Infrastructure of the Port of Poti: Current Condition, Key Constraints, and Strategic Prospects for Modernization

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Abstract. This paper presents a comprehensive assessment of the infrastructural, operational, and technological condition of the Port of Poti, Georgia's principal maritime gateway. The research evaluates the port's hydrotechnical parameters, cargo-handling capabilities, warehousing capacity, transport accessibility, and level of digital integration. Statistical data for 2019–2025 are analyzed to identify trends in container throughput, general and bulk cargo handling, and Ro-Ro operations. The findings indicate that insufficient navigational depth, aging lifting equipment, limited storage infrastructure, and the absence of an integrated digital ecosystem significantly constrain the port's competitiveness in the Black Sea region. The study evaluates the port's performance with reference to international standards established by UNCTAD, IMO, EMSA, and the World Bank. Strategic recommendations focus on dredging and channel expansion, modernization of cargo-handling equipment, terminal development, digital transformation through a Port Community System, and environmental sustainability measures.

Keywords: port infrastructure, maritime logistics, containerization, dredging, digitalization.

1. Introduction

The Port of Poti is the largest and most operationally diverse seaport in Georgia, acting as a gateway connecting the South Caucasus, Central Asia, and the Middle Eastern economies with global maritime trade networks. Its strategic location on the eastern coast of the Black Sea provides the port with a vital role within the Trans-Caucasian corridor and the Middle Corridor (Trans-Caspian International Transport Route). International maritime organizations, including UNCTAD and IMO, identify the port as an essential multimodal node whose efficiency directly influences regional cargo flows.

Despite its strategic advantages, the port faces a series of structural, technological, and organizational constraints that limit both operational productivity and long-term competitiveness. These include restricted navigational depths, aging cargo-handling equipment, insufficient warehousing facilities, road congestion, and a fragmented digital environment. This study seeks to address several research questions:

- What are the structural and operational limitations affecting the port's performance?

- How do these limitations correlate with observed cargo throughput trends?
- What modernization strategies would enable sustainable growth and alignment with international standards?

The study's relevance is supported by the growing strategic importance of the Middle Corridor, evolving logistics dynamics in the Black Sea region, and increasing global competition among medium-size ports.

2. Literature Review

The international literature on port competitiveness emphasizes five structural determinants: hydrotechnical parameters (depth, width, and navigational safety), terminal and superstructure capacity, digitalization level, hinterland connectivity, and regulatory efficiency (Martín-Navarro et al., 2020; Hakimi et al., 2025; World Bank & S&P Global Market Intelligence, 2024).

Studies by UNCTAD underline the importance of navigational depth as a critical bottleneck for medium-size ports facing sedimentation and seasonal fluctuations. Research from EMSA highlights safety and environmental considerations in ports where aging equipment remains in operation. Digitalization trends, including the implementation of Port Community Systems and AI-based port process optimization, are extensively analyzed in the works of Khazzar et al. (2025) and the annual reports of IMO.

Regional literature on Georgian ports, although limited, indicates persistent infrastructural disparities across the Black Sea basin, with most ports undergoing modernization to increase container handling capacity and support growing regional supply chains.

The review demonstrates that modernization of navigational infrastructure, handling equipment, and digital platforms is central to improving port performance—precisely the areas where the Port of Poti exhibits its most critical shortcomings.

3. Methodology

The study employs a mixed-methods approach integrating:

3.1 Quantitative Analysis

Statistical data for 2019–2025 sourced from Geostat, APM Terminals, shipping statistics, and public reports.

Time-series analysis of container, bulk, and Ro-Ro cargo flows.

Comparative evaluation using international performance indicators and publicly available port statistics.

3.2 Qualitative Operational Assessment

Technical review of dredging operations, superstructure performance, warehousing conditions, transport accessibility, and digitalization level.

Assessment based on publicly available technical documentation, industry reports, and regulatory publications.

3.3 International Comparative Assessment

Cross-comparison with recommendations and performance indicators published by UNCTAD, IMO, EMSA, and the World Bank.

The collected data were analyzed using descriptive statistical methods and comparative analysis to identify the principal infrastructural and operational constraints affecting the Port of Poti and to formulate strategic modernization priorities.

4. Results and Analysis

4.1 Navigational Constraints

Despite recent dredging activities and improvements in channel maintenance, navigational depth remains one of the principal operational constraints affecting the Port of Poti. Variations in channel depth and periodic sedimentation limit the reception of larger vessels and reduce operational flexibility. These conditions may contribute to vessel waiting times, increased freight costs, and reduced competitiveness compared with deeper Black Sea ports.

The figure 1 illustrates indicative operational depth ranges reported in publicly available port specifications, navigational notices, and technical documentation. For 30 April 2025, approved depths ranged from approximately 10.2 m to 10.5 m depending on the segment of the fairway, with working draft limits determined accordingly (Trans Logistic LLC declaration, 2025).

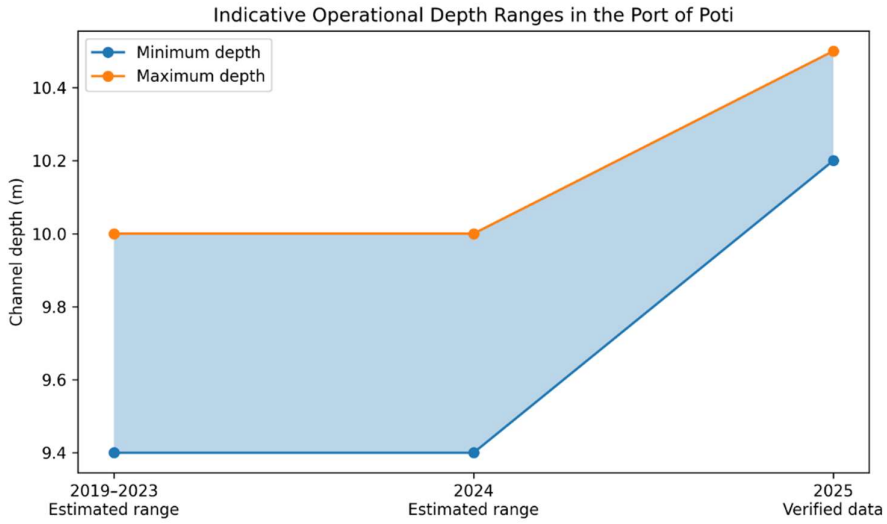

Figure 1. Estimated operational depth ranges and navigational limitations of the Port of Poti based on available port specifications, navigational notices, and verified 2025 channel depth data. Sources: Martín-Navarro et al. (2020); Hakimi et al. (2025).

Historical values presented for 2019–2024 represent estimated operational depth ranges derived from publicly available port specifications and technical documentation. Verified channel depth

information for 2025 is based on officially reported navigational data. The figure is intended to illustrate general navigational constraints rather than provide a complete empirical time-series dataset.

4.2 Cargo-Handling Superstructure

The port relies heavily on TAKRAF cranes (1970s), characterized by:

- limited maneuvering speed,
- insufficient lifting capacity,
- high downtime due to maintenance,
- poor adaptability to modern containerized operations.

Modern cranes produced by Tonghui Machinery demonstrate 2–3× higher operational efficiency, lower energy consumption, and greater versatility.

Table 1. Comparative Technical Characteristics of Legacy TAKRAF Cranes and Modern Multi-Purpose Port Cranes. Source: Martín-Navarro et al. (2020); Hakimi et al. (2025).

Parameter	**TAKRAF Crane**	**Modern multi-Purpose Crane**
Lifting Capacity	10–16 t	40–65 t
Container Handling Capability	Limited	Full capability
Automation Compatibility	Low	High
Energy Efficiency	Low	High
Maintenance Requirements	High	Moderate
Operational Flexibility	Low	High
Cargo Type Adaptability	Limited	High

Data represent typical performance ranges; modern cranes demonstrate improved lifting capacity, operational speed, automation potential, adaptability to diverse cargo types, and energy efficiency relative to older models.

4.3 Warehousing and Environmental Conditions

Current open storage facilities accommodate approx. 25,000 tons, with daily throughput around 3,000 tons - far below regional averages. Open-air operations increase environmental risks, including dust emissions from fertilizers and bulk materials, affecting workers and nearby communities.

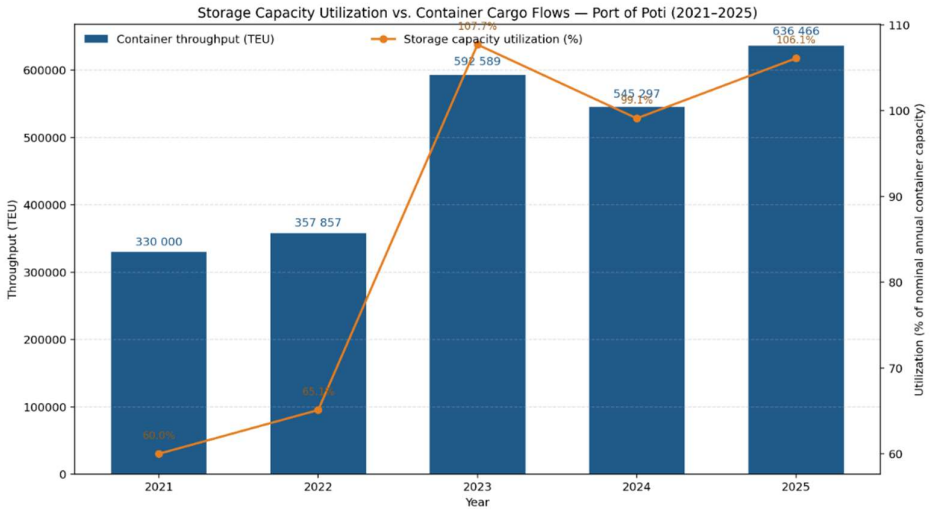

Figure 2: Storage capacity utilization vs. cargo flows (2021–2025). Source: Geostat (2024); APM Terminals Poti operational statistics.

4.4 Comparative Benchmarking

To assess the relative position of the Port of Poti within the Black Sea region, a comparative benchmarking analysis was conducted using selected infrastructural and operational indicators. The comparison includes the ports of Poti, Batumi, and Constanța, which represent different levels of infrastructure development and regional competitiveness.

Table 2. Comparative Infrastructure Indicators of Selected Black Sea Ports. Source: UNCTAD (2024); World Bank & S&P Global Market Intelligence (2024); official port data.

Indicator	**Poti**	**Batumi**	**Constanța**
Maximum Operational Depth (m)	10.5	14.0	19.0
Container Capacity (TEU/year)	500,000	100,000+	1,500,000+
Port Community System	Planned	Partial	Implemented
Modern Crane Infrastructure	Partial	Moderate	Extensive

The comparison demonstrates that although the Port of Poti benefits from a strategically important geographical location within the Middle Corridor, it remains constrained by limited navigational depth, partially modernized cargo-handling infrastructure, and a lower level of digital integration compared with leading Black Sea ports. These factors highlight the importance of continued investment in dredging, terminal modernization, and digital transformation initiatives.

4.5 Road and Hinterland Connectivity

The efficiency of cargo movements through the Port of Poti is significantly influenced by the quality of hinterland transport connections. At present, a substantial share of cargo traffic relies on municipal road infrastructure, creating operational bottlenecks and limiting the efficiency of port-related logistics activities. Road congestion, insufficient scheduling flexibility for truck operations, and growing traffic intensity contribute to longer cargo dwell times and increased transportation costs. In addition,

the concentration of freight traffic within urban areas generates environmental pressures through higher emissions, noise, and road wear.

Digitalization Level

Recent implementation of the Maritime Single Window (MSW) has improved the efficiency of vessel reporting procedures and facilitated compliance with international reporting requirements. However, cargo-related information flows remain fragmented across multiple stakeholders, limiting overall process transparency and coordination. The introduction of a Port Community System (PCS) would enable greater integration of port authorities, terminal operators, customs agencies, freight forwarders, and shipping companies. Such a system could reduce administrative burdens, improve information exchange, enhance operational transparency, and contribute to shorter cargo processing and dwell times.

Table 3. Functional Comparison of MSW and PCS. Source: UNCTAD (2024); IMO (2024).

Function	MSW	PCS
Vessel Reporting	✓	✓
Customs Integration	Limited	Full
Cargo Management	✗	✓
Logistics Coordination	✗	✓
Stakeholder Integration	Partial	Full

The comparison demonstrates the functional differences between the Maritime Single Window (MSW) and the Port Community System (PCS). MSW primarily standardizes mandatory maritime reporting and document submission processes within port calls, whereas PCS extends digital integration to include operational, logistical, and commercial functions across the entire port ecosystem. The two systems can be integrated, with PCS incorporating MSW modules while providing broader functionality for port community stakeholders.

5. Discussion

The analysis reveals a systemic pattern: the port's key constraints reinforce each other. Shallow depths restrict vessel size, which discourages liner services from routing through Poti. Aging terminal equipment slows cargo processing, limiting economies of scale. Insufficient warehouses create bottlenecks during seasonal peaks. Poor road connectivity extends dwell times, and a fragmented digital environment exacerbates coordination inefficiencies.

From a regional perspective, the port risks losing competitive advantage to neighboring facilities undergoing substantial modernization. Aligning infrastructure with international standards is no longer optional - it is a prerequisite for participating in evolving global supply chains and ensuring long-term sustainability of Georgia's transit function.

5.1 Recommendations

The modernization of the Port of Poti requires a comprehensive and integrated development strategy addressing both infrastructural and organizational constraints. Priority should be given to further dredging activities aimed at increasing basin and channel depths to approximately 10.5 m. In parallel, the acquisition of high-capacity dredging equipment would support the long-term maintenance of navigational parameters and reduce sedimentation-related operational limitations.

Another important direction concerns the modernization of cargo-handling infrastructure. The phased replacement of aging TAKRAF cranes with modern multi-purpose cargo-handling equipment would improve operational productivity, reliability, energy efficiency, and adaptability to contemporary containerized cargo operations.

Future development should also include the expansion of terminal and storage infrastructure. Increasing container terminal capacity to approximately 500,000 TEU annually, together with the construction of covered warehouses equipped with dust-suppression systems, would enhance operational efficiency while simultaneously improving environmental performance.

The efficiency of the port is closely linked to the quality of hinterland transport connections. Investments in road infrastructure, dedicated truck corridors, and digital vehicle scheduling systems could significantly reduce congestion and improve cargo flow efficiency between the port and inland transport networks.

Digital transformation should be considered a strategic priority. The implementation of a full-scale Port Community System (PCS) would strengthen coordination among port authorities, terminal operators, customs agencies, freight forwarders, and shipping companies, thereby improving transparency, information exchange, and overall operational efficiency.

Finally, environmental sustainability should remain an integral component of future development. The adoption of EU-aligned emission control measures, green port initiatives, and enhanced environmental monitoring practices would contribute to improving environmental performance and supporting the long-term sustainable development of the port.

6. Conclusion

The Port of Poti holds significant geopolitical and economic importance within the Black Sea and Trans-Caucasian transport networks. However, a combination of hydrotechnical, technological, infrastructural, and organizational challenges constrain its ability to meet growing regional demand. Strategic investments in dredging, modernization of superstructure, warehousing expansion, digitalization, and environmental safety are essential to align the port with contemporary global standards. Implementation of these measures will enhance throughput, strengthen the port’s role in regional logistics, and elevate Georgia’s position in transcontinental trade routes.

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