization, as the country's progress in economic and social inclusivity must be balanced by environmental efficiency.

Conversely, according to Rao (2011), India follows a community-driven bottom-up model, where progress in inclusivity and sustainability is shaped by democratic participation, gradual reforms, and a dynamic civil society. India's lower per capita emissions and more stable environmental index scores indicate that its growth is less carbon-intensive. However, deep-rooted social stratification, unequal asset distribution, and labor informality continue to

hinder the transformation of growth into equitable prosperity. Despite these challenges, India's more stable progress in the IGGI and BIGGI sectors demonstrates improved policy alignment between inclusion, equity, and environmental transition, indicating that a green India. These differences highlight that there is no single path to inclusive green growth—success depends on aligning national capabilities (Ibrahim & Law, 2016), institutional designs (Dwiputri et al., 2018), and policy priorities with sustainability goals.

CONCLUSION

This study constructs and compares the Inclusive Green Growth Index (IGGI) and the Balanced Inclusive Green Growth Index (BIGGI) for China and India during the post-pandemic period 2020–2024. The findings reveal that both countries have made measurable progress in aligning economic expansion with social inclusion and environmental sustainability, though through different development trajectories. China maintained a relatively stable IGGI throughout the period, but its environmental pillar lagged behind, mainly due to its heavy dependence on energy-intensive manufacturing and export-driven growth. In contrast, India showed a quicker rate of improvement and reached a higher BIGGI score by 2024, indicating that its growth pattern is becoming more balanced across economic, social, and environmental dimensions. This contrast highlights that sustainable progress depends not just on the size of growth, but on how effectively institutional and policy systems incorporate inclusiveness and ecological priorities into development.

This study compiles and compares the Inclusive Green Growth Index (IGGI) and the Balanced Inclusive Green Growth Index (BIGGI) for China and India during the post-pandemic period of 2020–2024. The findings indicate that both countries have made measurable progress in aligning economic expansion with social inclusion and environmental sustainability, albeit through different development trajectories. China maintained relatively stable IGGI growth throughout the pre- and post-pandemic periods; however, its environmental pillar lagged in the pre-pandemic era, primarily due to its high reliance on energy-intensive manufacturing and export-driven growth. India demonstrated a steady pace of improvement despite a decline in its BIGGI balance in the post-pandemic period, indicating that its growth pattern is balanced across economic, social, and environmental dimensions. These differences highlight that sustainable progress depends not only on the scale of growth but also on how effectively institutional systems and policies integrate inclusivity and ecological priorities into development.

While this study focuses on China and India, the insights gained may also be relevant to Indonesia and other developing Southeast Asian countries. Indonesia's growth continues to depend on natural resource extraction and energy-intensive industries, similar to the early development stages of China and India. Achieving inclusive green growth in Indonesia requires not only environmental policies but also expanding green jobs, enhancing human resource readiness for the green transition, and ensuring equitable access to sustainable

financing. Strengthening institutions remains essential—particularly in improving coordination among ministries, regional governments, and local stakeholders—to align environmental objectives with social welfare and development goals.

This study is limited by its reliance on macro-level secondary data, which may not fully capture regional disparities in China and India. Furthermore, the construction of the IGGI and BIGGI relies on selected indicators and normalization methods that may differ under alternative weighting schemes. Finally, the descriptive-comparative approach does not establish causality; future studies could employ econometric or structural modeling to examine the dynamic interactions between inclusive growth, institutions, and environmental performance.

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