



The Role of Small and Medium Enterprises in Promoting Maritime Economic Development

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ABSTRACT

Maritime economic development is often framed around ports, fleets and trade corridors, yet much of its local developmental effect is transmitted through small and medium enterprises (SMEs) operating in logistics, fisheries, aquaculture, coastal tourism, port services, ship repair, digital trade services and maritime supply chains. This paper examines how SMEs contribute to maritime economic development and why their contribution remains uneven across countries and regions. Using a structured secondary review and thematic synthesis of peer-reviewed studies, international policy reports and comparative case evidence from 2010 to 2026, the paper integrates literature on SME development, maritime clusters, port innovation ecosystems, trade facilitation, blue-economy livelihoods and digital-green transition pressures. The analysis finds that SMEs promote maritime development through five main channels: employment and local income generation, supplier and service linkages, transaction-cost reduction, innovation diffusion, and inclusive coastal livelihood upgrading. However, these effects are conditional. SMEs deliver stronger developmental outcomes where port community systems, maritime single windows, accessible finance, skills programmes, collaborative clusters and transition-support policies are present. Where these conditions are weak, maritime growth tends to remain concentrated in large operators, leaving smaller firms exposed to regulatory burdens, digital capability gaps and decarbonisation costs. The paper contributes by placing SMEs at the centre of maritime development analysis rather than treating them as background actors. It concludes that governments, port authorities and development institutions should move beyond infrastructure-only strategies and design integrated maritime SME ecosystems that combine digital trade facilitation, supplier development, climate-transition finance, skills upgrading and inclusive blue-economy governance. and coastal resilience.

1. Introduction

Maritime economic development is commonly discussed through the lenses of ports, fleets, shipping routes and large-scale infrastructure. However, the daily economic substance of maritime activity is often produced by smaller firms: freight forwarders, chandlers, ship repair workshops, seafood processors, cold-chain operators, customs brokers, coastal tourism providers, marine equipment suppliers, digital service providers, waste handlers and thousands of informal or semi-formal enterprises embedded in fisheries and coastal livelihoods. This paper argues that small and medium enterprises (SMEs) are not

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peripheral to maritime development. They are one of the principal mechanisms through which maritime connectivity is translated into jobs, local income, innovation diffusion and regional value added.

The relevance of SMEs is heightened by the scale and changing geography of the maritime economy. Maritime transport continues to carry the overwhelming majority of world merchandise trade by volume, while ocean-based sectors contribute materially to output, employment and urban-regional development. Recent maritime-trade assessments indicate that developing economies handle a large share of global goods loaded and discharged, which means that coastal and port regions in developing countries face a dual challenge: they must expand maritime capacity while also ensuring that more value is retained locally through enterprise development and skills formation (UNCTAD, 2024, 2025, 2026; OECD, 2025).

The ocean economy is also increasingly territorial rather than purely sectoral. The OECD highlights that local blue-economy strategies are driven by job creation, regional growth, innovation and sustainability concerns, not merely by aggregate trade volume (OECD, 2024). This is crucial because the presence of port infrastructure does not automatically generate inclusive development. Without dense networks of suppliers, service providers, coastal enterprises and innovation intermediaries, port growth may become enclave-like: commercially visible but weakly connected to local welfare and regional capabilities. The World Bank's blue-economy work similarly cautions that narrow output-based definitions can understate inclusion, livelihoods and ecosystem quality (World Bank, 2024c).

SMEs deserve special attention for four reasons. First, they are dominant employers in much of the private sector in developing economies, including the services and manufacturing activities that supply ports, shipping and coastal industries (Aga et al., 2015; Beck et al., 2005). Second, many maritime sectors are intrinsically SME-intensive, especially small-scale fisheries, aquaculture, post-harvest processing, local logistics, repair and coastal tourism (FAO, 2024). Third, maritime digitalisation and decarbonisation are altering competitive conditions in ways that create new markets but also risk excluding smaller firms with weaker finance, data and compliance capacity (IMO, 2023; Nguyen & Le, 2025). Fourth, maritime development increasingly depends on absorptive capacity: the ability of local firms and institutions to learn from global trade, adopt technologies and participate in value chains (Constante et al., 2023; Li & Luo, 2021).

The central proposition of this paper is that SMEs promote maritime economic development when the surrounding ecosystem allows them to participate, innovate, comply and upgrade. This makes the developmental role of SMEs conditional rather than automatic. Where ports provide digital trade facilitation, where firms access credit and training, where clusters connect businesses to universities and anchor organisations, and where transition policies share the costs of environmental compliance, SMEs deepen maritime development. Where these conditions are absent, maritime growth remains concentrated, fragile and exclusionary (World Bank, 2023; OECD, 2024; Kuntchev et al., 2013).

2. Literature Review

2.1. SMEs, growth and employment in development literature

General SME-development scholarship provides the foundation for analysing maritime SMEs. Beck et al. (2005) show that a larger SME sector is associated with growth and poverty reduction, while also cautioning that the causal relationship is complex and mediated by broader institutional conditions. Later World Bank evidence gives the argument a stronger employment base by showing that SMEs are dominant private-sector employers in developing economies and that smaller and younger establishments often display important job creation dynamics (Aga et al., 2015). For maritime development, this broader literature matters because most activities beyond the largest shipping lines and terminal operators depend on smaller firms in brokerage, logistics, repair, food processing, tourism and coastal services.

Finance constraints remain a recurring problem in the SME literature. Kuntchev et al. (2013) demonstrate that smaller firms are generally more financially constrained than large firms, which has direct implications for maritime sectors where working capital, compliance costs and equipment upgrading can be substantial. In coastal and port regions, limited finance can prevent SMEs from investing in cold storage, digital systems, clean equipment, safety standards or export certification. Thus, SME contribution to maritime development depends not only on entrepreneurial energy but also on financial inclusion, credit design and risk-sharing institutions.

2.2. Maritime clusters, port ecosystems and innovation

Maritime-cluster research explains how SMEs can localise value and knowledge spillovers within maritime economies. Monteiro et al. (2013) conceptualise maritime clusters as differentiated systems composed of port activities, shipping, maritime services, knowledge institutions and related industries. Makkonen (2013) further shows that innovation in maritime clusters involves multiple types of innovation rather than only technological invention. This is important because many SMEs contribute through

incremental process improvement, service specialisation, quality upgrading and supplier coordination rather than formal research and development.

Li and Luo (2021) argue that maritime-cluster scholarship remains comparatively young and still borrows heavily from general cluster theory. They note that maritime industries have distinctive features: shipping firms can be footloose, maritime service firms may serve global clients, and port-related activities are embedded in both local and international networks. This creates an analytical challenge. SMEs may be spatially close to ports but still disconnected from higher-value maritime functions unless cluster governance connects them to customers, standards, research bodies and innovation intermediaries.

Empirical studies reinforce this conditional logic. Guimaraes et al. (2021) show that collaboration among SMEs can support internationalisation, yet weak export orientation and limited innovation linkages can undermine the developmental value of a cluster. Constante et al. (2023), comparing Rotterdam and Valencia, argue that port innovation ecosystems depend on coalitions among firms, port authorities, research centres, incubators and public agencies. Their finding is directly relevant to SMEs because smaller firms rarely possess the resources to innovate alone; they require testbeds, standards, data access, procurement opportunities and coordinated ecosystem support.

Small and medium-sized ports make the issue even more visible. Gerlitz and Meyer (2021) show that these ports are essential to regional logistics and Europe's twin digital-green transition, but that they often face resource and governance constraints. Gerlitz et al. (2024) later argue that living labs can help smaller ports experiment with sustainability and innovation. These studies suggest that smaller ports can function as SME-development platforms when governance is collaborative, but may otherwise remain under-resourced nodes struggling with digital and environmental transition.

2.3. Digital trade facilitation and SME participation

Digital trade facilitation is one of the strongest mechanisms linking SMEs to maritime development. The World Bank's analysis of Port Community Systems explains that collaborative digital platforms can lower entry barriers for micro, small and medium enterprises by enabling single submission of trade information, reducing duplication, improving transparency, supporting clearance processes and lowering the need for expensive firm-specific ICT systems (World Bank, 2023). From an SME perspective, these systems reduce fixed costs and procedural uncertainty, both of which disproportionately burden smaller firms.

UNCTAD's recent maritime transport assessments connect digital procedural systems with broader logistics and connectivity outcomes. Countries with implemented port community systems, maritime single windows or trade single windows tend to display stronger logistics performance and maritime connectivity (UNCTAD, 2024, 2025, 2026). The World Bank also treats maritime and trade single windows as institutional infrastructure that can reduce fragmentation across agencies and improve the trading environment (World Bank, 2024d). For SMEs, this means that digital port systems are not merely administrative reforms; they are competitive-access mechanisms.

2.4. Blue economy, fisheries and coastal livelihoods

The blue-economy literature broadens the analysis beyond ports and shipping. FAO (2024) reports that tens of millions of people work in fisheries and aquaculture, with small-scale operations accounting for a major share of livelihoods and employment. Women are central to post-harvest processing, seafood trade and household welfare, which makes SME upgrading in fisheries and aquaculture directly relevant to inclusion and poverty reduction. Orkoh and Abouhatab (2025) provide impact evidence showing that training in small-scale fisheries value chains can improve women's income, household food security and dietary quality in Sub-Saharan Africa.

Country-level blue-economy work also supports the territorial importance of maritime SMEs. The World Bank's analysis of Indonesia emphasises the economic role of fisheries, tourism and coastal resources in a large archipelagic economy (World Bank, 2021). Its Croatia study shows how maritime and coastal sectors contribute to national and regional development while also requiring pathways that balance growth, sustainability and inclusion (World Bank, 2024a). These cases indicate that maritime development cannot be measured only through port throughput; it also depends on how coastal enterprises, fisheries value chains, tourism firms and support services capture and distribute value.

2.5. Digital and environmental transition pressures

The transition literature introduces a more cautionary perspective. IMO's 2023 strategy on greenhouse-gas reductions from ships places decarbonisation at the centre of future maritime competitiveness (IMO, 2023). However, decarbonisation and digitalisation can widen capability gaps if smaller firms lack finance, skills and compliance support. Nguyen and Le (2025), using evidence from Vietnamese shipping SMEs, show that weak sensing capability, poor data analytics, limited ecosystem

collaboration and fragmented supply chains can trap firms in a digital-transformation dead zone. This suggests that technology availability alone is insufficient; SMEs need organisational and ecosystem capability.

UNCTAD (2026) frames maritime transport as facing simultaneous pressures from digitalisation, energy transition, geopolitical disruption and evolving trade patterns. For SMEs, these pressures create both opportunity and risk. Digital platforms, alternative fuels, data-driven logistics and green procurement can open new markets, but they can also favour larger firms able to absorb compliance and capital costs. This is why maritime SME policy must be linked to transition finance, technical assistance and common infrastructure rather than treated as a separate small-business agenda.

2.6. Research Gap and Contribution

The reviewed literature contains valuable work on SMEs, maritime clusters, port digitalisation, blue-economy livelihoods and sustainability transition. However, these strands are often treated separately. General SME studies rarely examine maritime sectors in detail; maritime-cluster studies often emphasise port governance and innovation without placing SMEs at the centre; and blue-economy studies sometimes focus on aggregate output while under-analysing enterprise ecosystems. As a result, there remains a gap in explaining how SMEs transform maritime connectivity into local economic development (Li & Luo, 2021; OECD, 2024; World Bank, 2024c).

This paper contributes in three ways. First, it develops an integrated conceptual framework that positions SMEs as transmission mechanisms between maritime infrastructure and regional development outcomes. Second, it synthesises evidence across ports, logistics, fisheries, coastal services and innovation ecosystems rather than restricting the analysis to one maritime subsector. Third, it identifies the institutional conditions under which SMEs strengthen maritime development: finance access, digital trade systems, skills, cluster governance and transition support. The contribution is therefore both conceptual and policy-oriented.

2.7. Analytical Framework and Hypotheses

The analysis is organised around four propositions. H1 states that greater SME participation in maritime value chains is positively associated with employment creation, local income generation and welfare gains in coastal and port economies. This proposition draws on broader SME employment evidence and fisheries-livelihood data (Aga et al., 2015; FAO, 2024; Orkoh & Abouhatab, 2025). H2 states that the developmental contribution of maritime SMEs is stronger where digital trade facilitation tools such as port community systems and maritime single windows are implemented (World Bank, 2023, 2024d; UNCTAD, 2026). H3 states that maritime clusters and port innovation ecosystems improve SME innovation only when collaborative governance and extra-local linkages are strong (Constante et al., 2023; Guimaraes et al., 2021; Li & Luo, 2021). H4 states that digitalisation and environmental regulation widen SME capability gaps unless targeted finance, skills and compliance support are provided (Kuntchev et al., 2013; IMO, 2023; Nguyen & Le, 2025).

The conceptual framework in Figure 1 reflects this logic. Finance, digital systems, skills, cluster governance and transition support enable maritime SMEs to generate employment, service linkages, innovation, inclusion and resilience. These mechanisms then influence higher-level outcomes such as maritime economic development, regional value added, connectivity and inclusive blue-economy growth.

Table 1

Analytical propositions and evidence synthesis

Hypothesis	Assessment	Synthesis of evidence
H1: SME participation strengthens maritime employment, local income and welfare.	Supported	General SME evidence and fisheries value-chain studies show strong employment and livelihood channels (Aga et al., 2015; FAO, 2024; Orkoh & Abouhatab, 2025).
H2: Digital trade facilitation strengthens SME participation in maritime trade.	Supported	Port community systems and single windows reduce information, clearance and ICT costs for smaller firms (World Bank, 2023, 2024d; UNCTAD, 2026).
H3: Maritime clusters improve SME innovation when governance and external linkages are strong.	Conditionally supported	Cluster proximity is insufficient without universities, port authorities, incubators and extra-local knowledge networks (Constante et al., 2023; Guimaraes et al., 2021; Li & Luo, 2021).
H4: Digital and green transitions widen SME capability gaps unless targeted support is provided.	Supported	Finance constraints, weak analytics, compliance costs and fragmented collaboration can trap SMEs in transition lag (Kuntchev et al., 2013; IMO, 2023; Nguyen & Le, 2025).

Source: Author synthesis from the literature reviewed in this paper.

3. Methodology

This paper adopts a structured secondary research design based on thematic synthesis. The approach is appropriate because evidence on maritime SMEs is dispersed across multiple literatures and data systems rather than contained in one harmonised dataset. The review brings together peer-reviewed journal articles, international policy reports and comparative case evidence published primarily between 2010 and 2026. Earlier foundational sources are retained where they remain influential for understanding SMEs, enterprise growth and maritime clusters, including studies on SMEs and development, maritime cluster typologies and innovation in maritime agglomerations (Beck et al., 2005; Makkonen, 2013; Monteiro et al., 2013).

The literature was organised around five thematic domains: SME-led employment and enterprise development; maritime clusters and port innovation ecosystems; digital trade facilitation and port community systems; fisheries, aquaculture and coastal livelihoods; and digital-environmental transition pressures. Priority was given to sources from the World Bank, OECD, UNCTAD, FAO and IMO, supplemented by peer-reviewed studies in maritime policy, transport, sustainability and development. This combination allows the paper to capture both macro-level maritime trends and firm-level mechanisms affecting SMEs (World Bank, 2021, 2023, 2024a, 2024b, 2024c, 2024d; OECD, 2024, 2025; FAO, 2024; UNCTAD, 2024, 2025, 2026).

The analytical method is triangulation. Quantitative indicators from official sources are treated as directional evidence on employment, trade, connectivity, fisheries livelihoods and blue-economy output. Peer-reviewed studies are used to interpret mechanisms such as collaboration, absorptive capacity, digital transformation and cluster governance. Case-based interpretation then connects these mechanisms to different maritime contexts, including ports, coastal economies, small and medium-sized ports, fisheries value chains and shipping SMEs (Constante et al., 2023; Gerlitz & Meyer, 2021; Gerlitz et al., 2024; Guimaraes et al., 2021; Nguyen & Le, 2025).

Because SME definitions vary across countries and sources, this paper does not impose one universal size threshold. Instead, it interprets SMEs functionally as firms operating below the scale of large integrated maritime operators and global terminal or shipping companies. This is consistent with the World Bank Enterprise Surveys approach, which compares firms by size, sector and location while recognising that enterprise categories vary across institutional contexts (World Bank, 2024b; Aga et al., 2015). The limitation of this approach is that it does not produce a single econometric estimate of SME effects on maritime GDP. Its strength is that it captures the multidimensional pathways through which SMEs affect maritime development across heterogeneous settings.

4. Analysis and Discussion

4.1. Employment, local income and enterprise density

The first finding is that SMEs promote maritime development by increasing employment intensity and local income capture. Large ports and shipping lines are capital intensive, but the surrounding maritime economy is labour-rich. Freight forwarding, customs brokerage, ship supplies, repair, warehousing, seafood processing, tourism and small-scale fisheries all depend heavily on smaller firms. The broader SME literature confirms that SMEs are major employers in developing economies, while fisheries evidence shows that small-scale maritime activities sustain large numbers of coastal livelihoods (Aga et al., 2015; Beck et al., 2005; FAO, 2024).

This employment channel is especially important for emerging and coastal economies where formal job creation is limited. Maritime infrastructure can increase throughput, but SMEs determine whether throughput becomes local employment. For example, when ports expand without supplier development, procurement access or skills programmes, large operators may import services and technology from outside the region. When local SMEs are integrated into maintenance, logistics, cold chains, tourism, marine services and food processing, maritime growth becomes more locally embedded.

4.2. Digital facilitation and transaction-cost reduction

The second finding is that digital port and trade systems are powerful SME enablers. Port community systems and single windows reduce duplication, information asymmetry and administrative delay. These reforms are often presented as logistics-efficiency tools, but their distributional effect is equally important: they lower fixed participation costs for smaller firms that cannot afford dedicated compliance departments or proprietary ICT systems (World Bank, 2023, 2024d).

This supports the proposition that digital public infrastructure can be understood as SME policy. UNCTAD's maritime transport work links digital facilitation tools with improved connectivity and logistics performance, while also warning that maritime systems are becoming more complex and technology-intensive (UNCTAD, 2024, 2025, 2026). For SMEs, the policy question is

therefore not simply whether digitalisation occurs, but whether it occurs through inclusive platforms, affordable onboarding, common standards and support services.

4.3. Innovation, clusters and absorptive capacity

The third finding is that maritime clusters can improve SME innovation, but only under active ecosystem governance. Cluster proximity alone does not guarantee learning. Studies of maritime clusters show that firms may remain weakly innovative if they lack extra-local linkages, export orientation, research access and collaborative institutions (Guimaraes et al., 2021; Li & Luo, 2021). This is consistent with earlier cluster literature showing that maritime innovation occurs through diverse types of learning and capability formation (Makkonen, 2013; Monteiro et al., 2013).

The positive cases are those where port authorities, universities, incubators, research centres and firms jointly create innovation infrastructure. Rotterdam and Valencia illustrate how absorptive capacity and ecosystem coordination shape innovation outcomes (Constante et al., 2023). Small and medium-sized ports show the same pattern at a different scale: they can become living laboratories for sustainable and digital solutions, but only where institutional arrangements overcome resource constraints and fragmentation (Gerlitz & Meyer, 2021; Gerlitz et al., 2024).

4.4. Inclusion, welfare and coastal livelihoods

The fourth finding is that maritime SMEs contribute to inclusion and welfare through fisheries, aquaculture, coastal services and tourism. These sectors are often more directly connected to household income than large-scale port operations. FAO (2024) documents the scale of employment in fisheries and aquaculture and the importance of women in post-harvest processing. Orkoh and Abouhatab (2025) show that targeted training in small-scale fisheries value chains can raise income and improve household nutrition. These findings indicate that maritime SME development is not merely an industrial policy issue; it is also a welfare and food-security issue.

The implication is that inclusive maritime development requires attention to informal and semi-formal enterprises. Many coastal SMEs operate outside sophisticated port-governance systems, yet they are deeply affected by maritime policy, coastal infrastructure, climate risk and market access. Blue-economy strategies that overlook women-led processing, artisanal fisheries, coastal tourism microenterprises and small service providers will underestimate the true development potential of maritime economies (World Bank, 2021, 2024a, 2024c; OECD, 2024).

4.5. Digital-green transition and SME vulnerability

The fifth finding is that SMEs are vulnerable to the twin digital and green transition. Decarbonisation, emissions reporting, cleaner equipment, cybersecurity, data analytics and digital logistics can open new opportunities, but they can also raise fixed costs. IMO's climate strategy and UNCTAD's transition analysis make clear that maritime systems will increasingly reward compliance and digital capability (IMO, 2023; UNCTAD, 2026). Smaller firms may be excluded unless support mechanisms accompany regulation.

The Vietnamese shipping-SME study demonstrates the point empirically: digital stagnation is associated with weak sensing capacity, limited analytics, poor collaboration and fragmented supply chains (Nguyen & Le, 2025). This reinforces the need for policy packages that combine finance, skills, advisory services and shared platforms. Without such packages, maritime modernisation may intensify dualism between globally integrated firms and local SMEs.

4.6. Policy Implications

The findings have practical implications for governments, port authorities, development institutions and SME-support agencies. First, port infrastructure policy should be linked to supplier-development programmes. New terminals, logistics zones and coastal facilities should include procurement pathways, certification support and training for local SMEs. This allows maritime infrastructure to generate local spillovers rather than remain isolated within large operators' value chains.

Second, digital trade facilitation should be designed inclusively. Governments and port authorities should treat port community systems, maritime single windows and interoperable data standards as common infrastructure. SME onboarding support, simplified interfaces, cyber-awareness training and affordable access rules are necessary to prevent digital exclusion (World Bank, 2023, 2024d; UNCTAD, 2026).

Third, maritime clusters should shift from branding to institution-building. Port authorities, universities, incubators, research centres and industry associations should create testbeds, living labs and applied innovation programmes that help SMEs adopt technologies and meet standards (Constante et al., 2023; Gerlitz et al., 2024; OECD, 2024). Fourth, decarbonisation policy

should include transition finance for smaller maritime firms, especially in fisheries, logistics, repair and small-port services. Finally, gender-sensitive blue-economy policy should support women-led and women-intensive activities in processing, trade and coastal services through training, finance and market access (FAO, 2024; Orkoh & Abouhatab, 2025).

Table 2

Policy agenda for SME-centred maritime economic development

Policy area	Priority action	Expected development effect
Digital trade facilitation	Design port community systems and single windows with SME onboarding, simplified interfaces and affordable access.	Lower transaction costs and wider SME participation in maritime trade.
Supplier development	Link port investment and logistics zones to local procurement, certification and technical-extension programmes.	Greater local value capture and stronger maritime supply chains.
Innovation ecosystems	Create port-linked living labs, university partnerships, incubators and applied innovation testbeds.	Higher SME absorptive capacity and faster technology adoption.
Transition finance	Provide concessional finance, advisory support and shared compliance tools for digital and green upgrading.	Reduced risk of SME exclusion during decarbonisation and digitalisation.
Inclusive blue economy	Support women-led and small-scale fisheries, processing, coastal tourism and community enterprises.	Broader welfare gains, livelihood resilience and gender-inclusive maritime development.

Source: Author synthesis based on OECD (2024), UNCTAD (2026), World Bank (2023, 2024d), FAO (2024), and Gerlitz et al. (2024).

5. Conclusion

This paper examined the role of SMEs in promoting maritime economic development. The evidence indicates that SMEs are central but constrained actors. They create and sustain employment, connect coastal households to markets, localise supplier linkages, help ports and clusters absorb innovation, and provide many of the services through which maritime trade and blue-economy activity become embedded in regional economies. Their role is particularly visible in fisheries, aquaculture, logistics, coastal tourism, port services, repair and small-port ecosystems (Aga et al., 2015; FAO, 2024; OECD, 2024).

At the same time, SMEs do not automatically convert maritime growth into inclusive development. Their contribution is amplified by digital trade facilitation, collaborative cluster governance, infrastructure investment, training and finance access; it is weakened by fragmentation, procedural complexity, weak innovation systems and unmediated transition costs. Maritime development strategies therefore need to move beyond infrastructure-only approaches. Ports, coastal governments and development institutions should treat SMEs as capability-bearing actors and design ecosystems that enable them to participate, innovate and comply at scale (World Bank, 2023; UNCTAD, 2026; Nguyen & Le, 2025).

The central policy lesson is that maritime economies move from throughput to development only when infrastructure is combined with local enterprise formation. Common digital platforms, supplier development, living-lab experimentation, technical extension, credit access, quality infrastructure and inclusive fisheries and coastal-enterprise upgrading are not add-ons. They are the mechanisms through which maritime activity generates broad-based prosperity.

5.1. Limitations

This study has several limitations. First, it relies on secondary evidence and does not estimate a unified cross-country econometric model linking maritime SME density to maritime GDP or trade performance. Such a model remains difficult because internationally comparable SME data by maritime subsector are limited. Second, the evidence base is uneven. Ports, fisheries, clusters and digital trade facilitation are relatively well represented, while niches such as marine insurance, bunkering support, maritime data services and small-scale ship repair are less systematically measured. Third, some official sources use different sectoral boundaries and reporting years, so numerical comparisons should be interpreted as directional rather than strictly comparable.

A further limitation is that emerging transition dynamics are still unfolding. The long-run effects of maritime decarbonisation, digital platforms and single-window systems on SMEs are not yet fully observable. This means the paper's conclusions should be read as a structured synthesis of available evidence, not as a final causal settlement.

5.2. Future Research Directions

Future research should develop more disaggregated datasets on SMEs within maritime sectors. National statistical agencies, port authorities and development institutions should work toward harmonised indicators covering firm size, employment,

revenue, gender participation, digital adoption, finance access and environmental compliance within maritime value chains. Such datasets would allow stronger causal testing of SME effects on maritime development.

Second, future studies should examine how digital public infrastructure changes SME participation in maritime trade. Port community systems and maritime single windows are widely promoted, but more evidence is needed on which firms benefit, which firms remain excluded and how onboarding design affects outcomes. Third, more comparative research is needed on small and medium-sized ports, island economies and secondary coastal cities, because these contexts may reveal different SME-development pathways than global gateway ports.

Finally, research should examine the distributional effects of maritime decarbonisation. As regulation tightens, the key question is whether green transition produces broader upgrading or simply concentrates market share among larger firms. Studies combining firm surveys, port data and policy evaluation would be especially valuable for identifying effective transition-finance mechanisms for maritime SMEs.

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