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SUBSEA INFRASTRUCTURE WESTERN INDIAN OCEAN

Francois Vreÿ, Mark Blaine & Andre De Wet

ANALYSIS

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📱 FNFreiheit

Author

Prof. Francois Vreÿ
Mark Blaine
Andre De Wet

Editor

Theresa Caroline Winter
Global Themes Division
Friedrich Naumann Foundation for Freedom

Contact

Telephone +49 30 22 01 26 34
E-mail service@freiheit.org
www.freiheit.org

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EXECUTIVE SUMMARY

The East African coastal states, along with nearby island nations, are part of the Western Indian Ocean (WIO) region, situated on the western edge of the broader Indo-Pacific area. This region features ocean territories hosting energy resources and maritime infrastructure that are increasingly vital for development but require security governance and protection. Energy security is a top priority for African governments, whether they are coastal or landlocked. Simultaneously, safeguarding undersea connectivity infrastructure is a growing sector, critical for both governments and various international bodies. Notably, the WIO is home to numerous submarine cables, either passing through or connecting to the shores of nearly all African littoral countries bordering the region. By 2026, the WIO is projected to host 26 out of the 72 submarine cables being deployed in Africa. The increasing global reliance on undersea cable networks underscores the importance of securing maritime infrastructure supporting connectivity and data transmission, with Africa playing a central role in this effort.

The report first offers a background on energy and cable infrastructure, followed by a focus on the significance of subsea cable networks and their protection. It then outlines the subsea cable infrastructure in the WIO region, illustrating its connection to African coastal and landlocked countries. The third section discusses potential regulatory measures and collaborative efforts among East African countries and regions as platforms and conduits to enhance protection of the subsea cable infrastructure. Security measures for underwater cable networks are still evolving, with significant economic and security implications for policymakers, leaders, businesses, and society as a whole. Ideally, governments should incorporate the security of critical subsea infrastructure into their policies, security strategies, and programmes. Given the growing importance of the WIO as an energy and subsea cable hub, a coordinated approach is necessary to understand protection needs, establish partnerships across various stakeholders, and safeguard the region from potential threats.

Despite efforts to minimise vulnerabilities in subsea cable systems, risks remain due to human accidents, natural events, and external factors such as power failures, even in peacetime. In response, African countries should collaborate with willing partners to contribute to protection discussions through regulatory arrangements and partnerships, seeking consensus among governments, the private sector, and like-minded entities at regional and global levels. The report underscores the relevance of African countries in protecting subsea cable networks and emphasises the role of smart cooperative partnerships, whether among governments, among regional entities, or as private-public partnerships. Partnerships provide information and cooperation opportunities on subsea cable network protection, highlighting opportunities for African involvement and regulatory measures to protect critical undersea infrastructure in the WIO region.

1. Background

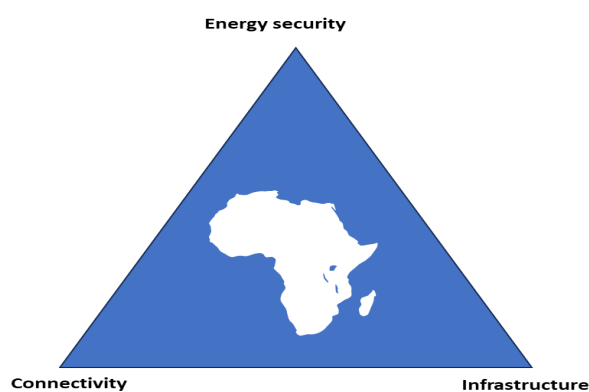
Historically, the oceans facilitated communication among nations and offered living resources to humanity to augment what was available on land. Over time, expectations turned to the oceans to satisfy human needs as expertise grew to use the ocean more productively, including the subsurface domain.¹ As for the latter, oceans use also expanded over a greater expanse of the seabed as overcoming depth restrictions was systematically mastered. Communication- and energy-related use became hallmarks of infrastructure traversing the seabed to satisfy two ever-growing modern human needs, namely being connected to gain access to information and being connected to address energy needs, both of which bring geopolitical matters to the fore that direct cooperation and competition, and even stimulate conflict.² Under the banner of blue acceleration, the use of, investment in, and claims to ocean domains are becoming intricate and dense and are increasing pressure on the oceans. Collectively, blue acceleration and its consequences call for close attention to matters of good governance as a response to risks stimulated by complexity, competition, and potential conflict.

¹ Jouffray, J.B., Blasiak, R., Norström, A.V., Österblom, H. & Nyström, M. 2020. The blue acceleration: The trajectory of human expansion into the ocean. *One Earth*, 2(1), 43-54. (43).

² Jouffray et al., op. cit. 46.

The drive for energy security and secure connectivity entails large maritime investments in critical infrastructure that require security guarantees of various kinds. Energy- and communication-driven offshore infrastructure grew as technological progress aligned with growing demands, resulting in a wider geographical expanse of infrastructure across ocean landscapes.³ While housing its own dynamic, the infrastructure debate ties into global agendas such as the United Nations Sustainable Development Goals (SDGs). SDGs 9, 14, and 17 are most relevant with their focus on quality infrastructure, life below water, and partnership building for the goals in pursuit of a better future for all. The drive for energy products such as oil and gas alongside secured connectivity networks and their geographic spread off Africa's eastern littoral brings African governments into the fold. African leaders pursue continental agendas to optimise the continent's connectivity and energy needs as embedded in Agenda 2063: The Africa we want. Denser cable networks, new oil and gas discoveries, as well as quests for quality infrastructure and data access thus highlight the relevance of subsea⁴ infrastructure (SSI) in the Western Indian Ocean (WIO). Remaining in step with energy security and that of communication networks and their enabling infrastructure, Africa's continental drives for communication, energy security, and quality infrastructure form a triad of interests that stresses their offshore growth and protection.

Figure 1. The protection triad



The rationale for this research report on underwater infrastructure in the WIO rests on three developments.

First, energy and information as prominent catalysts for economic growth and development. Second, the scope of, actorness of, geopolitics of, and threats to underwater infrastructure in the WIO that raise the protection imperative. Third, the criticality of secure underwater infrastructure in the WIO for Africa and Europe seen against the backdrop of the drive for better infrastructure provision, functional protection, and regulatory frameworks. This drive speaks to the lack of credible protection regimes for the said infrastructure amidst the ever-growing dependence of societies on energy and information. In pursuit of the rationale and problem setting, the report covers SSI in the WIO with a focus on the African eastern littoral and island states. The geographic demarcation from south to north includes South Africa, Mozambique, Tanzania, Kenya, Somalia, Djibouti, and Eritrea as coastal countries. The island states comprise Madagascar, Mauritius, Seychelles, Reunion, Mayotte, and Comoros. The scope of the report entails the following discussion themes: First, the scene is set on underwater infrastructure in the WIO, followed by a mapping of players, energy, and information infrastructure on the seabed. Then follows an outline of general threats to and vulnerabilities of information cable networks before turning to global and African regional and national frameworks deemed relevant to the protection of SSI off Africa in the WIO region (see Map 1).

Map 1: African countries in the WIO region⁵



3

Wrathall, L.R. 2010. The vulnerability of subsea infrastructure to underwater attack: Legal shortcomings and the way forward. *San Diego International Law Journal*, 12, 244.

4

African Union. 2022. Second continental report on the implementation of Agenda 2063. 33.

5

Africa Center for Strategic Studies. 2017. Maritime security in the Western Indian Ocean: A discussion with Asis Malaquias. <https://africacenter.org/spotlight/maritime-security-western-indian-ocean-a-discussion-with-assis-malaquias/>. Accessed 28 July 2023.

1. Setting the Scene – SSI as critical infrastructure

SSI sets are mostly classified as critical infrastructure whether globally, regionally, or nationally. The criticality features as “the necessity of these systems, networks and objects for facilitating vital functions of states, including government and nongovernment actors”.⁶ A corresponding dynamic pertains to the neglected protection debate and timely progress with agreements to promote security of the said critical infrastructure. With subsea energy and information infrastructure remaining somewhat opaque or invisible,⁷ its vulnerability lingered within security agendas. The geopolitical environment remained more cooperative during much of the early 21st century and facilitated cooperative pathways to protect SSI, but this operating environment recently became more hostile. As a result, protection of SSI has become more salient given its pervasive commercial and security value.⁸ As a result, the protection of SSI (energy infrastructure followed by data cable networks) increased with responsible state behaviour based on cooperation as the preferred mode for building a global consensus on best practices.⁹

As SSI grew globally alongside actor proliferation, scope, density of networks, and importance, how players viewed its significance also shifted.

Initially, ‘invisible’ SSI had to compete with security agendas framed by more immediate and perceptible concerns.¹⁰ Nonetheless, SSI increasingly began to feature in the recent maritime and maritime security strategies of, for example, the United Kingdom¹¹ and New Zealand,¹² and in general recognition of the importance of securing these networks as in the case of India.¹³ The 2022 attacks on the NORDSTREAM subsea energy network highlighted SSI vulnerabilities and elevated its ‘criticality’ label rapidly into the 21st-century world of policy, strategy, and practice. Africa is not exempted from SSI security concerns related to energy and data flows. Africa houses significant energy and gas industries and subsea cable networks off its coast. Although the Gulf of Guinea leads, energy developments off East Africa also grew (see Map 2). Extensive cable networks now also traverse the waters off East Africa from South Africa in the south northwards and cluster in the straits of the northern WIO before passing through the Red Sea to Europe and beyond.¹⁴ The upcoming energy infrastructure off Mozambique in the Mozambique Channel speaks to the global energy thirst but is already threatened by insurgency and armed conflict.¹⁵ Tanzania is also a latent offshore energy player waiting for its significant offshore energy deposits to be activated more widely and productively.¹⁶

⁶ Fridbertson, N. 2023. Protecting critical maritime infrastructure – the role of technology. Preliminary draft general report. NATO Parliamentary Assembly. 6 April 2023. 1.

⁷ Bueger, C. & Liebetrau, T. 2021. Protecting hidden infrastructure: The security policies of the global submarine data cable network. *Contemporary Security Policy*, 42:(3), 391-413. 393.

⁸ Fridbertson, N., op. cit. 3.

⁹ Kavanagh, C. 2023. Wading murky waters, subsea communication cables and responsible state behaviour. United Nations Institute for Disarmament Research. 31.

¹⁰ Pagnacco, A. 2021. Critical information infrastructure protection: Between cybersecurity and policymaking. In Italian Conference of Cybersecurity. (pp. 488-498) 498.

¹¹ United Kingdom. 2022. National strategy for maritime security. 66. www.gov.uk/official-documents Accessed 30 October 2023.

¹² New Zealand Department of Transport. 2020. Maritime security strategy. Guardianship of Aotearoa. New Zealand’s maritime waters. 4 & 22.

¹³ Arha, K. 2023. India at the centre of the Indian Ocean submarine cable network: Trusted connectivity in practice. ORF Issue Brief No. 630, April 2023, Oxford Research Foundation.

¹⁴ Indian Ocean Commission. 2021. Regional submarine cables protection and resilience. Framework for IOC member states. Working document 26 November 2021. 7.

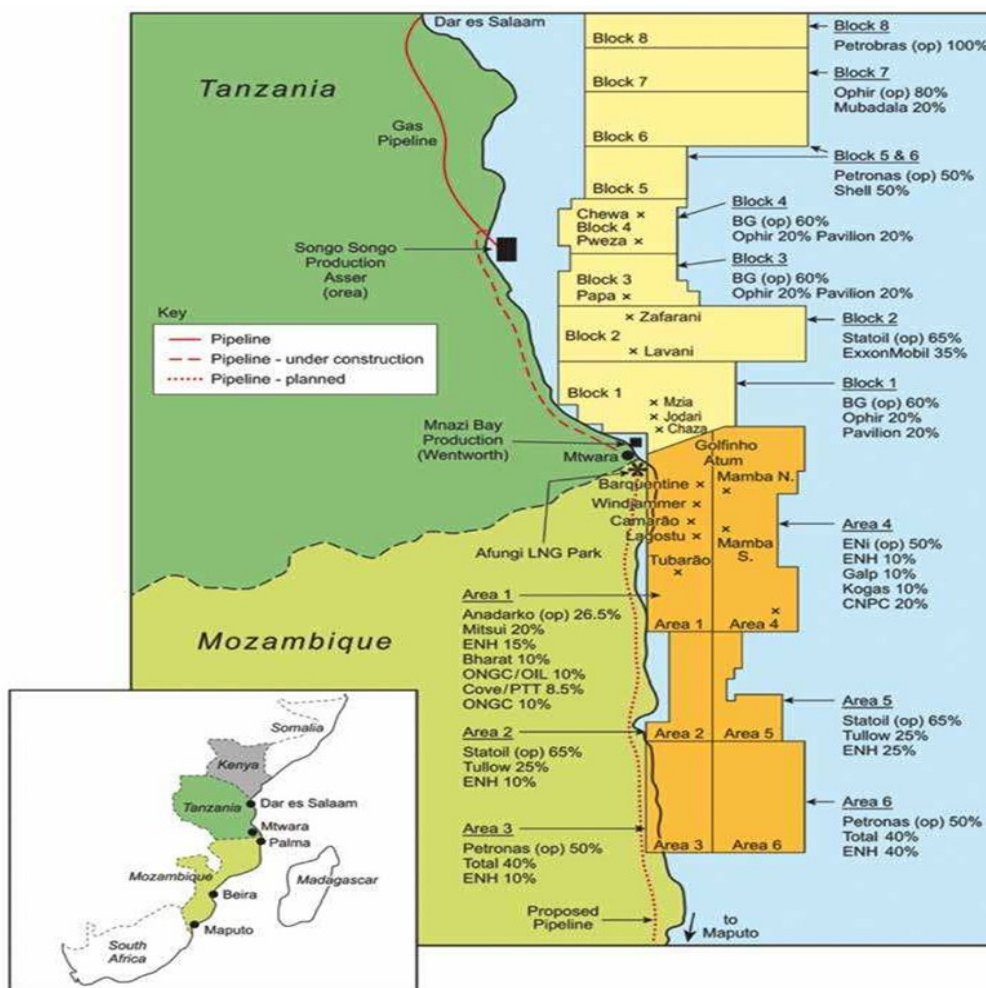
¹⁵ Mukpo, A. 2021. Gas fields and jihad. Mozambique’s Cabo Delgado becomes a resource-rich war zone. *Mongabay* 26 April 2021.

¹⁶ Katona, V. 2021. Why Tanzania’s oil and gas boom isn’t taking off. <https://oilprice.com/Energy/General/Why-Tanzania-Oil-And-Gas-Boom-Isnt-Taking-Off.html#:~:text=Tanzania%25E2%2580%2599s%2520challenges%2520in%2520developing%2520its%2520offshore%2520oil%2520and%2520three%2520main%2520categories%2520%25E2%2580%2593%2520structural%2520C%2520psychological%2520and%2520technological> Accessed 26 July 2023.

Collectively, Tanzania and Mozambique with their vast offshore gas fields (see Map 2) are emerging apex players from Africa on world energy markets. In similar fashion, the growing cable networks off Africa (as outlined in the next section) attest to the drive for data, connectivity, and communications within and with Africa, but different from their energy equivalent, these networks exist in the absence of a mature protection debate. Yet, the strategic importance of

data and energy to Africa and its partners holds potential under risk without also considering the SSI assets and their protection.

Map 2. Energy fields off Mozambique and Tanzania¹⁷



¹⁷ Richmond, M.D. 2016. Oil, gas and renewable energy. Western Indian Ocean, in Regional State of the Coast Report: Western Indian Ocean, UNEP. 343.

1.2. Security and instability along the Mozambique Channel, the Gulf of Aden and the Red Sea

Important subsea energy and communication infrastructure off Africa's eastern littoral are located along a coastline reflecting different shades of stability and security and is subject to the liminality effect whereby instability on land impacts negatively on good order at sea. Several ongoing armed conflicts characterise countries bordering the WIO. The claimed Islamic State-inspired insurgency in northern Mozambique, the

al Shabaab-influenced insurgency in Somalia, and the Houthi-led and Iranian-supported rebellion in Yemen are well publicised. All three uprisings have direct and indirect implications for maritime security and the safe use of the oceans in the Mozambique Channel, the Gulf of Aden, and the Red Sea. A snapshot of relevant African countries appears in Table 1 that includes selected security and stability indicators for those bordering the WIO.

Table 1: Coastline lengths, exclusive economic zone, size, and country security indicators¹⁸

Country	Coastline length (km)	Territorial waters	Claimed exclusive economic zone (km ²)	Security and rule of law count* / 100	Country governance count** /100
Djibouti	314	12 nm	7 459	40.4	42.2
Eritrea	2 234	12 nm	77 728	23.8	25.9
Kenya	536	12 nm	116 942	55.4	58.7
Mozambique	2 470	12 nm	578 986	45.1	48.6
Mauritius	330	12 nm	1 284 997	76.3	74.9
Madagascar	4 828	12 nm	1 225 259	47.8	44.2
Seychelles	491	12nm	1 350 000	76.5	73.4
Somalia	3 333	12 nm	825 052	19.3	23.2
South Africa	2 797	12 nm	1 535 538	68.1	67.7
Tanzania	1 424	12 nm	241 888	54.1	53.4

Given the connection between maritime security and stability on land, the nexus is important as the offshore landscape where underwater infrastructure is most at risk is also the most productive ocean zones that house important resources close to the coast.¹⁹ The size of these

territories is relevant as well given the scarcity of policing assets, interdependence, and multi-agency complexity underpinning the ways and means for protecting SSI. The aforementioned complicates how actors extend efficient rule of law given the different maritime jurisdictions that

¹⁸ Tourism Tavler. 2010. The coastlines of Africa's 38 countries ranked. Accessed 19 June 2023. https://www.bing.com/search?pglt=43&q=-+The+coastlines+of+Africa's+38+countries+ranked.&cvid=ff4cd2055974e80bbcc88d5feva438&gs_lcrp=EgZjaHJvbWUyBggAEEUYOTIHCAEQRRj8VdIBCDlwMTJgMGoxqAIAA&FORM=ANNAB1&PC=U531 Accessed 30 October 2023.

¹⁹ Bueger, C. & Stockbrugger, J. 2022. Maritime security and the Western Indian Ocean's militarisation dilemma. *African Security Review*, 31(2), 195-210.

apply to different ocean zones.²⁰ Littoral zones lure criminal, terrorist, insurgent, and other entities. These entities pose threats of sabotage, plundering, interferences, and even destruction of maritime resources and infrastructure, which include services of attractive blue economic enterprises dependent upon a safe and secure maritime environment.²¹ Good governance both on land and at sea requires stable security foundations to extend rule of law and services. In this regard, the governance counts in Table 1 suggest that Somalia, Eritrea, Madagascar, and Mozambique hold higher risks, harbour sovereign and claimed maritime territories that are weakly governed, reside in the WIO close to important transit zones and energy fields, and show overall weak governance counts. In contrast, South Africa, Kenya, Mauritius, Seychelles, and Tanzania hold more potential to maintain good order at sea, have average to particularly good security, and have overall governance counts. The latter five countries present as regional WIO partners to engage with in cooperative maritime security programmes and capacity building and as partners in the subsea protection debate. Regional African organisations with members bordering the WIO are also on offer as partners for collaboration. The Southern African Development Community (SADC) with 16 members and inclusive of island states, the East African Community (EAC) with seven members, and the Intergovernmental Authority on Development (IGAD) with eight members with overlapping membership patterns are the primary regional actors for cooperation and capacity-building purposes.²² Subsea energy and cable networks as targets are becoming increasingly relevant. Underwater infrastructure off the African eastern littoral must contend with threats emanating from instability on land and weak rule of law over some maritime territories, with both influencing the constituent elements underpinning maritime

insecurity.²³ This threat array includes crime, terrorism, and interstate rivalries and disputes driven by economic gain, political advantage, and national interests. Although maritime economic enterprises such as shipping, fishing, tourism, aquaculture, and infrastructure are all subject to threats and vulnerabilities that disrupt or threaten safe and secure operations, the focus on critical communication and energy infrastructure unfortunately remains neglected.

1.3. Subsea communication and energy infrastructure

Developments in subsea communication and energy infrastructure off Africa's eastern littoral are central to this report. To the south in the Southwestern Indian Ocean, South Africa is a pivotal country for cables encircling the continent and a halfway house for repair, maintenance, and harbouring of specialist vessels. South Africa also houses its own hubs of national underwater energy and information infrastructure critical to its economic interests and gravitates between being the second or third largest African economy.²⁴ Much of South Africa's energy infrastructure is also being shifted to its east coast around the port of Richard's Bay and thus closer to the WIO region. Mozambique's subsea energy infrastructure has a direct WIO connection while African countries and island states farther north and bordering the WIO have a direct or indirect interest in the protection of subsea energy infrastructure and data cables off their coasts. Collectively, their national interests are tied to data and energy having become apex goods for 21st-century economic development and modern industrialisation. For African governments and their societies, the important nexus is that both hold a vital maritime connection in their product flow and its enabling infrastructure.²⁵ The maritime connection is a given but is premised upon being secured and protected, thus flagging the concern with protecting SSI in two vital African developmental sectors, namely data security and energy security.

²⁰ Pandey, S.K. & Bhushan, A. 2023. Submarine cables: Issues of maritime security, jurisdiction, and legalities. *European Journal of Theoretical and Applied Sciences*, 1(4), 117-132.

²¹ Menzel, A. 2022. Maritime security and the blue economy (265-275), in Boşilcă, R.L., Ferreira, S. & Ryan, B.J. (eds.). *Routledge handbook of maritime security*. Taylor & Francis. 268.

²² SADC with coastal states South Africa, Mozambique, and Kenya, and island states Comoros, Madagascar, Mauritius, and Seychelles; EAC with Tanzania and Kenya as coastal states and IGAD in the Horn of Africa with Kenya, Somalia, and Djibouti as coastal states of note.

²³ Bueger, C. & Stockbrugger, J., op. cit. 195-210.

²⁴ Wright, D.W. & Hrabar, S.Z. 2022. A review of existing offshore and onshore oil and gas pipelines in SA. *Civil Engineering/Siviele Ingenieurswese*, 30(8), 49-56.

²⁵ Burns, H.B. 2022. Energy security and maritime security, in Boşilcă, R.L., Ferreira, S. & Ryan, B.J. (eds.). *Routledge handbook of maritime security*. Taylor & Francis. 201; Brewster, D., Grare, F., D'Adamo, N., Steedman, R., Sicre, M.A., Tummala, S.K., Ryan, A., Bashfield, M.S., Bergin, A. & Godbole, C.A. 2023. The Australia-France-India strategic partnership. Opinions for regional cooperation. Australian National University. 35-36.

Critical infrastructure off Africa's eastern littoral merges with an ever-growing maritime security debate but one that houses its own unique hubs of threats and vulnerabilities. As a result, key data and energy infrastructure sets are exposed to risks emanating from both human-caused and natural interferences. In this vein, Wrathall noted, "As the economic significance of this critical infrastructure grows, so does the motivation to hold it at risk", referring to both energy and subsea cable infrastructure.²⁶ According to Wrathall, the protection of infrastructure below the waterline is difficult in terms of both legal and physical protection and even more so beyond territorial waters. This difficulty highlights the need for African governments and regional entities to also bring their voices and interests to security governance and rule of law debates. Security of energy infrastructure has received more attention than data cable networks. As extraction moved farther offshore, security measures also migrated to remain in step to prevent fluctuations from supply flow disruptions. Conventional state action, militant and rebel forces, and terrorism form three strands of the threat to the offshore energy sector.²⁷

Recently, criminality and attacks dovetailing with transnational organised crime have become much more prevalent. In response, one can observe sets of security arrangements to protect the offshore energy sector. Private security contractors, inhouse security regimes, public-private partnerships, and state actions by navies, coast guards, and national police agencies make up configurations of collaboration to protect energy infrastructure and product flows. Much of the focus, however, remains on what one finds above the surface and is addressed by matters of law and other conventions. Absent and vague are explicit programmes and measures to protect subsea energy infrastructure. This raises the intriguing question of who brings to fruition the required security ways and means to protect critical subsea

energy infrastructure. Although the energy sector has been confronting this dilemma for some time and modalities for cooperation among public, private, and even global agencies have been shaped,²⁸ the militarisation of energy is also on the cards.²⁹ Overall, energy infrastructure harbours a legacy of security measures developed and shared over time. As a result, a practice of learning and sharing among oil and gas majors, governments, and other players operating in the energy security field shows a more mature protection landscape. As a critical infrastructural concern dependent upon protection and security, cooperation and information sharing are practical starting points.³⁰ With regard to Africa's eastern littoral, the offshore energy sector can learn from other cases with the Gulf of Guinea being a valuable African case shaped by the land-sea liminality argument. Such experiences hold lessons on the resilience and protection of energy infrastructure inclusive of its seabed architectures. In the Niger Delta, interferences with underwater infrastructure are a daily security concern with oil corporations and the Nigerian government involved in extensive measures to counter this threat.³¹

In addition, the multiple oil majors operating in the upcoming energy fields off East Africa bring their own institutional memories from elsewhere (including West Africa) to the industry, which include best practices on sharing information and building partnerships on security and protection. Protecting subsea cable networks offers elements of a blank canvas as opposed to the crowded offshore energy sector. While threats to subsea cable networks rose to global prominence in Europe in 2022, these remain underplayed in the WIO despite dense and growing cable networks (see Map 1). Although the WIO houses cable networks and continuous expansion as part of the larger African connectivity landscape,³² security in general and protection programmes in particular have hardly progressed upwards on the African security agenda. This lack of progress conflicts with the African emphasis on quality infrastructure and African growth indicators relying on access to digital infrastructure, much of

²⁶ Wrathall, L.R., op. cit. 223.

²⁷ Burns, H.B., op. cit. 201-202.

²⁸ Ralby, I. 2017. Downstream oil theft. Global modalities, trends and remedies. Global Energy Center, Atlantic Council. 102.

²⁹ Santori, N. 2010. The militarization of energy: A sustainable challenge for the EU? ESDF Workshop. A New European Security Architecture? Chatham House. 11 November 2010. 17.

³⁰ Panevski, V. 2023. Organizational resilience and critical infrastructure security systems. *Security & Future*, 7(1), 3-5.

³¹ See for example the exposé presented in Balogun, W.A. & Adesanya, O.P. 2022. "A sea of troubles": Oil theft, crude economy and the business of organised energy crime in the Gulf of Guinea. *African Journal of Stability & Development*, 14(1&2), 1-36.

³² Chan, G. 2022. The cable Silk Road: Over the land and under the sea, (pp. 91-103). In Monograph by Chan G. China's digital silk road, Edward Elgar Publishing: Cheltenham. 98.

which rests upon the security of subsea data cables encircling Africa.³³ Furthermore, the WIO maritime landscape off East Africa also harbours threats and vulnerabilities that hold dire consequences for Europe given the networks' centrality to connecting Africa, Europe, and Asia. Bueger and Liebetrau refer to the threat of militarisation in the WIO while Vines and Kell point to digital geopolitics comprising risks for states, businesses, and citizens.³⁴ Both are relevant to the WIO as a maritime connectivity hub off Africa. Different combinations of regional WIO interests and global geopolitical developments and wars directly and indirectly shape subsea data cable security debates, positioning the WIO as a concern for Europe and Africa. The region's proximity to big power competition in the Gulf of Aden, power plays of the Gulf States, and being located on the western fringe of the growing Indo-Pacific rivalry heighten security concerns in this region of the Indian Ocean.³⁵ Data cables traverse these vast ocean landscapes, and their location, landing points, clustering, and product flows underpin commercial, financial, social, environmental, and good governance elements that are strongly premised upon sustainable connectivity and regulatory mechanisms. Secure cable networks and data flows remain pivotal while big power standoffs now include physically and virtually targeting connectivity spheres, which impacts cable networks as part of power rivalries.³⁶ Militarisation and geopolitical rivalries alongside insurgencies and organised crime form hubs for human interferences with cable networks vitally important not only to African countries off the WIO but also to countries in Europe and Asia relying upon the

security and protection of these assets. It has also become a matter requiring African stances and contributions to threat mitigation that transcend broad calls for secure connectivity in the Digital Transformation Strategy for Africa (2020-2030) that hardly refers to subsea cable network protection.³⁷ In the Digital Transformation Strategy for Africa (2020-2030), subsea and terrestrial cable networks are labelled as primary to the transformation ambition as outlined in continental plans such as Agenda 2063 on infrastructure, digitisation, connectivity, and the continent's blue economy aspirations. Overall, cable networks have become strategic highways and gateways for Africa's socio-economic development and integration agendas.³⁸ They serve as carriers of information and connectivity to, within, and among African societies, leading to prioritising access and predictability, which calls for protected cable networks on land and at sea.³⁹ Secured access to information assets ties in with infrastructure protection that advances Africa's digital transformation aspirations. Safe access also offers avenues for partnership building and cooperation to reinforce drivers of growth and development, and this dynamic relies heavily on subsea cable infrastructure. For Africa, this is important and inherently rests upon secure cable networks in the WIO that link up littoral and contiguous landlocked states with the global digital world.⁴⁰ As about every African country is connected to the internet by at least one subsea cable alongside ever-growing networks, one also finds a vibrant African digital landscape drawing investment.⁴¹ To keep this dynamic healthy, access security and predictability are key and flag the neglected subsea domain. If mastered, it ensures digital inclusion and underscores dependency, economic development, and other governance domains such a security, politics, law and order, and social service delivery.

³³ Pagnacco, A. op. cit.

³⁴ Vines, A. & Kell, F. 2022. Oceans: African spaces: The new geopolitical frontlines. Chaillot Paper 173, European Union Institute for Security Studies. 18-26.

³⁵ Vines, A. & Kell, F., op. cit. 19-20.

³⁶ Tuan, T.A. 2020. Maritime security in the Indo-Pacific: Mixed opportunities and challenges from connectivity strategies, in Ecle, C. (ed). *Responding to the geopolitics of connectivity*. (125-137). Konrad Adenauer Stiftung.

³⁷ African Union. 2020. The digital transformation strategy for Africa (2020-30). Addis Ababa, Ethiopia. 139.

³⁸ Pawlak, P. 2022. Digital, in Faleg, G. (ed). African spaces. The new geopolitical frontlines. Chaillot Paper 173, European Union

Institute for Security Studies. 49.

³⁹ Pawlak, P., op. cit. 50.

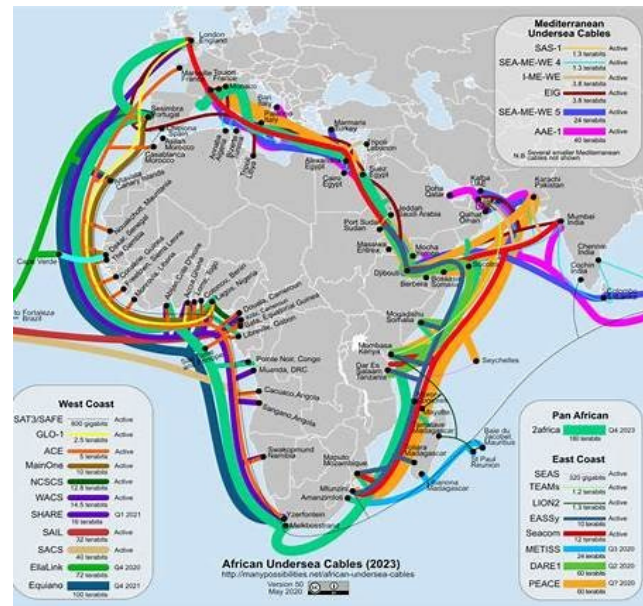
⁴⁰ See for example Teevan, C. 2021. Building strategic European digital cooperation with Africa. Available at <https://ecdpm.org/wp-content/uploads/Building-Strategic-European-Digital-Cooperation-With-Africa-ECDPM-Briefing-Note-134-2021>. Pdf. Accessed 30 October 2023.

⁴¹ Nanfuka, J. 2022. Digital access and economic transformation in Africa. Institute for New Economic Thinking. Africa Paper Series 4. 8-10.

In the WIO, militarisation expressed as the presence of naval forces, big power competition, and foreign penetration and footholds along the East African littoral is outlined in detail by the Stockholm International Peace Research Institute's background paper on foreign penetration and big power military presence in the north-western sector of the WIO off Africa.⁴² The military presence is motivated under a strong maritime banner to protect interests in the WIO, least of all against nontraditional maritime security threats inclusive of terrorism and insurgent forces. With hard militarisation and power competition dovetailing with nontraditional maritime security threats, a range of disruptive interventions and interferences with vulnerable SSI networks are possible in a region where SSI connecting Africa, Europe, and Asia clusters. However, this area also serves as a catalyst for cooperation on common interests such as protection of vital SSI that serves the interests of apex political players in Europe and Asia, and on the African continent. Overall and with reference to energy and data SSI, putting in place protection measures is subject to a range of difficulties. One is in the physical domain. Detecting underwater threats brings its own difficulties compared to perceiving threats on the surface.

It is a physically demanding environment requiring specialised equipment that restricts protection actions and facilitates actions of those who target SSI. Players that can cross the technology-cost and geographic hurdles can help societies with safe access to critical information flows that have become pivotal to societies. This normative view is unfortunately subject to various natural, accidental, and deliberate interferences in response to which protection debates, programmes, and responses must be carefully crafted. Information and communications technology (ICT) and its cable networks have become pressure points to supplant external influence in Africa, and proliferation of ICT infrastructure increases room for foreign power interferences. One example is China's techno-diplomacy with a surveillance focus. China is a primary financier, and its impact on African countries' vulnerabilities in their search for connectivity and digitalisation as a developmental

Map 1. Subsea cable networks around Africa



vehicle holds risks, more so when manipulation takes on a military synergy through coercion. Cable networks have become another domain of competition when providing infrastructure that easily morphs into a tool of influence and coercion. Critical developmental infrastructure such as data cable networks is also vulnerable to getting entangled in foreign power competition for influence in Africa.⁴³ An absent here is that the package of provision, use, maintenance, and extension of subsea networks is characterised by a lack of protection, clever cooperation, and capacity building with African partners. State and private providers seeking partnerships and contracts must play a greater role in protection to serve their own as well as African infrastructure, developmental, and connectivity interests, bearing in mind that cables traversing the WIO also serve important interests in Europe, Asia, and elsewhere.

⁴² Melvin, N. 2019. The foreign military presence in the Horn of Africa region. Background Paper, Stockholm International Peace Research Institute.

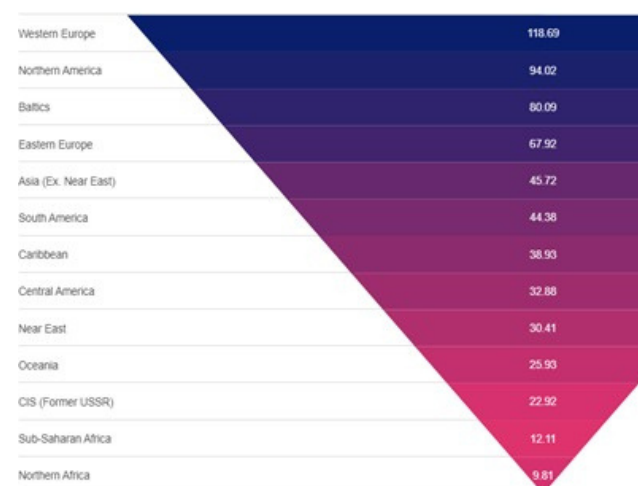
⁴³ Keller, J.B. 2023. The next superpower battlefield could be under the sea off Africa. Foreign Policy. Brookings Institute. <https://foreignpolicy.com/2023/03/10/africa-china-russia-subsea-cables/> Accessed 30 October 2023.

2. Physical submarine data cable infrastructure: Connectivity, actors, and criticality

Vital and critical communications infrastructure that must be protected and maintained is briefly addressed in the United Nations Resolution A/Res/66/231 (Oceans and the Law of the Sea) adopted 24 Dec 2011 that alludes to fibre-optic submarine cables. The resolution also mentions “the need for States to adopt national laws and regulations to protect submarine cables and render their wilful damage or damage by culpable negligence punishable offences”.⁴⁴ It has been 12 years since this resolution’s adoption, which in the ongoing digital revolution is a significant timespan. The reason for stating this is that in 2023, there are upward of 552 active or planned submarine cables, many of which are transmitting globally. It is widely known that more than 95% of global telecommunications traffic across Africa, Europe, and the Americas utilise subsea cable networks.⁴⁵ The larger Indian Ocean cable network configurations show that a similar percentage is true for servicing the Indo-Pacific region to the east. In combination, Europe and players from South, Southeast, and East Asia share a common interest in and strategic dependency on subsea cable networks traversing the WIO. Worldwide, nations are beginning to acknowledge their reliance on and the subsequent vulnerability of undersea cables. Although threats are primarily environmental or accidental, speculations flourish about subsea cables as potential targets of sabotage. The presence and further growth of subsea cable networks under construction off Africa are key to the continent’s leapfrogging a traditionally communication-deprived African population into the digital age. In this light, the said cables have become even more vital as critically important infrastructure not to be interfered with.

Unfortunately, subsea cables are laid and function mostly out of sight at the bottom of the ocean.⁴⁶ Their importance is only recognised when an accidental or human-induced cable break affects their performance and the users experience a tangible degradation in the performance of the internet and data flows, or worse, when the data flows are intercepted or manipulated. The first fibre-optic subsea cable for Africa was commissioned in 2002, and it has enabled digital connection in Africa, albeit at a relatively high cost and slow speed.⁴⁷ Soon, a sprawling undersea network of 72 cables will connect Africa to the rest of the world. These cables will improve internet speeds, connect rural and landlocked communities, and advance economic progress while being a vital enabler for machine learning and artificial intelligence applications.⁴⁸ This is an important aspect for the continent’s developmental agendas and for staying in contact with current and potential partners in, for example, Europe and Asia. In a recent study by Cable.co.uk (Worldwide broadband speed league, June 2022 – June 2023), internet speed tests were conducted for entities in 220 countries and regions. The results were consolidated, and Graph 1 below provides a snapshot of the results, which were grouped into 13 international regions.

Graph 1. Internet speeds in international regions



⁴⁴ United Nations. 2011. UN Resolution A/Res/66/231. Oceans and the Law of the Sea. Available at www.un.org/docs/g/lobalimpact. Accessed 30 October 2023.

⁴⁵ Worldwide Internet Speeds Cable League. 2023. Available at www.cable.co.uk/about/research/. Accessed 30 July 2023.

⁴⁶ Growing telecom infrastructure in Africa is a huge opportunity. 2023. Available at www.bizcommunity.com.

⁴⁷ Undersea cable systems in South Africa from 1879 to 2015. 2015. Available at mybroadband.co.za/forum/threads.

⁴⁸ Growing telecom infrastructure in Africa is a huge opportunity. 2023. Available at www.bizcommunity.com.

As can be seen in Graph 1, African regions reflect the slowest performing networks. It is well known that African leaders expect that the Fourth Industrial Revolution, of which subsea cables are a vital enabler, will justify this venture of connecting the world by creating a skilled labour force and thriving economic growth, and not allowing the continent to be left behind in this next iteration of digital transformation.⁴⁹ Smart partnerships, access, and protection are thus much-needed foundations

for realising such ambitions, and protection of the infrastructure is the key. Despite huge investments and efforts, Africa is still underperforming compared to the rest of the world. Hence, it should come as no surprise that Africa has captured substantial investment from private industries, such as Google and Meta, to digitise some of world's least-connected countries.⁵⁰ Considering the investments, the current profile of submarine cables in the WIO (Aug 2023) is summarised in Table 2 below:

Table 2: Cable networks along Africa's east coast

No	CABLE NAME	WIO NATIONS WITH LANDING STATIONS	TOTAL NR OF COMPANIES/PARTNERS	NR OF LANDING STATIONS	DESIGN CAPACITY
1	AFRICA-1 (ASN CABLE)	DJIBOUTI, KENYA, SOMALIA, TANZANIA, MOZAMBIQUE, SOUTH AFRICA, AND MADAGASCAR	> 5	> 11	----
2	2 AFRICA (ASN CABLE)	DJIBOUTI, SOMALIA, KENYA, TANZANIA, MOZAMBIQUE, SOUTH AFRICA, MADAGASCAR, SEYCHELLES, AND COMOROS	8	50	180 Tbps
3	INDIA EUROPE EXPRESS (IEX) (SUBCOM CABLE)	DJIBOUTI	> 1	9	100 Tbps
4	AFRICA, ASIA, EUROPE-1 (AAE-1) (SUBCOM/NEC CABLE)	DJIBOUTI	20	20	100 Tbps
5	AVASSA (HMN TECH CABLE)	COMOROS AND MAYOTTE	2	4	16 Tbps
6	COMOROS DOMESTIC CABLE (CDCS) (ASN CABLE)	COMOROS	1	3	---
7	DJIBOUTI AFRICA REGIONAL EXPRESS (DARE-1)	DJIBOUTI, SOMALIA, AND KENYA	4	4	60 Tbps
8	EAST AFRICA MARINE SYSTEM (TEAMS) (ASN CABLE)	KENYA	2	2	5.2 Tbps
9	EAST AFRICA SUBMARINE SYSTEM (EASSY) (ASN CABLE)	DJIBOUTI, SOMALIA, KENYA, TANZANIA, COMOROS, MADAGASCAR, MOZAMBIQUE, AND SOUTH AFRICA	16	9	10 Tbps
10	EUROPE INDIA GATEWAG (EIG) (SUBCOM/ASN CABLE)	DJIBOUTI	15	12	28 Tbps
11	FLY LION 3 (ASN CABLE)	COMOROS AND MAYOTTE	3	2	4 Tbps
12	GULF TO AFRICA (G2A) (HMN TECH CABLE)	SOMALIA	3	3	20 Tbps
13	LOWER INDIAN OCEAN NETWORK (LION) (ASN CABLE)	MADAGASCAR, MAURITIUS, AND REUNION	3	3	1.3 Tbps

⁴⁹ Markowitz, C. 2019. Harnessing the 4IR in SADC: Roles for policymakers. Occasional Paper 303. 6-7.

⁵⁰ Kemibaro, M. 2020. The current and future state of submarine cables in Kenya and East Africa. Available at <https://moseskemibaro.com/2020/03/06>.

*Note: Red indicates work in progress. set to increase as expectations/demands from Table 2 shows that considerable progress is being users increase, and Africa cannot be excluded made in the WIO region to connect Africa globally. from this equation. East Africa harbours some of It begs the question, How is the current the largest and most youthful populations on the investment performing in the WIO region in 2023 African continent (for example South Africa, (based on internet speed)? Indicated in Table 3 Tanzania, Ethiopia, and Kenya) and is set to grow below is the data obtained from Cable.co.uk for the future demand for connectivity in pursuit of African countries and two French territories in the economic, education, and social service delivery⁵¹ WIO. A speed greater than 10

Mps is considered requirements. acceptable for a normal household in 2023 but is Comparing Tables 2 and 3 shows a disparity among nations when it comes to internet speed that also affects numerous dependent landlocked countries to the west. Due to this disparity and the demand for improvement, terrestrial fibre networks connected through data centres from better-performing countries are attracting investments, making Africa the top-growing bandwidth market globally with a projected compound growth of 42% between 2022 and 2029.⁵² In all of this, existing and future well- protected subsea cables traversing the WIO form a critical component to lower disparities, ensure data access and integrity, and increase the projected growth towards 2029.

Table 3: Internet speeds in African states bordering the WIO

Country	Speed in Mbps	Benchmark (> 10 Mbps)	Time to download 5 Gb movie (rounded)
Eritrea	8.92	x	1 hour 16 minutes
Djibouti	4.66	x	2 hours 26 minutes
Somalia	5	x	2 hours 26 minutes
Kenya	12.46	✓	55 minutes
Tanzania	11.92	✓	57 minutes
Mozambique	11.06	✓	1 hour 2 minutes
South Africa	36.4	✓	19 minutes
Madagascar	20.4	✓	33 minutes
Comoros	24.35	✓	28 minutes
Mauritius	29.78	✓	23 minutes
Seychelles	18.15	✓	36 minutes
Mayotte	17.34	✓	39 minutes
Reunion	45.5	✓	15 minutes

⁵¹ World PopulaBon Review. 2023. Africa populaBon 2023. Available at <https://worldpopulaBonreview.com/conBnents/africa-populaBon>. Accessed 26 September 2023.

⁵² Signé, L. & Heitzig, C. 2022. EffecBve engagement with Africa: Capitalizing on shids in business, technology, and global partnerships. Brookings InsBtuBon. 29.

2. Western Indian Ocean nations and their infrastructure status

The paragraphs below map out the broad status profiles of WIO African states by providing information relating to their governance rating as per the Mo Ibrahim Index (/100), the cables that are landed (abbreviations contained in Table 2), the number of landing stations, the key national service provider status, the cost per gigabyte in United States dollar as obtained from Cable.co.uk, and the landlocked countries that benefit from the respective cables as listed in the Africa Fibre Reach Map.

Eritrea (governance rating 25.9%)

Eritrea is rebuilding its economy after a peace agreement with Ethiopia was signed in 2018, ending 20 years of war between the two nations. It currently has no landing stations for subsea cables although 17 subsea cables pass close to its territory through the Red Sea. Asmara may well become the first landing station for Eritrea when it connects to the India Europe Express (IEX) cable soon.⁵³ Eritrea's telecommunication sector operates under a state-owned monopoly for all services and houses the least-developed telecommunications infrastructure in Africa. Mobile penetration stands at 20%, while fixed-line internet use barely registers.⁵⁴ The cost for data is \$27.6/1 GB, and the Eritrean Telecommunication Services Corporation is the sole national service provider and continues to roll out a 3G network that provides basic internet access to Eritreans. The country has the potential to connect the African continent with a relatively short cable to the Middle East, and in addition, it could also harbour a cable repair ship to service the dense network of cables running through this maritime chokepoint to Africa, Asia, and Europe.

Djibouti (governance rating 42.2%)

Djibouti has three landing locations (Haramous, Ras Dika, and YAC A) for 15 different cables.⁵⁵ These cables are AAE-1, Aden-Djibouti, SEACOM, SMW3, ARE-1, MENA, EIG, EASSY, SMW5, IEX, PEACE, 2 AFRICA, AFRICA-1, SMW6, and RAMAN. The country is also located at the entrance/exit to the Red Sea, and the SSI is vulnerable due to its being a chokepoint for shipping and the many cables that land in and pass by its territory surrounded by a hostile littoral.⁵⁶ Djibouti Telecom is a government-run monopoly and in 2017 unveiled a 4G+ service. The cost for data is the highest in the region at \$37.6/1 GB. The company's main internet offerings throughout the country are currently specifically focused on ADSL services.⁵⁷ From Djibouti, the fibre network connects Ethiopia, Sudan, and Chad. Djibouti unfortunately has a slow internet speed despite so many cables landing in the capital. Djibouti also houses a large foreign military presence amidst the globally strategic clustering of data cables, shipping routes, and a sea strait that offers easy access for maritime and land-based actors that collectively present an interesting collection of actors capable of hybrid threats but also offering opportunities for collaboration.

Somalia (governance rating 23.2%)

Somalia has three landing stations (Berbera, Bosaso, and Mogadishu) for six different cables.⁵⁸ These cables are AFRICA-1, G2A, 2 AFRICA, DARE-1, PEACE, and EASSY. Despite being labelled as a failed state, the country offers some of the most technologically advanced and competitively priced telecommunications and internet services in the world.⁵⁹ The cost for data is \$6.19/1 GB. Funded by Somali entrepreneurs and backed by expertise from China, South Korea, and Europe, these nascent telecommunications firms offer affordable mobile phone and internet services that are not available in many other parts of the continent,⁶⁰

⁵³ 5G connectivity. India expands submarine cable. 17 June 2021. Available at www.serviceteamit.com.

⁵⁴ Africa telecom transmission network map. 2022/23 Transmission Map. Accessed Aug 2023. Available at www.africabandwidthmaps.com.

⁵⁵ The submarine cable map updated by Telegeography. 2023. Available at www.submarinecablemap.com.

⁵⁶ Submarine cable networks in Africa. 2021. Available at <https://afr-ix.com>.

⁵⁷ Eritrea telecommunication market report. 2023. Available at www.budde.com.au. Accessed in Jul 2023.

⁵⁸ Submarine Cable Map. Telegeography Interactive Map. Accessed in Aug 2023. Available at <https://www.submarinecablemap.com>.

⁵⁹ Future of Somalia telecommunication market trends and outlook. Accessed Jul 23. Available at <https://www.orbisresearch.com/reports>.

and Europe, these nascent telecommunications firms offer affordable mobile phone and internet services that are not available in many other parts of the continent.⁶¹ At least seven telecommunications companies are currently operating in 18 administrative regions that constitute the Federal Republic of Somalia. From Berbera in the northeast, the fibre network connects to Ethiopia that is a landlocked country but a major regional player and much dependent on the Somalia connection for its own internet connectivity services.

Kenya (governance rating 58.7%)

Kenya houses two landing stations (Mombasa and Mtwapa) for eight different cables.⁶² These cables are AFRICA-1, DARE-1, LION 2, PEACE, EASSY, SEACOM, TEAMS, and 2 AFRICA. With Mombasa as a landing point for Liquid Intelligent Technology's (LIT) newly completed East and West Africa terrestrial network, the country serves as a key junction for onward connectivity to the Arabian states and East Asia. Airtel Kenya, Telkom Kenya, Safaricom, and Jamii Telecom are the main providers of internet services in Kenya. The additional internet capacity from the multiple cables landing on the coast has lowered the cost of internet access dramatically in recent years. This allowed more affordable services to a greater proportion of the population. In parallel, the sector's regulator (Communications Authority of Kenya) has reduced interconnection tariffs and implemented a range of measures aimed at developing further competition.⁶³ The cost for data is subsequently the cheapest in the region at \$0.75/1 GB. The considerable number of subsea cables entering Kenya also connects Ethiopia, Uganda, South Sudan, Malawi, Burundi, Zambia, the Democratic Republic of the Congo (DRC), Botswana, and Zimbabwe via an extensive terrestrial network and

inherently also promotes redundancy in case of breakages.

Tanzania (governance rating 53.4%)

Tanzania harbours one landing station at Dar-es-Salaam for the five cables that land at this site.⁶⁴ These cables are AFRICA-1, 2 AFRICA, SEAS, EASSY, and SEACOM. The landing of the first international submarine cables in the country revolutionised the telecommunications market, which up to that point had depended entirely on expensive satellite connections. LIT has an important terminus at Dar es Salaam linking to three submarine cables. In parallel, the government aims to complete a national fibre backbone network in-country and so extend broadband availability to 94% of the population.⁶⁵ The cost for data is also low at \$0.75/1 GB. VODACOM, AIRTEL, and TIGO are the main providers of internet services in the country. Tanzania together with its partners has created the backbone for the landed cables to serve eight other landlocked countries to its west (Uganda, Rwanda, Malawi, the DRC, Zimbabwe, Zambia, South Sudan, and Burundi). Tanzania is probably geography wise a core state to extend digital infrastructure to a vast hinterland of populous countries such as Burundi, Rwanda, and the volatile east of the DRC and South Sudan.

Mozambique (governance rating 48.6%)

Mozambique has two landing stations (Nacala and Maputo) for four different cable systems.⁶⁶ These cables are 2 AFRICA, AFRICA-1 (in process), EASSY, and SEACOM. The country is an attractive investment destination due to its abundant offshore gas reserves in the Rovuma Basin to the north. Production has begun in Area 4 of the Mozambique Channel with the arrival of the Coral Sud platform, and Coral Norte will follow soon; this will bring energy and data infrastructure into vogue.

⁶¹ Somalia telecommunications market report. Accessed in Jul 2023. Available at <http://budde.com.au/research>

⁶² Submarine Cable Map. Telegeography interactive map., Accessed Aug 23. Available at <https://www.submarinecablemap.com>

⁶³ Kenya telecoms market report. Accessed in Jul 2023. Available at www.budde.com.au/research

⁶⁴ Submarine Cable Map. Telegeography interactive map., Accessed in Aug 23. Available at <https://www.submarinecablemap.com>

⁶⁵ Tanzania telecoms market report. Accessed in Jul 2023. Available at <https://www.budde.com.au/research>

⁶⁶ Submarine Cable Map. Telegeography interactive map., Accessed Aug 23. Available at <https://www.submarinecablemap.com>

This area does not pose a threat to any subsea cables as gas production takes place far offshore. Area 1 with its process gas plant on the coast in Palma under construction brings the associated risk of damaging subsea cables while the subsea energy infrastructure heightens the need for protection. In addition, Nacala is adjacent to the insurgency in Cabo Delgado while Maputo is much farther south although neither have registered any indicators of insurgent interest in the subsea networks to date. Mozambique was one of the first countries in the region to embark upon telecommunications reform and to open the sector to competition. There are currently three telecommunications operators although provision of digital communication to the whole nation is far below the average for the region.⁶⁷ The excessive cost of international bandwidth had long hampered Mozambique's internet use. Fortunately, international submarine cables landing at Nacala and Mozambique have reduced the cost of bandwidth, leading to drastic reductions in broadband retail prices and a significant jump in available bandwidth.⁶⁸ The cost of data is \$15.82/1 GB, which is still relatively high. The landed networks also connect with landlocked states in Southern Africa such as Malawi, Zambia, Zimbabwe, and Botswana.

South Africa (governance rating 67.7%)

South Africa has six landing stations (Mtunzini, Amanzimtoti, Gqberha, Melkbosstrand, Duynefontein, and Yzerfontein).⁶⁹ Eleven cable systems serve the nation/region represented by EASSY, EQUIANO, SEACOM, SAFE, 2 AFRICA, T3, METISS, WAS/SAT 3, ACE, WASC, and AFRICA-1 (in process). Seven cables are located along the east coast in the Southeastern WIO while four cables are located along the west coast on the Atlantic Ocean.

Two datacentres located in Cape Town and Johannesburg connect a host of landlocked nations to the north via a terrestrial network to the internet.⁷⁰ These include Zimbabwe, Eswatini, Lesotho, Zimbabwe, Botswana, Zambia, and the Great Lake Region. Cape Town also harbours the cable repair ship Leon Thevenin that services the east and west coast of Africa, which became a critical location debate and asset when the internet cables south of the Gulf of Guinea off the African west coast were damaged during August 2023 while the vessel was working off Kenya in East Africa.⁷¹ South Africa's telecommunications sector boasts one of the most advanced infrastructures on the continent. There has been considerable investment from Telkom, LIT, Broadband InfraCo, and mobile network operators, such as MTN and Vodacom, all aimed at improving network capabilities. The focus in recent years has been on backhaul capacity, fibre infrastructure, and long-term evolution (LTE) networks to extend and improve internet service connectivity to many other countries in Africa. Data cost is \$2.67/1 GB, which is low when compared to the other WIO nations but by far not the lowest tariff.

Seychelles (governance rating 73.4%)

Seychelles has two landing stations (Carana and Victoria), while four cable systems land in Seychelles.⁷² These are PEACE, SEAS, METISS, and 2 AFRICA. Seychelles Cable Systems Ltd is a private-public partnership comprising Airtel, Cable, and Wireless Seychelles, and the Seychelles government.⁷³ Given its island location, the country is well positioned to become a nodal point to link Asia and East Asia with Africa in the future. Data cost is \$19.55/1 GB, which is relatively high when compared to the other WIO nations and considering that the country is a very popular international tourist destination. Seychelles also comprises several islands, which is a cost and vulnerability factor to consider.

⁶⁷ Mozambique telecommunication market report. Available at <https://www.budde.com.au/Research/Mozambique-Telecoms-Mobile-and-Broadband-StaBsBcs-and-Analyses>.

⁶⁸ Mozambique telecommunication market report. n.d. Available at <https://www.budde.com.au/Research/Mozambique-Telecoms-Mobile-and-Broadband-StaBsBcs-and-Analyses>.

⁶⁹ Submarine Cable Map. Telegeography interactive map., Accessed in Aug 23. Available at <https://www.submarinecablemap.com>.

⁷⁰ Undersea cable systems in South Africa from 1879 to 2015. 2015. Available at <http://mybroadband.co.za/news/telecoms>.

⁷¹ Caboz, J. 2023. The cable repair ship Leon Thevenin led Cape Town. Available at <https://www.news24.com/news24/bi-archive/heres-what-you-need-to-know-about-the-leon-thevenin-the-cable-repair-ship-tasked-with-fixing-sas-slow-internet-2020-1-3>. Accessed 26 September 2023.

⁷² Comoros and Seychelles connected to the world's biggest submarine cable. 2021. Available at <https://www.lejournaldesarchipels.com>, (translate to english)

⁷³ 2022/23 Africa Telecom Transmission Map Published : SEAS submarine cable lands in Seychelles. Available at www.africabandwidthmaps.com

Madagascar (governance rating 44.2%)

Madagascar has four landing stations (Mahanjanga, Toamasina, Toliary, and Libanona). The landing stations are well positioned along the east and west coasts of the island, and five cable systems from the ocean land on the island.⁷⁴ These cables are 2 AFRICA, LION, EASSY, METISS, and AFRICA-1 (in process). Telecommunications services in Madagascar have benefited from intensifying competition among the main operators, including Orange Madagascar, Airtel, and the incumbent telco Telma. A national fibre backbone has been implemented connecting the major cities. Telma has progressively expanded the network to reach smaller towns. In addition, the government has progressed with its five-year plan to develop a digital platform running to 2024.⁷⁵ Data cost is \$3.39/1 GB, which is relatively cheap for an island nation with a low-income society and holds the potential to draw more attention when the envisaged but delayed BRICS (Brazil, Russia, India, China, and South Africa) subsea cable from China across the Indian Ocean to South Africa via selected African countries and Brazil is laid.⁷⁶

Mauritius (governance rating 74.9%)

Mauritius has three landing stations (Baie Jaconet, Grand Baie, and Terre-Rouge) with a total of five subsea cables landing on the island.⁷⁷ These cables are LION 2, METISS, T3, SAFE, and MARS. Mauritius is a sought-after tourist paradise, and the telecommunications development and investment have been driven by the varied needs of tourists. Mauritius was the first country in the region to provide services based on 3G technology. The Mauritius-Rodrigues Submarine Cable (MARS) is the first optical fibre submarine communications cable linking Mauritius to the island of Rodrigues. It

was commissioned in November 2017 by the government of Mauritius. The project was awarded to Mauritius Telecom and executed by PCCW Global with Huawei Marine as the installer.⁷⁸ Recently, the T3 submarine cable landed in Mauritius. The incumbent telco Mauritius Telecom, part-owned by the Orange Group, now provides comprehensive LTE and fibre broadband coverage, and in late 2021, it launched a gigabit fibre-based broadband service.⁷⁹ Data cost in the country is \$13.47/1 GB, which places the island state in the more expensive category of data and internet access and usage.

Reunion (French territory)

The island of Reunion has two landing stations (Sainte-Marie and Saint Paul). Three cable systems land in Reunion: LION 2, METISS, and SAFE.⁸⁰ Orange Reunion has launched 5G services in the capital of Reunion, Saint-Denis. It is anticipated that around 83% of the population is scheduled to benefit from the service by the end of 2023.⁸¹ The 4G equipment dismantled in Reunion will be sent to Madagascar to densify the network of the Malagasy subsidiary of Orange Reunion. Reunion is home to three wireless network operators, the largest of which is SFR Reunion, a subsidiary of Altice Group. SFR competes with Orange Reunion (backed by French telecommunications giant Orange Group) and Telco OI (trading under the Only and Free banners), which is currently controlled by Iliad Group of France and Axian Group, the parent of Madagascar telecommunications operator Telma.⁸² Data cost is \$0.75/1 GB, which is exceptionally low when compared to the islands in the area, but because Reunion is a French overseas territory, the low cost is probably reflective of the French connection.

⁷⁴ Submarine Cable Map. Telegeography interacBve map, Accessed Aug 23. Available at <https://www.submarinecablemap.com>.

⁷⁵ Madagascar market report. Accessed Jul 23. Available at www.budde.com.au/Research

⁷⁶ MYBROADBAND/SAPA. 2012. Investors eye BRICS undersea cable. Available at <https://businesstech.co.za/news/telecommunicaBons/14760/investors-eye-brics-undersea-cable/>. Accessed 3 October 2023

⁷⁷ Submarine Cable Map. Telegeography interacBve map. Accessed in Aug 23. Available at <https://submarinecablemap.com>

⁷⁸ Offshore Energy. 2018. MARS cable lands on Rodrigues island. Available at <http://www.offshore-energy.biz>. Accessed 26 September 2023.

⁷⁹ Nqcoya, Z. 2023. Liquid subsea T3 cable promises to bring major changes. *Sunday Tribune* 13 June 2023. Available at www.iol.co.za/sundaytribune/news. Accessed 26 September 2023.

⁸⁰ Submarine Cable Map. Telegeography interacBve map. Accessed Aug 23. Available at <https://www.submarinecablemap.com>

⁸¹ Reunion market report. Accessed Jul 23. Available at www.budde.com.au/research.

⁸² Reunion market report. Accessed Jul 23. Available at www.budde.com.au/Research.

Comoros (governance rating 42.5%)

The Union of the Comoros, consisting of three main islands, is an archipelago off Africa's east coast with high levels of poverty. The island group has four landing stations (Moroni, Chindini, Mutsamudu, and Moheli), and five cables systems land on the main island. These cables are 2 AFRICA, EASSY, FLY LION 3, AVASSA, and CDCS.⁸³ From the main island, the domestic cable serves the remainder of the islands with the Comoros Domestic Cable (CDCS) and of Mayotte with the AVASSA cable system.⁸⁴ The government of Comoros is actively seeking strategies to improve communications, trade, and economic opportunities by expanding mobile communications and internet services. With support from the World Bank Group, an international tender was awarded for a second telecommunications license to Telma Comoros, a subsidiary of Telecom Malagasy S.A. Significant international funding was recently granted to Telma Comoros to extend its network. Through competition, Comoros now has better-quality and cheaper telecommunications services, and broader coverage.⁸⁵ The average data cost for the island group is \$12.5/1 GB, and a small and fragmented clientele is served via subsea connectivity infrastructure.

Mayotte (French territory)

The island of Mayotte has two landing stations (Kaweni and Mamoudzou), and three cable systems land on the island. These cables are FLY LION3, LION 2, and AVASSA.⁸⁵ The island benefits from the efforts of France and regional partners to connect the French overseas territories to the region and the rest of the world. France Telecom-Orange and its subsidiaries operate the communication system of the island.⁸⁶ The data cost in the French overseas territory is \$5.01/1 GB.

3. Addressing vulnerabilities of subsea cable networks in the Western Indian Ocean

It is relatively rare to hear about spectacular cable faults because most companies/operators that depend on subsea cables follow a 'safety-in-numbers' approach, spreading their networks' capacity over multiple cables so that if one breaks, the network will run smoothly over other cables while service is restored on the damaged one.⁸⁷ At present, the island nations of the WIO remain more vulnerable to cable breaks because of the limited number of landing stations and cables that are available.

Worldwide, cable faults are common, and on average, over 100 occur every year. Unintentional damage from fishing vessels and ships dragging anchors (classified as human accidents) account for two-thirds of all cable faults worldwide. Table 4 below indicates the vulnerability of subsea cables located in the WIO nations due to four distinct threats, namely human accidents (e.g. fishing and anchoring), human attacks (e.g. sabotage), natural causes (e.g. earthquakes, tropical storms, and thunderstorm activity), and external causes (e.g. unstable power grid). Table 4 indicates that the risk of human attacks on subsea cables is low; however, the threat to the terrestrial networks that connect to coastal and landlocked countries is high. Complex terrestrial cable networks in South Africa, Kenya, and Tanzania aim to mitigate the risk through a system or network embedded in growing redundancy.⁸⁸ Redundancy through numbers is a slow process although the projected number of subsea cables foreseen for the WIO holds potential to mitigate the impact of physical damage or destruction. Numbers, however, do not prevent or reduce interferences related to tapping and similar interferences with the data flows that entail little if any physical damage.

⁸³ Submarine Cable Map. Telegeography interacBve map., Accessed in Aug 23. Available at <https://www.submarinecablemap.com>

⁸⁴ Huawei Marine Networks successfully deliver AVASSA submarine cable project. 2016. Available at www.huawei.com/en/news. Accessed 26 September 2023.

⁸⁵ Submarine Cable Map. Telegeography interacBve map., Accessed in Aug 23. Available at <https://www.submarinecablemap.com>

⁸⁶ Orange-Marine. High-speed broadband submarine cable FLY LION 3 makes landfall in MayoVe. Available at <http://marine.orange.com/en/news-en>. Accessed 26 September 2023.

⁸⁷ Cable breakage: When and how cables go down. KirsBn Lee. 28 Feb 23. Available at <https://blog.telegeography.com>.

⁸⁸ Africa telecom transmission network map. Accessed Aug 2023. Available at www.africabandwidthmaps.com.

The World Energy Trilemma Index assessed the external threats of the nations included in the study. A country is deemed to be at 'medium risk' if an overall score below 50 was achieved, while a

'low risk' is a score above 50. Although Somalia was not assessed, it is a failed/failing state deemed to be at 'high risk' based on a World Bank report that states that Somalia has an electrification rate of only 15%.⁸⁹

Table 4: Threats to submarine cables

COUNTRY	THREATS TO SUBMARINE CABLES			
	HUMAN ACCIDENTS	HUMAN ATTACKS	NATURAL CAUSES	EXTERNAL CAUSES
ERITREA	Not applicable as Eritrea has no subsea cables currently			
DJIBOUTI	Medium	Low	Low	Data not available
SOMALIA	Medium	Low	Low	Data not available
KENYA	Medium	Low	Low	Low
TANZANIA	Medium	Low	Low	Medium
MOZAMBIQUE	Medium	Low	Medium	Medium
SOUTH AFRICA	Medium	Low	Low	Low
SEYCHELLES	Medium	Low	Medium	Data not available
MADAGASCAR	Medium	Low	Medium	Medium
MAURITIUS	Medium	Low	Medium	Low
REUNION	Medium	Low	Medium	Data not available
COMOROS	Medium	Low	Medium	Data not available
MAYOTTE	Medium	Low	Medium	Data not available

REGIONAL INFRASTRUCTURE SUMMARISED

Based on the country analysis within the region, the following conclusions are drawn: Public- private enterprises are essential to roll out infrastructure rapidly, create competition in the telecommunications sector, and ultimately reduce the data costs while increasing data speed. Coastal nations are essential conduits to help ensure stability and growth for landlocked states. One cable repair ship to service the cable networks of sub-Saharan Africa is not sufficient. (At the time of writing, the ship was conducting repairs off Kenya while two cables on the African west coast needed

to be repaired off the coast of the DRC.) Twenty-six cables traversing the WIO ensure that all the nations in the region are being serviced; however, the island nations with just one cable are vulnerable. For the moment, ASN and SUBCOM are the main cable suppliers in the region. One major building block for the optimal use of opportunities that arise from subsea cable networks is effective protection regimes based on consensus, cooperation, and practical delivery of such services. For Africa, this also relies heavily on legislative and regulatory matters, and policies that direct attention, resources, and capacity towards the protection of SSI.

⁸⁹ Somalia data report.. Accessed Aug 23. Available at <http://data.Worldbank.org/country/somalia>

4. African policies, strategies, and positions

1. International

The International Convention for the Protection of Submarine Telegraph Cables⁹⁰ was established in 1884 and came into force on 1 May 1888. It was signed and ratified by 36 states and can be viewed as the initial steps in the international law to protect submarine cables and pipelines. The convention applied only to the high seas, but it was understood that coastal states would enact laws protecting submarine cables within their territorial waters.

The International Cable Protection Committee (ICPC)⁹¹ was established in 1958 to improve the security of undersea cables by providing a community for discussion of technical, legal, and environmental information relating to subsea cables. The committee has become a leading authority on subsea cables and is seen as a guardian of subsea cable infrastructure. It has more than 200 members from over 70 countries and represents 98% of the world's subsea telecommunications cables. An example of the utility of the ICPC is the promulgation of Recommendation No 6, Issue 10A on 26 March 2020,⁹² which recommends actions for effective cable protection (post installation). The document recommends actions to monitor cable routes and corridors while encouraging governments to enact national legislation on cable protection.

The current apex institution entrusted with the governance of ocean affairs remains the United Nations and more specifically through the United Nations Convention on the Law of the Sea (UNCLOS)⁹³. UNCLOS incorporated cable protection measures previously encapsulated in other conventions. It specifically empowers coastal states to exercise sovereign jurisdiction in their exclusive economic zones and continental shelves

while permitting other states the freedom to lay and maintain submarine cables in the same zones. The convention further allows coastal states to establish conditions for the entering of submarine cables and pipelines into their territorial zones; the laying and servicing of such cables are considered reasonable use of the sea. The UNCLOS legal principles relating to submarine cables are as follows:

- Freedom to lay, maintain, and repair cables outside of the territorial seas.
- Parties are to apply domestic laws to prosecute abuse of such cables.
- Vessels, unless saving lives, should avoid action that would damage cables.
- Vessels are to sacrifice anchors and fishing gear to avoid damage to cables.
- Cable owners are to indemnify vessel owners for lawful sacrifices of anchors and fishing gear.
- If repairs to cables result in damage to other cables, the owners of the cables being repaired should indemnify the owners of the damaged cables for repair costs.
- Coastal states and pipeline and cable owners are not to prejudice repair and maintenance of existing cables.

UNCLOS makes no distinction between the functions (telecommunications or power) of the cable or the use (military, commercial, or scientific) of the cable. The literature on cable protection is also united in its emphasis on impressing upon states the importance of treating submarine cables as critical infrastructure that would require strong national protection in addition to the traditional international cable law as stipulated above.

2. Continental

African Union Agenda 2063⁹⁴ advances the blue economy as a major contributor to continental transformation and growth that would require world-class infrastructure, including well-developed ICT and a digital economy. Although

⁹⁰ Carter, L., et al. 2009. Submarine cables and the oceans: connecting the world. UNEP-WCMC Biodiversity Series No 31. ICPC/UNEP/UNEP-WCMC.

⁹¹ International Cable Protection Committee (ICPC) website. <https://www.iscpc.org/about-the-icpc/history/> accessed 15 October 2023.

⁹² ICPC. 2020. ICPC Recommendation No6, Issue 10A. Issued 26 March 2020.

⁹³ UNCLOS. 1982. United Nations Convention on the Law of the Sea. https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf

⁹⁴ Agenda 2063. 2015. Agenda 2063 – The Africa We want. African Union Commission. September 2015. <https://au.int/en/agenda2063/overview>

the subsea arena is not specifically mentioned, the development of specifically ICT infrastructure must be seen as including submarine cables and pipelines as integral to any ICT ambitions. One step down, Africa's Integrated Maritime Strategy 2050 (AIMS 2050)⁹⁵ contends that threats to the maritime domain and more specifically the strategic communications systems are real. The strategy encourages cooperation among regional economic communities, regional mechanisms, and other international bodies to defend against threats posed by cybercrime in this regard. AIMS 2050 dovetails with the Revised African Maritime Transport Charter (2010)⁹⁶ that promotes mutual assistance and cooperation among state parties in maritime safety, security, and protection in the maritime environment.

The Digital Transformation Strategy for Africa (2020-2030)⁹⁷ strives to harness digital technologies and innovation to transform African societies and economies. It decries the low level of cooperation, coordination, and harmonising among regional and continental actors and the limited policy and regulatory reform in this regard. The 2016 African Charter on Maritime Security, Safety and Development in Africa (Lomé Charter) pushes for a sustainable blue economy while highlighting the responsibilities of states to combat crime in the maritime domain through national, regional, and continental cooperation and the harmonising of national legislation. Keeping to the security narrative, the African Union Convention on Cyber Security and Personal Data Protection (2014)⁹⁸ through Article 25 pushes for the protection of critical infrastructure. It urges states to adopt measures to classify identified communications technologies as critical infrastructure.

3. Regional

Southern African Development Community

The SADC Integrated Maritime Security Strategy⁹⁹ focuses on its alignment with the continental measures mentioned above and the United Nations SDGs 14 and 16. SDG 14 aims to conserve and sustainably develop ocean resources while SDG 16 promotes peaceful and inclusive institutions for sustainable development. The strategy contends that secure infrastructure could enhance economic development and poverty reduction and that inadequate and insecure infrastructure could be costly for the economy. Among the recommendations, the strategy recommends public/private partnerships to enhance maritime security and the assessment of the security efficiency of SADC major ports and transport corridors.

The SADC Industrialisation Strategy and Roadmap (2015-2063)¹⁰⁰ highlights the fact that the blue economy initiatives should be prioritised to develop infrastructure required to accelerate industrialisation. One can aver that secured data cables are integral to this roadmap as data and its related infrastructure are enablers of modern industrialisation and the Fourth Industrial Revolution.

The SADC Regional Infrastructure Master Plan (2012)¹⁰¹ has minimal information on ICT infrastructure but pushes for the development and review of the enabling policy and regulatory environment to maximise ICT infrastructure deployment. This push ties in with the global drive by the United Nations for a consensus on regulatory matters to frame the protection and safe operation of subsea data cables. Although the SADC policies and regulations do not explicitly mention submarine cables and pipelines, one could deduce from the references to ICT infrastructure development, use, and plans that this would be one of the areas covered by the documents.

⁹⁵ AIMS 2050. 2012. 2050 Africa's Integrated Maritime Strategy. <https://au.int/en/documents/20130225/2050-aim-strategy>.

⁹⁶ African Transport Charter. Adopted 2010. <https://au.int/en/treaties/revised-african-maritime-transport-charter>

⁹⁷ Digital Transformation Strategy for Africa (2020-2030). 2020. <https://au.int/en/documents/20200518/digital-transformation-strategy-africa-2020-2030>

⁹⁸ AU Convention on Cyber Security and Personal Data Protection. 2014. <https://au.int/en/treaties/african-union-convention-cyber-security-and-personal-data-protection>

⁹⁹ SADC Integrated Maritime Security Strategy. 2021. Approved in July 2021.

¹⁰⁰ SADC Industrialisation Strategy and Roadmap (2015-2063). 2015. <https://www.sadc.int/document/sadc-industrialisation-strategy-and-roadmap-english>

¹⁰¹ SADC Regional Infrastructure Development Master Plan. 2012. [https://www.sadc.int/sites/default/files/202108/Regional Infrastructure Development Master Plan Executive Summary.pdf](https://www.sadc.int/sites/default/files/202108/Regional%20Infrastructure%20Development%20Master%20Plan%20Executive%20Summary.pdf)

Intergovernmental Authority on Development The IGAD Regional Blue Economy Strategy and Implementation Plan for 5 Years (2021-2025)¹⁰² focuses mainly on cooperation and coordination of activities on the continental and regional levels. As for the security imperative, the IGAD Integrated Maritime Security Strategy 2015-2030¹⁰³ acknowledges the protection of critical maritime infrastructure as a safety and security concern. This infrastructure includes ports, facilities, and underwater infrastructure such as pipelines and seabed cables. The noted safety and security concerns stem from natural or human-made disasters, terrorism, and other intentional unlawful acts at sea specifically directed towards critical maritime infrastructure. This is one of the only policies from the region that specifically identifies the protection of maritime critical infrastructure as an issue to be tackled.

Indian Ocean Commission¹⁰⁴

The five island states mentioned in this report (Madagascar, Mauritius, Reunion, Comoros, and Seychelles) are members of the Indian Ocean Commission (IOC), which is an intergovernmental organisation that inter alia deals with maritime security while promoting peace and stability. Of interest is that the IOC hosted a regional stakeholder workshop in 2021¹⁰⁵ on the protection of submarine cables. It vowed to continue working with the United Nations Office on Drugs and Crime's Global Maritime Crime Programme to draft a Submarine Cables Protection and Resilience Plan that would reflect the regional submarine cable landscape, promote international law, and best practices in the Indian Ocean region. This is probably one of the very few activities whereby a regional entity directly addressed SSI and its protection.

4. National

South Africa The Defence Review 2015¹⁰⁶ argues that the security of infrastructure remains a South African Police Service responsibility while the South African National Defence Force (SANDF) also has a contingent liability towards the securing of such infrastructure. It highlights Defence Goal 2 as Safeguarding South Africa, which would include Task 5 – the safeguarding of critical infrastructure. Task 7 similarly directs the SANDF to ensure information security. The South African Navy is to have an underwater security capability to protect strategic infrastructure.

The National Key Points Act 1980¹⁰⁷ directs that any place or area whose loss, damage, or immobilisation may prejudice the Republic may be declared a national key point. Although the current list of national key points includes energy and pipelines, no mention is made of any subsea data cables as the act is still embedded in 1980 and to be updated.

The South African Police Service Act 1995¹⁰⁸ makes no reference of any tasks in relation to critical infrastructure, also on the maritime side. The South African Defence Act 2002¹⁰⁹ dictates that the SANDF should assist to ensure the provision of essential services. More to the point, the Guidelines for Rapid Deployment of Electronic Communications Facilities 2008¹¹⁰ spell out the jurisdictional powers of provinces and national bodies for the laying of submarine cables. The guidelines do not, however, cover the security of such cables. Furthermore, the Electronic Communications Act of 2005¹¹¹ contains provisions for the regulation of all areas of communication, which specifically include submarine cables (also fibre optic cables) and landing stations. The act also declares that submarine cables are to be designated as essential facilities.

¹⁰² IGAD Regional Blue Economy Strategy and Implementation Plan for 5 Years (2021-2025). 2020. <https://igad.int/wp-content/uploads/2022/03/IGAD-Blue-Strategy-Drad.pdf>

¹⁰³ IGAD Integrated Maritime Strategy (2015-2030). 2014. Sourced from UNODC (Nairobi)

¹⁰⁴ IOC. 2023. <https://www.commissionoceanindien.org/en/ioc-presentaBon/>

¹⁰⁵ UNODC. 2021. Protecting Submarine Cables in the Indian Ocean. <https://www.unodc.org/easternAfrica/en/Stories/protecting-of-submarine-cables-in-indian-ocean.html>

¹⁰⁶ South African Defence Review. 2015. <https://staBc.pmg.org.za/170512review.pdf>

¹⁰⁷ NKPA. 1980. National Key Points Act. https://www.gov.za/sites/default/files/gcis_document/201503/act-102-1980.pdf

¹⁰⁸ SAPS. 1995. SA Police Service Act 68 of 1995. <https://www.saps.gov.za/legislation/acts/act68of1995.pdf>

¹⁰⁹ SANDF. 2002. SA Defence Act 42 of 2002. <https://www.gov.za/documents/defence-act>

¹¹⁰ NoBce 279 of 2008. Guidelines for the Rapid Deployment of Electronic Communications Facilities. <https://staBc.pmg.org.za/gazeVes/080229com-guidelinesfacilities.pdf>

¹¹¹ Electronic Communications Act 36 - 2005. <https://www.gov.za/documents/electronic-communications-act>

Mozambique

Although many institutions are linked to the maritime domain, the security issues mainly deal with piracy and its possible impact on the country. There seems to be no holistic plan for coastal management. Domestic laws such as the Policy and Strategy of the Sea (POLMAR) 2017,¹¹² which strives to develop a blue, profitable, and sustainable economy of the sea, and the Sea Act 1996,¹¹³ which outlines the jurisdictions and components of Mozambique maritime policy and the authority and duty of related governmental bodies, contribute to the governance of the maritime domain. Although the legislation does not deal with SSI security, both laws are ideal regulatory documents through which decision makers can locate matters of subsea cable networks and their protection.

Tanzania

The Tanzania Telecommunications Corporation 2018 is mandated to develop telecommunications services and manage infrastructure. The Tanzania Telecommunications Regulatory Act 2003¹¹⁴ established the Telecommunications Regulatory Authority while the National ICT Policy 2016¹¹⁵ has as one of its focus areas ICT infrastructure, which implicitly covers SSI. None of the acts, regulations, or policies, however, focus on the security of SSI such as submarine cables and pipelines.

Kenya

The Kenya ICT Authority prioritised infrastructure investment during the past years stemming from Kenya Vision 2030,¹¹⁶ which has a focus on information and communications technology development. The following key documents focus on the ICT sector: the Cyber Security Strategy 2014,¹¹⁷ Kenya ICT National Master Plan 2017,¹¹⁸ National Broadband Strategy,¹¹⁹ and Kenya Communications Act 1998 (revised 2011).¹²⁰ The National Broadband Strategy updated legislation to include broadband as critical infrastructure and directs collaboration with the police to secure infrastructure. The following bodies are responsible for the management and security of ocean affairs: the Kenya Navy, Kenya Coast Guard, Kenya Police, Coast Development Authority, and Kenya Ministry of Transport. The Kenyan policies and regulations lack the details of physical security, the financing of such security, and the specific responsibilities. Most of the strategies are good documents, but they fail to deal with security, and more specifically subsea cable security. The policies and regulations are in all probability best suited to also include the rising topic of SSI, its protection, and how to go about it.

Somalia

The Somalia National Infrastructure Strategy 2019-2063 of 2018¹²¹ deals with the availability of submarine cables, the connections, and opportunities for such connections. However, it does not deal with the security of such cables. What is important is that Somalia's geographic position and its weak governance put the country at risk but its position on the Gulf of Aden brings it close to the clustering of SSI.

¹¹² FAO. 2017. FAOLEX Database. <https://www.fao.org/faolex/results/details/en/c/LEX-FAOC172386/#:~:text=The%20Policy%20and%20Strategy%20of%20the%20Sea%20pursues%20the%20following,acBviBes%20at%20sea%20and%20in>

¹¹³ FAO. Mozambique Law of the Sea No 4/96. [https://www.fao.org/faolex/results/details/en/c/LEX-FAOC022054/#:~:text=The%20Law%20of%20the%20Sea,Law%20shall%20be%20applied%20\(Chap.](https://www.fao.org/faolex/results/details/en/c/LEX-FAOC022054/#:~:text=The%20Law%20of%20the%20Sea,Law%20shall%20be%20applied%20(Chap.)

¹¹⁴ ICT Policy Africa. 2003. Tanzania CommunicaBons Regulatory Authority Act 2003. <https://ictpolicyafrica.org/pt/document/oc7gkxrspi?page=1>

¹¹⁵ ICT Policy. 2016. Tanzania NaBonal InformaBon and CommunicaBons Technology Policy. <https://www.ega.go.tz/uploads/publicaBons/sw-1574848612-SERA%202016.pdf>

¹¹⁶ Vision 2030. Kenya Vision 2030. <https://vision2030.go.ke/>

¹¹⁷ Kenya ICT Ministry. 2014. NaBonal Cybersecurity Strategy 2014. <https://www.ict.go.ke/downloads/NATIONAL%20CYBERSECURITY%20STRATEGY%20HIGH.pdf>

¹¹⁸ Kenya ICT Ministry. 2014. Kenya NaBonal ICT Masterplan 2013/14 to 2017/18. <https://www.ict.go.ke/wp-content/uploads/2016/04/The-NaBonal-ICT-Masterplan.pdf>

¹¹⁹ Kenya ICT Ministry. 2018. The NaBonal Broadband Strategy 2018-2023. <https://www.ict.go.ke/wp-content/uploads/2019/05/NaBonal-Broadband-Strategy-2023-FINAL.pdf>

¹²⁰ Kenya ICT Ministry. 2011. Kenya InformaBon and CommunicaBons Act. <https://infotradekenya.go.ke/media/Kenya%20InformaBon%20CommunicaBons%20ACT.pdf>

¹²¹ SNIS. 2018. Somali NaBonal Infrastructure Strategy 2019-2063. <https://mpwr.gov.so/wp-content/uploads/2019/03/SOMALI-NATIONAL-INFRASTRUCTURE-STRATEGY-SNIS.docx>

Djibouti

None of the documents on Djibouti's telecommunications sector (Djibouti Vision 2035 and the Djibouti World Trade Policy Statement 2014)¹²² relate to security of subsea cables or infrastructure. The literature acknowledges that the availability of submarine cables should direct the development of a national ICT strategy and a national ICT master plan but reflects the general trend of not including the all-important protection side of the networks within the strategy or master plan. Djibouti has a strategic location and is a hub for foreign military clustering and SSI and is therefore an important actor, albeit one lacking regulatory regimes.

Eritrea

Legislation for security of data is almost non-existent, making the country a primary partner for capacity building to protect SSI in the confined seas close to the volatile Yemen.

Seychelles

The Broadcasting and Communication Act of 2022¹²³ regulates the communications environment in Seychelles but does not direct action for its security. The Department of Information Communication Technology, resorting under the Office of the President, is responsible for sector policy and regulation. Although the National ICT Policy¹²⁴ has the promotion of modern ICT infrastructure and the fostering of an enabling legal and regulatory framework as two of its five focus areas, regulations and actions pertaining to the security of SSI remain absent.

Madagascar

The telecommunications sector in Madagascar is

administered by Law No 2016-02¹²⁵ on communications code and Law No 2005-023¹²⁶ relating to institutional reform of the telecommunications and ICT sectors. The available information depicts a sector that is underregulated and does not make provision for security of submarine cables and pipelines.

Mauritius

The ICT sector is regulated by the Information and Communications Act of 2001,¹²⁷ which established the Information and Communications Technology Authority to regulate the environment.

Comoros

Comoros has a National ICT Policy and Strategic Plan¹²⁸ encompassing nine principles including the promotion of good governance and the promotion of new policies for cooperation and partnership. The document acknowledges that the country has a poor and underdeveloped ICT infrastructure. None of the sources contain any reference to the physical security of any infrastructure, especially SSI.

5. Summary

The above shows a region with differing levels of effort and commitment to deal with the protection and/or regulation of submarine cables and pipelines. The ICPC provides best practices for the protection and security of submarine cables while the United Nations provides policies for responsible state behaviour in this regard. While regional policies and guidelines are mostly available, there is a general lack of national policies and/or guidelines to regulate the sector. The submarine data cable sector remains a vital but often-ignored part of any country's critical infrastructure. Because the security risk to the cables has a greater direct financial effect on the owners and managers of such cables, they see cable security very differently from national governments, and this is in itself fertile ground for cooperation on protection regimes and partnerships.

¹²² Lixi, M., Foch, A., Dahan, M. 2015. Telecommunications Sector in Djibouti: Finding the Path to Growth. https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/2022-06/ICT_in_Djibouti_2015.pdf

¹²³ Seychelles. 2022. Broadcasting and Telecommunications Act of 2022. <https://www.gazeve.sc/sites/default/files/2022-12/SI%20122%2022%20BroadcasBng%20and%20TelecommunicaBon%20Act%202022.pdf>

¹²⁴ Seychelles. 2015. National ICT Policy – Connected to the Community, Connected to the World. <https://www.ict.gov.sc/resources/policy.pdf>

¹²⁵ Madagascar. 2016. Code of Media Communications. <https://lexota.org/country/madagascar/>

¹²⁶ EDBM. 2017. ICTS: Madagascar, a Connected Island. https://edbm.mg/economic-data_sectors_icts-madagascar-a-connected-island/

¹²⁷ Mauritius. 2001. Information and Communications Act 44/2001. https://www.icta.mu/documents/2022/04/ict_act.pdf

¹²⁸ Comoros. 2007. Survey of ICT and Education in Africa. <https://openknowledge.worldbank.org/server/api/core/bitstreams/42121900-3224-56f9-87c2-e38151e57383/content#:~:text=Comoros%20has%20a%20national%20ICT,use%20of%20ICTs%20in%20educaBon.&text=promoted%20by%20the%20president.&text=commitment%20to%20women's%20empowerment%20and,def%20programmes%20in%20this%20area.>

5. Conclusion and recommendations

This report covers SSI in the WIO with specific reference to subsea cable networks. Overall, the aim of the report is to map and discuss infrastructure in the literal region off the east coast of Africa. Geographically, the report is limited to East African countries from South Africa to Eritrea and the African small island states in the WIO. Conceptually, energy and data cable infrastructure are addressed but the focus is on subsea data cable networks. Three broad themes are addressed. First, a background and scene-setting narrative on SSI is presented. Second, subsea cable networks and country specifics of African states bordering the WIO are discussed. Third, regulatory measures are presented with a focus on the selected East African countries and regions as platforms for protection cooperation.

The emphasis of the report is on subsea cable systems and the way in which these systems not only play a key role in terms of the digital transformation of Africa but are also essential for wider connectivity to Europe, Africa, and the Indo-Pacific region. To these ends, the discussion first frames the WIO as a maritime region showing consistent growth regarding the density and number of cable networks traversing the region and passing around the southern tip of Africa and north through the Red Sea towards Europe. Second, the region harbours seven countries and five small island states that have different potential to play pivotal roles to bring digital connectivity to African countries and also act as important allies regarding the protection of the infrastructure on the seabed off East Africa. The discussion points out cable specifics and ownership, country data on landing and distribution, connectivity to landlocked neighbours, and national players. Third, Africa's digital transformation ambitions are highly dependent on these subsea cables and thus their protection. General security around these networks must therefore be maintained, whether by contributions of individual states, through partnerships among states, or through public-private partnerships. Of relevance are the regulatory measures of the designated African countries, arrangements among countries and regions to consider protection measures, and roles to be played by a range of actors. Connectivity has become key in the conduct of interstate relations,

modern business dynamics to keep the global economy going, and the idea of ensuring safe and well-governed oceans. African countries bordering the WIO must play their role in this regard. To this end, recommendations in this report point to the role of African countries, the importance of understanding their role in terms of protection, and the way in which the subsea cable network protection is dependent upon smart partnerships. The report offers information to players in the subsea cable network protection domain to consider opportunities that include African partners in the overall ambition to protect data cable networks on the seabed in the WIO.

Countries have departments and agencies with specific jurisdiction to operate in the territorial zones. However, as data cables move farther away from these zones, there seems to be a lack of capacity to deal with any security issues related to subsea cables and pipelines. This results in closer cooperation with other international entities for the global good. The mostly private ownership of the cables results in those owners taking a greater interest in cable safety and security, mostly due to their better knowledge, capability, understanding, and experience, and also due to financial considerations. The delineation between the responsibilities of the state and those of the private sector should therefore be clearly articulated and regulated.

Recommendations

Subsea infrastructure relates to energy and information flow networks that manifest as a setting comprised of physical infrastructure, and the products they carry. As modern stimuli of development and prosperity, both the infrastructure as well as the product flows, are vulnerable to a range of threats and vulnerabilities that governments must help to prevent or mitigate. Taking a more prospective view, greater data dependence and drives towards renewable energy continue to expand oceans use and stand to add future infrastructure settings that increase the scope and need for protecting subsea networks. Current progress on protection of subsea infrastructure reflects the general neglect of critical assets in a difficult subsea domain. Protection of energy infrastructure houses a legacy of progress that offer [learning and information sharing](#) opportunities. Protection of subsea data cable networks are more complex given

their geographic expanse, dangerous subsea locations in different jurisdictional zones and multiple ownership patterns. This cluttering promotes complexity and requires careful consensus building and smart vertical and horizontal partnerships on ways and means to move forward. The latter forms primary underpinnings of national, regional, and global consensus building on best practices that international, national, and non-state actors must craft and ascribe to.

Subsea data cables traversing the WIO off Africa reside in a maritime region supporting a global cable network and mirror the features, ownerships, and vulnerabilities of this ocean region. Given that data cable networks in the WIO facilitate connectivity between Europe, Africa and Asia, the region's status underlines the importance of protection arrangements that include African governments and regional bodies should Europe and Asia negotiate protection agreements. As for the latter, secured data cables also play a pivotal role in Africa's digital transformation as a developmental catalyst and therefore the continent's inclusion in protection debates and decisions. Inclusion not only supports prospects for leapfrogging African communities towards the digital era, but also flags African states as equal partners to help guarantee secure networks in their territorial waters, and even in the wider WIO. Furthermore, African states are also critical to global consensus building on regulatory arrangements and evolving best practice on protection architectures whether dedicated to the WIO, or more general in kind.

For the above to manifest, African countries must be included in the debates and decisions and endowed with the capacity and legitimacy recognition to play their role. This includes setting up PPPs between the multiple actors in the cable network realm that present an intricate, but likely pathway to protect the ever-growing subsea data cable networks in the WIO. This is a maritime matter where co-located African governments are

important players given their geographic location, their own dependence on the networks and product flows, as well as regional partners on the western fringe of the Indo-Pacific to help protect subsea information highways to Africa, Asia and Europe.

To include African players the following are first order matters. First, an equal role for African players in decision-making on protection of subsea cable networks in the WIO. Second, global corporations as private cable owners must engage African governments bordering the WIO and their communication agencies to negotiate protection partnerships and a practical division of responsibilities regarding finances, information sharing, capacity building and divisions of labor. The most neglected sector here is governments and the private sector not fully engaging African partners in the WIO as fully fledged players in the protection game. This goes for their territorial waters where African governments have exclusive jurisdiction to formulate legislation and regulatory frameworks to enforce rule of law. African governments, maritime and security agencies as well as private actors must also be capacitated to become equal partners in the protection of subsea cables to set up regulatory and agency architectures to strengthen protection arrangements already in place at the continental, regional and national levels.

About the Authors



Prof. F. Vreÿ (Stellenbosch University). Francois Vreÿ is Emeritus Professor in Military Science, Stellenbosch University, and the Research Coordinator for the Security Institute for Governance and Leadership in Africa (SIGLA) located within the Faculty of Military Science.



Mark Blaine is a former South African Navy Captain and lecturer in Nautical Science at the Faculty of Military Science and is currently a research fellow with SIGLA.



Andre De Wet is a former South African Navy Rear Admiral (jg) who served in the submarine branch of the South African Navy. He served as a co-researcher for this report given his extensive experience in the subsea environment.

WIO Submarine Cable Information as at October 2023

COUNTRY	PHYSICAL INFRASTRUCTURE			GOVERNANCE AND REGULATORY MATTERS			
	TOTAL LANDING STATIONS	TOTAL CABLES	LANDING STATION LOCATION	CABLE NAMES	UNCLOS RATIFICATION	ICPC MEMBER ORGANISATION	MAIN LEGISLATION
ERITREA	0	0	NONE	NONE	No	Nil	None
DJIBOUTI	3	15	YAC A, HARAMOUS, RAS DIKA	AAE1, ADEN-DJIBOUTI, SEACOM, SMW3, DARE-1, MENA,EIG,EASSY,SMW5, IEX, PEACE, 2AFRICA, AFRICA 1, SMW6, IEX, RAMAN	Yes	Nil	Djibouti Vision 2035 Djibouti World Trade Policy Statement 2014 National ICT Strategy and Action Plan 2003
SOMALIA	3	6	BERBERA, BOSASO, MOGADISHU	AFRICA 1, GZA, 2 AFRICA, DARE-1, PEACE, EASSY	Yes	Dalkom Somalia DMCC	National Infrastructure Strategy 2019-2063 of 2018
KENYA	2	8	MOMBASA. MTWAPA	AFRICA 1, 2 AFRICA, DARE-1, LION2, PEACE, SEACOM, EASSY, TEAMS	Yes	Telkom Kenya The East Africa Marine System Ltd	Kenya Visions 2030 Cyber Security Strategy 2014 Kenya ICT National Master Plan 2017 National Broadband Strategy Kenya Communications Act 1998
TANZANIA	1	5	DAR-ES-SALAAM	AFRICA 1, 2 AFRICA, SEAS, EASSY, SEACOM	Yes	Nil	Tanzania Telecommunications Regulatory Act 2003 National ICT Policy 2016
MOZAMBIQUE	2	4	NACALA, MAPUTO	2 AFRICA, AFRICA 1, EASSY, SEACOM	Yes	Nil	Policy and Strategy for the Sea 2017 Sea Act 1996 Draft Policy for Information and Communication Technologies 2002
SOUTH AFRICA	6	11	MTUNZINI, AMANZIMTOTI, GQBERHA, MELKBOSSTRAND, DUYNEFONTEIN, YZERFONTEIN	AFRICA 1, 2 AFRICA, EASSY, SEACOM, SAFE, T3, METISS, WASC/SAT3, EQUIANO, ACE, WACS	Yes	Mertech Marine Pty Ltd Telkom SA Ltd	Defence Review 2015 National Key Points Act 1980 SA Police Service Act 1995 Electronic Communications Act 2005
MADAGASCAR	4	5	MAHAJANGA, TOAMASINA, TOIJARY, LIBANONA	AFRICA 1, 2 AFRICA, LION, EASSY, METISS	Yes	Telma SA	Law No 2016-029 Communications Code Law No 2005-023 Telecommunications and ICT Sector reform
COMOROS	4	5	MORONI, CHINDINI, MUTSAMUDU, MOHELI	2 AFRICA, EASSY, FLY LION 3, AVASSA, CDCS	Yes	Comoros Cables	National ICT Policy 2004
MAYOTTE	2	3	KAWENI, MAMOUDZOU	FLY LION 3, LION2, AVASSA	Yes (France)	Nil	France
SEYCHELLES	2	4	VICTORIA, CARANA	PEACE, SEAS, METISS. 2 AFRICA	Yes	Nil	Broadcasting and Communication Act 2022 National ICT Policy National Cyber Security Policy 2019
REUNION	2	3	SAINTE-MARIE, SAINT PAUL	LION2, METISS, SAFE,	Yes (France)	Nil	France
MAURITIUS	3	5	TERRE-ROUGE, BAIE JACOTET, GRAND BAIE(RODRIGUES ISL)	LION2, METISS, T3, SAFE, MARS	Yes	Mauritius Telecom Seacom Ltd WIOCC	National IT Strategy Plan 1998 Information and Communications Act 2001

	Satisfactory
	Problematic
	Concerning

