Why Capital Is Not Enough: Institutional Fragility and Financial Barriers to the Energy Transition in the BRICS

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Article

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Abstract

Capital mobilization is often portrayed as the main bottleneck to decarbonization in emerging economies, yet BRICS countries struggle to scale clean energy even when funding is formally available. This paper argues that capital is a necessary but insufficient condition for the energy transition in the BRICS because institutional fragility creates binding financial barriers. Drawing on a comparative, document-based analysis of Brazil, Russia, India, China and South Africa, the study synthesizes academic literature, international reports and policy documents on clean energy investment, governance and financial systems. It develops a conceptual framework linking political and regulatory risk, fiscal constraints and the role of public development banks to the cost and allocation of capital for low-carbon projects. The analysis highlights common patterns—such as high perceived country risk, policy instability and weak project pipelines—that raise the cost of capital and deter private investment, as well as country-specific institutional configurations that condition outcomes. The paper concludes that improving governance, policy credibility and the design of public financial institutions is as important as mobilizing new capital, and discusses implications for climate-finance strategies and future research on the political economy of the energy transition in emerging markets.

Keywords: energy transition; climate finance; BRICS; institutional fragility; governance; renewable energy investment; green finance; emerging markets

JEL Classification: G20; G28; Q48; Q54; O16

1. Introduction

The decarbonization of the global economy has brought unprecedented attention to the problem of financing the energy transition, particularly in emerging markets. The BRICS countries – Brazil, Russia, India, China and South Africa – are central to this challenge. They account for a large and growing share of global energy demand, significant reserves of fossil fuels, and rapidly urbanizing populations. At the same time, they are increasingly exposed to both physical climate risks and transition risks, as global policy, technology and investor preferences shift toward low-carbon pathways. In this context, the availability and cost of capital have become key concerns in policy debates and academic research on sustainable finance.

A dominant narrative in climate-finance discussions portrays the transition gap in emerging economies primarily as a problem of insufficient capital. Estimates of the trillions of dollars required annually for clean energy investment often lead to calls for scaling up green funds, blended finance and international climate flows. This narrative implicitly assumes that, if enough capital is mobilized, the energy transition will follow. However, the experience of the BRICS suggests a more complex reality. Despite the rapid growth of sustainable finance instruments, the creation of dedicated green funds and the rising interest of institutional investors, clean energy deployment in many BRICS

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remains below what would be expected given their economic size, resource endowments and projected energy needs.

This paper argues that capital is a necessary but insufficient condition for the energy transition in the BRICS because institutional fragility creates binding financial barriers. Institutional fragility is understood here as a constellation of political, regulatory and administrative weaknesses – including policy instability, governance deficits, fiscal constraints, weak project preparation capacity and limited coordination between public and private actors. These factors shape how risks are perceived and priced, how financial resources are allocated, and whether announced climate-finance commitments are translated into bankable projects on the ground. In other words, they mediate the relationship between "available capital" and effective low-carbon investment.

The central puzzle addressed in this study is why substantial pools of global and domestic capital coexist with persistent underinvestment in clean energy in the BRICS. Rather than treating institutions as a background control or as an ex post explanation for implementation problems, the analysis places institutional and political factors at the core of the inquiry. It examines how institutional fragility influences the cost of capital, the structure of financial intermediation and the credibility of policy frameworks, thereby affecting the risk-return profile of renewable energy and other low-carbon investments. By focusing on these channels, the paper seeks to move beyond simple claims that "more money is needed" and to show why, under certain institutional configurations, additional capital alone may fail to close the transition gap.

The contribution of the paper is threefold. First, it synthesizes and systematizes dispersed literature on climate finance, institutional quality and energy transition in the BRICS, bringing together insights from finance, political economy and development studies. Second, it develops a conceptual framework that links institutional fragility to financial barriers, emphasizing mechanisms such as political and regulatory risk premia, weak project pipelines, fiscal space limitations and the dual role of public development banks. Third, it provides a comparative, document-based analysis of the five BRICS countries, highlighting both common patterns and country-specific institutional arrangements that shape the effectiveness of capital mobilization for the energy transition.

Methodologically, the paper relies on a qualitative, document-based approach. It draws on academic studies, reports from international organizations, national policy documents, and materials from public development banks and other financial institutions. Rather than constructing a new quantitative dataset, the analysis maps and interprets existing evidence on governance, financial structures and energy transition strategies in the BRICS. This approach is well suited to the objective of understanding how institutional configurations condition financial outcomes, and it aligns with the growing body of work that examines the political economy of climate finance and the role of public institutions in shaping markets for sustainable investment.

The remainder of the paper is structured as follows. Section 2 reviews the literature on finance and the energy transition, and on the role of institutions and governance in shaping climate and energy outcomes, with particular attention to emerging economies. Section 3 presents the conceptual framework, defining institutional fragility and financial barriers and discussing the role of public development banks and international coordination. Section 4 applies this framework to the BRICS, providing a comparative analysis of institutional and financial obstacles to the energy transition in Brazil, Russia, India, China and South Africa. Section 5 discusses the implications of the findings for policy design and for the broader debate on climate finance in emerging markets. Section 6 concludes and outlines avenues for future research.

2. Literature Review

2.1. Finance and the Energy Transition

A rapidly expanding literature examines the role of financial systems in enabling or constraining the low-carbon transition. Early work tended to treat finance as a supporting background condition, proxied by indicators of financial development or depth, and focused primarily on how access to

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credit, stock market development or foreign capital flows correlate with energy use, emissions and growth. More recent contributions place the energy transition itself at the center of the analysis and investigate how different financial channels – bank lending, capital markets, institutional investors and innovative instruments – affect investment in renewable energy and other low-carbon assets. Comprehensive reviews by Fan (2025) and Ramos Farroñán et al. (2025) show that most empirical studies find a positive association between financial development and the deployment of renewables in both advanced and emerging economies, although results depend on the composition and quality of financial intermediation.

Within this broad field, a first strand of research emphasizes green finance as a distinct subset of sustainable finance. Studies synthesize the evolution of green bonds, green loans and other labeled instruments, and discuss how they can lower the cost of capital for clean energy through use-of-proceeds commitments, signaling effects and support from public institutions. Conceptual overviews highlight the proliferation of green finance schemes, taxonomies and disclosure frameworks, while also pointing to challenges such as greenwashing, limited project pipelines and fragmented standards. Systematic reviews of economic instruments for renewable energy deployment in emerging economies show that financial tools – including concessional loans, guarantees and blended-finance structures – have been crucial for scaling up specific technologies, but their effectiveness hinges on the broader policy and institutional environment in which they operate.

A second strand examines the impact of financial innovation and digital finance on the energy transition. Recent studies document how FinTech, digital lending platforms and alternative data can expand access to capital for small-scale renewables and distributed energy resources, particularly in countries with underdeveloped traditional banking systems. Emerging evidence from China and other large emerging economies suggests that digital finance can facilitate investment in clean technologies, improve risk assessment and support green entrepreneurship, thereby accelerating the transition when combined with supportive regulation and climate policies.

A third line of work focuses more explicitly on financial risk and the cost of capital. Analyses by international organizations and policy-oriented research highlight that projects in emerging markets face higher risk premia, reflecting macroeconomic volatility, currency risk and institutional weaknesses. These higher costs of capital can make otherwise viable renewable projects uncompetitive relative to fossil alternatives. Recent empirical studies examine how financial market stress, sovereign risk and global liquidity conditions affect renewable energy investment, including in BRICS economies, and call for stronger domestic financial policies and international de-risking instruments to crowd in private capital.

Overall, the finance–energy transition literature converges on the view that financial systems matter for decarbonization: deeper and more sophisticated finance tends to support clean energy investment, while financial constraints, high risk premia and underdeveloped markets hinder progress. However, many of these studies either treat institutions and governance as control variables or discuss them qualitatively, without placing institutional fragility at the center of the analytical framework. This leads to an incomplete understanding of why abundant capital sometimes fails to translate into concrete low-carbon investment, especially in emerging economies.

2.2. Institutions, Governance and Climate/Energy Finance

Parallel to the work on finance, another body of literature explores how institutional quality and governance shape environmental outcomes, including emissions, energy structures and the effectiveness of climate policies. Studies using cross-country and panel data typically employ indicators of institutional quality – such as government effectiveness, rule of law, control of corruption and political stability – to examine how they interact with energy use, environmental regulation and climate policy performance. Recent contributions in this line find that stronger institutions tend to enhance the effectiveness of environmental and energy policies, supporting cleaner energy mixes and lower emissions for a given level of economic development.

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More recently, these two strands have begun to converge in work that explicitly combines institutions, green finance and renewable energy. For example, Yadav et al. (2024) analyze BRICS economies and show that renewable energy investment reduces CO_2 emissions much more strongly when accompanied by effective governance and green finance; they identify threshold effects in government effectiveness below which additional renewable investment has limited environmental impact. Ben Cheikh (2025) finds that both institutional quality and financial sector size are important drivers of renewable energy development in African countries, with heterogeneous effects across institutional regimes. Other studies highlight that weak institutions can dampen or even reverse the environmental benefits of financial development, as capital may be misallocated or diverted towards carbon-intensive activities when governance is poor.

Within the BRICS, empirical work has examined various combinations of institutional indicators, green finance and environmental outcomes. Some papers investigate how green finance and governance effectiveness jointly influence the relationship between renewable energy investment and CO_2 emissions, generally finding that good governance amplifies the positive environmental impact of green finance and renewables. Others explore how innovation, financial development and institutional quality together shape sustainable growth trajectories, again emphasizing that institutional improvements are needed to fully realize the potential of green and inclusive finance.

In addition to academic studies, policy reports by international organizations stress that enabling institutional environments are critical for mobilizing and effectively using climate finance in emerging economies. Institutions such as the IMF, World Bank, OECD, and UN-linked initiatives argue that countries must strengthen regulatory frameworks, climate-related disclosure regimes and public financial institutions in order to reduce perceived risks, lower financing costs and attract private investment into clean energy. This work emphasizes governance reforms, capacity building and coordination between ministries, regulators and financial intermediaries as key components of successful climate-finance strategies.

Taken together, this literature underscores that institutions are not merely background variables: they condition how finance interacts with the energy system and the environment. Nonetheless, most quantitative studies operationalize institutional quality through aggregate indices and use them as covariates or moderators in regressions focused on emissions or aggregate growth. There is comparatively less work that explicitly theorizes and empirically unpacks the multiple channels through which institutional fragility generates financial barriers to the energy transition, especially in specific country groups such as the BRICS.

2.3. Gaps in the Literature on BRICS

Despite the rapid growth of research on climate finance, green instruments and institutional quality, several gaps remain, particularly with respect to the BRICS. First, while there is a substantial body of empirical work on BRICS that links renewable energy, green finance and environmental outcomes, most of these studies focus on aggregate relationships between variables such as green finance indices, renewable energy shares and CO_2 emissions. They provide important evidence that governance matters for environmental performance but offer limited insight into the specific institutional mechanisms and financial channels through which those effects operate.

Second, the literature tends to prioritize environmental indicators (emissions, energy intensity) over the processes and barriers that shape investment decisions. Much less attention is given to how political risk, regulatory uncertainty, fiscal constraints, state-owned enterprises and public development banks jointly influence the cost of capital, project bankability and the allocation of funds within and across sectors in BRICS economies. Existing studies that do engage with these issues are often single-country case studies or focus on one aspect, such as the role of a particular green bond program or a specific development bank, without situating these within a broader comparative and conceptual framework.

Third, only a small number of contributions explicitly frame institutional fragility as a central explanatory factor for climate-finance outcomes in BRICS, even though policy reports and qualitative

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analyses frequently emphasize the importance of governance, policy credibility and administrative capacity. For example, recent work on inclusive green finance and sustainable development in BRICS highlights the influence of legal and institutional frameworks on the effectiveness of green finance initiatives, but often treats these findings as secondary to the main empirical focus on financial indicators. The political economy literature on energy transition, in turn, has begun to analyze conflicts over who bears the costs and reaps the benefits of decarbonization, yet it seldom connects these distributional struggles to the design of climate-finance architectures in a systematic way for BRICS.

Finally, there is relatively little work that combines a comparative BRICS perspective with a document-based institutional analysis of energy-transition finance. Existing comparative studies either rely solely on econometric techniques with standard institutional indices, or they provide descriptive overviews of each country's green finance policies without integrating them into a unified analytical framework. This creates space for a study that: (i) places institutional fragility at the center of the analysis; (ii) examines how it creates financial barriers to the energy transition across the BRICS; and (iii) synthesizes insights from academic research, policy reports and institutional documents. The present paper seeks to fill this gap by developing a conceptual framework that links institutions and finance, and by applying it to a comparative, document-based analysis of the BRICS energy transition.

3. Conceptual Framework

The starting point of this paper is the claim that capital is a necessary but insufficient condition for the energy transition in the BRICS. The key mediating element is institutional fragility. Rather than treating institutions as a residual category that explains implementation failures ex post, the framework presented here places institutional and political factors at the core of the analysis. It conceptualizes the energy transition finance problem in BRICS as a configuration of risks, incentives and constraints that arise from the interaction between domestic institutions, financial systems and the international monetary and financial architecture.

In this framework, institutional fragility is not understood as a single index or score, but as a multidimensional phenomenon that affects how risks are perceived and priced, how projects are prepared and selected, and how public and private actors coordinate over time. These institutional dimensions generate financial barriers that operate alongside more familiar constraints such as macroeconomic volatility or limited fiscal space. The objective of this section is to clarify these channels and to motivate the comparative, document-based analysis carried out in the subsequent sections.

3.1. Institutional Fragility and Financial Barriers

Institutional fragility, in the sense used here, refers to a configuration of political, regulatory and administrative characteristics that increase uncertainty for investors and limit the state's capacity to shape and sustain long-term development strategies. In the BRICS context, it encompasses features such as volatile policy priorities, weak enforcement of contracts and regulations, fragmented decision-making, pervasive corruption, low bureaucratic capacity and fragile public finances. These factors affect energy transition finance through at least four interrelated channels.

First, institutional fragility shapes the level and composition of perceived risk. When investors and lenders observe unstable governments, frequent policy reversals, opaque regulatory processes or weak judicial systems, they attach higher political and regulatory risk premia to projects. The result is a higher cost of capital, shorter loan tenors and more conservative collateral requirements. Renewable energy projects, which are capital intensive and depend on long-term price and policy visibility, are particularly sensitive to these risk premia. Where institutions are fragile, capital that is in principle available may still not flow to low-carbon projects, or may do so only at prohibitively high cost.

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Second, institutional fragility undermines the development of credible and coherent policy frameworks for the energy transition. The adoption of targets, plans and taxonomies is not sufficient if these are not backed by stable implementation arrangements and clear accountability structures. Frequent changes in subsidy schemes, auction designs, local content rules or environmental licensing procedures can erode investor confidence, even when headline policies appear ambitious. Inconsistent signals between ministries, regulators and state-owned enterprises can further confuse expectations. In such environments, financial institutions may be reluctant to adjust their business models or to build specialized capabilities for green lending, and the pipeline of bankable projects remains thin.

Third, institutional fragility constrains fiscal and administrative capacity. Energy transitions require not only private investment but also public spending on infrastructure, guarantees, planning and social policies. High levels of public debt, rigid budget structures and weak public financial management reduce the state's ability to provide long-term support to green investment or to absorb risks that private actors are unwilling to bear. Administrative capacity limitations, including shortages of skilled staff in energy ministries, regulators and development banks, can delay project preparation, risk assessment and contract management. These constraints translate into transaction costs and delays that further weaken the financial case for low-carbon projects relative to business-as-usual investments.

Fourth, institutional fragility distorts the allocation of capital. Where governance is weak, political connections, short-term considerations and rent-seeking can influence which projects receive funding, regardless of their social or environmental value. Fossil-fuel incumbents may use political influence to maintain favorable treatment in credit allocation, subsidies or regulatory exemptions. The financial system may continue to channel resources towards carbon-intensive sectors, even as formal commitments to climate goals proliferate. In such settings, expanding the overall volume of capital does not necessarily lead to a shift towards low-carbon investments; in extreme cases, it can reinforce existing patterns of carbon-intensive development.

In summary, institutional fragility generates financial barriers not only by raising country risk and the cost of capital, but also by weakening policy credibility, constraining public support functions and distorting capital allocation. These mechanisms help explain why, in some BRICS countries, large pools of domestic savings, international climate funds and development finance coexist with persistent underinvestment in clean energy.

3.2. Public Development Banks and International Coordination

Public development banks and other public financial institutions occupy a central position in the conceptual framework developed here. In principle, these institutions can help overcome some of the financial barriers created by institutional fragility. They can provide long-term credit at lower cost, offer guarantees and other de-risking instruments, support project preparation and crowd in private investment. They can also act as vehicles for implementing government priorities and coordinating complex multi-stakeholder projects. In practice, however, their effectiveness depends on their own governance, mandates and constraints, and on the broader institutional context in which they operate.

In the BRICS, public development banks have played important but heterogeneous roles in financing energy and infrastructure. China's policy banks and state-owned commercial banks have supported large-scale renewable deployment as part of broader industrial and development strategies. In Brazil, the national development bank has been a major financier of wind and other renewables, especially in periods of macroeconomic and political stability. In India, a mix of public and private institutions has been involved in scaling up solar and wind power, with varying degrees of success. In Russia and South Africa, development banks and state-owned utilities have had more limited impact on clean energy expansion, in part due to fiscal and governance challenges.

From the perspective of this framework, public development banks can mitigate financial barriers through three main functions. First, they can absorb and redistribute risks by lending at

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longer tenors, in local currency and with lower collateral requirements than commercial banks would offer, thereby reducing the effective cost of capital for low-carbon projects. Second, they can invest in project preparation, technical assistance and pipeline development, addressing capacity constraints in line ministries and the private sector. Third, they can signal long-term policy commitments by aligning their portfolios with national climate strategies and by imposing environmental and social criteria on their clients. When these functions are performed well, public development banks act as institutional anchors that partially compensate for broader governance weaknesses.

At the same time, public development banks themselves are embedded in domestic political and fiscal structures. They may be subject to political interference in lending decisions, pressured to support non-viable projects for short-term reasons, or constrained by fiscal rules and capital adequacy requirements. Their ability to take on risk may be limited by concerns about credit ratings and access to international capital markets. In such cases, development banks can reproduce rather than correct the distortions created by institutional fragility, channeling resources to politically favored sectors or delaying the reorientation of portfolios toward low-carbon investments.

International financial institutions and coordination mechanisms form another layer of the framework. Multilateral development banks, climate funds and initiatives such as the BRICS New Development Bank can provide additional resources, technical assistance and risk-sharing instruments. They also influence domestic institutional reforms through policy dialogues and conditionalities. However, their impact is mediated by the same institutional features that shape domestic finance. Where domestic institutions are fragile, international finance can be slowed by implementation bottlenecks, misaligned incentives or lack of ownership. Moreover, the global financial architecture – with its reliance on hard currencies and credit ratings – can amplify the effects of perceived institutional weakness in BRICS by making external capital more expensive and volatile.

In this perspective, the effectiveness of both domestic and international public finance hinges on institutional quality broadly defined. Public financial institutions can partially offset institutional fragility, but they are also constrained and shaped by it. Strengthening their mandates, governance and coordination mechanisms is therefore a key component of reducing financial barriers to the energy transition.

3.3. Conceptual Propositions

The conceptual framework developed in this section leads to a set of propositions that guide the subsequent analysis. First, improvements in institutional quality – in terms of policy stability, regulatory credibility, governance and administrative capacity – are expected to reduce perceived risks and the cost of capital for low-carbon investments in BRICS, making existing capital more effective. Second, where institutional fragility is pronounced, increases in the supply of capital alone are unlikely to result in proportional increases in clean energy investment, as financial barriers linked to risk premia, weak project pipelines and distorted allocation patterns remain binding. Third, public development banks and international financial institutions can relax some of these constraints, but their impact will depend on their own governance and on their ability to operate as credible, counter-cyclical and mission-oriented institutions within fragile environments.

These propositions do not take the form of testable hypotheses in a narrow econometric sense, but they structure the comparative, document-based examination of the BRICS in the following section. By applying this framework to each country, the paper seeks to identify how different combinations of institutional characteristics and financial arrangements generate distinct sets of barriers and opportunities for the energy transition.

4. Institutional and Financial Barriers in the BRICS

This section applies the conceptual framework developed above to the five BRICS countries. The aim is not to provide an exhaustive account of each national energy system, but to identify the main institutional features and financial obstacles that condition the effectiveness of capital mobilization for the energy transition. The analysis is based on existing academic studies, reports from

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international organizations and national policy documents, and focuses on the channels emphasized in the framework: perceived risk and cost of capital, policy credibility, fiscal and administrative capacity, the role of public development banks and the allocation of capital between low-carbon and carbon-intensive activities.

4.1. Brazil

Brazil is often cited as a relatively advanced emerging economy in terms of renewable energy, with a historically high share of hydropower and a rapid expansion of wind and, more recently, solar power. Over the past two decades, a combination of policy instruments and public finance has supported this trajectory. Competitive auctions for long-term power purchase agreements, credit lines from the national development bank and specific tax incentives helped build a pipeline of projects and attract both domestic and foreign investors. In periods of macroeconomic stability and clear policy direction, these arrangements contributed to lowering the cost of capital and reducing perceived risks for renewable energy projects.

At the same time, Brazil illustrates how institutional fragility can re-emerge and undermine the effectiveness of capital. Episodes of political turmoil, corruption scandals and abrupt changes in energy and industrial policy have periodically shaken investor confidence. Regulatory decisions affecting tariffs, local content rules and market design have often been subject to legal disputes and last-minute revisions. The governance of key institutions, including the national development bank and the federal energy planning agencies, has at times been influenced by short-term political considerations, leading to inconsistencies between long-term transition objectives and actual project portfolios.

Fiscal constraints have become more binding in recent years, with high public debt and tight budget rules limiting the state's ability to maintain concessional credit at former scales. This has required a recalibration of the role of development banks and increased reliance on private and capital-market financing. In a context of institutional volatility, however, the shift towards greater private participation has not fully compensated for the reduction in public support. Projects in newer segments, such as distributed generation and storage, still face difficulties in accessing long-term, reasonably priced finance, especially in subnational contexts where regulatory and bureaucratic capacity is weaker.

4.2. Russia

Russia's energy system remains heavily dominated by fossil fuels, particularly oil and natural gas, which are central to its export revenues and fiscal base. Renewable energy, with the exception of large hydropower, plays a marginal role in the overall mix. Formal plans for diversification and energy efficiency exist, but they have generally been subordinated to the objective of maintaining the competitiveness of the fossil-fuel complex. In this setting, capital for the energy transition is constrained less by the absence of financial resources than by the political economy of incumbency and the institutional structures that support it.

Institutional fragility in Russia manifests in weak rule of law, concentrated political power and a close intertwining of state and major energy firms. This configuration reduces the incentives of both public and private actors to shift capital toward low-carbon technologies that could undermine established interests. The banking system and capital markets remain oriented toward supporting traditional extractive and infrastructure projects, with limited specialized instruments for green finance. Where renewable projects have been developed, they often rely on ad hoc arrangements and are subject to significant regulatory and policy uncertainty.

International factors further complicate the picture. Sanctions and geopolitical tensions have increased the cost of external finance and limited access to certain technologies and investors. This raises the risk premium on long-term projects and reduces the scope for international climate finance and cooperation to support a domestic energy transition. Even when multilateral or foreign capital is nominally available, institutional and geopolitical risks make large-scale reallocation toward

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renewables unlikely under current conditions. In this sense, Russia illustrates how a combination of institutional fragility and entrenched fossil interests can effectively block the translation of capital into meaningful transition investments.

4.3. India

India faces the dual challenge of rapidly growing energy demand and the need to decarbonize its power sector and broader economy. In the past decade, it has adopted ambitious targets for solar and wind capacity, launched competitive auctions and attracted substantial domestic and international investment into renewable energy. Several public and private financial institutions have developed green products, and international climate finance has supported specific programs. These developments suggest that capital, in various forms, is available and increasingly interested in the Indian transition story.

Yet significant institutional and financial barriers persist. A key constraint lies in the financial health and governance of distribution companies, which are critical counterparties for renewable energy projects. Chronic losses, tariff-setting controversies and delays in payments increase counterparty risk and translate into higher financing costs and stricter contractual terms. Policy implementation has also suffered from inconsistencies between central and state-level authorities, with frequent changes in regulations affecting land acquisition, grid connection and compensation schemes. These factors contribute to uncertainties around project revenues and timelines, weakening the bankability of potential investments.

Public financial institutions have played an important role in supporting large-scale solar and wind projects, including through dedicated credit lines and guarantees. However, their ability to extend support to smaller projects, distributed systems and less creditworthy regions is constrained by balance sheet considerations and broader fiscal pressures. In addition, currency risk and perceptions of macroeconomic volatility lead foreign investors to demand higher returns, particularly for long-tenor projects. As a result, despite impressive growth in installed renewable capacity, India continues to face a gap between the scale of investment needed for its long-term targets and the volume of capital that actually reaches viable projects. Institutional fragility in key nodes of the energy and financial systems helps explain this gap.

4.4. China

China has become the world's largest investor in renewable energy, rapidly expanding its solar, wind and grid infrastructure while also remaining a major producer and consumer of coal. This duality reflects a distinctive institutional configuration in which strong state capacity, long-term planning and powerful public financial institutions coexist with regional disparities, complex local governance and the continued influence of fossil-fuel interests. The central government has articulated clear goals for energy transition and low-carbon development, which have been integrated into national plans and sectoral strategies. Policy banks and state-owned commercial banks have been instrumental in channeling large volumes of capital into priority sectors, including renewables.

In this environment, capital constraints at the aggregate level are less binding than in other BRICS. However, institutional factors still create specific financial barriers and distortions. One set of issues concerns the allocation and quality of investment. The combination of ambitious targets, local government incentives and easy access to credit has, at times, led to overcapacity, suboptimal project siting and financial stress in parts of the renewable energy value chain. Another set relates to grid integration, curtailment and the coordination between transmission planning, dispatch rules and investment decisions. Regulatory and governance challenges in these areas affect the revenue stability of projects and, by extension, the risk assessment of lenders and investors.

China's experience underscores the importance of institutional design and governance even in contexts where public financial power is substantial. Strong state-led capital mobilization has delivered a massive increase in low-carbon assets, but questions remain regarding efficiency,

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long-term financial sustainability and the balance between central directives and local implementation. For other BRICS, China offers both a demonstration of what coordinated public finance can achieve and a cautionary tale about the risks of relying solely on capital mobilization without addressing underlying governance and planning challenges.

4.5. South Africa

South Africa faces acute energy and climate challenges. A legacy of coal-dependent electricity generation, aging infrastructure and governance problems in the state-owned utility have produced recurrent supply crises and load shedding. At the same time, the country has substantial renewable energy potential and has implemented a well-known procurement program that initially attracted strong private investment into wind and solar projects. Early rounds of competitive tenders, backed by standardized contracts and support from development finance institutions, helped establish a track record and reduce financing costs.

However, institutional fragility has increasingly constrained the effectiveness of these arrangements. Governance and financial difficulties at the state-owned utility have undermined its role as a reliable off-taker and system planner. Delays in decision-making, renegotiations of procurement processes and uncertainty about future market structures have deterred some investors and increased perceived risk. Fiscal pressures and concerns about contingent liabilities have limited the government's ability to provide guarantees and other forms of support at the scale required for a rapid transition. In addition, broader political and social contestation around coal-related employment and regional development has complicated efforts to design and implement a just transition framework that can anchor long-term investment expectations.

The South African case illustrates particularly clearly how high levels of perceived country and sectoral risk can raise the cost of capital and constrain renewable energy deployment, even when significant interest from private and public investors exists. Institutional reforms aimed at improving utility governance, clarifying market rules and strengthening regulatory independence are therefore as important as mobilizing additional capital. Without such reforms, the financial architecture of the energy transition will remain fragile, and the gap between available funds and effective investment is likely to persist.

Taken together, the BRICS cases show that while the specific manifestations of institutional fragility and financial barriers differ across countries, certain patterns recur: elevated risk premia linked to political and regulatory uncertainties, constraints on public financial institutions, weak or volatile policy frameworks and the persistent influence of carbon-intensive incumbents. These patterns support the central argument of the paper that capital alone is insufficient to drive the energy transition in the absence of robust, credible and well-governed institutions.

5. Discussion and Policy Implications

The comparative analysis of the BRICS highlights a central theme of this paper: the effectiveness of capital in driving the energy transition depends critically on institutional conditions. In all five countries, there is evidence of substantial financial resources that could, in principle, be mobilized for low-carbon investment. Domestic savings, public development banks, international climate funds and private investors have shown increasing interest in renewable energy and related infrastructure. Yet the pace and composition of the transition remain uneven and, in several cases, insufficient relative to stated climate goals.

A first implication is that high perceived country and sectoral risk, rooted in political and regulatory uncertainties, plays a decisive role in shaping the cost and availability of capital. Brazil's episodes of policy reversal, India's challenges with distribution company finances, South Africa's utility governance crises and Russia's geopolitical tensions all translate into higher risk premia and more cautious lending practices. Even in China, where state capacity and public finance have delivered large-scale renewable deployment, governance and coordination issues have created inefficiencies and integration problems. These experiences suggest that improving the credibility,

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transparency and stability of energy and climate policies can be as important as, if not more important than, expanding formal green finance instruments.

A second implication concerns the role of public development banks and other public financial institutions. The BRICS cases confirm that these actors can be powerful catalysts for the energy transition when their mandates, governance and balance sheets are aligned with long-term low-carbon strategies. They can lower the cost of capital, extend maturities, support project preparation and crowd in private investors. At the same time, they are vulnerable to the broader institutional environment: politicized lending decisions, fiscal constraints and governance weaknesses can limit their impact or divert resources towards carbon-intensive activities. Strengthening the autonomy, transparency and technical capabilities of development banks, and embedding climate objectives in their operational frameworks, emerges as a core policy priority.

A third implication is that institutional fragility affects not only the quantity of investment but also its quality and distribution. Where institutional checks and balances are weak, capital may be allocated to projects that do not contribute meaningfully to decarbonization or that exacerbate social inequalities. This risk is particularly salient in large, state-driven investment programs, where the pressure to meet capacity targets can overshadow considerations of system integration, environmental integrity and just transition. Conversely, contexts with stronger participatory mechanisms and regulatory oversight may be better positioned to align capital flows with broader development goals, even if their aggregate financial firepower is smaller.

For policymakers in BRICS and other emerging economies, these findings point towards a multi-dimensional climate-finance agenda. Efforts to mobilize additional capital, whether through green bonds, blended finance or international facilities, need to be complemented by reforms that enhance institutional quality. This includes improving regulatory governance in the energy and financial sectors, strengthening the rule of law and contract enforcement, building bureaucratic capacity for project preparation and monitoring, and clarifying the roles and responsibilities of different public actors. Without such reforms, new climate-finance initiatives risk underperforming or reinforcing existing patterns of carbon-intensive investment.

International policy debates also need to recognize the interaction between domestic institutions and the global financial architecture. The reliance on hard-currency finance, the importance of credit ratings and the structure of risk-weighting frameworks can amplify the impact of perceived institutional fragility on the cost of capital in emerging markets. Initiatives to provide guarantees, local-currency instruments and other de-risking tools can help mitigate these effects, but their success will depend on sufficient domestic ownership and institutional capacity. In the case of the BRICS, mechanisms such as the New Development Bank offer a potential platform for collective action on these issues, although their current scale and design remain limited relative to the needs of the transition.

Finally, the analysis has implications for research. The findings support the view that studies of climate finance and energy transition in emerging economies should move beyond aggregate correlations between financial development, renewable energy shares and emissions. There is a need for more work that explicitly theorizes and empirically investigates the institutional mechanisms through which financial barriers arise, and that combines macro-level indicators with sectoral and project-level evidence. The comparative, document-based approach adopted here represents one step in that direction, but further research using mixed methods and more granular data could deepen understanding of how institutional reforms translate into changes in risk perception, capital costs and investment patterns.

6. Conclusions

This paper has argued that capital is a necessary but insufficient condition for the energy transition in the BRICS. By developing a conceptual framework focused on institutional fragility and applying it to a comparative analysis of Brazil, Russia, India, China and South Africa, the study has shown how political, regulatory and administrative characteristics shape the financial landscape in which low-carbon investments are made. The core finding is that institutional weaknesses generate

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financial barriers that prevent available capital from being fully deployed for the transition. These barriers manifest as elevated risk premia, unstable policy frameworks, constrained public support functions and distorted patterns of capital allocation.

The analysis contributes to the literature in three main ways. First, it synthesizes dispersed insights from climate finance, institutional economics and energy transition studies, placing institutions at the center rather than treating them as background controls. Second, it elaborates specific channels through which institutional fragility affects the cost and allocation of capital, thereby providing a more fine-grained understanding of why additional funding does not automatically translate into increased clean energy investment. Third, it offers a comparative, document-based examination of the BRICS that highlights both common patterns and country-specific configurations of institutions and finance.

For policymakers, the central implication is that strategies to accelerate the energy transition in emerging economies must go beyond mobilizing new capital. Reforms that improve policy credibility, regulatory quality, governance of public financial institutions and administrative capacity are essential complements to financial innovations and international climate-finance commitments. In the absence of such reforms, even well-designed green finance mechanisms may have limited impact, and the gap between climate ambition and implementation is likely to persist.

The paper has limitations that create opportunities for future research. The use of qualitative, document-based methods allows for a broad comparative perspective but does not provide the kind of causal identification that econometric approaches can offer. The focus on five large emerging economies also leaves open questions about the generalizability of the findings to smaller or lower-income countries with different institutional histories and financial structures. Further studies could build on this framework by constructing quantitative indicators of institutional fragility tailored to energy and climate finance, by examining specific sub-sectors such as transmission networks or distributed energy, or by analyzing the micro-level behavior of financial institutions in response to institutional reforms.

Despite these limitations, the evidence reviewed here supports a clear conclusion: in the BRICS, and likely in many other emerging economies, solving the climate finance challenge requires addressing institutional fragility at least as much as it requires mobilizing new funds. Capital that is abundant on paper but constrained by governance gaps, policy instability and weak public institutions will not be sufficient to deliver a timely and socially just energy transition. Strengthening institutions is therefore not a secondary or long-term concern; it is a central component of any realistic strategy to align financial systems with climate goals.

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