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Marine Economy-Driven Conversion of Old and New Growth Drivers: The Development Foundations, Transformation Characteristics, Current Conditions, and Major Problems of SMEs in Yantai

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Abstract

Against the backdrop of the continued transformation from old to new growth drivers at the regional level, the marine economy has become an important force for coastal cities seeking to restructure their industrial systems, cultivate new engines of growth, and enhance the level of openness. As an important coastal open city on the Shandong Peninsula, Yantai possesses both a solid accumulation of traditional marine industries and a relatively clear layout of emerging marine sectors such as marine engineering equipment, marine biomedicine, seawater desalination, modern port shipping, and marine ranching. At the same time, small and medium-sized enterprises (SMEs) in Yantai are large in number, broad in industrial coverage, strongly private in ownership structure, and increasingly active in technological innovation, industrial coordination, and market expansion. Based on public statistical communiqués, marine economic plans, and policy documents of Yantai, and informed by the literature on the marine economy, SME transformation, and regional industrial upgrading, this paper examines the development foundations, transformation characteristics, current conditions, and major problems of SMEs under the marine-economy context. The study finds that Yantai's marine economy has moved beyond the stage of traditional resource exploitation and scale expansion, and is gradually evolving toward a development model that emphasizes industrial-chain extension, innovation-driven growth, green and low-carbon development, and coordinated openness. In this process, SMEs have shifted from being general market actors to becoming important supporters, innovators, and value creators within marine industrial chains. Their development shows three salient features: stronger embeddedness in marine industries, a deepening innovation orientation, and a rising trend toward green, digital, and collaborative transformation. Nevertheless, Yantai's SMEs still face a series of constraints, including insufficient participation in high-end segments of industrial chains, limited access to innovation resources, high costs of green and digital transformation, and relatively weak capabilities in outward market expansion. The findings suggest that the marine economy affects SMEs not simply through industrial "pull effects," but through a deeper restructuring of firm capabilities and competitive logic.

Keywords

Marine economy; Conversion of old and new growth drivers; Small and medium-sized enterprises; Industrial upgrading; Yantai

1. Introduction

In recent years, the marine economy has assumed a more prominent position in the development strategies of China's coastal regions. For coastal cities, the significance of the marine economy no longer lies merely in expanding the scale of fisheries, ports, and coastal tourism. More importantly, it lies in promoting a transition from traditional growth drivers to new ones through marine resource utilization, marine technological innovation, industrial-chain extension, and the construction of open platforms. Smith-Godfrey defines the blue economy as a marine development concept that attempts to coordinate economic growth,

marine resource use, and environmental sustainability [1]. Keen et al. further argue that the real value of the blue economy lies not in rhetoric itself, but in whether it can be translated into operable frameworks for industry, governance, and regional coordination [2]. Bennett et al. caution that marine economic expansion focused solely on growth, while neglecting equity, ecological concerns, and governance risks, may undermine long-term performance [3]. These insights imply that the relationship between Yantai's marine economy and its SMEs should not be reduced to a simple matter of industrial scale; rather, it should be understood through the interaction among industrial structure, firm capability, and regional governance.

Yantai provides a representative case for examining this issue. According to the 14th Five-Year Plan for the Development of Yantai's Marine Economy, the city's gross marine product reached RMB 180.87 billion in 2019, accounting for 23.6% of local GDP, with the city ranking among the leading coastal cities in Shandong Province. The same plan proposed that Yantai should advance quality, efficiency, and growth-driver transformation in marine economic development and build a modern marine industrial system [11]. By 2024, Yantai's GDP had reached RMB 1.078283 trillion, making it a trillion-yuan city; 94,200 new market entities were registered during the year, the total number of market entities reached 1.0785 million at year-end, the number of national science-and-technology-based SMEs reached 4,317, invention patents granted totaled 5,661, and the number of valid invention patents per 10,000 people reached 32.23. In the same period, Yantai added two new national-level marine ranching demonstration zones, bringing the total to twenty-two; the Changdao "Blue Granary" marine economic development zone was fully launched; the shipbuilding and marine engineering equipment industry was selected as a national advanced manufacturing cluster; and the country's largest wind-turbine blade testing center and a seawater desalination project with a daily capacity of 140,000 tons were put into operation [12]. These developments show the mutually reinforcing relationship between marine industrial upgrading and the enhancement of overall urban economic strength.

SMEs carry a dual significance in this regional context. On the one hand, they are the most widespread market actors in the local economy and serve as a critical basis for employment absorption, market vitality, and industrial-chain stability. On the other hand, in the process of replacing old growth drivers with new ones, SMEs are often the first to experience the pressures arising from industrial upgrading, market change, and technological restructuring. Acs and Audretsch demonstrated early on that small firms are not inherently low in innovation; in many specialized fields, they can in fact display considerable innovative vitality [5]. Cohen and Levinthal's concept of absorptive capacity suggests that a firm's ability to identify, absorb, and transform external knowledge is a key source of innovation performance differences [6]. Teece, Pisano, and Shuen argue that the dynamic capability to continuously reconfigure resources, organizational arrangements, and strategies under uncertainty determines whether firms can maintain competitive advantage amid industrial change [7]. In the context of Yantai's marine economy, the transformation of SMEs is therefore not simply a matter of launching projects or switching products; it entails finding new positions in an evolving industrial system, rebuilding capabilities, and forming new market linkages.

Against this background, this paper addresses three related questions. First, what kind of development foundation does the marine economy provide for SMEs in Yantai? Second, what transformation characteristics have Yantai's SMEs displayed under the marine economy context? Third, what major problems do these SMEs still face in the course of converting old and new growth drivers? Unlike general analyses of local firm development, this study places SMEs within a continuous analytical chain of "marine economy – industrial-chain restructuring – capability reshaping – market expansion," so as to more accurately capture their role and limitations in regional high-quality development.

2. Theoretical Foundations and Analytical Framework

Existing studies suggest that the marine economy is not merely a statistical category of industrial activity; rather, it is a compound concept with strong spatial, ecological, and governance dimensions. Smith-Godfrey argues that the blue economy seeks to establish a new development framework that reconciles economic growth, sustainability, and social benefit beyond the traditional logic of marine resource exploitation [1]. Keen et al., in their study of Pacific island states, also find that without effective linkages among industry, governance, and community interests, the blue economy easily remains at the level of discourse [2]. Chen and Shih's research on Taiwan's marine regional revitalization further shows that marine development can be converted into local economic vitality not merely because marine resources exist, but because local governments, social organizations, and enterprises build cooperative mechanisms around the "local DNA" of a region [4]. These studies suggest that the influence of Yantai's marine economy on SMEs should not be understood as a one-way policy push; rather, it should be viewed as a process jointly shaped by industrial scenarios, institutional arrangements, and regional coordination.

From the perspective of firm growth, the performance of SMEs in regional upgrading is determined less by

absolute size than by their capability structures. Acs and Audretsch's classic research showed that small firms are not naturally disadvantaged in innovation; in sectors characterized by rapid technological change and highly differentiated demand, small firms often possess greater flexibility [5]. Cohen and Levinthal emphasize that the deeper a firm's prior knowledge base, the stronger its ability to identify and utilize new external knowledge [6]. Teece et al. refer to this ability as dynamic capability: the capability to integrate, reconfigure, and renew resources under changing conditions [7]. For SMEs in Yantai, this implies that the real opportunity created by the marine economy does not lie simply in more orders or industrial expansion, but in capability upgrading through new scenarios such as marine engineering equipment, marine ranching, seawater desalination, modern port shipping, and marine cultural tourism.

At the same time, SME growth depends heavily on the regional networks in which firms are embedded. Porter argues that competitive advantage is derived to a large extent from localized knowledge, relationships, and collaboration rather than from abstract market size alone [8]. Love and Roper, in a review of the literature, suggest that there is a significant linkage among SME innovation, exporting, and growth: stronger innovation capacity usually increases the likelihood that firms will enter broader markets and achieve sustained growth [9]. Cassiman and Golovko likewise show that innovation and internationalization often reinforce each other; exporting is not only a sales activity, but can also promote learning and capability upgrading [10]. Accordingly, this paper analyzes the development of Yantai's SMEs under the marine economy through three dimensions: whether their positions in marine industrial chains have improved, whether they have developed stronger absorptive and dynamic capabilities, and whether they can use ports, open platforms, and regional cooperation networks to expand into wider markets.

3. The Real Foundations of Marine Economic Development and SME Growth in Yantai

3.1 Foundations of Marine Economic Development in Yantai

The foundations of Yantai's marine economy are first reflected in the industrial base accumulated over a long period. According to the 14th Five-Year Plan for the Development of Yantai's Marine Economy, the city's gross marine product reached RMB 180.87 billion in 2019, accounting for 23.6% of GDP, and a relatively comprehensive system had taken shape in which traditional sectors such as marine fisheries, marine transportation, and coastal tourism coexisted with emerging sectors such as marine engineering equipment manufacturing, marine pharmaceuticals and bioproducts, and seawater desalination and comprehensive utilization [11]. This means that Yantai's marine economy is not simply the expansion of a single industry; rather, it is a relatively systematic and layered industrial complex. Such systemic characteristics matter greatly for SMEs, because only when industrial categories are sufficiently complete and value chains sufficiently extended can firms find multiple entry points and specialized niches within them.

Recent developments indicate that Yantai's marine economy has clearly entered a stage characterized by structural optimization rather than simple quantitative expansion. In 2024, Yantai's GDP reached RMB 1.078283 trillion, up 6.1% year on year; value added in the service sector reached RMB 550.689 billion; coastal ports handled 501.9924 million tons of cargo and 5.091 million TEUs of containers. In the same year, Yantai added two national-level marine ranching demonstration zones, bringing the total to twenty-two; the Changdao "Blue Granary" marine economic development zone was fully launched; the shipbuilding and marine engineering equipment industry was selected as a national advanced manufacturing cluster; and the country's largest wind-turbine blade testing center and a seawater desalination project with a daily output of 140,000 tons went into operation [12]. The meaning of these figures is not simply that "the marine economy is growing fast," but that Yantai's marine industry is extending from traditional fisheries and port shipping advantages into more technology-intensive segments such as advanced equipment, marine energy testing, and comprehensive utilization of marine resources. The industrial environment faced by SMEs has therefore become increasingly similar to that of a modern marine industrial system rather than a simple "seaside economy."

Moreover, the policy discourse surrounding Yantai's marine economy is also changing. In its public solicitation of opinions for the 15th Five-Year Plan for marine economic development in 2026, Yantai explicitly proposed building a modern marine industrial system that is "distinctive in characteristics, complete in industrial chains, innovation-led, and green and safe." It also emphasized upgrading traditional marine industries, fostering emerging marine industries, making forward-looking arrangements for future industries, promoting the integration of port, industry, and city, strengthening key core technology research, and expanding openness-oriented cooperation toward Northeast Asia [13]. This shows that Yantai's understanding of marine development has shifted from the traditional logic of "living off the sea" to a new logic of "using the sea to shape industrial chains, using chains to strengthen industries, and using openness to expand development space." It is precisely under such a policy orientation that the marine economy can become a core carrier for the transformation of old and

new growth drivers rather than a merely ornamental local label.

3.2 Overview of SME Development in Yantai

Corresponding to the marine industrial base, Yantai's SMEs also possess a very substantial foundation in terms of numbers and market presence. In 2024, the city registered 94,200 new market entities, bringing the total number of market entities to 1.0785 million by year-end. By the end of January 2025, the number of privately owned market entities had reached approximately 1.05 million, accounting for 98% of all market entities. Private enterprises accounted for more than 95% of national high-tech enterprises and national science-and-technology-based SMEs in the city, and also represented more than 80% of national-level specialized and sophisticated "little giant" firms, provincial innovation-oriented SMEs, provincial specialized SMEs, provincial gazelle firms, and provincial unicorn firms [12][14]. These figures show that the micro-foundation of Yantai's economy is clearly dominated by private and small businesses; SMEs are not peripheral actors, but the principal support of regional economic operations.

More importantly, these SMEs are not merely numerous; their innovative capacity is also rising. In 2024, Yantai had 4,317 national science-and-technology-based SMEs, up 13.7% from the previous year. During the same year, 5,661 invention patents were granted, and the total number of valid invention patents reached 22,748, with 32.23 valid invention patents per 10,000 people [12]. These indicators suggest at least two things: first, the regional innovation environment is improving overall; second, an increasing number of SMEs are entering the track of technological innovation, knowledge accumulation, and intellectual property development. Considering the high share of private firms among Yantai's specialized, high-tech, and innovation-oriented enterprises, SMEs are no longer merely vehicles for employment absorption but are becoming increasingly important actors within the local innovation system.

Placed against the industrial background of the marine economy, the significance of this innovation structure becomes even clearer. Yantai's marine industrial categories are relatively complete, covering both traditional marine sectors such as fisheries, seafood processing, and cold-chain logistics, and emerging sectors such as marine engineering equipment, marine pharmaceuticals and bioproducts, seawater desalination, port services, and marine cultural tourism [11][12]. This means that the roles available to SMEs in Yantai's marine economy are not confined to ordinary processing and low-end services. Rather, SMEs can be found across component manufacturing, specialized equipment support, technical services, logistics organization, end-market consumption, and scenario operation. In other words, the marine economy offers Yantai's SMEs not merely a larger market, but a denser and more differentiated network of industrial division of labor.

4. Transformation Characteristics of Yantai's SMEs under the Marine Economy

One of the most visible recent changes in Yantai's SMEs is that their transformation direction has become increasingly "marine-related." In the past, a considerable number of local SMEs relied primarily on local demand, low-cost manufacturing, and general trading activities for survival. Under the accelerating development of the marine economy, however, more and more firms have begun to define their roles and accumulate capabilities around marine industrial chains. They may not directly engage in offshore fisheries or large-scale marine engineering manufacturing, but they participate in related segments such as cold-chain logistics, testing services, equipment matching, technical maintenance, tourism development, and information services. This change indicates that the development logic of SMEs is shifting from general business operations serving regional markets to specialized division of labor oriented toward marine industrial chains. This is consistent with Porter's emphasis on regional clusters and localized networks: firm growth increasingly depends on relative position within an industrial network rather than on isolated scale expansion [8].

A second salient characteristic is that the driving force of SME transformation is moving from traditional factor inputs toward innovation. The continued increase in the number of national science-and-technology-based SMEs, as well as in granted and valid invention patents, should not be interpreted merely as attractive statistics; they indicate substantial changes in technological learning, knowledge accumulation, and R&D activity among firms [12]. From the viewpoint of firm theory, Cohen and Levinthal's notion of absorptive capacity suggests that the ability to absorb external knowledge largely determines a firm's innovation potential [6], while Teece et al.'s discussion of dynamic capabilities indicates that firms must continuously reconfigure resources and adjust strategies in response to changing technological and market environments [7]. The new scenarios emerging in Yantai's marine economy—marine engineering equipment, marine ranching, seawater desalination, marine bioproducts, and offshore wind blade testing—provide SMEs with fresh knowledge sources and application scenarios. Through process improvement, product upgrading, and service innovation, firms can therefore build differentiated advantages.

A third feature is that the transformation path of SMEs is increasingly characterized by green, digital, and collaborative development. In the public

solicitation of opinions for the 15th Five-Year Plan for Yantai's marine economic development, the city explicitly proposed upgrading traditional marine industries, arranging future industries, strengthening smart ocean construction, and adhering to green and safe development [13]. This means that future competition can no longer rest primarily on low cost, low entry thresholds, or simple imitation. Instead, it will depend more on digital technology adoption, green production methods, value-chain collaboration, and cross-organizational cooperation. Bennett et al.'s analysis of blue growth and blue justice reminds us that marine economic development is sustainable only when ecological and social effects are properly incorporated [3]. Chen and Shih likewise show that regional marine revitalization often relies on collaboration among government, firms, and social actors [4]. For Yantai's SMEs, this means that the firms with the greatest future growth potential are likely to be those that can combine ecological compliance, digital capability, and industrial coordination.

5. Current Conditions and Major Problems of SME Development in Yantai

5.1 Overall Development Conditions of SMEs

In terms of overall scale and vitality, Yantai's SMEs have already formed a strong collective foundation. The large number of market entities, the very high share of private firms, the continuous growth in national science-and-technology-based SMEs, and Yantai's entry into the trillion-yuan city category all suggest that the external support conditions for SME development are generally favorable [12][14]. In practical terms, Yantai's SMEs are no longer adequately described by the traditional image of being simply "small and scattered." A considerable number of firms have already developed notable specialization in manufacturing niches, modern service industries, and marine-related industrial chains. This change is attributable both to the upgrading of the local industrial structure and to Yantai's policy support for specialized, high-tech, and private-sector development in recent years.

At the same time, however, the overall development of Yantai's SMEs still shows clear stratification. A small group of firms has entered emerging marine industries, high-tech manufacturing, and the ladder of innovation-oriented enterprises, thereby acquiring relatively strong competitiveness in niche markets. Many more firms, by contrast, remain concentrated in traditional industries and ordinary service segments characterized by lower value added, more intense competition, and higher substitutability. In other words, although Yantai's SMEs have moved beyond a stage of growth driven purely by increases in numbers, they have not yet broadly completed the transition from a "quantitative advantage in the number of firms" to a "qualitative advantage in firm capability." Such differentiation is not unusual. Love and Roper note that the positive relationship among SME innovation, exporting, and growth often concentrates in a smaller subset of firms with stronger innovation bases and organizational capabilities [9]. In Yantai's case, this means that the transformation of old and new growth drivers has created new opportunities, but the firms capable of effectively capturing these opportunities are still primarily those with stronger pre-existing capabilities.

5.2 Technological Innovation and Market Expansion of SMEs

In terms of technological innovation, Yantai's SMEs are moving from imitative and adaptive innovation toward more application-oriented innovation driven by concrete industrial scenarios. In 2024, Yantai had 4,317 national science-and-technology-based SMEs, 5,661 granted invention patents, 22,748 valid invention patents, and 32.23 valid invention patents per 10,000 people [12]. These figures indicate that local innovation is no longer merely a patent game played by a handful of large enterprises, but is increasingly diffusing toward a broader set of firms. Especially in sectors such as marine engineering equipment, marine ranching, seawater desalination, and marine bioproducts, SMEs do not necessarily need to begin with basic scientific research from scratch. Instead, they can develop process optimization, product iteration, and supporting service innovation around industrial sites and user needs. This innovation pathway is much better aligned with the practical characteristics of SMEs and better reflects their flexibility advantages [5][6].

With respect to market expansion, Yantai's SMEs are also gradually moving from local market dependence toward wider regional linkages and openness. In 2024, Yantai's total imports and exports reached RMB 472.34 billion, including RMB 166.95 billion with other RCEP members and RMB 133.39 billion with countries along the Belt and Road; coastal ports handled 501.9924 million tons of cargo and 5.091 million TEUs of containers [12]. Meanwhile, in its consultation on the 15th Five-Year Plan for marine economic development, Yantai explicitly proposed building itself into an open gateway hub for the Bohai Rim and strengthening its outward radiation toward Northeast Asia [13]. For SMEs, the significance of this opening-up structure lies in the fact that they are no longer limited to relying on local consumer markets, but have the opportunity to enter wider supply chains and market networks through ports, logistics, cross-border trade, and regional cooperation platforms. Cassiman and Golovko argue that export experience can in turn promote firm capability upgrading [10]. If Yantai's marine-related SMEs can become more deeply embedded in regional and international markets, the logic of their growth will change in fundamental ways.

That said, technological innovation and market expansion among Yantai's SMEs remain highly uneven. Firms with stronger R&D foundations, better access to platform resources, and closer coordination with leading enterprises or research institutions are more likely to achieve innovation breakthroughs and market extension. By contrast, many SMEs still suffer from insufficient R&D investment, weak brand influence, limited modes of market development, and inadequate experience in international business. In the marine economy in particular, many emerging industrial chains require higher standards in certification, equipment, talent, and capital. Without platform support, SMEs can easily remain trapped in low-end supporting roles. In this sense, the innovation and market expansion of Yantai's SMEs are best characterized as a pattern of "localized breakthroughs with broader gradual catch-up," rather than as a generalized high-level upgrading across the board.

5.3 Major Problems in SME Development

First, insufficient participation in high-end segments remains a prominent problem. Although Yantai has a relatively complete marine industrial system and a strong industrial base, many SMEs are still concentrated in ordinary processing, basic supporting activities, traditional trade, and low-value-added services. They are connected to marine industrial chains, but this connection often remains peripheral rather than extending into high-value areas such as technology, branding, standards, and key components. Porter's work on cluster competitiveness suggests that firms can truly share the benefits of a cluster only when they develop irreplaceable specialized advantages within local networks [8]. For Yantai's SMEs, therefore, the crucial issue is whether they can move from merely "participating in the chain" to "controlling key segments" of the chain.

Second, constraints on innovation resources remain significant. Although Yantai's overall innovation environment is improving, innovation activities among SMEs do not automatically become smooth simply because patent statistics are increasing. Many firms still face obvious shortcomings in R&D investment, the recruitment of technical talent, industry-university-research cooperation, and the commercialization of technological achievements. Cohen and Levinthal's notion of absorptive capacity is not an abstract idea; it requires the internal foundation needed to continuously learn from and digest external knowledge [6]. Likewise, the dynamic capabilities discussed by Teece et al. are not something that can be quickly acquired through short-term policy subsidies [7]. In Yantai's practical reality, many SMEs are willing to transform but lack stable sources of technology, specialized talent, and sustained investment capacity. As a result, their innovation often remains at the level of process adjustments and localized optimization rather than developing into genuine technological barriers.

Third, green and digital transformation involves relatively high costs. Yantai's proposed direction for marine economic development during the 15th Five-Year Plan period emphasizes smart ocean construction, green and safe development, and ecological civilization [13]. This means that marine-related firms will face stricter environmental constraints, higher requirements for data application, and more complex demands for organizational coordination. For large firms, these requirements may become new sources of competitive advantage; for most SMEs, however, they initially mean pressure in the form of equipment renewal, staff training, compliance spending, and organizational restructuring. Bennett et al. remind us that if ecological and governance costs are ignored, marine economic development may create new forms of vulnerability [3]. Therefore, the real difficulty of green and digital transformation for Yantai's SMEs is not that they do not know which direction to move in, but that transformation costs are high, return periods are long, and risk-bearing capacity is limited.

Finally, outward market expansion capabilities still need to be strengthened. Yantai enjoys strong port, location, and opening-up advantages, and its foreign trade and port shipping data demonstrate a solid external foundation [12][13]. Yet the existence of open platforms does not mean that every SME can automatically make effective use of them. Many SMEs still lack internationally recognizable brands, the capacity to adapt to international rules, cross-regional sales networks, and the experience required to sustainably serve overseas clients. Love and Roper as well as Cassiman and Golovko both show that innovation and internationalization reinforce one another, but this relationship typically presupposes a certain level of accumulated capability [9][10]. In this sense, the challenge for Yantai's SMEs in "going out" or connecting to larger markets is, at root, still a capability problem rather than merely a channel problem.

6. Conclusion

Overall, the development of the marine economy in Yantai has already provided a relatively solid foundation for the transformation of SMEs. Whether measured by the fact that marine industries accounted for 23.6% of GDP in 2019 or by the city's entry into the trillion-yuan category in 2024 and the rapid emergence of new scenarios related to marine engineering and marine industries, it is clear that the marine economy has become an important support for the regional conversion of old and new growth drivers [11][12]. In this context, SMEs are no longer simply numerous general market actors in the local economy; they are gradually becoming specialized participants in

marine industrial chains, technology adopters, and connectors to broader markets. The direction of their transformation is also increasingly clear: rather than merely expanding scale, they need to improve the level of their embeddedness in industrial chains, strengthen innovation absorption capacity, enhance green and digital transformation capabilities, and build stronger outward market linkages.

At the same time, however, the marine economy does not automatically translate into high-quality development for SMEs. The problems currently faced by Yantai's SMEs—including insufficient participation in high-end segments, constraints on innovation resources, high costs of green and digital transformation, and weak market expansion capabilities—indicate that a substantial path still lies between "marine industrial growth" and "firm capability upgrading." Future research should therefore move beyond simple descriptions of growth in numbers and industrial scale, and pay greater attention to changes in the positions of SMEs within marine industrial chains, the mechanisms of knowledge absorption, the structure of collaborative innovation networks, and the alignment between institutional support and enterprise needs. Only by revealing these micro-level processes of capability reshaping can we more accurately understand the real mechanism through which the marine economy promotes the transformation of old and new growth drivers in coastal regions.

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