

A Study on the Current Development Status and Challenges of SMEs in the Context of the Marine Economy

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Abstract

The marine economy has become an important growth pole for China's high-quality economic development and a key support for regional coordination, industrial upgrading, and high-level opening-up. Against the background of continued expansion of the marine economy and the optimization of industrial structures, small and medium-sized enterprises (SMEs), by virtue of their organizational flexibility, specialized division of labor, and rapid market responsiveness, have gradually become major actors in extending marine industrial chains, absorbing regional employment, and promoting the transition from old to new growth drivers. Drawing on enterprise life-cycle theory and focusing on the practical context of marine economic development, this paper systematically examines the functional positioning of SMEs in the marine economy, their stage-specific characteristics, their practical difficulties, and their development trends in the era of globalization and digitalization. The study finds that SMEs in the marine industrial system perform both basic supply functions and more strategic roles in experimentation, model iteration, and regional spillovers, while also facing multiple constraints, including financing difficulties, shortages of talent, insufficient innovation capability, rising costs of green transformation, and relatively weak positions in industrial chains. As global competition in marine industries is restructured and digital technologies penetrate more deeply, the competitive advantages of marine SMEs are shifting from resource possession and cost advantages toward technological capability, data capability, coordination capability, and brand capability. In the future, it will be necessary to combine differentiated policy support, stage-specific assistance, a stronger innovation ecosystem, and better public services in order to promote higher-quality and more sustainable development of SMEs in the marine economy.

Keywords

Marine economy; Small and medium-sized enterprises; Life-cycle theory; Digital transformation; High-quality development

1. Introduction

Small and medium-sized enterprises (SMEs) are among the most dynamic, most widespread, and most employment-intensive microeconomic actors in China's national economy. In the traditional stage of industrialization, SMEs mainly served as supporting producers and local economic stabilizers. Under the current stage of high-quality development, however, their roles in innovation diffusion, industrial coordination, employment stabilization, and regional governance have become increasingly prominent. In particular, as the marine economy continues to expand and blue industries are cultivated at a faster pace, SMEs have become deeply embedded in marine fisheries, marine equipment manufacturing, marine

transportation, marine engineering services, marine biological resource development, coastal tourism, and marine information services, thus forming an important part of the vitality and resilience of the marine economy.

Existing studies show that foreign scholars began early to examine the relationship between small-firm growth stages, financing constraints, organizational evolution, and innovation performance. Churchill and Lewis argued that the core issues, organizational forms, and resource demands of firms differ across stages of development [1]. Hanks et al. further demonstrated, through research on stage configurations, that firm growth is not a simple linear process but one shaped by strategic choices and organizational adaptation [2]. With regard to finance, Beck and Demirguc-

Kunt pointed out that inadequate access to finance remains a major constraint on SME growth [3]. In research on the marine economy, the OECD has emphasized that marine development is moving from traditional resource exploitation toward innovation-driven and sustainable development [6][7], implying that organizational forms, innovation modes, and competitive logics of firms in marine industries are also changing. At the same time, studies on maritime clusters, marine knowledge networks, and the innovation performance of marine firms indicate that a firm's ability to embed itself in regional innovation systems and collaborative industrial networks has become an important determinant of the quality of its growth [4][5][8].

By comparison, although domestic studies on the marine economy and SME development have steadily increased, comprehensive research that systematically discusses the “functions–growth stages–difficulties–trends” of SMEs from the perspective of the marine economy remains relatively limited. Existing work has focused either on general problems of SME development or on the macrostructure and regional layout of the marine economy, without sufficiently revealing the specific constraints and capability-restructuring requirements faced by SMEs in marine economic settings. Against this background, this paper builds on prior studies while taking account of the industrial attributes and practical context of the marine economy. It offers a systematic analysis of the functional position, life-cycle characteristics, practical dilemmas, and development trends of SMEs in the marine economy, with a view to providing a theoretical basis and practical reference for future research and policy design.

2. The Role of SMEs in the Development of the Marine Economy

2.1 Key Carriers of Deepening Division of Labor in Marine Industrial Chains

The marine economy is not a single-sector economy; rather, it is a composite industrial system composed of marine resource development, marine manufacturing, marine transportation and logistics, marine science and technology services, and coastal consumption-oriented industries [6]. Within this system, large firms usually control core infrastructure, key resources, and major projects, whereas SMEs are widely distributed across upstream and downstream supporting segments, specialized services, technical applications, and end markets. Whether in marine food processing, ship component supply, port-adjacent logistics services, coastal cultural and tourism product development, marine ecological restoration services, or marine informatics applications, SMEs perform important

embedded support functions.

From the perspective of industrial organization, the longer the marine industrial chain, the more complex the application scenarios, and the more diversified the technological thresholds, the more the system depends on large numbers of flexible SMEs to participate in division of labor and coordination. Doloreux and Melançon's study of innovation dynamics in coastal maritime industries shows that industrial innovation in coastal regions does not depend solely on leading firms; large numbers of specialized SMEs also play important roles in knowledge diffusion, collaborative innovation, and value-chain extension [4]. Doloreux and Shearmur further argue that the competitiveness of maritime clusters is not merely a reflection of the scale of core firms; it also depends on whether surrounding enterprise networks, service systems, and regional coordination structures are sound [5]. This suggests that, in the context of the marine economy, SMEs are not simply a collection of market actors but important carriers of fine-grained marine industrial division of labor and cluster formation.

2.2 An Important Supporting Force for Regional Employment and Livelihood Improvement

The development of the marine economy is not reflected only in output growth and industrial upgrading; it is also closely connected to employment expansion, income growth, and social stability in coastal areas. A large number of marine-related SMEs are rooted in coastal cities, areas surrounding ports, and coastal counties, where they have clear advantages in absorbing local labor, stimulating entrepreneurship-based employment, and expanding service-oriented business forms. In labor-intensive and composite sectors such as seafood processing, port services, fishery logistics, coastal homestays, tourism consumption, and ecological management, SMEs often show stronger local embeddedness and greater capacity to absorb employment.

Compared with large marine enterprises, individual SMEs are limited in scale, but their large numbers and broad geographic distribution make it easier for them to transform the growth effects of the marine economy into tangible improvements in regional livelihoods through dispersed and localized channels. Therefore, from the perspective of regional development, SMEs are both an important micro-foundation of marine economic growth and a key channel through which the social benefits of the marine economy are realized. This is especially significant in the current context of promoting regional coordinated development and building China into a strong maritime nation.

2.3 Major Drivers of the Transition from Old to New Growth Drivers in the Marine Economy

The development logic of the marine economy is

undergoing profound change. The previous extensive growth model, which relied mainly on resource exploitation and scale expansion, is gradually giving way to a pattern oriented toward technological progress, green and low-carbon development, and higher value added [6][7]. In this process, SMEs, by virtue of flexible organizational mechanisms, fast market responses, and relatively low trial-and-error costs, are often better positioned to move early into emerging marine economic tracks. For example, in smart fisheries, marine sensing, cold-chain e-commerce, marine cultural and creative industries, marine big-data services, and blue carbon services, SMEs are frequently the first actors to test new technologies, validate new business models, and cultivate new forms of business.

OECD research on sustainable ocean innovation points out that future growth in the marine economy will rely increasingly on innovation capability, technological integration, and green development [7]. In this sense, SMEs not only perform practical functions in stabilizing growth and employment, but also shoulder the strategic mission of promoting innovation diffusion and the transition from old to new growth drivers in marine industries. Put differently, the high-quality development of the marine economy is not determined only by leading firms and major projects; to a considerable extent, it also depends on whether a broad base of SMEs can complete capability upgrading and pathway transformation.

3. Development Characteristics of Marine SMEs from the Perspective of Life-Cycle Theory

3.1 Start-Up Stage: Strong Innovation Orientation but High Resource Vulnerability

Life-cycle theory holds that enterprise growth exhibits clear stage characteristics, and that the problems and strategic tasks faced by firms differ substantially across stages [1][2]. In the context of the marine economy, start-up SMEs are often concentrated in emerging fields such as marine technology, marine biotechnology, marine information services, coastal cultural tourism, and green marine services. These firms usually have strong technological orientation and exploratory market behavior, allowing them to enter niche tracks relatively quickly, but they also commonly face long R&D cycles, high market uncertainty, insufficient fixed assets, and narrow financing channels.

Marine technology start-ups in particular may possess technical concepts, experimental results, or prototype patents, yet remain far from developing stable products and mature business models. As a result, such firms are prone at an early stage to the dilemma of being technically feasible, commercially unstable, and financially constrained at the same

time. Accordingly, what marine SMEs need most in the start-up stage is not merely generic financing support, but also a comprehensive support system including technology incubation, commercialization services, market matching, institutional guidance, and risk-sharing mechanisms.

3.2 Growth Stage: The Contradiction Between Expansion Speed and Governance Capacity Becomes Increasingly Salient

After entering the growth stage, marine SMEs usually begin to form clearer product structures and target markets, and may rely on port systems, industrial parks, regional supply chains, or platform economies to expand rapidly. However, at this stage the central issue facing the firm shifts from whether it can enter the market to whether it can sustain expansion. On the one hand, expanding market scale is conducive to revenue growth and brand accumulation; on the other hand, problems in internal management, talent allocation, supply-chain stability, regulatory compliance, and risk control also tend to intensify at the same time.

Research by Hanks et al. on stage configurations suggests that, during growth, the rise in organizational complexity often outpaces institutional construction [2]. This tendency is even more pronounced among marine firms because marine industries are also affected by multiple external factors such as natural conditions, transportation cycles, market fluctuations, environmental regulations, and international standards. In other words, the challenge facing growth-stage marine SMEs is not merely how to expand in scale, but how to improve governance capacity, coordination capacity, and risk resilience at the same time.

3.3 Maturity and Adjustment Stages: From Scale Competition to Quality Improvement and Structural Reshaping

Once firms enter the maturity stage, their product systems, customer networks, and profit models tend to stabilize, and their central task is no longer simply to expand scale. Instead, they need to advance brand building, green upgrading, digital transformation, and service extension in order to shift from quantitative expansion to quality-oriented development [1]. For marine SMEs, the maturity stage in particular requires a move beyond traditional processing, basic supporting activities, and regionally confined operations, toward stronger technological barriers, clearer brand recognition, and greater control over value chains.

At the same time, some traditional marine SMEs may enter a stage of adjustment or even decline, especially those relying on low-end processing, extensive management, and homogeneous competition. Under tightening resource constraints, faster technological substitution, and stricter environmental standards,

their original comparative advantages are likely to weaken continuously. If they cannot renew themselves through technological upgrading, managerial optimization, and business-model transformation, they are likely to be marginalized in a new round of market restructuring. This indicates that the development of marine SMEs is not a linear upward process but a dynamic one that evolves along with changes in the external environment, which in turn requires stage-specific and differentiated analysis.

4. Major Difficulties Faced by Marine-Related SMEs

4.1 Financing Constraints Remain the Primary Bottleneck to Growth

Financing constraints are among the most classic issues in SME research. Beck and Demirguc-Kunt argue that, because of stronger information asymmetry, insufficient collateral, and limited credit accumulation, SMEs generally find it more difficult to obtain stable and low-cost financing [3]. This problem has not weakened in the marine economy; rather, it has been magnified by the fact that marine industries are typically characterized by high investment requirements, long cycles, and high uncertainty. Upgrading fishery equipment, building cold-chain systems, supporting port and shipping services, manufacturing offshore engineering components, and commercializing marine technological achievements require substantial upfront capital. Yet many SMEs lack sufficient collateral and long-term credit records, leading to poor access to finance.

This is particularly evident in emerging industries such as marine biotechnology, marine information services, marine environmental protection services, and marine technology R&D, where firms are often light in assets, heavy in R&D, and slow in generating returns. In such cases, a mismatch easily arises between capital supply and innovation demand. The Asian Development Bank's work on financing the blue economy likewise notes that blue-economy SMEs and related projects generally face financing gaps and inappropriate financial instruments [12]. Thus, financing difficulty is not merely a generic issue; it is one of the most prominent foundational obstacles preventing marine SMEs from moving toward high-quality development.

4.2 Shortages of Talent and Weak Management Capacity Interact and Reinforce Each Other

The marine economy is highly composite and specialized, which means that marine firms need not only general managerial capability but also marine-specific technological knowledge, digital application skills, environmental awareness, and

compliance capability. In reality, however, most SMEs are clearly weaker than large firms in terms of pay levels, R&D platforms, career prospects, and organizational attractiveness, making it difficult for them to attract and retain high-level talent on a stable basis. The shortage of composite talent is particularly prominent in fields such as marine equipment, marine information, smart port and shipping operations, and ecological governance.

At the same time, some SMEs continue to rely on experience-based management and extensive operational models, with weak internal systems, unreasonable job allocation, and underdeveloped performance mechanisms. This leaves them less able to respond effectively to market fluctuations, external shocks, and upgrading pressures. In other words, the talent problem of marine SMEs is not simply one of not being able to recruit people; it is closely linked to governance structure, corporate culture, technological platforms, and expectations of growth. Only by combining talent development with improvements in governance capacity can their development foundation be truly strengthened.

4.3 Insufficient Innovation Capability and Weak Commercialization Chains

Innovation is the core support for the transition from old to new growth drivers in the marine economy. In reality, however, many SMEs remain weak in R&D investment, technological accumulation, innovation organization, and industry–university–research collaboration. Doloreux and Melançon show that innovation in coastal maritime industries is not merely a matter of technological breakthroughs; it is also closely connected to regional networks, cooperation mechanisms, and institutional environments [4]. Zhou et al. further demonstrate that maritime knowledge clusters, organizational learning, and firm performance are significantly associated, and that a firm's ability to enter knowledge networks and innovation ecosystems directly influences the quality of its growth [8].

For marine SMEs, on the one hand, the lack of continuous and stable R&D resources makes it difficult to sustain high-intensity and long-cycle technological development. On the other hand, even when certain innovative outcomes are generated, they often fail to be commercialized effectively because of insufficient pilot-testing platforms, weak market linkages, inadequate intellectual-property protection, and poor industrial coordination mechanisms. As a result, many firms find themselves trapped in the dilemma of having innovative ideas that cannot be industrialized, or technological accumulation that cannot be converted into market advantage. Insufficient innovation capability, therefore, is not a single-point problem; it is the combined reflection of shortcomings in R&D, commercialization, coordination, and institutional supply.

4.4 Green Transformation Pressure and Low-End Lock-In in Industrial Chains

As marine ecological protection, green and low-carbon development, and carbon-reduction goals continue to advance, the requirements for the greening of the marine economy are becoming increasingly stringent [7]. For SMEs with weak technological foundations and limited capital strength, green transformation often means higher environmental investments, rising costs of technological retrofitting, and tighter constraints on energy use and emissions, all of which can create significant short-term operating pressure. At the same time, many marine SMEs have long remained in the middle and lower ends of industrial chains, mainly engaging in basic processing, general supporting services, and low-value-added activities, with relatively weak brand influence and limited bargaining power. This makes them prone to homogeneous and price-based competition.

Valenza et al., in their study of sustainability management approaches among family SMEs in the blue economy, note that such firms often oscillate between cost pressure and transformation opportunities when facing sustainability requirements [11]. This suggests that green transformation is not merely a matter of stricter external regulation; it is also a process through which firms must redefine their competitive advantages and development paths. If firms cannot turn green requirements into opportunities for technological upgrading, service upgrading, and brand upgrading, they are likely to become even more marginalized during industry restructuring.

5. Development Trends of Marine SMEs in the Context of Globalization and Digitalization

5.1 Globalization Is Embedding Firms More Deeply in International Industrial Division of Labor

The marine economy is by nature open, mobile, and international. Port and shipping transport, seafood trade, marine engineering services, and maritime logistics are all closely tied to international markets [6]. As global supply chains are restructured, marine trade rules adjusted, and international standards raised, marine SMEs are becoming more deeply embedded in cross-regional and even cross-border divisions of labor. Some firms expand through seafood exports, port-supporting services, offshore equipment component orders, and participation in international maritime services; others improve competitiveness by importing advanced foreign equipment, aligning with international standards, and learning from international management experience.

Yet globalization is not only about expanding opportunities; it also means higher standards, stronger competition, and greater uncertainty. For smaller firms

with limited risk-bearing capacity, internationalization requires not only quality control and supply-chain coordination but also stronger compliance capability, market adaptability, and risk identification capability. Accordingly, whether marine SMEs can truly benefit from globalization depends less on whether they have entered international markets and more on whether they possess the comprehensive capabilities needed to operate in high-standard markets.

5.2 Digitalization Is Reshaping the Organizational Form and Value-Creation Logic of Marine Industries

The development of digital technologies has opened new growth paths for marine SMEs. Gavalas et al. find that digital adoption can effectively improve operational efficiency in the maritime industry, although its advancement is also constrained by organizational inertia, limited capabilities, and difficulties in transformation coordination [9]. Raza et al. further point out that data, artificial intelligence, the Internet of Things, and cloud services are becoming major drivers of transformation in maritime logistics [10]. For marine SMEs, digitalization does not simply mean going onto platforms, buying software, or connecting systems; rather, it means using digital technologies to reshape production organization, market connections, and value realization.

For example, in marine fisheries, intelligent sensing, remote monitoring, and platform-based sales can improve both production and circulation efficiency. In port and shipping logistics, digital scheduling, intelligent warehousing, and supply-chain coordination can help reduce costs and increase turnover efficiency. In coastal tourism and marine cultural services, online communication, platform operation, and digitalized consumption scenarios can broaden market space. In other words, the value of digitalization for marine SMEs lies not in the mere addition of technology, but in its ability to help firms break information barriers, strengthen coordination efficiency, and realize a higher level of specialized division of labor.

5.3 The Overall Trend Is a Shift from Resource Dependence to Capability-Based Competition

Taken together, the combined effects of globalization and digitalization are driving profound changes in the competitive logic of marine SMEs. In the past, firms participated in market competition mainly through locational advantages, resource endowments, and cost control. In the new stage of development, however, technological capability, data capability, platform access capability, organizational coordination capability, and brand communication capability are increasingly becoming the new core sources of competitiveness [7][9][10]. This means that, if SMEs are to secure sustainable development space in the future marine economy, they must transform themselves from

traditional production-oriented firms into technology-driven, platform-coordinated, and service-extended firms.

This transformation does not imply that all firms must follow the same path. Rather, each firm needs to formulate a differentiated development strategy based on its life-cycle stage, its position in a specific segment, and its resource endowment. For start-ups, the priority lies in using digitalization to improve market linkage and innovation efficiency. For growth-stage firms, the key lies in strengthening supply-chain coordination and organizational governance through digital tools. For mature firms, the focus should be on using digitalization and greening to upgrade brands and extend services. In this sense, the core issue facing marine SMEs has gradually shifted from whether they can survive to how they can improve the quality of competition and the resilience of development.

6. Conclusion

In the context of the marine economy, SMEs have become important forces in extending marine industrial chains, absorbing regional employment, promoting cluster formation in marine industries, and supporting the transition from old to new growth drivers. Based on life-cycle theory and the practical setting of marine economic development, this paper argues that the development of marine SMEs is characterized by strong stage specificity, differentiation, and dynamism. Firms at different stages face markedly different resource constraints, organizational problems, and policy demands. At the same time, financing constraints, talent shortages, insufficient innovation capability, pressure for green transformation, and low-end lock-in within industrial chains remain the main factors constraining the high-quality development of marine SMEs.

Under the combined influence of globalization and digitalization, the development environment and competitive rules facing marine SMEs are undergoing profound change. Whether SMEs can achieve stable growth in the future depends not only on their own technological accumulation and market adaptability but also on whether they can effectively embed themselves in marine industrial networks, innovation ecosystems, and institutional support systems. Accordingly, policy design should attach greater importance to stage-specific support, differentiated guidance, and systemic institutional supply for marine SMEs, with particular emphasis on improving financial support systems, talent support systems, commercialization mechanisms, incentives for green transformation, and digital-empowerment platforms. In this way, a stronger

micro-foundation can be built for the high-quality development of the marine economy.

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