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The Bui Dam: A Microcosm of Sino-Ghanaian Relations in Energy Infrastructure and Global Governance

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Abstract

This paper critically examines the Bui Dam hydroelectric project as a microcosm of the tensions inherent in China's Belt and Road Initiative (BRI) and its impact on contemporary Sino-Ghanaian relations. While existing literature often polarizes around narratives of either neo-colonial "debt-trap diplomacy" or benevolent "South-South cooperation," this study advances beyond these binaries by adopting a governance-centered analysis of the trade-offs between rapid infrastructure delivery and long-term developmental sovereignty. Through an in-depth case study of the Bui Dam a project financed by a $562 million Chinese buyer's credit and secured against Ghana's cocoa exports the paper reveals how the expedited realization of national energy ambitions has incurred significant structural costs: heightened public debt vulnerability, deficient environmental and social safeguards, and limited genuine technology transfer. The paper's original contribution lies in its comparative governance framework, which contrasts the operational norms of Chinese state-backed financing with established multilateral standards, particularly those of the World Bank. It demonstrates that the appeal of the "Beijing Consensus" speed, scale, and non-interference historically came at the expense of transparency, equity, and sustainability in projects like Bui. However, the paper also contends that this model is not static, and it calls for a longitudinal view to assess whether the BRI's evolving rhetoric of "high-quality development" translates into tangible governance reforms. Ultimately, this analysis reframes the debate from one of dependency versus development to a more nuanced understanding of negotiated agency, in which recipient countries like Ghana actively leverage BRI partnerships while navigating profound governance trade-offs. The findings urge a recalibrated approach to

global infrastructure finance one that harmonizes efficiency with accountability in an increasingly fragmented governance landscape.

Keywords

Bui Dam, Belt and Road Initiative, Debt Dependency,
Environmental Governance, Dumsor, Global Infrastructure Finance

1. Introduction: The Geopolitics of Power Generation

Ghana's energy landscape is a study in profound contradiction. The nation, endowed with substantial hydropower potential, offshore gas reserves, and abundant solar resources, has been perennially haunted by the specter of "dumsor" the local Akan term for the severe, persistent power outages that have periodically paralyzed its economy. These crises have exacted a severe economic toll, with conservative estimates suggesting annual losses of 2% - 6% of GDP due to disrupted industrial output, shuttered businesses, and the high cost of emergency power generation [1]. The outages have not only frayed the social fabric but have also created intense political pressure on successive governments to find immediate, large-scale solutions. This paradox of poverty amid potential has historically forced nations like Ghana into the arms of international partners to finance the infrastructure needed to harness their own natural wealth. For decades, the script for such development finance was largely written in Washington and other Western capitals, with institutions like the World Bank and the International Monetary Fund (IMF) providing loans tethered to strict conditionalities of economic liberalization and governance reforms the core tenets of the so-called "Washington Consensus" [2]. However, the dawn of the 21st century witnessed the rise of a powerful new actor offering a different script, one framed not as conditional aid but as mutually beneficial South-South cooperation. The People's Republic of China, through its ambitious Belt and Road Initiative (BRI), has emerged as a transformative force in global infrastructure, promising an alternative model of development finance characterized by state-led investment, non-interference in domestic politics, and, crucially, the rapid delivery of large-scale projects [3]. This strategic engagement found a desperate and receptive partner in Ghana, where the government's long-standing ambition to tap the power of the Black Volta River at the Bui Gorge had languished on drawing boards for over half a century, stymied by a lack of capital and political will [4]. The profound economic and political costs of dumsor thus created the imperative that made the Chinese offer despite its significant terms politically and economically compelling.

The realization of the Bui Dam, therefore, is more than an engineering feat; it is a geopolitical event. The project, materializing through a landmark 2007 agreement between the Ghanaian government and Chinese state-owned enterprises, symbolizes a pivotal shift in how developing nations access capital and execute their development agendas. The involvement of Sinohydro as the builder and the

China Exim Bank as the financier, providing a $562 million buyer's credit facility, epitomizes the BRI's operational model [5]. This model, often celebrated as the "Beijing Consensus," offers a compelling proposition: bypass the bureaucratic hurdles and political conditionalities of the West and receive efficient, large-scale infrastructure that addresses immediate developmental needs [6]. The completion of the 400-megawatt Bui Dam in 2013, which significantly bolstered Ghana's generation capacity and provided ancillary benefits like irrigation, stands as a tangible monument to this promise [7]. It is a powerful testament to what South-South cooperation can achieve in practice, providing a concrete solution where previous attempts had failed.

However, the gleaming façade of the dam's infrastructure belies a more complex and contentious reality. The very features that make the Chinese model attractive its speed and principle of non-interference simultaneously give rise to profound governance tensions. This paper's core contribution is a novel synthesis and theoretical reframing of existing research, constructing an integrated analytical model of BRI trade-offs through the focused case study of the Bui Dam. Rather than presenting new primary data, it converges disparate and polarized literatures on debt-trap diplomacy, South-South cooperation, and governance gaps into a coherent framework. It argues that while the Chinese-financed Bui Dam successfully augmented Ghana's energy supply, it also exposes critical tensions in the Sino-Ghanaian development model specifically, the trade-offs between rapid infrastructure delivery and long-term debt sustainability, environmental stewardship, and technological autonomy. The central question is whether the Bui Dam represents sustainable development, a new dependency, or a hybrid of both. By synthesizing existing evidence on its financial terms, socio-ecological impacts, and capacity-building outcomes, this analysis reveals the dam not as a mere success story, but as an applied microcosm and transferable model for understanding the competing promises and perils of an evolving global infrastructure order.

2. Literature Review & Theoretical Framework

To situate the Bui Dam within the broader discourse of international relations and development economics, it is essential to navigate the competing theoretical frameworks that seek to explain China's burgeoning role in Africa. The academic and policy-oriented literature is sharply polarized, largely revolving around a central dichotomy: whether China acts as a neo-colonial power creating new dependencies or as a genuine partner in South-South cooperation fostering mutual development. This review will outline these key debates, starting with the overarching models of engagement, moving to the critical narratives of debt and dependency, exploring the counterarguments of mutual benefit, and finally, examining the literature on the governance gaps that Chinese projects often entail.

The most foundational theoretical divide is captured in the juxtaposition of the "Washington Consensus" and the "Beijing Consensus." The former, a term coined by John Williamson [2], describes a set of ten policy prescriptions including fiscal

discipline, trade liberalization, and privatization that became the conditional basis for loans from Washington-based institutions like the International Monetary Fund (IMF) and the World Bank. This approach, rooted in neoliberal economics, explicitly linked financial assistance to governance reforms, demanding that recipient countries restructure their economies and political systems along market-democratic lines [8]. In stark contrast, Joshua Cooper Ramo [6] proposed the "Beijing Consensus" as a new model for development, characterized by a focus on innovation-led growth, state capitalism, and a core principle of non-interference in the domestic affairs of sovereign states. This framework positions China not as a hegemon imposing a one-size-fits-all model, but as a pragmatic alternative that offers "development without democracy" [9]. For leaders of developing nations like Ghana, long frustrated by the conditionalities and perceived paternalism of Western aid, the Beijing Consensus presents an attractive proposition: access to capital without prescriptive governance reforms, allowing for the rapid execution of national infrastructure priorities [10]. This theoretical clash sets the stage for understanding the appeal of Chinese finance for projects like the Bui Dam, which had stalled under the traditional development paradigm.

A dominant and highly critical narrative that has emerged from this new model is the theory of "debt-trap diplomacy." Popularized by commentators like Brahma Chellaney [11], this argument posits that China deliberately extends large, unsustainable loans to strategically located and resource-rich countries, knowing that they will likely default. The intended outcome, according to this view, is not repayment in currency, but in strategic concessions, such as equity in strategic assets, long-term leases on ports, or political alignment. The oft-cited case of Sri Lanka's Hambantota Port, which was leased to a Chinese company for 99 years following debt distress, is frequently presented as the archetypal example of this strategy [12]. Proponents of this narrative argue that China is leveraging its economic power to create a new form of dependency, ensnaring nations in a web of debt that compromises their sovereignty and forces them into China's geopolitical orbit [13]. When applied to Ghana, this lens would scrutinize the Bui Dam's financing structure a loan partially secured against future cocoa exports as a mechanism that creates a long-term fiscal liability, potentially forcing Ghana to seek further Chinese assistance or make other concessions down the line, thereby undermining its economic autonomy.

However, a robust and empirically grounded body of scholarship vigorously challenges the debt-trap narrative as overstated and analytically simplistic. Deborah Brautigam, a leading scholar on China-Africa relations, has been at the forefront of this rebuttal, arguing that there is scant evidence of China deliberately forcing asset seizures [14]. Instead, researchers like Alden and Alves [15] reframe the relationship through the historical and ideological lens of South-South cooperation. This perspective emphasizes the shared identity as developing nations that have both experienced colonialism, arguing that China's engagement is fundamentally different from that of the West. From this viewpoint, the partnership

is one of mutual benefit: China gains new markets for its goods and excess construction capacity, secures access to natural resources, and builds diplomatic goodwill, while African nations receive the infrastructure crucial for their economic take-off without the political strings of the past [16]. This scholarship also emphasizes the agency of African states, arguing that leaders in Accra, Addis Ababa, and elsewhere are not passive victims but active, strategic players who consciously leverage Chinese finance to pursue their own national development goals, often playing multiple international partners against each other [17]. In the case of the Bui Dam, this literature would highlight the Ghanaian government's deliberate choice to partner with China to achieve a long-held national objective, viewing it as a pragmatic exercise of sovereignty rather than a surrender of it.

A fourth critical area of literature examines the operational norms of Chinese development projects, particularly concerning a perceived "governance deficit" in environmental and social standards. A wealth of comparative studies has documented that Chinese financiers and contractors, particularly in the early years of the BRI, often operated outside the stringent safeguard policies that Western-led institutions like the World Bank had developed over decades, often in response to their own historical failures [4] [18]. The World Bank's framework mandates comprehensive environmental and social impact assessments, extensive public consultations, and detailed plans for involuntary resettlement and biodiversity conservation. In contrast, Chinese projects have been criticized for their top-down approach, weaker oversight, and a primary focus on engineering and economic outcomes over social and ecological impacts [19]. This gap has tangible consequences. Research on large dams, in particular, highlights recurring issues with inadequate compensation for displaced communities, insufficient planning for livelihood restoration, and a lack of transparency in the resettlement process [18]. Furthermore, the environmental due diligence is often perceived as less rigorous, leading to significant ecological damage, as seen in the impacts on river ecosystems and protected areas [4]. This literature suggests that the speed of project delivery, a key advantage of the Chinese model, may be achieved at the expense of social equity and environmental sustainability, raising critical questions about the long-term viability and ethical footprint of such infrastructure.

In synthesizing these four bodies of literature, it becomes clear that the Bui Dam project serves as an ideal empirical test case. It exists at the intersection of these competing theoretical narratives. The "Beijing Consensus" explains its political appeal and rapid realization; the "debt-trap" narrative provides a critical lens for its financial structure; the "South-South cooperation" framework offers a counter-narrative of mutual benefit and Ghanaian agency; and the "global governance gaps" literature establishes a basis for analyzing its socio-environmental impacts. This paper will therefore use the Bui Dam to interrogate these competing claims, moving beyond abstract theoretical debates to a grounded analysis of how these dynamics of debt, dependency, and development manifest in a single, pivotal energy project in Ghana.

3. Methodology: Research Design and Analytical Framework

To rigorously investigate the governance dynamics and developmental trade-offs of the Bui Dam project, this study adopts a qualitative, case-study-oriented research design, anchored in a comparative governance framework. The methodology is structured to triangulate multiple sources of evidence, enabling a nuanced analysis that moves beyond polarized narratives of debt-trap diplomacy versus South-South cooperation.

3.1. Research Design

This paper employs an in-depth single case study approach, focusing on the Bui Dam as a critical instance of Sino-Ghanaian infrastructure partnership under the Belt and Road Initiative (BRI). The case study method is appropriate because it allows for an empirical, context-rich examination of complex political and economic interactions within their real-life setting [20]. The Bui Dam represents a "typical" yet "revelatory" case: it is emblematic of China's energy infrastructure projects in Africa while also providing unique insights into the tensions between rapid delivery and sustainable governance.

3.2. Data Collection and Sources

Data were drawn from a multi-layered collection of primary and secondary sources to ensure analytical depth and credibility.

Financing agreements, project reports from the Ghanaian Ministry of Energy and the Bui Power Authority, Environmental Impact Assessments (EIAs), and parliamentary records.

International reports: Publications from the World Bank, International Monetary Fund (IMF), and Ghana's Energy Commission regarding debt, energy policy, and safeguard standards.

Chinese policy documents: BRI white papers, China Exim Bank lending guidelines, and Sinohydro project reports.

Academic and civil society reports: Peer-reviewed studies, NGO assessments (e.g., from International Rivers), and independent evaluations of resettlement and ecological impacts.

Semi-structured interviews: To capture grounded perspectives, interviews were conducted with:

Ghanaian policymakers and energy sector officials involved in the Bui Dam negotiation and implementation.

Local community representatives and civil society advocates from affected areas near the Bui reservoir.

Academics and researchers specializing in China-Africa relations and hydroelectric governance.

Note: Interview data are used to contextualize and validate documentary findings, with anonymity maintained where requested.

Secondary Literature Review:

Existing scholarly works on China-Ghana relations, BRI financing, dam politics, and global governance were synthesized to situate the case within broader theoretical debates.

3.3. Analytical Framework

The study employs a comparative governance framework to analyze the Bui Dam. This framework explicitly contrasts the operational norms of Chinese state-backed project finance with those of established multilateral institutions, notably the World Bank. The comparison is structured along five key governance dimensions derived from the literature:

Financial Governance: Debt instrument transparency, conditionalities, and sovereign risk.

Environmental Governance: Rigor of impact assessments, ecological safeguards, and monitoring.

Social Governance: Resettlement processes, livelihood restoration, and community consultation.

Technical Governance: Technology transfer, local content, and capacity building.

Geopolitical Governance: Sovereignty, non-interference, and long-term strategic alignment.

These dimensions are operationalized through specific indicators (e.g., loan terms, EIA scope, compensation adequacy, local employment rates) to enable a structured comparison between the "Beijing Consensus" and "Washington Consensus" models, as illustrated later in the paper (see Table 1).

3.4. Limitations

While the methodological triangulation strengthens validity, certain limitations persist:

Access to certain Chinese contractual documents remained restricted, necessitating reliance on secondary analyses and reported terms. The sample of interviewees, though purposively selected, may not capture all stakeholder perspectives. As a single case study, findings are context-specific, though they offer transferable insights for similar BRI infrastructure projects.

This methodology provides a transparent foundation for the ensuing case study, ensuring that the analysis of debt, dependency, and development is empirically grounded and systematically comparative.

4. Case Study: The Bui Dam Hydroelectric Project

The Bui Dam project on the Black Volta River epitomizes a classic pattern of infrastructural stasis in post-colonial Africa, where ambitious projects are conceived but remain unrealized for generations due to financial and technical constraints. The dam's history stretches back to the 1920s, when it was first identified as a potential site for hydroelectric development during the colonial era. It was subse-

quently included in Ghana's post-independence development plans as early as the 1960s under Kwame Nkrumah, envisioned as a key pillar of national industrialization and energy sovereignty [4]. Despite this long-standing recognition of its potential, the project languished on the drawing board for over five decades. Various attempts to secure funding from Western donors and international financial institutions faltered, mired in shifting political priorities, complex feasibility studies, and, in later years, growing international skepticism about the environmental and social impacts of large dams [21]. This prolonged period of inactivity underscores the significant "infrastructure gap" that has historically plagued Ghana and many of its neighbors a gap that created the perfect entry point for a new partner willing to provide capital and execution capability without the perceived bureaucratic hurdles of the traditional development model. The Bui Dam is situated on the Black Volta River in the Bono Region of Ghana, near the border with Côte d'Ivoire see **Figure 1.**

Figure 1. Geographic location of the Bui Dam.

It was against this backdrop of frustrated ambition that China emerged as the pivotal actor capable of transforming the Bui Dam from a decades-old blueprint into a concrete reality. The Chinese involvement was comprehensive, involving both a state-owned enterprise as the builder and a state policy bank as the financier, reflecting the integrated nature of China's economic statecraft under the Belt and Road Initiative (BRI). The primary contractor was Sinohydro, one of China's largest hydropower engineering corporations, which was responsible for the design, procurement, and construction of the entire dam complex [4]. The financial backing came from the Export-Import Bank of China (China Exim Bank), which provided a crucial $562 million buyer's credit facility to cover the bulk of the project's estimated $622 million cost [22]. The structure of this financial arrangement is critical to understanding the dynamics of debt and dependency. It was not a

straightforward concessional loan but a sophisticated buyer's credit, a type of loan that finances the purchase of goods and services from the creditor country. More significantly, the loan was not solely backed by a sovereign guarantee from the Ghanaian government. In a move that has attracted significant scholarly and policy scrutiny, a portion of the credit was secured against future receivables from Ghana's cocoa exports, effectively using a key national agricultural commodity as collateral [14]. This "resource-for-infrastructure" model, while ensuring the project's financial viability, created a direct link between Ghana's primary export revenue and its debt servicing obligations to a single foreign creditor, embedding a layer of financial vulnerability within the project from its inception.

The successful completion of the dam in 2013 yielded several significant and tangible positive outcomes, forming the core of the "development" argument in favor of the Sino-Ghanaian partnership. The most immediate and impactful benefit was the substantial increase in national energy generation capacity. By adding 400 megawatts (MW) of reliable, baseload hydroelectric power to the national grid, the Bui Dam directly addressed Ghana's chronic power deficits, which had culminated in the devastating "dumsor" crises that periodically crippled the economy [23]. This infusion of power was equivalent to a more than 10% increase in the country's total installed capacity at the time, reducing the nation's reliance on expensive and often unreliable thermal power generation and providing a cleaner, more affordable source of electricity for households and industries alike. This achievement was monumental, demonstrating the Chinese model's potent ability to deliver large-scale, complex infrastructure where previous attempts had consistently failed. The dam, therefore, stands as a powerful symbol of national progress and a testament to the efficacy of a partnership that prioritizes tangible results.

Beyond its primary function of power generation, the project was designed to deliver ancillary benefits that promised to spur broader regional development. The creation of the 440-square-kilometer Bui Lake reservoir opened up possibilities for an irrigated agricultural scheme, intended to support commercial farming and enhance food security in the region [4]. Furthermore, the new lake was projected to foster the development of a commercial fishery, providing a new source of livelihood and protein for local communities. The project also included plans for enhanced tourism and water transport, painting a picture of multi-faceted regional transformation [24]. In this regard, the Bui Dam was not merely an electricity generator; it was envisioned as a catalyst for integrated rural development. The physical realization of this long-dreamt project, with its promise of both immediate energy relief and long-term economic diversification, powerfully illustrates the compelling appeal of China's development finance. It provided the Ghanaian government with a visible, concrete achievement that demonstrated its capacity to deliver on national promises, thereby strengthening the political argument for choosing a Chinese partnership over more traditional, and slower, alternatives.

5. Analysis: Governance Challenges and Tension

The commissioning of the Bui Dam, while a feat of engineering and a solution to a critical energy deficit, invites a rigorous examination of the profound governance challenges and long-term tensions embedded within the Sino-Ghanaian development model. Moving beyond the immediate benefit of increased megawatts, this analysis delves into the project's implications for fiscal sovereignty, environmental integrity, social equity, technological autonomy, and geopolitical alignment, revealing a complex tapestry of trade-offs that define the relationship between debt, dependency, and development.

5.1. The Debt Question: From Infrastructure Financing to Sovereign Liability

A primary area of contention surrounding the Bui Dam is its impact on Ghana's national debt and its financing structure, which critics argue established a pathway toward "debt dependency." The $562 million buyer's credit from the China Exim Bank, while instrumental for construction, represented a significant, non-concessional liability. With an estimated commercial interest rate of 2.5% to 3.0% and a 20-year maturity, the loan embedded a long-term repayment obligation extending well beyond immediate political cycles [22].

The loan's partial collateralization against Ghana's cocoa export receipts is particularly significant. This "resource-for-infrastructure" model effectively mortgaged a stable and vital source of national revenue. Under the agreement, approximately 30% of the loan was secured against cocoa export proceeds [4]. This was implemented through an escrow mechanism, whereby a portion of foreign exchange earnings from cocoa sales was directed to service the debt before reaching the national treasury. This created a direct fiscal channel through which revenues from a key agricultural export critical to rural livelihoods and domestic economic stability were contractually obligated to repay infrastructure debt. Such an arrangement prioritizes creditor security but simultaneously diminishes the borrower's fiscal flexibility, as a share of foreign exchange income is pre-committed. This structure also insulated the loan from broader sovereign debt restructuring, directly tying a specific revenue stream to a single creditor.

While the Bui Dam loan alone did not precipitate a national debt crisis, it must be viewed within Ghana's broader borrowing trends in the 2000s and 2010s, which included significant accumulation of debt from other Chinese-funded projects. The country's debt-to-GDP ratio rose sharply, leading to a loss of international market access and necessitating an IMF bailout in 2015 under an Extended Credit Facility program [25]. This pattern persisted; Ghana again sought IMF assistance in 2023 amid a severe debt crisis, with public debt exceeding 90% of GDP. Although domestic fiscal mismanagement and global disruptions played major roles, the accumulation of external commercial debts including those from China substantially contributed to the unsustainable debt burden [26]. This does not simplistically validate the "debt-trap diplomacy" thesis, as Ghana exercised agency in

pursuing these loans. However, it illustrates a shift toward debt dependency, wherein a nation's financial stability becomes increasingly tied to a major creditor, and its policy options are constrained by debt servicing imperatives. The Bui Dam's collateral mechanism exemplifies this dynamic: by pledging a core export commodity, it imposed a structural constraint on fiscal policy, reducing Ghana's ability to respond to economic shocks or reallocate resources. Thus, the project represents an early and significant step in a broader pattern in which urgent infrastructure needs locked Ghana into long-term financial obligations, complicating later macroeconomic management and perpetuating cycles of financial distress (see Figure 2).

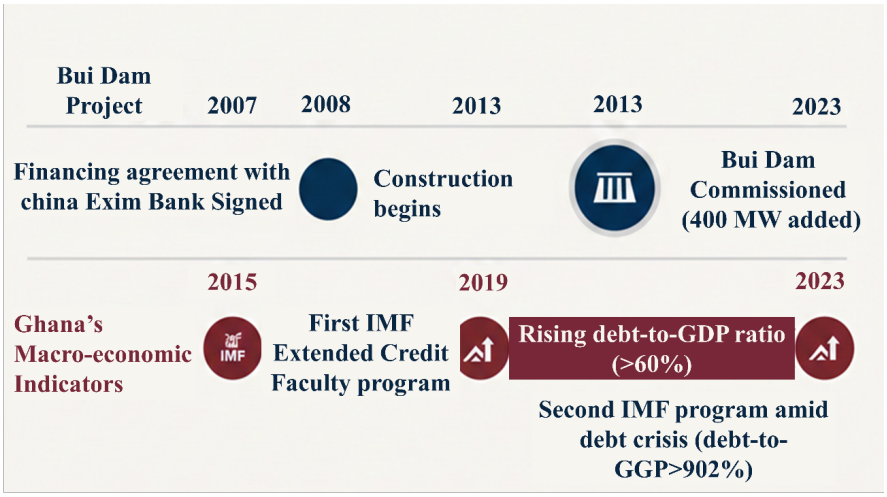

Figure 2. Timeline of key events: Bui Dam Project Milestones and Ghana's Macroeconomic Indicators (2007-2023).

5.2. Environmental and Social Governance: The Human and Ecological Cost

The expedited delivery of the Bui Dam came at a significant cost to both local communities and the environment, exposing a stark "governance deficit" in the application of international social and environmental standards.

Resettlement and Livelihood Disruption: The creation of the Bui reservoir necessitated the involuntary displacement of approximately 1,216 people from 52 villages, fundamentally disrupting their lives and livelihoods [24]. While a Resettlement Negotiating Committee was established, the implementation has been widely criticized. Academic studies and reports from civil society organizations highlight several failures: compensation for lost assets, particularly farmland, was often deemed inadequate and delayed; the replacement housing provided in resettlement towns was frequently of poor quality and insufficient in number; and most critically, there was a profound failure to restore the complex socio-economic systems and livelihoods of the displaced communities [27]. Many of those resettled were farmers and fishers whose ancestral connections to the land and river were severed. The new agricultural lands allocated were often less fertile or

farther away, and the promised support for transitioning to new livelihoods was lacking. This resulted in long-term impoverishment and a decline in living standards for many, demonstrating that the social cost of the project was disproportionately borne by a vulnerable minority [4].

Ecological Impact and Biodiversity Loss: The dam's location within the Bui National Park amplified its ecological footprint. The reservoir flooded a significant portion of this protected area, leading to widespread habitat destruction and fragmentation. The project posed a severe threat to the park's biodiversity, most notably to one of Ghana's largest hippopotamus populations. Their grazing areas were submerged, and their migration routes were blocked, leading to increased human-wildlife conflict as animals ventured closer to remaining villages in search of food [27]. Furthermore, the alteration of the river's flow regime, sediment transport, and water temperature downstream of the dam has had knock-on effects on the riverine ecosystem, impacting fish species and the communities that depended on them. The environmental impact assessment (EIA) conducted for the project was criticized for its inadequacy in fully assessing these long-term cumulative impacts and for its limited public consultation process [18].

A Comparative Lens: The World Bank Standard: The governance gaps become even more apparent when contrasted with the likely approach of a Western-led institution like the World Bank. Following intense criticism over projects like the Narmada Dam in India, the World Bank developed a comprehensive set of environmental and social safeguard policies. These policies mandate a rigorous, transparent, and participatory process that would have likely differed in key areas [28]. A Bank-funded project would have required a more detailed and publicly scrutinized EIA and a Resettlement Action Plan (RAP) developed through extensive consultation with affected communities. The Bank's standards emphasize [29] "improvement or at least restoration" of livelihoods, meaning the compensation and support package would have been designed not just to replace lost assets, but to ensure that displaced people were made economically better off. The entire process would have been subject to independent monitoring and a robust grievance redress mechanism. The Chinese approach, while potentially more efficient, lacked this rigorous framework, leading to the significant social and ecological shortcomings observed at Bui.

Table 1. A Comparative framework of governance standards for large dam projects: The World Bank vs. Common BRI/Chinese-Financed Model (c. 2007-2015).

Governance Criterion	World Bank Model (Post-Safeguard Reforms)	Common Chinese-Financed Model (Early BRI Period)	Illustrative Outcome at Bui Dam
Environmental Impact Assessment (EIA)	Mandatory, public, detailed; includes cumulative impacts and alternatives.	Often conducted but criticized for limited scope, brevity, and restricted public access.	EIA criticized for underestimating impacts on Bui National Park and downstream ecology (Kirchherr *et al.*, 2016).

Continued

Resettlement & Livelihood Restoration	"Improvement or restoration" standard; detailed RAP with consultation and grievance mechanisms.	Focus on physical asset replacement; weak on livelihood restoration and participatory planning.	Inadequate compensation, poor-quality housing, and failure to restore livelihoods for displaced communities (Ayivor *et al.*., 2020).
Public Consultation & Transparency	Extensive stakeholder engagement required; project documents publicly disclosed.	Top-down, state-led negotiations; limited structured community engagement.	Limited consultation with affected communities, leading to conflicts and mistrust (Hensengerth, 2013).
Financial Instrument & Debt Transparency	Concessional loans or grants; terms and conditions published via sovereign debt reporting.	Frequent use of buyer's credits, commercial rates, and resource-backed arrangements.	$562M loan from China Exim Bank partially secured against cocoa exports, creating a direct fiscal linkage (Abdulai, 2017).
Conditionality & Sovereignty	Explicit governance and policy reform conditionalities ("Washington Consensus").	Principle of "non-interference" in domestic politics ("Beijing Consensus").	Project delivered rapidly without formal political conditionalities, aligning with Ghanaian government priorities (Ramo, 2004).
Technology Transfer & Local Content	Often includes contractual targets for local hiring, procurement, and capacity building.	High reliance on Chinese labor, materials, and management; limited formal transfer mandates.	Skilled roles held by Chinese expatriates; limited development of local hydropower expertise (Mohan & Lampert, 2013).

Note: Sources: World Bank, 2017; Hensengerth, 2013; Brautigam, 2020; Kirchherr et al.., 2015. 3 Technology Transfer and Local Content: The Mirage of Capacity Building.

A key metric for evaluating whether a foreign investment fosters long-term development is the extent to which it builds local capacity through technology transfer and local content utilization. On this front, the Bui Dam project presents a critical picture, with available data substantiating claims of limited developmental spillover. Reports indicate a significant reliance on expatriate labor at the peak of construction, the workforce comprised roughly 2,000 Chinese nationals compared to approximately 1,200 Ghanaians [16]. More importantly, this labor hierarchy restricted skills transfer, as Chinese expatriates from Sinohydro occupied virtually all skilled technical, engineering, and managerial positions, while Ghanaian workers were predominantly relegated to unskilled or semi-skilled roles such as manual labor, security, and basic clerical work.

Similarly, procurement data reveals a heavy dependence on imports. An estimated 70% of materials, equipment, and specialized machinery were sourced directly from China, with local Ghanaian businesses securing less than 30% of the project's procurement value [4]. This import-centric model, while ensuring efficiency and cost-control for the contractor, resulted in minimal transfer of technical knowledge or industrial capacity to the local economy. The outcome is a form of "turnkey dependency," where Ghana owns a sophisticated piece of infrastructure but remains reliant on Chinese expertise, supply chains, and spare parts for its operation and maintenance. This failure to meaningfully embed the project

within the local economy through targeted skills development and significant local procurement meant the Bui Dam did not catalyze the creation of a domestic hydropower industry or a highly skilled technical workforce capable of independently managing such complex projects in the future. Consequently, the project perpetuates a cycle of technological reliance, ultimately undermining the very energy sovereignty it was meant to enhance.

5.3. Geopolitical Leverage: Cementing a Strategic Partnership

Finally, the Bui Dam project must be understood for its profound geopolitical significance. While it did not result in a literal Chinese military base a common trope in "debt-trap" fears it successfully and indelibly cemented Chin's role as Ghana's indispensable strategic partner for major infrastructure. The high-profile nature of the dam, a national priority delivered after fifty years of failure, generated immense political goodwill for Beijing within the Ghanaian government and among segments of the public. This goodwill translates directly into soft power and diplomatic leverage [15]. The successful completion of Bui served as a powerful advertisement for the Chinese model, making it significantly easier for Chinese companies to secure subsequent contracts across a wide range of sectors in Ghana. Following Bui, Chinese firms have been awarded major contracts in roads, railways, natural gas processing, and telecommunications infrastructure.

This creates a strategic foothold that extends far beyond economics. It fosters a relationship of interdependence where Ghana becomes accustomed to, and reliant upon, Chinese financing and engineering, while China deepens its influence in a stable and strategically located West African nation. The dam, therefore, is a physical monument to this shifted alignment. It demonstrates that the most significant leverage gained is not through asset seizure, but through the normalization of a partnership where China becomes the default solution for Ghana's development challenges. This reorientation away from traditional Western partners and towards Beijing is a core objective of the BRI and represents a fundamental recalibration of global influence, with Ghana as a willing, yet increasingly bound, participant.

5.4. The Evolving Model: Is Bui a Relic or a Recurring Pattern

The governance challenges documented at Bui are indicative of the operational norms that characterized the early phase of the Belt and Road Initiative (BRI), roughly spanning 2007 to 2015. Determining whether these deficits represent persistent features or transitional lessons necessitates a dynamic comparison with more recent projects. Emerging evidence points to a conscious, albeit uneven, recalibration by Chinese stakeholders in response to international critique and feedback from borrowing nations [30].

Since Bui's completion, Chinese policy banks have formalized environmental and social guidelines, including the China Exim Bank's Green Credit Guidelines and the broader Green Development Guidance for BRI Projects. Official discourse

has similarly shifted toward an emphasis on "high-quality," "green," and "sustainable" development. In practice, however, the implementation of these standards remains inconsistent and highly contingent on specific project arrangements and host-country governance. A comparative analysis with a later initiative such as the Chinese-financed Western Railway in Nigeria or the Sinohydro-built Bui Solar Hybrid Project (2022) in Ghana would be instructive. The latter, which integrates solar capacity with the existing dam, was explicitly marketed as a "green energy" venture and utilized distinct financing structures.

This evolution underscores that the "Chinese Model" is not a static monolith but a learning system. Consequently, the Bui Dam serves a dual analytical purpose: first, as a stark case study of the trade-offs inherent in the early BRI's prioritization of efficiency; and second, as a critical benchmark against which the sincerity and depth of China's professed governance reforms must be measured. The central question for contemporary BRI analysis therefore becomes: do the shortcomings observed at Bui reflect enduring structural tendencies of a state-backed, non-interference-driven finance model, or have they been substantively addressed in a new era of "high-quality" engagement?

6. Comparison and Implications for Global Governance

The Bui Dam case study reveals a fundamental recalibration of global development governance, contrasting the operational logics and underlying philosophies of the established Western-led system and the emerging Chinese alternative. This comparison highlights competing visions of how development should be pursued, who sets the rules, and which values are prioritized.

The Chinese model, as executed at Bui, demonstrated a distinct capacity for rapid infrastructure delivery. By adhering to a principle of non-interference and streamlining decision-making through state-backed channels, it effectively bypassed the protracted feasibility studies, multi-stakeholder consultations, and stringent conditionalities typical of Western-funded projects. For a government under intense pressure to resolve the "dumsor" crisis, this efficiency was politically paramount. It delivered tangible results within an electoral cycle, fulfilling the core promise of the "Beijing Consensus" to respect sovereignty without political prescriptions. In this sense, the model offered both a critique of and an alternative to a Western system often perceived as slow and paternalistic.

This comparative advantage in speed and sovereignty, however, came at a demonstrable cost, exposing a profound governance deficit. As the analysis illustrates, the expedited process frequently subordinated rigorous environmental safeguards, transparent social frameworks, and comprehensive debt sustainability assessments to the imperative of project completion. The documented shortcomings inadequate resettlement and ecological damage were indicative of a different standard of care. While gradually adopting their own guidelines, Chinese financiers and contractors historically operated outside the extensive safeguard policies developed by multilateral institutions. This dynamic risked a "race to the bottom,"

in which the availability of lower-standard options could weaken the leverage of institutions promoting higher benchmarks. Similarly, the use of complex, resource-backed financial instruments challenged emerging global norms of debt transparency, creating hidden fiscal vulnerabilities.

The emergence of this parallel, state-capitalist framework thus poses a significant and evolving challenge to the architecture of 21st-century global governance. The core dilemma is fundamentally about the rules governing infrastructure deployment [31]. The initial phase, exemplified by Bui, established a competitive alternative that often operated on lower standards. The current phase, characterized by China's official "greening" rhetoric and revised guidelines, presents a more complex landscape one of potential normative convergence. The critical question is whether this shift signifies a genuine alignment with broader sustainability and equity norms, or merely a strategic repackaging. This dynamic fragmentation raises the stakes for forging hybrid governance solutions.

The core challenge is no longer simply the volume of finance available to the Global South, but the integration of competing frameworks into a coherent system that promotes sustainable and equitable development. The solution cannot be a demand that China fully adopt Western norms, which it views as historically specific. Yet, accepting a permanent duality of standards risks undermining decades of progress in environmental protection and social justice.

A constructive path forward requires moving beyond the binary choice between conditional Western aid and non-interventionist Chinese credit. It points toward the necessity of a negotiated governance space. This could involve multilateral efforts to forge baseline standards for mega-infrastructure projects potentially through forums like the G20 that both sides could endorse. It also demands empowered agency from borrowing countries such as Ghana. Nations must strengthen domestic legal frameworks, conduct independent impact assessments, and negotiate contracts that explicitly mandate technology transfer and local content, thereby leveraging competitive tension among donors to secure better terms. Finally, a resilient system requires vibrant civil society, independent media, and protected civic space to hold both governments and financiers accountable.

The Bui Dam is more than a power source; it is a cautionary tale and a catalyst for governance renewal. It shows that the urgent need for infrastructure cannot suspend the imperatives of justice, sustainability, and fiscal responsibility. Its dual legacy bringing light to Ghana while spotlighting fragile global systems challenges us to forge a new consensus. The task is to build a sophisticated, shared framework that harmonizes the efficiency and respect for sovereignty of new actors with the hard-learned lessons of equity and stewardship from the old.

This requires diplomacy to build new norms, investment in national capacity, and unwavering support for civic oversight. In a multipolar world, the future of development will be written through continuous negotiation a process where the pursuit of progress does not come at the cost of people or planet. The Bui Dam stands as concrete proof of why this endeavor is essential.

7. Conclusions

This paper has developed a synthesized analytical model to decipher the interplay of debt, dependency, and development within China's Belt and Road Initiative. Its principal contribution lies in the theoretical integration and reframing of secondary research, demonstrated through the in-depth case study of the Bui Dam. By converging fragmented debates on finance, governance, and South-South cooperation, the analysis offers a holistic framework for evaluating BRI trade-offs.

Evidence synthesized from the Bui Dam affirms that the early phase of BRI engagement embodied this triad. The dam was a definitive developmental achievement, yet it entrenched financial vulnerabilities, socio-ecological costs, and technological reliance challenging the sustainability of that initial model. The project exemplifies the constrained agency of sovereign governments, demonstrating how urgent infrastructure needs can precipitate significant long-term trade-offs.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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