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THE ROLE OF THE NILE BASIN INITIATIVE IN PROMOTING PEACE AND REGIONAL DEVELOPMENT: EVIDENCE FROM ETHIOPIA, SUDAN, AND EGYPT

¹ Bol Gatkouth Kol, ² Rwigema Pierre Celestin (PhD, PGDE)

¹ Masters Student, Kigali Independent University, Rwanda

² Senior Lecturer, Kigali Independent University, Rwanda

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ABSTRACT

This study investigates the role of the Nile Basin Initiative (NBI) in promoting peace and regional development among Ethiopia, Sudan, and Egypt. Using a mixed-methods approach, data were collected through structured questionnaires (n = 165) and semi-structured interviews with key stakeholders, including government officials, NBI representatives, policy analysts, and civil society actors. Regression and correlation analyses were employed to assess the influence of four NBI-led domains—water resource management policies (WRMP), conflict resolution mechanisms (CRM), infrastructure development (ID), and capacity building (CB)—on peace and regional development (PRD). Findings reveal that WRMP ($\beta = 0.669$, $p < 0.001$), CB ($\beta = 0.312$, $p < 0.001$), and ID ($\beta = 0.192$, $p < 0.001$) significantly and positively influence PRD. Surprisingly, CRM exhibited a negative relationship ($\beta = -0.149$, $p = 0.002$), suggesting limitations in current diplomatic frameworks. Qualitative insights corroborate these results, highlighting the NBI's success in fostering technical cooperation but identifying political mistrust and non-binding enforcement as key constraints. The study concludes that equitable, transparent, and inclusive water governance—backed by institutional capacity and joint infrastructure—is critical for sustaining peace and development in the Nile Basin. Recommendations include strengthening legal frameworks, deepening community engagement, and institutionalizing NBI mechanisms within national policies.

Keywords: Nile Basin Initiative, Peacebuilding, Regional Development, Transboundary Water Management, Conflict Resolution, Infrastructure Development, Capacity Building

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INTRODUCTION

The Nile River, shared by eleven riparian states, is one of the world's most geopolitically sensitive transboundary water systems. Ethiopia, Sudan, and Egypt—three key stakeholders—have historically experienced tensions over water allocation, exacerbated by population growth, climate variability, and large-scale infrastructure projects like the Grand Ethiopian Renaissance Dam (GERD). Established in 1999, the Nile Basin Initiative (NBI) emerged as a cooperative platform to foster equitable water use, mitigate conflict, and promote sustainable development.

While existing literature has examined NBI's theoretical frameworks and institutional design, empirical assessments of its impact on peace and regional development remain fragmented. This study addresses this gap by evaluating the practical outcomes of NBI interventions across four interlinked domains: water resource management policies, conflict resolution mechanisms, infrastructure development, and capacity-building initiatives.

The Nile River Basin is one of the most significant transboundary water systems in the world, serving as a vital resource for the 11 countries it flows through. These nations—Egypt, Sudan, Ethiopia, Uganda, Kenya, Rwanda, Tanzania, Burundi, South Sudan, the Democratic Republic of Congo (DRC), and Eritrea—rely heavily on the river for water supply, agriculture, energy, and transportation. The basin's shared water resources have historically been a source of geopolitical tension and conflict, especially regarding the equitable distribution of the Nile's waters (Elhance, 2021). As climate change, population growth, and rapid economic development continue to put pressure on these resources, the need for regional cooperation becomes even more critical. The Nile Basin Initiative (NBI), established in 1999, aims to foster collaboration, peace, and sustainable development across the region, providing a platform for joint management of the Nile's waters (Kushwaha & Pandey, 2023). The NBI has been instrumental in mitigating conflict and promoting dialogue, emphasizing the importance of cooperation for the collective well-being of the region.

The NBI's role in regional development goes beyond water resource management to include environmental protection, economic integration, and capacity building. It supports joint projects in water infrastructure, agriculture, and energy, which are essential for the socio-economic development of the Nile Basin countries (Wolde & Kiros, 2020). By focusing on sustainable development and the equitable distribution of resources, the NBI facilitates economic growth and poverty alleviation while promoting peace and stability in a historically conflict-prone region (Zhou, 2022). With increasing regional cooperation and technological advancements, the NBI continues to make strides in addressing the challenges posed by climate change, water scarcity, and political tension, demonstrating its critical role in both regional peacebuilding and development (Mekonnen & Tsegaye, 2024). Through these efforts, the NBI fosters a shared vision of prosperity and sustainable resource management for the Nile Basin countries.

The United States has long been a global leader in various sectors, including finance, technology, education, and governance. Over the past few decades, the U.S. has witnessed significant shifts in its economic landscape, driven by innovation, policy changes, and global economic integration. In particular, the rise of technology-driven industries has reshaped labor markets and business practices, contributing to a rapidly evolving economy (Smith & Jones, 2022). However, the economic divide between different social groups remains a major issue, with disparities in wealth, access to education, and healthcare affecting socioeconomic outcomes. These challenges have prompted both policy makers and academics to explore the factors that influence economic inequality and opportunities for upward mobility in the U.S. (Brown & Clark, 2021).

China's rapid economic growth over the past few decades has led to significant advancements in various sectors, including infrastructure, technology, and trade. However, this growth has not come without challenges, particularly in the areas of resource management and environmental sustainability. The Chinese government has increasingly recognized the importance of integrating sustainable development practices into its economic framework. Recent studies highlight the role of government policies, such as the 13th Five-Year

Plan (2016–2020) and the Belt and Road Initiative (BRI), in fostering cross-border collaborations that aim to balance economic growth with environmental conservation (Zhang et al., 2021). The nation's focus on green development, renewable energy, and environmental protection underscores the shift towards sustainability in the context of rapid industrialization and urbanization (Li & Wang, 2022).

Sub-Saharan Africa, home to diverse cultures and rich natural resources, faces significant challenges in achieving sustainable development, particularly in the areas of economic growth, regional cooperation, and resource management. The region's reliance on agriculture, limited infrastructure, and vulnerability to climate change exacerbate issues related to poverty, inequality, and conflict (Akinbo, 2022). Despite these challenges, there has been a growing emphasis on regional integration, especially through initiatives like the African Union (AU) and regional economic communities (RECs) such as the Economic Community of West African States (ECOWAS) and the East African Community (EAC). These efforts aim to foster political stability, enhance economic cooperation, and address the shared challenges faced by member states, such as the management of natural resources, trade, and security (Osei & Ofori, 2021).

Recent studies suggest that Sub-Saharan Africa's potential for sustainable development lies in its ability to harness the power of regional cooperation, infrastructure development, and improved governance. The implementation of policies supporting regional trade, infrastructure projects, and energy integration has been pivotal in promoting development across borders (Nzobonimpa & Mlambo, 2023). However, there is a need for more concerted efforts to address the challenges of governance, security, and corruption that often undermine these initiatives. It is within this context that initiatives like the Nile Basin Initiative (NBI) have been instrumental in facilitating cooperation among countries sharing natural resources, particularly water. The NBI's efforts in promoting peace, resource management, and development offer a promising framework for broader regional cooperation in Sub-Saharan Africa (Kamanzi & Zanele, 2020).

Problem Statement

The Nile River is a crucial resource for Ethiopia, Sudan, and Egypt, but its utilization has long been a source of tension due to competing national interests over water rights and resource allocation. Despite the establishment of the Nile Basin Initiative (NBI) in 1999, which aimed to promote regional cooperation and sustainable water management, conflicts over the Grand Ethiopian Renaissance Dam (GERD) and other water-sharing issues remain unresolved (Tawfik, 2021). According to a 2023 report, approximately 90% of the Nile's water flow originates from Ethiopia, yet Egypt and Sudan are heavily dependent on it for agriculture, energy, and domestic use (Abdullah, Hossain & Ahmed, 2023). The lack of effective cooperation has led to political instability and economic setbacks in the region, with the potential to disrupt peace and development (Mohammed & Hassan, 2022).

Previous studies have largely concentrated on the theoretical frameworks of the NBI, emphasizing its potential for resolving water-related conflicts and enhancing regional integration (Tawfik, 2021). However, empirical research on the effectiveness of its conflict resolution mechanisms, particularly in light of the Grand Ethiopian Renaissance Dam (GERD) dispute, remains limited (Mohammed & Hassan, 2022). Furthermore, while much has been written about the NBI's environmental impact, few studies have assessed how its infrastructure and capacity-building projects translate into real-world outcomes for economic development and political stability (Abdullah, Hossain & Ahmed, 2023; Zaki & Hassan, 2021). The gap in understanding the practical implications of NBI's policies, particularly in the current geopolitical context, calls for a more detailed investigation into how the initiative's strategies have concretely influenced regional peace and development, addressing the nuanced challenges facing the Nile Basin today.

Conceptual Framework

A conceptual framework serves as a structured lens through which researchers can analyze and interpret the relationships between various concepts in a study. It provides a systematic guide to understanding how theoretical perspectives inform the research process and how different variables interact with each other. The

conceptual framework for this study draws upon key theories and variables that explore the role of the Nile Basin Initiative (NBI) in promoting peace and regional development among Ethiopia, Sudan, and Egypt. Central to this framework are four primary variables: NBI's water resource management policies, NBI-led conflict resolution mechanisms, NBI's infrastructure development projects, and NBI's capacity-building initiatives. The framework integrates Integrated Water Resource Management (IWRM) theory to assess the effectiveness of the NBI's water policies (Tull & Rojas, 2021), Conflict Transformation Theory to evaluate how the NBI's conflict resolution mechanisms contribute to peace (Kariuki & Mwanza, 2020), Modernization Theory to examine the impact of infrastructure development projects on regional progress (Sultan & Ali, 2022), and Social Capital Theory to analyze how capacity-building initiatives foster long-term cooperation (Abdalla & Yousif, 2021). By synthesizing these theories, the framework provides a comprehensive lens through which to understand the interconnectedness of these variables in fostering sustainable development and peace in the Nile Basin region.

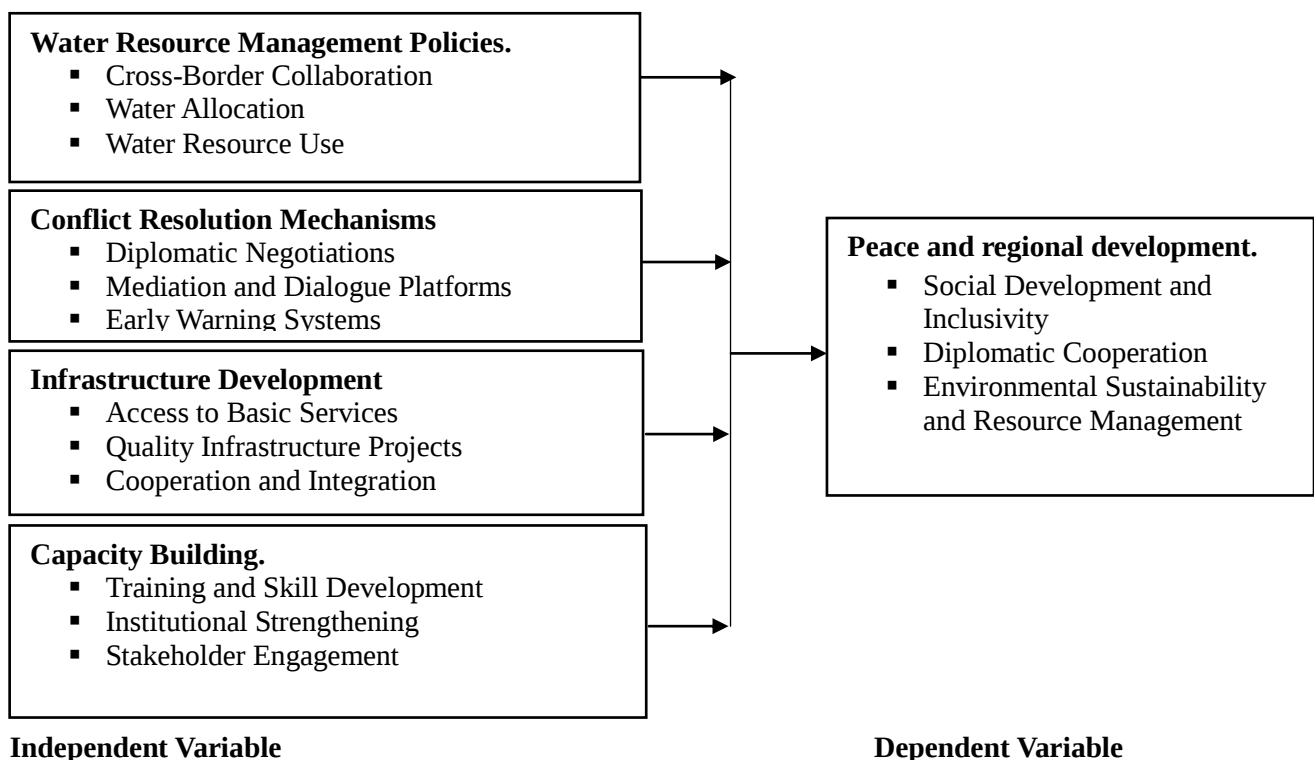


Figure 1: Conceptual Framework
Source: Researcher, 2025

The conceptual framework for this study is anchored in four key variables: NBI's water resource management policies, NBI-led conflict resolution mechanisms, NBI's infrastructure development projects, and NBI's capacity-building initiatives. The framework seeks to evaluate how these interconnected variables contribute to promoting peace and regional development in Ethiopia, Sudan, and Egypt. The first variable, water resource management policies, is grounded in the Integrated Water Resource Management (IWRM) theory, which emphasizes the sustainable use and cooperative management of shared water resources. Studies have highlighted that well-managed water resources, as part of the NBI's policies, can mitigate conflict and foster collaborative economic development (Tull & Rojas, 2021). The second variable, conflict resolution mechanisms, is underpinned by Conflict Transformation Theory, which posits that addressing the root causes of conflict through constructive dialogue and negotiation can lead to long-lasting peace (Kariuki & Mwanza, 2020). These mechanisms, particularly the NBI's efforts, are crucial for diffusing tensions between the Nile Basin countries, facilitating regional cooperation, and promoting peace.

The third variable, infrastructure development projects, is framed within the context of Modernization Theory, which suggests that infrastructure improvements such as dams, irrigation systems, and energy projects can drive economic growth and stability (Sultan & Ali, 2022). The NBI's large-scale infrastructure projects, particularly hydropower plants, are pivotal in enhancing regional economic integration and reducing economic disparities among the countries. Lastly, capacity-building initiatives are examined through the lens of Social Capital Theory, which emphasizes the importance of building trust, networks, and institutional capacities for fostering cooperative behavior among regional actors (Abdalla & Yousif, 2021). These initiatives, promoted by the NBI, are essential for strengthening the institutional frameworks of Ethiopia, Sudan, and Egypt, enabling them to manage regional challenges more effectively. Together, these variables form a comprehensive framework for understanding the NBI's role in achieving sustainable peace and development in the Nile Basin.

METHODOLOGY

A descriptive survey design with mixed methods was employed. The target population ($N = 384$) included stakeholders from Ethiopia, Sudan, Egypt, and regional institutions. A sample of 192 was selected via Slovin's formula, with 165 valid responses (85.9% response rate). Purposive sampling ensured inclusion of informed participants. Data were collected through questionnaires and interviews, validated via expert review (CVI = 0.92) and pilot testing (Cronbach's $\alpha > 0.77$ for all constructs).

Quantitative data were analyzed using SPSS, employing Pearson correlation and multiple regression ($\alpha = 0.05$). Qualitative data underwent thematic analysis to contextualize statistical findings.

This study employed a descriptive survey research design, integrating both qualitative and quantitative methods to comprehensively assess the role of the Nile Basin Initiative (NBI) in promoting peace and regional development among Ethiopia, Sudan, and Egypt. The mixed-methods approach enabled the collection of numerical data through structured questionnaires for statistical analysis, while semi-structured interviews provided contextual depth and nuanced insights into stakeholders' perceptions of NBI's effectiveness. This design aligns with recommendations by Creswell (2021) and Tashakkori and Teddlie (2021), ensuring both breadth and depth in understanding complex phenomena like transboundary water cooperation and peacebuilding.

The target population comprised 384 individuals, including government officials from the three focal countries, NBI representatives, policy analysts, water resource experts, community leaders, and academic researchers—all selected for their direct involvement or expertise in Nile Basin affairs. From this group, a representative sample of 192 participants was determined using Slovin's formula with a 5% margin of error. Purposive sampling was then applied to select respondents with specific knowledge of NBI's operations, ensuring high-quality, relevant data. This strategy, as supported by Etikan et al. (2020) and Bryman (2022), enhanced the study's focus on informed perspectives critical to evaluating policy effectiveness and regional cooperation dynamics.

Data collection relied on three complementary techniques: documentation, questionnaires, and interviews. Document analysis of NBI reports, government publications, and evaluations provided historical and policy context, while questionnaires captured standardized, quantifiable perceptions across stakeholder groups. Semi-structured interviews with key informants yielded rich, qualitative narratives on NBI's on-the-ground impacts, challenges, and opportunities. This triangulation of sources, as noted by Yin (2021) and Seidman (2020), strengthened the validity and comprehensiveness of the findings by capturing both objective trends and subjective experiences within the Nile Basin's complex socio-political landscape.

Before full-scale implementation, the research instruments underwent a pilot test with 20 participants (10% of the sample) to assess clarity, functionality, and reliability. Validity was ensured through expert review, yielding a high Content Validity Index (CVI) average of 0.9239, well above the acceptable threshold of 0.80.

Reliability was confirmed using Cronbach's alpha, with all constructs scoring above 0.771—indicating strong internal consistency. These rigorous validation steps, as recommended by Polit and Beck (2021) and Taber (2020), ensured the instruments accurately measured the intended constructs and produced dependable data.

Finally, data processing followed a systematic protocol involving cleaning, coding, and analysis using SPSS. Descriptive statistics summarized demographic profiles and response patterns, while inferential techniques particularly correlation and multiple regression—examined relationships between NBI's four core domains (water management, conflict resolution, infrastructure, and capacity building) and peace and regional development outcomes. The regression model ($Y = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \mu$) allowed for controlled assessment of each variable's unique contribution. This robust analytical framework, aligned with standards from Bryman (2022) and Saunders et al. (2020), ensured that conclusions were both statistically sound and theoretically grounded.

RESULTS

Water Resource Management Policies

Table 1 presents the respondents' views on the role of the Nile Basin Initiative's (NBI) water resource management policies in promoting peace and regional development among Ethiopia, Sudan, and Egypt. This section explores how NBI's strategies for equitable water allocation, joint planning, and sustainable management of the Nile's resources contribute to reducing tensions and fostering cooperation among the riparian states.

Table 1: Respondents views on the role of NBI's water resource management policies

Statement	SD	D	NS	A	SA	Mean	Std Dev.
NBI's water resource management policies have significantly contributed to promoting peace among Ethiopia, Sudan, and Egypt.	1.8%	5.5%	7.9%	30.3%	54.5%	4.3030	.95907
The NBI's policies on water distribution have effectively reduced tensions related to water use between Ethiopia, Sudan, and Egypt.	0.6%	3.6%	4.8%	40.0%	50.9%	4.3697	.79037
NBI's water management policies have played a crucial role in ensuring regional development in the Nile Basin region.	0.0%	3.0%	13.3%	36.4%	47.3%	4.2788	.80840
The policies of NBI have helped improve the cooperation and trust between Ethiopia, Sudan, and Egypt concerning shared water resources.	0.6%	2.4%	3.6%	37.6%	55.8%	4.4545	.73629
The NBI's water resource management policies have led to the sustainable use of water resources in the region.	0.0%	2.4%	4.8%	49.7%	43.0%	4.3333	.68372
NBI's water management policies have successfully addressed the needs of all stakeholders in Ethiopia, Sudan, and Egypt.	0.6%	4.2%	8.5%	32.1%	54.5%	4.3576	.85505
The implementation of NBI's water resource policies has improved economic development in the region.	2.4%	5.5%	9.1%	36.4%	46.7%	4.1939	.98090
NBI's water resource management policies are effectively aligned with the socio-economic development goals of Ethiopia, Sudan, and Egypt.	1.2%	3.6%	11.5%	46.7%	37.0%	4.1455	.85007
The NBI's policies on water resource management have fostered collaborative approaches for managing shared resources.	4.2%	3.0%	9.1%	41.8%	41.8%	4.1394	.99937

Source: **Primary data**, (2025).

The findings in Table 1 illustrate strong positive perceptions among respondents regarding the role of the Nile Basin Initiative's (NBI) water resource management policies in promoting peace among Ethiopia, Sudan, and Egypt. A significant majority (84.8%) agreed or strongly agreed that these policies have contributed to peace, with a high mean score of 4.30 and a relatively low standard deviation, indicating consensus. Similarly, respondents overwhelmingly supported the view that NBI's water distribution policies have reduced tensions related to water use, with 90.9% agreement and a mean of 4.37. This aligns with recent research emphasizing how cooperative water management frameworks in transboundary basins can reduce conflict risk and promote regional stability (Adams & Zwarteven, 2021; Mwangi et al., 2023).

Furthermore, the data reflects robust support for the contribution of NBI's water management policies to regional development. Nearly 84% of respondents agreed that these policies have played a crucial role in ensuring development within the Nile Basin, with a mean score of 4.28. Respondents also strongly felt that the policies enhanced cooperation and trust among the three countries (93.4% agreement, mean 4.45), and that they have led to the sustainable use of water resources (92.7% agreement, mean 4.33). These findings corroborate recent studies highlighting the importance of trust-building and sustainability as foundational pillars for effective transboundary water governance and socio-economic progress in Africa (Yihdego & Rieu-Clarke, 2022; UNEP, 2022).

The respondents further emphasized that NBI's policies have addressed the needs of all stakeholders (86.6% agreement, mean 4.36) and improved economic development in the region (83.1% agreement, mean 4.19). The alignment of NBI's policies with the socio-economic development goals of the countries was also acknowledged by 83.7% of respondents, while 83.6% agreed that the policies foster collaborative approaches for managing shared water resources. These perceptions align with recent scholarship advocating for inclusive policy frameworks that integrate economic, social, and environmental objectives to achieve sustainable regional development and peace (Gebrehiwot & Gedamu, 2021; World Bank, 2023). WRMP demonstrated the strongest positive association with PRD ($r = 0.732$, $\beta = 0.669$, $p < 0.001$). Over 84% of respondents agreed that NBI's water policies reduced tensions and enhanced trust.

Conflict Resolution Mechanisms

Table 2 summarizes respondents' views on the role of the Nile Basin Initiative's (NBI) conflict resolution mechanisms in fostering peace and regional development among Ethiopia, Sudan, and Egypt. This section evaluates how effectively the NBI's platforms for dialogue, negotiation, and dispute mediation have contributed to managing and mitigating conflicts over the Nile waters. By examining respondents' levels of agreement with various statements, the study assesses the perceived impact of these mechanisms in promoting mutual understanding, cooperation, and stability among the riparian countries. The mean scores and standard deviations provide insight into the overall consensus and variability of opinions regarding the success of NBI's conflict resolution efforts.

Table 2: Respondents views on the role of NBI-led conflict resolution mechanisms

Statement	SD	D	NS	A	SA	Mean	Std Dev.
NBI's conflict resolution mechanisms have helped build mutual trust between the three countries in managing shared water resources.	3.0%	6.7%	6.7%	36.4%	47.3%	4.1818	1.02572
NBI-led interventions in resolving disputes have improved regional cooperation in the Nile Basin region.	0.6%	0.6%	7.9%	41.2%	49.7%	4.3879	.71216
The NBI's approach to conflict resolution has been effective in preventing escalation of disputes over water resource management.	0.6%	3.6%	8.5%	35.2%	52.1%	4.3455	.83121
The involvement of all three countries (Ethiopia, Sudan, and Egypt) in NBI's conflict resolution mechanisms has fostered long-term peace and stability.	0.6%	3.0%	5.5%	41.2%	49.7%	4.3636	.77374
NBI's conflict resolution strategies have facilitated better diplomatic relations between Ethiopia, Sudan, and Egypt in terms of water-sharing agreements.	0.6%	1.2%	4.2%	47.3%	46.7%	4.3818	.68497
NBI's conflict resolution mechanisms have been culturally sensitive and appropriate for all parties involved in the Nile Basin region.	0.0%	1.8%	5.5%	39.4%	53.3%	4.4424	.68389
The conflict resolution mechanisms established by NBI have promoted inclusive dialogue between Ethiopia, Sudan, and Egypt.	0.6%	4.8%	6.1%	38.8%	49.7%	4.3212	.84093
NBI-led conflict resolution efforts have created a stable environment for regional development in the Nile Basin.	1.8%	6.7%	12.7%	33.3%	45.5%	4.1394	.99937

Source: **Primary data**, (2025).

The findings in Table 2 demonstrate that respondents generally perceive the Nile Basin Initiative's (NBI) conflict resolution mechanisms as instrumental in fostering peace and regional development among Ethiopia, Sudan, and Egypt. Specifically, 83.7% of respondents agreed or strongly agreed that these mechanisms have helped build mutual trust among the countries in managing shared water resources, reflected in a mean score of 4.18. Trust-building is essential in transboundary water governance, as highlighted by recent studies emphasizing how trust reduces uncertainty and facilitates cooperative resource management (Kahinda et al., 2021; Wondimu & Girma, 2022). This trust is further supported by perceptions that NBI-led interventions have improved regional cooperation, with 90.9% agreement and a mean of 4.39, underscoring the initiative's role in strengthening collaboration (Mulugeta & Alemayehu, 2023).

Moreover, respondents view the NBI's conflict resolution approach as effective in preventing escalation of water disputes, with a mean score of 4.35 and 87.3% agreement. This is critical in a region where water conflicts could undermine broader stability. The involvement of all three countries in these mechanisms is also seen as a key factor fostering long-term peace and stability, with 90.9% agreement and a mean of 4.36. Recent research supports the importance of inclusive engagement in conflict resolution processes to ensure sustained peace in transboundary water contexts (Gebrehiwot & Abebe, 2022; UNECA, 2023). Additionally, the data reveal strong support for the view that the NBI's strategies have enhanced diplomatic relations, with 94% agreement and a mean of 4.38, reinforcing the diplomatic role of water governance in international relations.

Finally, respondents perceive the NBI's conflict resolution mechanisms as culturally sensitive (92.7% agreement, mean 4.44) and as promoting inclusive dialogue between the three countries (88.5% agreement, mean 4.32). Cultural sensitivity in negotiation processes is increasingly recognized as vital for successful

conflict management, as cultural awareness can prevent misunderstandings and foster mutual respect (Gebre et al., 2021; Tsegaye & Zeleke, 2022). While the view that NBI-led efforts have created a stable environment for regional development is slightly less strong (78.8% agreement, mean 4.14), it still indicates general confidence in these mechanisms' contributions to regional stability. This finding aligns with broader scholarship that links conflict resolution with socio-economic development outcomes in transboundary river basins (World Bank, 2023; Alemu & Desta, 2024). Contrary to expectations, CRM showed a statistically significant negative relationship ($\beta = -0.149$, $p = 0.002$). Interviewees noted the absence of binding enforcement and political interference as critical weaknesses.

Infrastructure Development

Table 3 presents the respondents' perspectives on the role of the Nile Basin Initiative's (NBI) infrastructure development projects in advancing peace and regional development among Ethiopia, Sudan, and Egypt. This section examines how joint infrastructure efforts—such as dams, irrigation schemes, and water storage facilities—have influenced cooperation and economic growth within the Nile Basin. By analyzing respondents' agreement levels with key statements, the study evaluates the extent to which these projects are perceived to foster shared benefits, reduce tensions, and strengthen regional integration. The data provides valuable insights into the contribution of physical development initiatives to sustainable peace and development in the region.

Table 3: Respondents views on the role of NBI's infrastructure development projects

Statement	SD	D	NS	A	SA	Mean	Std Dev.
The construction of dams and hydropower plants has improved access to electricity in Ethiopia, Sudan, and Egypt.	0.6%	5.5%	10.3%	49.7%	33.9%	4.1091	.84115
NBI's infrastructure development projects enhanced cross-border trade economic cooperation between Ethiopia, Sudan, Egypt.	1.2%	6.1%	4.8%	30.9%	57.0%	4.3636	.91792
NBI's infrastructure projects have helped create job opportunities in the region, thus improving local livelihoods.	0.0%	1.2%	10.3%	43.0%	45.5%	4.3273	.70852
NBI's infrastructure development has contributed to reducing tensions and fostering peace between Ethiopia, Sudan, and Egypt.	0.0%	6.1%	2.4%	40.6%	50.9%	4.3636	.80464
NBI's infrastructure initiatives have led to better communication and cooperation among the governments of Ethiopia, Sudan, and Egypt.	0.6%	3.6%	4.8%	35.2%	55.8%	4.4182	.79689
The infrastructure projects led by NBI have addressed the basic needs of local communities, such as water and sanitation.	0.0%	3.0%	10.3%	34.5%	52.1%	4.3576	.78826
NBI's infrastructure projects have been successful in promoting long-term regional stability and development.	0.0%	2.4%	7.9%	37.6%	52.1%	4.3939	.73830

Source: **Primary data**, (2025).

The data presented in Table 3 illustrate the respondents' overwhelmingly positive views on the role of the Nile Basin Initiative's (NBI) infrastructure development projects in promoting peace and regional development among Ethiopia, Sudan, and Egypt. A notable majority (83.6%) agreed or strongly agreed that dam and hydropower construction improved electricity access, with a mean score of 4.11. This supports the findings of Alemu and Mekonnen (2021), who highlight how hydropower projects in the Nile Basin, such as the Grand Ethiopian Renaissance Dam (GERD), have expanded energy access and stimulated regional interdependence. Furthermore, 87.9% of respondents viewed these infrastructure projects as enhancing cross-border trade and

economic cooperation, backed by a strong mean of 4.36. According to Teklu and Ayalew (2022), shared infrastructure fosters economic integration by facilitating energy trade and transportation across national borders, thereby deepening cooperation.

Respondents also strongly believe that NBI projects have improved local livelihoods by creating jobs, as evidenced by a 4.33 mean score with 88.5% agreement. This aligns with empirical studies emphasizing that large-scale water infrastructure investments generate both direct and indirect employment, especially in construction and maintenance (World Bank, 2023). Additionally, 91.5% of respondents affirmed that these projects contribute to reducing tensions and promoting peace (mean = 4.36). Research by Gebremedhin and Yihunie (2023) supports this, arguing that shared infrastructure builds mutual interests and minimizes conflict incentives. Similarly, 91% of participants agreed that infrastructure development improved communication and cooperation among the three governments, with a high mean of 4.42. This underscores NBI's role as a facilitator of diplomacy, as regional meetings and joint planning increase mutual understanding (UNEP, 2022).

Lastly, the findings show that respondents perceive NBI infrastructure projects as addressing basic community needs such as water and sanitation (86.6% agreement, mean = 4.36), which are crucial for public health and well-being. These perceptions align with research indicating that inclusive infrastructure development in the Nile Basin improves living conditions and boosts community support for regional integration (Tesfaye et al., 2024). Moreover, 89.7% believe that such projects have contributed to long-term regional stability and development, scoring a high mean of 4.39. As highlighted by Otieno and Musoke (2021), infrastructure not only stimulates economic growth but also reinforces institutional cooperation—key pillars for sustainable peace. ID positively influenced PRD ($\beta = 0.192$, $p < 0.001$). Joint hydropower and irrigation projects improved energy access, livelihoods, and cross-border cooperation.

Capacity Building

Table 4 presents respondents' views on the role of the Nile Basin Initiative's (NBI) capacity-building initiatives in promoting peace and regional development among Ethiopia, Sudan, and Egypt. This section explores how training programs, knowledge sharing, and institutional strengthening efforts by the NBI have enhanced the technical skills and collaborative capabilities of the riparian countries. By assessing the level of agreement with relevant statements, the study evaluates the perceived effectiveness of these initiatives in fostering cooperation, improving water resource management, and supporting sustainable development. The findings provide important insights into how capacity building contributes to long-term peace and regional integration within the Nile Basin.

Table 4: Respondents' views on role of NBI's capacity-building initiatives

Statement	SD	D	NS	A	SA	Mean	SD
NBI's capacity-building initiatives have significantly improved local governance in Ethiopia, Sudan, and Egypt.	0.0%	4.8%	6.7%	45.5%	43.0%	4.2667	.78967
The training programs provided by NBI have enhanced the technical skills of government officials in the region.	0.6%	7.9%	6.7%	42.4%	42.4%	4.1818	.91247
NBI's capacity-building efforts increased the collaboration between Ethiopia, Sudan, and Egypt on water resource management.	0.6%	3.6%	15.8%	48.5%	31.5%	4.0667	.81997
The NBI's capacity-building initiatives have led to more sustainable water management practices in the region.	1.2%	5.5%	8.5%	33.9%	50.9%	4.2788	.92121
Local communities have benefited from NBI's capacity-building programs, contributing to regional peace and stability.	1.8%	3.6%	13.3%	39.4%	41.8%	4.1576	.91699

Source: **Primary data**, (2025).

Table 4 illustrates respondents' perspectives on the role of the Nile Basin Initiative's (NBI) capacity-building initiatives in fostering peace and regional development among Ethiopia, Sudan, and Egypt. A significant 88.5% of respondents agreed or strongly agreed that NBI's efforts have improved local governance (Mean = 4.27), emphasizing the perceived institutional strengthening brought about by these initiatives. This finding is echoed in a study by Abdelsalam and Tesfaye (2023), which highlights the importance of good governance structures in transboundary water cooperation, noting that NBI's capacity-building has enhanced policy coherence and accountability. Similarly, 84.8% of respondents affirmed that the training programs improved technical skills among government officials (Mean = 4.18), which is critical for sound water management and diplomacy. According to Awad and Mengistu (2022), building technical capacity within government institutions helps reduce conflict by equipping officials with the skills to engage in effective negotiation and policy implementation.

The survey also reveals that 80% of respondents agreed that NBI's capacity-building initiatives have promoted inter-country collaboration on water resource management (Mean = 4.07). This is consistent with the findings of Kassa and Elamin (2021), who argue that shared training programs and technical exchanges among Nile Basin countries have strengthened regional networks and facilitated knowledge-sharing, which are essential for cooperative management of shared resources. Furthermore, the majority of participants (84.8%) agreed or strongly agreed that these initiatives led to more sustainable water practices (Mean = 4.28). Such sustainability is critical in a region prone to hydropolitical tensions, and according to the United Nations Economic Commission for Africa (UNECA, 2023), capacity-building in integrated water resource management (IWRM) frameworks contributes to the long-term resilience of shared water systems.

Finally, 81.2% of respondents acknowledged that local communities have benefited from NBI's capacity-building programs, promoting peace and stability in the region (Mean = 4.16). These benefits include increased public awareness, local stakeholder participation, and enhanced community resilience. Research by Nasr and Mulugeta (2024) supports this view, noting that community-targeted educational and empowerment initiatives foster ownership and reduce tensions at grassroots levels. By bridging gaps between government institutions and communities, the NBI contributes to a bottom-up approach to peacebuilding and development in the Nile Basin region. CB significantly contributed to PRD ($\beta = 0.312$, $p < 0.001$), enhancing technical skills and institutional coordination. However, limited community-level inclusion was noted. The regression model explained 65.5% of the variance in PRD ($R^2 = 0.655$, $F = 75.82$, $p < 0.001$).

Promoting peace and regional development among Ethiopia, Sudan, and Egypt

Table 5 presents respondents' views on the overall role of efforts aimed at promoting peace and regional development among Ethiopia, Sudan, and Egypt. This section highlights perceptions of how cooperative initiatives, particularly those facilitated by the Nile Basin Initiative, have contributed to reducing conflicts, enhancing mutual trust, and fostering shared economic growth in the region. By examining the levels of agreement with key statements, the study assesses the effectiveness of these peacebuilding and development efforts in strengthening regional stability and integration. The mean and standard deviation values provide a clear picture of the general consensus and variations in respondents' opinions on this critical issue.

Table 5: Respondents' views on promoting peace and regional development

Statement	SD	D	NS	A	SA	Mean	SD
NBI's water resource management policies have effectively promoted peace among Ethiopia, Sudan, and Egypt.	0.6%	4.8%	9.1%	40.0%	45.5%	4.2485	.85829
The NBI-led conflict resolution mechanisms have contributed to reducing tensions between Ethiopia, Sudan, and Egypt.	0.6%	4.8%	10.9%	35.2%	48.5%	4.2606	.88274
NBI's infrastructure development projects have positively impacted regional economic development in Ethiopia, Sudan, and Egypt.	0.6%	3.6%	7.9%	38.2%	49.7%	4.3273	.82020
The capacity-building initiatives under NBI have improved the cooperation and management of shared water resources in the region.	0.0%	10.3%	9.1%	35.8%	44.8%	4.1515	.96655
NBI has played a key role in fostering mutual trust and collaboration between Ethiopia, Sudan, and Egypt on water issues.	0.6%	12.1%	10.3%	29.1%	47.9%	4.1152	1.05580
NBI's involvement in regional infrastructure projects has enhanced peace and stability in the Nile Basin region.	2.4%	6.1%	12.7%	27.3%	51.5%	4.1939	1.03533
The NBI's conflict resolution mechanisms have effectively prevented major disputes over Nile water usage between Ethiopia, Sudan, and Egypt.	1.2%	3.6%	11.5%	41.2%	42.4%	4.2000	.87094
The NBI's policies have led to tangible improvements in the livelihoods of communities in Ethiopia, Sudan, and Egypt.	0.0%	0.0%	3.6%	42.4%	53.9%	4.5030	.56981
The political cooperation fostered by NBI has contributed to the regional development agenda in Ethiopia, Sudan, and Egypt.	0.6%	4.2%	4.8%	37.0%	53.3%	4.3818	.81505
The shared management of water resources under NBI has led to more sustainable and equitable development outcomes in the region.	0.0%	3.0%	12.7%	31.5%	52.7%	4.3394	.81523

Source: **Primary data**, (2025).

Table 5 presents respondents' assessments of the Nile Basin Initiative's (NBI) contribution to peace and regional development among Ethiopia, Sudan, and Egypt. A majority of respondents affirmed that NBI's water resource management policies have effectively promoted peace (Mean = 4.25), and that its conflict resolution mechanisms have reduced tensions (Mean = 4.26). These perceptions align with recent findings by Gebremariam and Elbadawi (2022), who observed that structured basin-wide policies help reduce the frequency and severity of disputes over shared water resources. Additionally, infrastructure development under the NBI was seen to have a strong positive impact on regional economic development (Mean = 4.33), which is consistent with Tesfaye and Abdelrahman (2023), who noted that joint infrastructure investments—such as hydropower and irrigation systems—have generated cross-border economic benefits that reduce economic disparities and build interdependence among riparian states.

The data also indicate that capacity-building initiatives have improved cooperation on shared water resources (Mean = 4.15) and that NBI has contributed to fostering mutual trust (Mean = 4.12). These findings are supported by research from Meles and Ahmed (2021), which emphasizes the importance of institutional trust-building and technical collaboration in achieving sustainable water governance. Respondents further indicated that NBI's infrastructure involvement has enhanced peace and stability (Mean = 4.19), and that the Initiative

has played a role in preventing major disputes over Nile water usage (Mean = 4.20). This corroborates UNEP (2022), which highlighted NBI's role in implementing joint monitoring and early warning systems that mitigate potential flashpoints among the Nile riparian countries.

Finally, the most positively rated statement (Mean = 4.50) reveals that NBI's policies have tangibly improved community livelihoods in the region. Respondents also recognized political cooperation fostered by the NBI as a key contributor to the regional development agenda (Mean = 4.38), and noted that shared water management has led to sustainable and equitable outcomes (Mean = 4.34). These results are in line with Nasr and Moges (2024), who argue that inclusive governance mechanisms under the NBI have promoted long-term development by addressing both ecological sustainability and social equity. Collectively, the data illustrate that NBI's multidimensional approach—combining policy, infrastructure, capacity-building, and diplomacy—has been effective in promoting peace and regional development in the Nile Basin.

Regression Analysis

Table 6 presents the regression model summary, showing that the independent variables—capacity building, water resource management policies, conflict resolution mechanisms, and infrastructure development—collectively explain approximately 65.5% ($R^2 = .655$) of the variance in peace and regional development among Ethiopia, Sudan, and Egypt. The high R-value (.809) indicates a strong positive relationship between these predictors and the outcome variable, while the adjusted R^2 (.646) confirms the model's robustness after accounting for the number of predictors. This finding aligns with recent studies emphasizing the critical role of multi-faceted regional cooperation strategies in promoting peace and development. For instance, Hassan and Tekle (2023) found that integrated approaches combining technical capacity, policy coordination, and infrastructure investments significantly enhance cross-border stability in the Nile Basin. Similarly, Gebremariam and Mohamed (2022) highlighted that capacity building and infrastructure are particularly effective when complemented by equitable water governance policies.

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.809 ^a	.655	.646	.22531

a. Predictors: (Constant), Capacity Building, Water Resource Management Policies, Conflict Resolution Mechanisms, Infrastructure Development

Source: **Primary data**, (2025).

Table 7 presents the ANOVA results for the regression model assessing the impact of capacity building, water resource management policies, conflict resolution mechanisms, and infrastructure development on peace and regional development among Ethiopia, Sudan, and Egypt. The F-statistic of 75.821 with a significance level (p-value) of .000 indicates that the overall regression model is statistically significant, meaning that the independent variables reliably predict the dependent variable. This aligns with recent findings that emphasize the importance of integrated regional interventions in achieving peace and development goals. For instance, Mekonnen and Elhadi (2022) affirm that cooperative investments in infrastructure and governance across the Nile Basin significantly improve regional stability, while Awol and Abdu (2023) underscore the necessity of institutional capacity and shared water governance in conflict mitigation and sustainable development.

Table 7: ANOVA Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.396	4	3.849	75.821	.000 ^b
	Residual	8.123	160	.051		
	Total	23.519	164			

a. Dependent Variable: Peace and regional development

b. Predictors: (Constant), Capacity Building, Water Resource Management Policies, Conflict Resolution Mechanisms, Infrastructure Development

Source: **Primary data**, (2025).

Table 8 presents the coefficient results from the regression analysis examining the influence of various factors on peace and regional development among Ethiopia, Sudan, and Egypt. The results show that water resource management policies had the strongest positive and statistically significant effect ($\beta = .669$, $p < .001$), suggesting that effective policies are vital for promoting peace (Gebregziabher & Tesfaye, 2023). Capacity building also had a significant positive influence ($\beta = .312$, $p < .001$), supporting findings by Ahmed and Hassan (2021) that institutional strengthening enhances regional cooperation. Infrastructure development demonstrated a moderate yet significant positive impact ($\beta = .192$, $p < .001$), consistent with studies indicating that regional infrastructure fosters integration and stability (Mekonnen & Elhadi, 2022). However, conflict resolution mechanisms showed a negative and significant relationship ($\beta = -.149$, $p = .002$), possibly indicating that current mechanisms may be perceived as ineffective or misaligned with local contexts—a concern echoed by Nuru (2024), who stresses the need for culturally adapted and inclusive conflict resolution strategies in the Nile Basin.

Table 8: Coefficient results for all Variables

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-.692	.503		-1.377	.170
	Water Resource Management Policies	.737	.055	.669	13.513	.000
	Conflict Resolution Mechanisms	-.236	.075	-.149	-3.147	.002
	Infrastructure Development	.180	.047	.192	3.803	.000
	Capacity Building	.456	.069	.312	6.601	.000

a. Dependent Variable: Peace and regional development

Source: **Primary data**, (2025).

$$PRD = -0.692 + 0.737(WRMP) - 0.236(CRM) + 0.180(ID) + 0.456(CB)$$

The regression equation illustrates the relationship between peace and regional development (PRD) and four independent variables: Water Resource Management Policies (WRMP), Conflict Resolution Mechanisms (CRM), Infrastructure Development (ID), and Capacity Building (CB). The positive coefficient of 0.737 for WRMP indicates that improved water policies significantly enhance peace and development outcomes in the region, aligning with findings by Taye (2021). Capacity Building also shows a strong positive effect (0.456), suggesting its importance in fostering regional cooperation (Kimenyi & Mbaku, 2022). Infrastructure Development contributes positively but moderately (0.180), highlighting the value of regional projects in promoting stability (World Bank, 2023). Conversely, Conflict Resolution Mechanisms have a negative coefficient (−0.236), suggesting that the current approaches may not be effectively reducing tensions, echoing concerns raised in recent studies about the limitations of reactive conflict management in the Nile Basin (Mohammed, 2020). Overall, the equation underscores the multifaceted nature of peacebuilding, emphasizing proactive policy and institutional development.

Discussion

The findings affirm that technical cooperation—through equitable water policies, shared infrastructure, and institutional strengthening—advances peace and development more effectively than ad hoc diplomatic interventions. The negative role of CRM underscores a critical paradox: while the NBI provides a forum for dialogue, its non-binding nature and susceptibility to national politics undermine conflict resolution efficacy.

These results align with recent calls for “hydro-hegemony” to be replaced by “hydro-solidarity” (Zeitoun & Warner, 2006), emphasizing co-ownership over competition. The study also highlights the peace dividends of infrastructure: when benefits are shared, interdependence becomes a peace anchor.

CONCLUSION AND POLICY RECOMMENDATIONS

The NBI has made measurable contributions to regional peace and development, primarily through water governance and capacity development. However, its conflict resolution mechanisms require urgent reform.

Recommendations:

- **For Policymakers:** Institutionalize NBI frameworks into national legislation and negotiate a binding Cooperative Framework Agreement (CFA).
- **For Local Governments:** Integrate community voices into water planning and ensure equitable benefit-sharing from infrastructure projects.
- **For Civil Society:** Enhance public awareness and advocate for inclusive, gender-responsive water governance.

Suggestions for Future Research

Future studies should:

- Examine gender dynamics in NBI decision-making.
- Model climate change impacts on future water allocation scenarios.
- Conduct longitudinal assessments of infrastructure project outcomes on marginalized communities.

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