

Innovation Testbeds: A Pathway to a Green Shipping Corridor in West Africa

Maudlyn Victor-Ikoh¹; Okardi Biobele²; Victor Ikoh³

^{1,2}Department of Computer Science and Informatics, Federal University Otuoke, Nigeria.

³MLA College, Sustainable Maritime Operations, University of Plymouth, United Kingdom.

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Abstract: Green shipping corridors are strategic to the pathways to decarbonization. This is a route in the maritime sector that connects ports where only ships operating with zero or near-zero emissions are permitted. Despite the promising nature of this plan, many of the nations are fraught with challenges that have impeded their progress. This reality poses a challenge to the vision of the Green Shipping Corridor for major shipping ports on the West African coastline. Against this backdrop, this paper explores the pathways to green shipping corridors in the West African Region. This study adopts an exploratory approach through secondary sources. The study finds that West Africa may not be ready to launch into a full green corridor immediately, as many corridor initiatives stall because the leap from initiation to realization is too large without a cost-bridging mechanism. Therefore, an innovation testbed approach is considered a profitable pathway to the Green Shipping corridor in West Africa.

Keywords: Green Shipping Corridors; Decarbonization, Greenhouse Gas.

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I. INTRODUCTION

Decarbonization is the process or response to climate change that is targeted at reducing carbon dioxide and other greenhouse gases from a system. When there is a combustion of fuel in an environment, carbon dioxide is released into the environment, and when this continues for a long time, it affects the ozone layer (global warming) and can harm the ecosystem. In the maritime sector, ships and other heavy-duty carriers are the major source of greenhouse gas (GHG) emissions. This happens as fossil fuels are used to power the ships for movement and haulage. Decarbonization, simply, is the actions taken to curtail the release of carbon dioxide and other GHG while decarbonization pathways, on the other hand, are the strategies adopted or recommended by international and/or regulatory bodies to reduce the level of greenhouse gas emissions for a safer planet, which and ultimately achieving the thirteenth Sustainable Development (SDG) Goal 13 on Climate Action.

Green shipping corridors are strategic to the pathways to decarbonization. This is a route in the maritime sector that connects ports where only ships operating with zero or near-zero emission infrastructures, with other technological and regulatory apparatus that enable the ships to operate within the expected net-zero agenda, are allowed to ply (Jugovic, et al., 2025). Green shipping Corridors are designated maritime routes between two or more ports where zero or near-zero emission shipping is established and scaled. Therefore, only

vessels that meet certain standards of net-zero emissions travel through the corridors. In November 2021, at the Conference of the Parties in Glasgow, 21 countries signed the Clydebank Declaration, signaling their intent to promote the development of green shipping corridors. The declaration set a target of establishing at least six green corridors on major deep-sea routes by 2026. Since then, the movement has gained remarkable momentum with positive traction. Green corridors are now seen as more than just environmental projects; they are market tools that facilitate compliant trade, unlock green financing, and give advantages to ports and routes that can provide verified low-emission operations.

Shipping corridors that are low-carbon have become a fundamental requirement for trade that is efficient and built to last. (Fenwick, 2025). Evidence of this progress can be seen across the globe. Singapore is positioning itself as an international center for sustainable fuels, while Norway continues to pioneer vessels that produce zero emissions. Chile is driving the development of green shipping routes across the Pacific, and nations along Africa's coast are tying port development to the growth of their blue economies. Numerous green shipping corridors have been announced, particularly between Clydebank signatories (including Australia, Belgium, Canada, Chile, Costa Rica, Denmark, Fiji, Finland, France, Germany, Ireland, Italy, Japan, Morocco, Netherlands, New Zealand, Norway, Spain, Sweden, the UK and the US)(Edwardes-Evans, 2024), which indicates seriousness and follow-up action post COP26

summit. These corridors include: Australia-East Asia Iron Ore; Rotterdam-Singapore GDSC; Singapore-Australia GDSC; Singapore-Japan GDSC; the Silk Alliance; Dover-Calais/Dunkirk Ferry; FIN-EST; Gothenburg-Rotterdam; Oslo-Rotterdam; Stockholm-Turku; Tyne-Ijmuiden; Vaasa-Umea; Port of Los Angeles-Port of Long Beach-Singapore GDSC; Port of Los Angeles-Port of Long Beach-Port of Shanghai; US-Republic of Korea: Seattle and Tacoma-Busan; and Chile-Japan/Korea copper concentrate. The 2025 Annual Progress Report on Green Shipping Corridors identified Ghana as one of the new green corridor initiatives in West Africa (Chan et al., 2025).

Despite the promising nature of this plan, many of the nations are fraught with challenges that have impeded their progress in the journey (Kramel et al., 2024). According to Jugovic et al. (2025), many green shipping corridors are still at the stage of initiation and would require the cooperation of all stakeholders involved in the value chain to succeed. The strategy, while good and promising, is likely to face challenges such as logistics, regulatory alignment, fuel cost, and technology standardization. While the West African region is still lagging, a pressing concern along the West African region corridors is the condition of the vessels currently in operation. A significant proportion of the fleet is ageing, with many vessels having surpassed their optimal operational lifespan (Acheampong, 2025). And in most cases, they have not yet yielded a tangible pathway to close the fuel cost gap for ammonia gas, methanol, electric, methane, hydrogen, advanced bio ammonia gas, or wind turbine which are expensive to pull off. This reality poses a challenge to the vision of the Green Shipping Corridor for major shipping ports in West Africa coastline such as the Port of Abidjan (Ivory Coast), Port of Tema & Takoradi (Ghana), Port of Lagos/Lekki (Nigeria), Port of Lomé (Togo), Port of Cotonou (Benin), and Port of Dakar (Senegal). It is on this premise that this study is carried out to explore the pathways to green shipping corridors in the West African Region. This study adopts an exploratory approach through secondary sources.

II. STAGES TO GREEN SHIPPING CORRIDOR

The implementation of a green shipping corridor follows four progressive stages. The first, Initiation, involves establishing the initiative. This leads into Exploration, which has two sub-stages: an early phase focused on aligning stakeholders on what the initiative should look like, and an advanced phase dedicated to understanding what needs to happen to realise the opportunity. The third stage, Preparation, is reached only when an initiative is actively engaged in removing shared barriers and taking the necessary steps toward realisation. Activities that include policy dialogues, policy papers, contract signings, and engineering and design work. This stage is likewise divided into a pre-commercial phase, concerned with removing shared barriers, and a commercial phase, focused on taking the concrete actions needed for realisation. The final stage, Realisation, marks the point at which the corridor becomes operational, beginning with Construction, where vessels, infrastructure, and fuel plants are built — and culminating in Operation, when zero-emission shipping formally begins on the corridor.

Chan et al. (2025) report that four corridors reached the Realisation stage for the first time, comprising three short-sea European routes: the Stockholm–Turku ferry, the Vaasa–Umeå ferry, and the Oslo–Rotterdam container service, and one deep-sea route in the Asia-Pacific, covering the Australia–East Asia iron ore corridor.

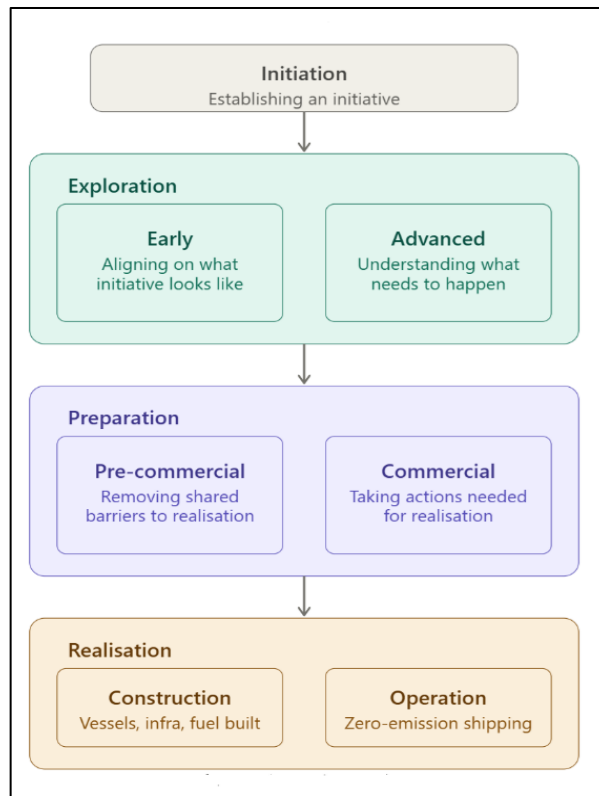


Fig 1 Stages to Green Shipping Corridor

III. INNOVATIVE TESTBED

West Africa may not be ready to launch into a full green corridor immediately, as many corridor initiatives stall because the leap from feasibility study to vessel deployment is too large without a cost-bridging mechanism. We can decarbonize by reduction but not by elimination (Green).

This study proposes an innovation testbed approach in West Africa as the pathway to the Green Shipping corridor. The innovation testbed model solves this by sitting in a controlled, real-world environment where new zero-emission fuels, vessel technologies, and shipping infrastructure are trialled and tested on a small, manageable scale without the full commitment of a formal green shipping corridor. New technology developments can be tested in controlled but near-real-world conditions. It creates a shared space for ports, shippers, fuel producers, governments, researchers, and financiers to test zero-emission technologies, build institutional capacity, and generate the evidence base needed to eventually formalize a corridor. It offers a lower-stakes entry point for countries or companies not yet ready to commit to a full corridor designation. Across the West African region, innovative testbeds can be formalized amongst ports as a formal initiative towards a green shipping corridor. Nigeria's Lekki Deep Sea Port and Tema (Ghana) are

the region's highest-volume transshipment hubs, positioning them as the backbone for its green shipping corridor. With ports including: Lekki Deep Sea Port; Onne Port Complex; Apapa Port; Tin Can Island Port Complex; Calabar Port Complex. Delta Ports, Ibom Deep Sea Port, Bonny Deep Sea Port, the Lekki Deep Sea Port are Nigeria's first fully automated deepwater facilities, which were built and equipped with cutting-edge ship-to-shore super-post-Panamax cranes and advanced scanning technology. This positions it as a natural anchor for a future green shipping corridor hub.

➤ *Port and Fleet Modernization*

Successful green shipping corridors require modern port infrastructure capable of supporting alternative fuels and zero-emission vessels. Nigeria's ports at Apapa, Tin Can Island, and Lekki must be prioritized. The condition of Nigeria's existing fleet demands urgent attention alongside infrastructure development. As Africa's largest ship-owning nation with 291 vessels totalling 7.94 million deadweight tons, the scale of Nigeria's fleet means that retrofitting is far more immediately achievable than wholesale fleet replacement. The Cabotage Vessel Financing Fund (CVFF), which NIMASA is working to disburse to indigenous shipowners, can be structured as incentives to green retrofits and innovative beds as a condition of funding access.

➤ *Transition to Alternative and Sustainable Fuel*

West Africa already has LNG vessels operating on its routes and NLNG Bonny Island provides immediate supply of LNG. Nigeria is expanding its LNG capacity from 22.5 million tonnes per annum to 30 million tonnes per annum, leveraging these reserves (Klein, 2026). LNG as a marine fuel offers a meaningful step down in emissions intensity. LNG reduces sulphur oxides and particulate matter almost entirely, cuts nitrogen oxides by up to 85% and lowers carbon dioxide emissions by roughly 20% compared to conventional marine fuels. Globally, more than 1,200 LNG-capable vessels are now in operation or on order, a number that has more than doubled over the past five years. However, in West Africa, Nigeria has explored LNG bunkering given its gas reserves, yet infrastructure development has been slow. Accelerating LNG bunkering infrastructure at Lagos and Lekki ports is therefore an urgent near-term priority. (Irungu, 2026) Nigeria is among the countries identified by the African Hydrogen Partnership as a potential landing zone for storing and distributing green hydrogen. Green ammonia, which is emerging as one of the most viable zero-emission marine fuels for deep-sea shipping, and Nigeria's gas infrastructure and coastal position give it a comparative advantage in its production and export. Mauritania–Senegal LNG exports anchor a regional gas transition opportunity too (Greater Tortue - Kosmos Energy, 2026).

➤ *Monitoring Established Emission Baseline*

At COP28 in Dubai, Nigeria announced the establishment of an emissions inventory to define its national maritime emissions baseline. Building on this, NIMASA collaborated with University College London researchers to develop Nigeria's first verifiable maritime emissions inventory, presented at COP29. Most recently, at COP30 in

Brazil, NIMASA showcased a pioneering Public-Private Partnership model for African maritime decarbonization through the establishment of the Nigerian Maritime Continuous Emissions Monitoring System, which is Africa's first comprehensive framework for tracking vessel emissions in real-time. For any green shipping corridor initiative to be successful, a bedrock of data-based decision-making is imperative. Data sharing and transparency between value chain stakeholders are required. IoT systems can be incorporated into a unified carbon intelligence platform—aggregating data from smart sensors, grids, and supply chain nodes. IoT devices provide unprecedented visibility into supply chain operations. Data generated via IoT-based carbon sensors can and is already being used to make informed decisions about reducing emissions. Green shipping corridors rely on verified emissions reductions, creating a strong business case for digital monitoring and verification services. Platforms that gather emissions data from vessels and ports, provide certified reporting, and ensure compliance. In sum, digitalization is not merely a supporting tool for maritime decarbonization; it is a foundational enabler that makes every other pathway (alternative fuels, energy efficiency retrofits, carbon capture) more measurable, more accountable, and more investable. Maritime academies (such as NIMASA Maritime Academy, Oron) must integrate data science, AI, and digital systems into seafarer and officer training curricula for robust digital monitoring infrastructure,

IV. CONCLUSION

Green shipping corridors are strategic to the pathways to decarbonization. However, the experience across the region shows that ambition alone is insufficient as significant gaps remain between initiation, exploration, preparation, and realization. For West Africa, realizing the operation of the green shipping corridor can safely start as an innovative testbed. Building this foundation is both the most actionable step toward a decarbonized maritime sector and a green shipping corridor. The development is not easy because many of the required technologies are still, to some extent, experimental, but ports like Bonny Port can serve as a testbed model since it holds a record of the LNG ships at its terminals. By enabling controlled, near real-world experimentation, testbeds can help bridge the gap between initiation to realization.

REFERENCES

- [1]. Acheampong, B. O. (2025, February 11). *Green shipping corridors in West Africa: Overcoming barriers and unlocking opportunities for maritime decarbonization* (Master's thesis, World Maritime University). https://commons.wmu.se/cgi/viewcontent.cgi?article=3614&context=all_dissertations
- [2]. BusinessDay. (2026, January 8). *Green shipping corridors: Nigeria's path to sustainable maritime trade*. Businessday NG. <https://businessday.ng/news/legal-business/article/green-shipping-corridors-nigerias-path-to-sustainable-maritime-trade/>

- [3]. Chan, I., Boyland, J., & Talalasova, E. (2025, November 27). *At a crossroads: Annual progress report on green shipping corridors 2025*. Getting to Zero Coalition; Global Maritime Forum. <https://globalmaritimeforum.org/report/annual-progress-report-on-green-shipping-corridors-2025/>
- [4]. Edwardes-Evans, H. (2024, November 14). COP26: 22 countries sign Clydebank Declaration to boost green shipping. *S&P Global Energy*. <https://www.spglobal.com/energy/en/news-research/latest-news/energy-transition/111021-cop26-22-countries-sign-clydebank-declaration-to-boost-green-shipping>
- [5]. Famave, S., Ezechukwu, I., Oyewole, B., Theophilus, J., & Agukwe, L. (2026, January 8). *Green shipping corridors: Nigeria's path to sustainable maritime trade*. *Businessday NG*. <https://businessday.ng/news/legal-business/article/green-shipping-corridors-nigerias-path-to-sustainable-maritime-trade/>
- [6]. Fenwick, I. (2025, September 10). *A global blueprint for green shipping corridors*. ORF Online. <https://www.orfonline.org/expert-speak/a-global-blueprint-for-green-shipping-corridors>
- [7]. Irungu, S. (2026, January 11). Kenya's Port of Mombasa docks East Africa's first LNG-powered cargo vessel, marking a new phase in sustainable maritime trade. *African Sustainability Matters*. <https://africasustainabilitymatters.com/kenyas-port-of-mombasa-docks-east-africas-first-lng-powered-cargo-vessel-marking-a-new-phase-in-sustainable-maritime-trade/>
- [8]. Jugovic, A., Sirotic, M., Jugovic, T. & Zgaljic, D., 2025. Green Shipping Corridors: A Bibliometric Analysis of Policy, Technology, and Stakeholder Collaboration. *Journal of Applied Sciences*, 15(6), pp. 1-37. doi:<https://doi.org/10.3390/app15063304>
- [9]. Kosmos Energy. (2026, March 6). *Greater Tortue*. <https://www.kosmosenergy.com/greater-tortue/>
- [10]. Klein, A. (2026, February 3). *The billion-dollar gas question: Can upcoming infrastructure reshape African LNG?* *Energy Capital & Power*. <https://energycapitalpower.com/the-billion-dollar-gas-question-can-upcoming-infrastructure-reshape-african-lng/>
- [11]. Kramel, D. et al., 2024. Maritime sector transition pathways towards netzero within global energy scenarios. *Research Square*, pp. 1-20. doi:<https://doi.org/10.21203/rs.3.rs-4471628/v1>
- [12]. Review of maritime transport 2023: Facts and figures on Africa. (2023, September 27). *UN Trade and Development (UNCTAD)*. <https://unctad.org/press-material/review-maritime-transport-2023-facts-and-figures-africa>.