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## The role of exchange-traded funds (ETFs) in financing sustainable infrastructure projects: a conceptual framework for emerging markets

Olakojo Yusuff Ogunsola<sup>1</sup>, Yetunde Adenike Adebayo<sup>2</sup>, Ikiomoworio Nicholas Dienagha<sup>3</sup>,  
Nwakamma Ninduwezuo-Ehiobu<sup>4</sup>, & Zamathula Sikhakhane Nwokediegwu<sup>5</sup>

<sup>1</sup>Boston Consulting Group Dallas, Texas, USA

<sup>2</sup>Independent Researcher, UK

<sup>3</sup>Shell Petroleum Development Company, Lagos Nigeria

<sup>4</sup>Independent Researcher, Canada

<sup>5</sup>Independent Researcher, Durban, South Africa

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Corresponding Author:

Email: [ogunsolaoyusuff@gmail.com](mailto:ogunsolaoyusuff@gmail.com)

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### Abstract

Sustainable infrastructure development is critical for addressing emerging markets' economic, social, and environmental challenges. However, significant financing gaps hinder the progress of such initiatives. This paper explores the role of exchange-traded funds (ETFs) as innovative financing instruments for sustainable infrastructure projects in these regions. It begins by outlining the unique challenges and opportunities in sustainable infrastructure financing, highlighting the importance of financial markets in bridging funding deficits. The paper then delves into ETFs' structural features and mechanisms, emphasizing their potential to support long-term, diversified, and accessible investments. A conceptual framework is proposed, linking ETF design to the specific requirements of sustainable infrastructure while addressing critical factors such as regulatory support, ESG integration, and investor education. The framework also identifies potential risks and barriers, such as market maturity and transparency concerns. Finally, actionable recommendations are provided for policymakers, financial institutions, and stakeholders to optimize the deployment of ETFs for financing sustainable infrastructure. By leveraging ETFs effectively, emerging markets can enhance their resilience and achieve balanced development aligned with global sustainability goals.

**Keywords:** Sustainable infrastructure, Exchange-traded funds, Emerging markets, ESG integration, Green finance, Financial innovation.

### INTRODUCTION

Sustainable infrastructure fosters economic growth and environmental resilience in emerging markets. These projects typically encompass energy, transportation, water management, and urban development systems designed to meet present needs without compromising the ability of

future generations to thrive (Mahmood, Misra, Sun, Luqman, & Papa, 2024). By integrating environmental, social, and governance (ESG) considerations into the planning and execution phases, sustainable infrastructure ensures a balance between economic advancement and ecological preservation (Arzo & Hong, 2024). This dual focus is particularly significant in emerging economies, where rapid urbanization and industrialization exert considerable pressure on existing systems, making sustainable solutions more urgent.

Despite the recognized importance of sustainable infrastructure, financing such projects remains a formidable challenge for emerging markets. Many of these economies grapple with limited public resources, underdeveloped capital markets, and competing priorities for scarce fiscal funds (Nasir & Ahmed, 2024). Traditional funding sources like government budgets and development loans often fall short of bridging the vast infrastructure investment gap. According to the World Bank, trillions of dollars are needed annually to meet the global demand for sustainable infrastructure, with emerging markets shouldering a substantial portion of this burden. The inability to secure adequate funding delays critical projects and exacerbates environmental and social vulnerabilities (Bhattacharya & Jeong, 2018).

Amid these challenges, exchange-traded funds (ETFs) have emerged as an innovative tool for mobilizing private sector capital toward sustainable initiatives. ETFs, which pool assets from multiple investors to track specific indices, offer liquidity, diversification, and accessibility, making them attractive to a broad range of investors (Marszk & Lechman, 2023). In the context of sustainable infrastructure, ETFs can provide a vehicle for channeling global investments into green projects while offering transparent and efficient portfolio management. Moreover, the increasing investor demand for ESG-aligned financial products positions ETFs as a strategic instrument to link capital markets with sustainable development goals (El Aynaoui & Canuto, 2022).

This paper explores the potential of ETFs to bridge the financing gap for sustainable infrastructure in emerging markets. It examines the role of ETFs within the broader financial ecosystem, their alignment with the unique characteristics of these economies, and the critical factors influencing their success. By presenting a conceptual framework, the paper seeks to contribute to ongoing discourse on innovative financing mechanisms and provide actionable insights for stakeholders, including policymakers, financial institutions, and investors.

## **OVERVIEW OF SUSTAINABLE INFRASTRUCTURE FINANCING IN EMERGING MARKETS**

### **Unique Challenges in Financing Infrastructure**

Sustainable infrastructure is a cornerstone for achieving balanced development in emerging economies. It addresses critical energy, water, and transportation needs while integrating environmental and social considerations (Hariram, Mekha, Suganthan, & Sudhakar, 2023). However, financing such projects in these regions presents challenges and opportunities due to varying economic, institutional, and environmental conditions. Understanding these dynamics is essential for designing effective financing strategies supporting sustainable growth.

Emerging markets face several barriers that impede the financing of sustainable infrastructure. Limited fiscal space is a primary constraint for governments in these economies. Many are already burdened by debt, leaving insufficient resources to allocate toward large-scale, capital-intensive projects (Gurara, Klyuev, Mwase, & Presbitero, 2018). Additionally, underdeveloped

domestic capital markets limit the availability of long-term funding options. Local financial institutions often lack the capacity or risk appetite to provide substantial loans for projects with extended payback periods (Prasad, Loukoianova, Feng, & Oman, 2022).

Another critical issue is the perceived risk associated with investing in these regions. Political instability, regulatory uncertainty, and currency fluctuations deter private sector participation. Investors often demand higher returns to compensate for these risks, which increases the cost of financing and makes projects less feasible. Furthermore, there is a lack of technical expertise and institutional capacity to effectively structure and implement sustainable projects, leading to delays and inefficiencies (Al-Thaqeb, Algharabali, & Alabdulghafour, 2022).

### **Opportunities in Financing Sustainable Infrastructure**

Despite these challenges, emerging markets offer significant opportunities for innovative financing mechanisms. The increasing global focus on environmental sustainability has created a growing appetite for green investments. International investors are actively seeking opportunities to align their portfolios with global sustainability goals, providing an untapped source of capital for these regions.

Moreover, the rapid adoption of digital technologies in emerging markets enables greater project planning and implementation efficiency. Digital tools can improve transparency, streamline procurement processes, and enhance monitoring and evaluation systems. These advancements help reduce risks, thereby attracting more private sector participation (Bhuiyan et al., 2024).

Public-private partnerships (PPPs) also represent a promising avenue for sustainable infrastructure financing. Governments can overcome budgetary constraints and accelerate project timelines by leveraging private sector resources and expertise. Additionally, the increasing availability of blended finance—a combination of concessional and commercial funding—helps mitigate risks and improve project bankability (Herath & Herath, 2023).

### **Role of Financial Markets and Instruments**

Financial markets play a crucial role in addressing funding gaps for sustainable infrastructure. They provide much-needed liquidity and long-term financing by mobilizing capital from diverse investors. Instruments such as green bonds, sustainability-linked loans, and structured funds have gained traction in recent years, offering targeted solutions for sustainable projects (Jiang, 2023).

Green bonds, for instance, are specifically designed to finance environmentally beneficial projects. Their transparent use-of-proceeds framework reassures investors about the alignment of funds with sustainability objectives. Similarly, sustainability-linked loans incentivize borrowers to achieve pre-agreed ESG performance targets, aligning financial and environmental goals. These instruments attract institutional investors and raise awareness about the importance of sustainable finance in emerging markets (Sartzetakis, 2021). The development of local capital markets is equally important. Governments can mitigate currency risks and ensure greater participation from domestic investors by fostering the issuance of local-currency debt instruments. Strong regulatory frameworks and incentives, such as tax benefits or guarantees, further encourage the growth of sustainable financial products.

### **Key Stakeholders in Sustainable Infrastructure Financing**

The successful financing of sustainable infrastructure requires coordinated efforts from multiple stakeholders. Governments play a pivotal role as policymakers, regulators, and project sponsors. They establish the legal and institutional frameworks that enable investment and ensure

alignment with national development goals. Public sector entities also provide seed funding and guarantees to de-risk projects and attract private capital.

The private sector contributes through financial investments, technical expertise, and operational efficiency. Private companies are essential partners in PPPs and are increasingly involved in sustainability-focused initiatives due to growing consumer and investor demand for responsible business practices (Okeke, Bakare, & Achumie, 2024; Omowole, Urefe, Mokogwu, & Ewim, 2024).

Development banks and international financial institutions (IFIs) are critical enablers in the financing ecosystem. These entities provide concessional funding, technical assistance, and capacity-building support to governments and private sector players. They also catalyze by mobilizing additional resources through blended finance mechanisms (Marston, 2022). Civil society organizations and local communities are equally important stakeholders. They ensure that projects are inclusive and aligned with the population's needs. By participating in decision-making processes, these groups enhance accountability and social acceptance, reducing the risk of opposition or delays.

## **EXCHANGE-TRADED FUNDS AND THEIR MECHANISMS**

### **Structure and General Role in Financial Markets**

Exchange-traded funds (ETFs) are a transformative innovation in the financial markets, providing investors with an efficient way to access diversified portfolios of assets. An ETF pools capital from multiple investors to track the performance of a specific index, sector, commodity, or theme (Marszk & Lechman, 2019). These funds are traded on stock exchanges, just like individual stocks, offering liquidity and flexibility to investors. ETFs have gained significant traction globally due to their simplicity, cost-effectiveness, and adaptability, making them an integral part of modern financial ecosystems.

The structure of an ETF is straightforward yet effective. It consists of a portfolio of underlying assets, such as stocks, bonds, or other securities, managed by a fund manager. The fund issues shares that are listed on exchanges, allowing investors to buy and sell these shares throughout the trading day. Unlike traditional mutual funds, ETFs enable real-time pricing, which reflects market dynamics (Sushko & Turner, 2018).

In financial markets, ETFs serve multiple roles. They provide an accessible entry point for individual investors, enabling participation in markets that were traditionally reserved for institutional players. Their transparent structure allows investors to see the fund's composition, fostering trust and informed decision-making (Marszk et al., 2019). ETFs also contribute to market efficiency by improving liquidity and reducing transaction costs, as they often trade at lower fees compared to other investment vehicles. Furthermore, they allow for precise exposure to specific sectors, regions, or themes, catering to the diverse preferences of investors.

### **Features That Make ETFs Suitable for Supporting Sustainable Projects**

ETFs possess several features that make them particularly well-suited for advancing sustainability initiatives. One of the most compelling attributes of ETFs is their liquidity. The ability to trade ETF shares on exchanges throughout the day provides investors with flexibility and ease of access. For sustainable infrastructure projects, liquidity is vital as it enables a steady inflow of capital, ensuring that projects can be financed and scaled efficiently. The tradable

nature of ETFs also reduces the entry and exit barriers for investors, making them attractive to a broad audience (Cullen, 2023).

ETFs inherently offer diversification by pooling investments across multiple assets. This reduces risk for investors by spreading exposure across various companies or sectors. For sustainability-focused investments, diversification minimizes the potential impact of underperforming projects or sectors. It also allows investors to support various environmentally beneficial initiatives through a single financial instrument (Chidi, 2018).

ETFs democratize access to investment opportunities. Their relatively low minimum investment requirements enable retail investors to participate in markets previously dominated by institutional players. Accessibility is particularly important for sustainable projects, as it broadens the investor base and mobilizes a larger pool of capital. Additionally, the transparent nature of ETFs ensures that investors are fully informed about the allocation of their funds, fostering trust in sustainability-focused products (Grund, 2020).

These features collectively position ETFs as an effective tool for financing sustainable development. They attract institutional capital and engage retail investors, creating a robust ecosystem to support long-term goals.

#### **Trends in Green or Sustainability-Focused ETFs Globally**

The rise of green or sustainability-focused ETFs reflects a broader shift in investor priorities toward environmental and social responsibility. These ETFs are specifically designed to align with ESG criteria, focusing on companies or projects that contribute positively to sustainability goals. Globally, the market for these ETFs has grown exponentially in recent years (Acar, 2023). For instance, funds tracking renewable energy companies, electric vehicle supply chains, and climate-friendly technologies have witnessed significant inflows. This growth is driven by increasing awareness of climate change and a strong regulatory push for sustainable finance. Governments and international bodies are encouraging the development of ESG-aligned financial products through incentives and policy support (Junaedi, 2024).

Another notable trend is the integration of thematic approaches within these ETFs. Many funds now focus on themes such as clean energy, water conservation, and green infrastructure. These thematic ETFs allow investors to align their portfolios with specific sustainability objectives, fostering targeted investment in areas of high impact.

The geographical distribution of sustainability-focused ETFs is also noteworthy. While developed markets, particularly in Europe and North America, have led the adoption of these funds, emerging markets are beginning to catch up. Countries in Asia, Latin America, and Africa are increasingly exploring green finance mechanisms to address local environmental challenges (Acar, 2023).

Technological advancements have further contributed to the evolution of sustainability ETFs. Digital platforms and robo-advisors are making it easier for investors to identify and invest in ESG-aligned funds. This accessibility is particularly appealing to younger, tech-savvy investors who prioritize sustainability in their investment decisions (Marszk & Lechman, 2023). Despite their growth, green ETFs face certain challenges, including concerns about "greenwashing," where funds may overstate their sustainability credentials. However, increasing regulatory scrutiny and the development of standardized ESG metrics are addressing these issues and

enhancing the credibility of these funds (Mokogwu, Achumie, Gbolahan, Adeleke, & Ewim, 2024).

### **CONCEPTUAL FRAMEWORK FOR ETFs IN FINANCING SUSTAINABLE INFRASTRUCTURE**

#### **Linking ETF Design to Sustainable Infrastructure Needs**

A conceptual framework for ETFs in financing sustainable infrastructure must focus on bridging the gap between investor preferences and project requirements. The design of such ETFs should prioritize alignment with the key features of sustainable infrastructure, including long-term investment horizons, social impact, and environmental benefits.

The first element of the framework involves the creation of indices that track sustainable infrastructure-related assets. These indices could include publicly listed companies involved in renewable energy, water management, or green transportation and project bonds issued by governments or private entities to fund infrastructure development. By using a well-defined index as a benchmark, ETFs can provide investors with targeted exposure to sustainability-focused initiatives.

Secondly, these ETFs should incorporate a diversified portfolio of assets across different sectors and geographies to mitigate risks associated with single-project dependency or regional volatility. Diversification ensures that investors are not overly exposed to the performance of any one asset while enabling sustainable projects in less-developed regions to attract capital. Lastly, fund structures must include mechanisms for periodic impact reporting to assure investors of their investments' social and environmental benefits. Transparent metrics, such as carbon emissions reductions, renewable energy generation, or communities positively impacted, can enhance investor confidence and encourage participation (Alemede, Usuemerai, & Ibikunle, 2022).

#### **Key Factors for Successful Implementation**

Certain enablers must be in place for ETFs to successfully finance sustainable infrastructure. Governments and regulatory bodies are vital in creating an enabling environment for sustainability-focused ETFs (Bakare, Achumie, & Okeke, 2024). Policies that incentivize green investments, such as tax benefits or subsidies, can encourage participation from institutional and retail investors. Moreover, establishing clear guidelines on ESG reporting and disclosure ensures that funds are aligned with genuine sustainability objectives, reducing concerns about "greenwashing."

Awareness and understanding of ETFs among investors, particularly in emerging markets, are crucial for their adoption. Many retail investors remain unfamiliar with the mechanics of ETFs and the potential benefits of sustainability-focused funds. Educational campaigns, seminars, and digital platforms can bridge this knowledge gap. Additionally, promoting the long-term benefits of sustainable investments can shift investor focus from short-term returns to enduring social and environmental gains (Ezeife, Eyeregba, Mokogwu, & Olorunyomi, 2024).

Robust ESG criteria must underpin the selection of assets within the ETFs. This integration ensures that the funds genuinely contribute to sustainability goals while attracting investors who prioritize ethical investing. Standardized frameworks for ESG evaluation, developed by international organizations, can guide fund managers in asset selection (Landi, Turriziani, Muto, & Ricciardi, 2024). Collaboration among various stakeholders—including governments, private

sector entities, and development institutions—is essential. Public-private partnerships can de-risk ETFs by providing guarantees or concessional funding. Similarly, partnerships with international organizations can enhance credibility and attract global investors (Adeleye, Awonuga, Ndubuisi, Oyeyemi, & Asuzu, 2024).

### **Potential Risks and Barriers**

While the potential of ETFs in financing sustainable infrastructure is significant, some several risks and barriers must be addressed. Many emerging markets lack the depth and sophistication of financial markets necessary to support ETFs. Limited liquidity, underdeveloped stock exchanges, and a small investor base hinder the establishment and growth of such funds. Strengthening financial market infrastructure and encouraging broader participation from both institutional and retail investors are critical steps. Concerns about transparency in the management of ETFs and the authenticity of ESG claims can undermine investor trust. To address this, fund managers must adopt rigorous reporting standards and provide regular updates on the performance and impact of their portfolios. Independent audits and third-party certifications can further enhance credibility (Alemede, Usuemerai, & Ibikunle, 2023; Aniebonam, Chukwuba, Nwafor, & Taylor, 2023).

Inconsistent regulatory frameworks across emerging markets create hurdles for the standardization and cross-border operation of ETFs. Harmonizing regulations, particularly concerning ESG disclosures and financial reporting, is necessary to facilitate the growth of sustainability-focused funds. Many sustainable infrastructure projects in emerging markets involve local currencies, while ETFs often attract international investors dealing in foreign currencies. Fluctuations in exchange rates can introduce additional risks, deterring participation. Currency hedging mechanisms within ETFs can mitigate this issue, albeit at an increased cost. A lack of awareness among both issuers and investors about the potential of ETFs to finance sustainable infrastructure continues to be a significant barrier. Governments and industry bodies must actively promote these instruments and their benefits (Lettau & Madhavan, 2018).

The successful implementation of this conceptual framework involves a phased approach. Initially, pilot projects can be launched in more mature emerging markets with supportive regulatory environments and active capital markets. These pilots can provide valuable insights into fund design, risk management, and investor preferences. Subsequently, lessons learned from these pilots can guide the replication of ETFs across other emerging economies. Capacity-building initiatives targeting local financial institutions, fund managers, and policymakers can ensure that best practices are widely adopted. Finally, ongoing collaboration among stakeholders and periodic review of fund performance and impact can refine the framework and drive continuous improvement.

### **CONCLUSION**

The growing demand for sustainable infrastructure in emerging markets is accompanied by the limitations of traditional financing mechanisms, creating a critical need for innovative solutions. Exchange-traded funds (ETFs) present a compelling opportunity to address this challenge due to their unique attributes such as liquidity, diversification, and accessibility. By aligning with environmental, social, and governance (ESG) principles, ETFs can bridge the significant financing gaps in these regions, enabling capital flows toward projects that drive long-term development while promoting environmental preservation and social equity.

This discussion has highlighted key insights into the role of ETFs in supporting sustainable infrastructure. Infrastructure development is fundamental to achieving balanced economic growth while mitigating environmental and societal challenges. However, emerging markets face financial constraints and elevated risks, necessitating alternative funding mechanisms. ETFs offer a transparent and flexible platform for mobilizing both institutional and private investments, leveraging their ability to pool resources and diversify risks across various asset classes and geographies. This flexibility makes them particularly appealing in environments where traditional finance struggles to meet infrastructure demands.

For ETFs to fulfill their potential, a robust framework is necessary. Policymakers must strengthen regulatory systems by establishing standardized ESG disclosure requirements, ensuring transparency and accountability for all stakeholders. Clear and enforceable guidelines will prevent issues like greenwashing and foster investor confidence. Additionally, offering targeted incentives such as tax benefits or subsidies can further encourage the adoption of sustainability-focused ETFs, making them an attractive proposition for both domestic and international investors. Policymakers should also focus on market development, creating a financial ecosystem that supports liquidity, accessibility, and cross-border collaboration.

Financial institutions have a critical role in designing ETFs that cater specifically to sustainable infrastructure needs. Fund managers should prioritize creating diversified products that align with ESG principles, leveraging impact metrics to track and communicate these funds' social and environmental benefits. Collaboration with development banks and multilateral organizations can enhance fund design, de-risk investments, and attract a wider range of investors. Furthermore, educational campaigns to simplify ETF concepts and emphasize their long-term societal benefits are crucial in increasing investor participation and awareness.

Public-private partnerships and stakeholder collaboration are equally important. Development banks, international organizations, and private entities should work together to de-risk sustainable infrastructure projects through mechanisms like blended finance. Transparent monitoring and impact evaluations of ETFs will further enhance credibility, ensuring that investments align with their intended sustainability goals. Independent audits and certifications can also provide reassurance to investors and create a framework for accountability.

In conclusion, ETFs represent a transformative tool for addressing the persistent financing challenges of sustainable infrastructure in emerging markets. By implementing targeted policies, fostering financial innovation, and enhancing stakeholder collaboration, the full potential of ETFs can be realized. Such efforts will accelerate the development of essential infrastructure and contribute to achieving global sustainability objectives, ensuring inclusive growth and resilience for future generations.

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