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# Mechanism and realization path of new quality productivity enabling modern marine industrial system

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New quality productivity (NQP) has infused fresh impetus into the construction and development of the modern marine industrial system (MMI), becoming a pivotal force in driving the high-quality development of the marine economy. This paper elucidates the value implications of NQP in fostering the formation and expansion of the MMI. By clarifying the internal mechanisms of this system, we delineate the goal orientation of the MMI enabled by NQP. We conduct an in-depth exploration of the enabling process of the MMI across five dimensions: innovation-driven growth, factor matching, integrated development, supply-demand adaptation, and green and low-carbon practices. The paper highlights that leveraging NQP can unlock the potential of traditional industries, strategically position emerging and future industries, enhance the impetus for innovation in marine science and technology, optimize the environment for marine industry development, accelerate industrial and digital integration, and improve policies related to green industries, technologies, and sustainable development. These measures aim to further implement the maritime power strategy and promote the empowerment and enhancement of the high-quality development of the marine economy.

## KEYWORDS

new quality productivity, modern marine industrial system, high-quality marine development, enabling mechanism, implementation path

## 1 Introduction

In September 2023, Chinese State leader proposed the important concept of “NQP” for the first time during his investigation in Heilongjiang (Xi, 2023). In March 2024, the National Two sessions, State leader three times to the group, three times to talk about “NQP”, to further explain the development of NQP methodology. It has important theoretical and practical significance to grasp the important connotation of NQP, correctly understand the internal relationship between NQP and traditional productivity, and constantly explore the practical path to speed up the formation of NQP. The report of

the 20th National Congress of the Communist Party of China proposed “building a modern industrial system”, which is the key to laying the cornerstone of a modern economic system, and emphasized the goal of “developing the marine economy, protecting the marine ecological environment, and accelerating the construction of a marine power” (Wang Z. et al., 2019). In the strategic layout of building a “marine power”, the construction of a MMI occupies a pivotal position and is the key to promoting the high-quality development of the marine economy. NQP enables the MMI, which has a profound and significant impact on promoting the sustained and healthy growth of the marine economy, optimizing the allocation of marine resources, and enhancing the overall competitiveness of the marine industry.

As the core driving force leading the future economic development and social progress, NQP has become the focus of researchers and decision makers. The existing research mainly focuses on the following three aspects: First, the concept of NQP is deeply analyzed. From the perspective of different disciplines, this paper systematically studies the definition (Pan and Tao, 2024), characteristics (Zhang and Pu, 2023) and formation mechanism of the NQP (Li L., 2023). At the same time, the relationship and differences between the NQP and the traditional productivity are also discussed in depth (Su and Sun, 2024), which provides a theoretical basis for further research on the NQP. Secondly, the driving factors of NQP are systematically sorted out. Scholars generally believe that scientific and technological innovation, institutional reform, and human resource training are important driving forces for the development of NQP (Xu et al., 2023; Shi and Xu, 2024). On this basis, the interaction mechanism among various driving factors and their specific influence paths and effects on the development of NQP are discussed (Yao and Zhang, 2024). Finally, the practical application of NQP is studied. Scholars have explored the application and actual effects of NQP in various fields through case analysis and empirical research (Du et al., 2025; Feng et al., 2024).

At present, the research on the MMI has received extensive attention worldwide. Scholars and research institutions from various countries have been investing resources one after another, dedicated to exploring the sustainable development and utilization of marine resources, as well as innovative development paths for marine industries (Li et al., 2022). The research focuses mainly on new growth points of the marine economy, Mmarine technological innovation, protection and restoration of the marine ecological environment, and the formulation and optimization of marine industrial policies (Wang J. et al., 2021). In terms of new growth points in the marine economy, researchers focus on how to tap the potential of marine resources, promote the transformation and upgrading of traditional industries such as marine fishery, marine oil and gas, and marine transportation (Shao et al., 2021), and at the same time actively cultivate emerging industries such as marine biomedicine, marine new energy, and seawater desalination to form a diversified marine economic system (Yang and Hou, 2019). Marine science and technology innovation is a key factor in

promoting the development of the modern marine industrial system (Wang L. et al., 2021). Research institutions and enterprises in various countries have been increasing their investment in research and development, and are committed to making innovative breakthroughs in fields such as marine exploration technology, marine resource development technology, and marine environmental protection technology, in order to enhance the competitiveness and sustainable development capacity of the marine industry (Feng et al., 2024). In addition, the protection and restoration of marine ecological environment is also one of the current research hotspots (Wei et al., 2021). With the increasingly serious marine pollution, researchers are actively exploring the restoration technologies and protection strategies of marine ecology, in order to maintain the balance and stability of the marine ecosystem and provide a strong guarantee for the sustainable development of the marine industry (Zhang, 2024). In terms of the formulation and optimization of marine industry policies, governments and relevant institutions of various countries have successively introduced a series of policy measures, aiming to guide and support the healthy development of marine industries (Li et al., 2021). These policies cover multiple aspects such as the planning and management of marine resources, the layout and optimization of Marine industries, and the incentives and support for marine scientific and technological innovation (Ma et al., 2023), providing a strong policy guarantee for the construction of a MMI system.

In recent years, China’s marine economic industrial system has been continuously improved, and the development is increasingly diversified. However, the imbalance of marine industrial structure, the lack of coordinated development of regional industries and environmental degradation are still serious constraints on the sustainable development of MMI (Liang et al., 2025). The formation and development of NQP provides fundamental guidance and compliance for the in-depth implementation of innovation-driven development strategy in the new development stage, the active promotion of industrial structure optimization and upgrading, the effective promotion of regional economic coordination and common progress, the acceleration of the cultivation of strategic emerging industries and future industrial clusters, and the promotion of high-quality economic development (Zhan, 2012; Wang F. et al., 2019).

Therefore, grasping the new historical opportunities in the new era, how to use the NQP to promote the construction of MMI and promote the high-quality development of marine economy has become a major issue and urgent task facing our country. This study follows the development law of NQP and combines the development reality of MMI. On the basis of clarifying the multiple implications of NQP enabling MMI, this study deeply explores the internal mechanism of NQP enabling MMI, such as innovation drive, factor matching, integrated development, supply and demand adaptation and green and low-carbon. Identify the realistic challenges of MMI enabled by NQP, and propose the realization path of MMI enabled by NQP, in order to provide

theoretical value and practical reference for further implementing the strategy of marine power and promoting the high-quality development of marine economy.

## 2 The multiple implications of NQP enabling modern marine industrial system

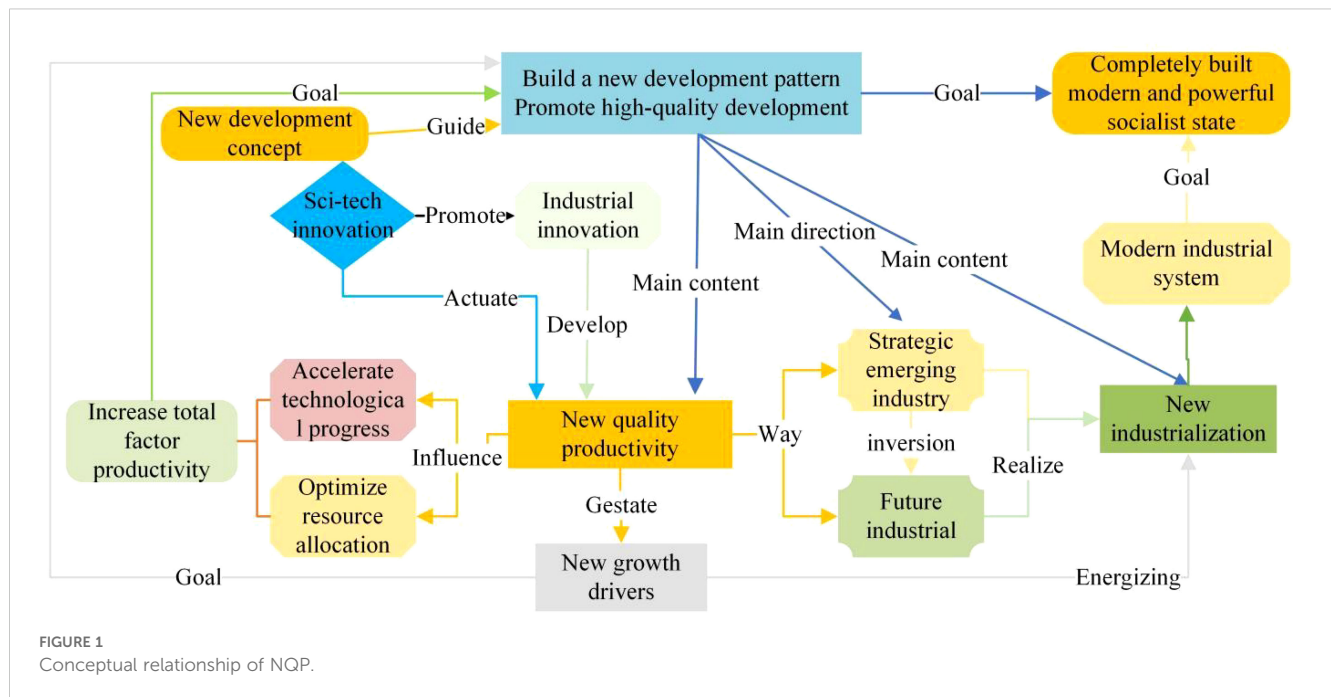
The 17th National Congress of the Communist Party of China proposed to “develop a modern industrial system, vigorously promote the integration of informatization and industrialization, transform industries from being large-scale to strong, revitalize the equipment manufacturing sector, and eliminate outdated production capacity” (Li and Wang, 2022). Building on this, the 19th National Congress, based on an analysis of China’s actual conditions, further called for “accelerating the development of an industrial system characterized by the coordinated growth of the real economy, technological innovation, modern finance, and human resources” (Fan and He, 2021). The Fifth Plenary Session of the 19th Central Committee of the CPC emphasized the need to “accelerate the establishment of a modern industrial system, promote the optimization and upgrading of the economic structure, enhance industrial infrastructure and supply chain modernization, and improve the quality and efficiency of economic development” (Ding and Heo, 2022). Subsequently, the 20th Party Report reiterated the importance of “building a modern industrial system” and advocated for “establishing a high-quality, efficient service industry system while fostering deep integration between modern services, advanced manufacturing, and modern agriculture” (Sheng et al., 2021; Zhang and Tang, 2023). Despite the government’s strong emphasis on the modern industrial system, its definition remains somewhat vague. To address this, this paper aims to clarify the essential connotation of the modern industrial system through an in-depth analysis of key government policies and relevant literature.

In academia, the understanding of the modern marine industry (MMI) can be categorized into two main perspectives (Yang, 2013): Static Perspective: The MMI is viewed as a comprehensive marine industrial system, anchored by high-end production factors, supported by a high-quality industrial development environment, and led by the MMI itself. This system aims to optimize resource allocation and achieve integrated industrial development (Yu, 2015; Pu and Xiang, 2019). Dynamic Evolution Perspective: The MMI is seen as the result of the gradual transformation of traditional marine industries under the combined influence of technological progress and specialized labor division. It represents the modernization, systematization, and upgrading of the marine industry, highlighting the critical role of technological innovation and labor specialization in advancing the marine economy (Zhou and Xu, 2023). While prior research has contributed to the understanding of the MMI, its definition remains ambiguous in terms of both content and process. This paper argues that the MMI is a comprehensive industrial system encompassing marine fisheries, marine energy, marine tourism, marine transportation,

and other related sectors. Centered on the rational development and utilization of marine resources, the system strives to achieve sustainable and healthy growth in the marine economy through technological innovation and industrial upgrading. Ultimately, it seeks to establish a fully integrated and coordinated industrial chain.

NQP represents an advanced form of production emerging in the digital, informational, and intelligent society. It arises from rapid technological breakthroughs, scientific and technological innovation, optimized allocation of production factors, and profound industrial transformation and upgrading. NQP comprises three core elements: (1) high-skilled laborers, (2) “new media” labor tools, and (3) “new material and quality” labor objects (Zhou and Xu, 2023). Key characteristics of NQP include: Scientific and technological innovation as the primary driver, Enhanced total factor productivity, Cultivation of emerging and future industries, High-quality development as the ultimate goal (Du et al., 2023). Technological innovation not only underpins the modern industrial system but also accelerates industrial advancement, fostering NQP. This, in turn, generates new growth momentum, supporting high-quality development and a modernized economic framework aligned with the new development philosophy (Qian and Wang, 2024). NQP is closely linked to strategic emerging industries and future industries. Over time, strategic emerging industries evolve into future industries, collectively advancing new industrialization and reinforcing the modern industrial system. This symbiotic relationship strengthens the foundation for new industrialization, ultimately contributing to the overarching objective of building a modern socialist society (Xi, 2013). (See Figure 1 for further details.)

With the continuous progress and innovation of science and technology, NQP is gradually changing the face of the marine industry and promoting its development in a more efficient and sustainable direction. First, NQP can improve the MMI. Through the introduction of advanced scientific and technological equipment and intelligent management systems, the production process of the marine industry will be greatly optimized. Secondly, the NQP can promote the sustainable development of the marine industry. The traditional marine industry often has the problems of over-exploitation of resources and environmental damage, but the introduction of NQP can effectively alleviate these problems. Finally, the NQP also brings new development opportunities for the marine industry. With the continuous progress of science and technology, the marine industry is facing more and more new opportunities and new challenges. For example, the development and utilization of deep-sea resources and the development and utilization of new marine energy have brought new growth points and development space for the MMI. At the same time, the introduction of NQP can also help the marine industry better cope with various challenges and risks, and improve its competitiveness and adaptability. In view of this, it is necessary to actively promote the application and development of NQP in the marine industry, so as to inject new impetus and vitality into the sustained prosperity and continuous growth of the marine industry (Figure 2).



### 3 NQP enhances the internal mechanism of modern marine industrial system

On the basis of in-depth study of the development law of NQP and the development state of marine industry, according to the enabling effect of NQP on the connotation of MMI, an internal mechanism framework is constructed, which follows the logical context of “guidance - drive - factor - organization - carrier - direction”. The framework focuses on the goal orientation of NQP enabling MMI, highlights the core position of innovation-driven, emphasizes the necessity of factor innovation and integration, pays attention to the implementation of kinetic energy conversion and structural optimization, pays attention to the adaptation of supply and demand and the improvement of circulation intelligence, and adheres to the direction of green development and low-carbon transformation. The aim is to provide theoretical support and practical guidance for the effective application of NQP in MMI.

#### 3.1 Goal orientation: the inevitable trend of NQP enabling MMI

##### 3.1.1 NQP to enable the MMI of the era mission and goal vision

With the rapid development of science and technology and the in-depth exploration of marine resources, the MMI is facing unprecedented opportunities and challenges for development. The rise of NQP brings new opportunities for the development of marine industry, but also puts forward higher requirements for it.

1. It is an inevitable choice to practice the strategy of maritime power. With the continuous progress of science and technology, NQP to be the core force to promote the development of the MMI, which not only greatly improves the efficiency of the marine industry, but also provides strong support for the realization of the strategy of maritime power. The empowerment of NQP has enabled the marine industry to achieve breakthroughs in many fields. In the field of marine resources development, through advanced technological means, marine resources can be explored, developed and utilized more efficiently, so as to meet the needs of society for energy, minerals and other resources. In the field of marine transportation, the application of NQP makes ships more intelligent and safe, greatly improving transportation efficiency and reducing transportation costs. In the field of marine ecological protection, NQP provides more accurate and efficient protection means, which helps to maintain the balance and sustainable development of marine ecology. In short, the NQP to enable the MMI is the inevitable choice to realize the strategy of maritime power.
2. The key to promoting the high-quality development of the marine industry. NQP, with its unique innovation ability and technological breakthroughs, brings development opportunities for the marine industry. First of all, the NQP aim to improve the production efficiency and intelligence level of the marine industry through the introduction of advanced scientific and technological means, such as big data, artificial intelligence, and the Internet of Things. Secondly, the introduction of NQP also brings broader development space for the marine



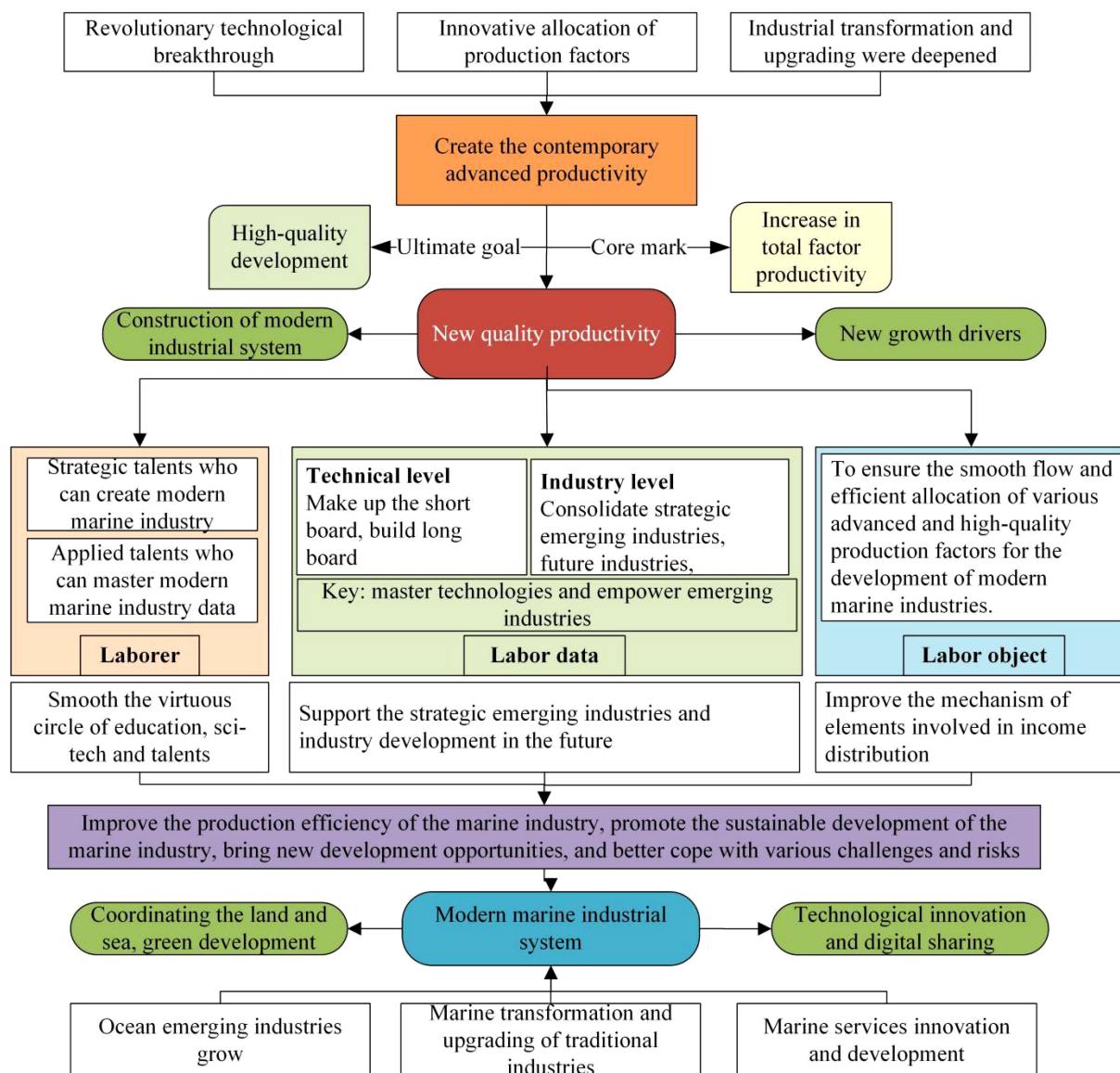


FIGURE 2  
Multiple implications of NQP enabling MMI.

industry. The development of marine economy is no longer limited to traditional fields such as fishery and salt industry, but gradually expands to marine energy, marine tourism, marine biomedicine and other fields. The rise of these emerging areas not only injects new vitality into the development of the marine economy, but also provides a broader space for the upgrading and transformation of the marine industry. Finally, NQP can also facilitate the cross-border integration of marine industries. In the modern economic system, the cross-border integration of industries has become a trend. Through the introduction of the Internet, finance, tourism and other related industries, the NQP promotes the deep integration of the marine industry with other industries, forms a diversified marine industry

ecology, and provides more possibilities for the future development of the marine industry.

### 3.1.2 Strategic positioning and layout planning of MMI empowered by NQP

1. Promote the MMI to become a pillar industry of the national economy as a strategic basis. In particular, it is necessary to improve the exploitation capacity of marine resources and strive to promote the transformation of marine economy into a quality and benefit type. At the same time, it also emphasizes the importance of cultivating and expanding marine strategic emerging industries, so as to increase the contribution rate of marine industry to

economic growth, and strive to make marine industry a pillar industry of the national economy. This strategic decision reflects a deep understanding of marine resources and marine economy, as well as a high degree of responsibility for the long-term development of the country (Li X., 2023). The report of the 20th National Congress put forward “adhere to the focus of economic development on the real economy.” The 14th Five-Year Plan for Marine Economy Development approved by The State Council clearly puts the focus of marine economy development on the real economy, builds a MMI with strong competition, and especially promotes the vigorous development of emerging marine industries (Yang et al., 2023). The strategic positioning of the MMI is a systematic and long-term project. Only by continuously strengthening scientific and technological innovation, stimulating the potential of marine resources, and promoting green and sustainable development can we build an efficient, green and sustainable MMI and inject new vitality into the country’s economic and social development.

2. The MMI escorts the construction of a maritime power and promotes the sustainable development of the marine economy. NQP through technological innovation, mode innovation and other means to enhance the core competitiveness of the industry. In the field of marine industry, the introduction and application of NQP are injecting new vitality into this field. Building a MMI requires not only efficient, green and sustainable development and utilization of marine resources, but also new breakthroughs in marine science and technology innovation, marine management and marine ecological protection. It is necessary to continue to increase investment in science and technology, strengthen industry-university-research cooperation, train a group of high-quality marine science and technology talents, and provide strong talent support for the development of

marine industry. The construction of a maritime power cannot be separated from the support of the MMI. We should take the NQP as the guide, promote the transformation and upgrading of the marine industry, and improve the quality and efficiency of the marine economy.

## 3.2 Innovation-driven: NQP enables innovation, development and industrial iteration of MMI

Scientific and technological innovation plays an increasingly prominent role in enabling MMI with NQP. With the continuous progress of science and technology, the marine industry is ushering in unprecedented development opportunities. The innovative development and industrial iteration mechanism of MMI enabled by NQP is shown in Figure 3.

### 3.2.1 Innovative development: traditional transformation - cost reduction - quality cultivation - emerging cultivation - multi-dimensional drive of industrial integration

With NQP as the guide, we will promote the transformation and upgrading of marine industries and improve the quality and efficiency of the marine economy. The innovation of modern industrial system enabled by NQP is an inevitable trend of current economic and social development. With the continuous progress of science and technology, NQP has become a key factor to promote the upgrading and transformation of modern industrial system, which not only changes the production mode and efficiency of traditional industries, but also provides strong support for the development of emerging industries. The empowerment of NQP is first reflected in the innovation and transformation of traditional industries. Through the introduction of advanced scientific and

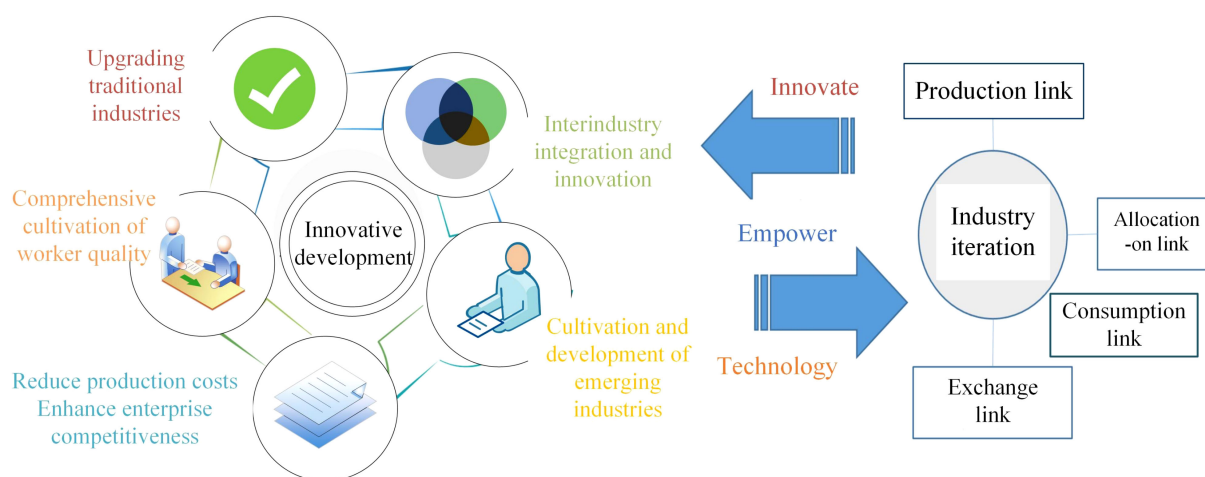


FIGURE 3  
NQP enables innovation, development and industrial iteration of MMI.

technological means, such as artificial intelligence, big data, cloud computing, etc., traditional industries can realize automated and intelligent production, greatly improving production efficiency and product quality. At the same time, the application of NQP can also reduce production costs, enhance the competitiveness of enterprises, and inject new impetus into the sustainable development of traditional industries. At the same time, the NQP also emphasizes the comprehensive training of the quality of workers, and needs to rely on innovative talents and the improvement of quality and efficiency to promote the upgrading and jump of the industry, and ultimately realize the construction of the modern industrial system and the high-quality development of the economy. In the cultivation and development of emerging industries, NQP also plays an irreplaceable role. Emerging industries such as new energy, new materials, biomedicine and other fields need the support of NQP to achieve technological breakthroughs and rapid industrial development. The introduction of NQP provides strong technical support and innovation impetus for these fields, and promotes the rapid rise of emerging industries. With the wide application of NQP, the integration and innovation between industries are increasingly strengthened, and new industrial models and business models continue to emerge.

### 3.2.2 Innovative development: traditional transformation - cost reduction - quality cultivation - emerging cultivation - multi-dimensional drive of industrial integration

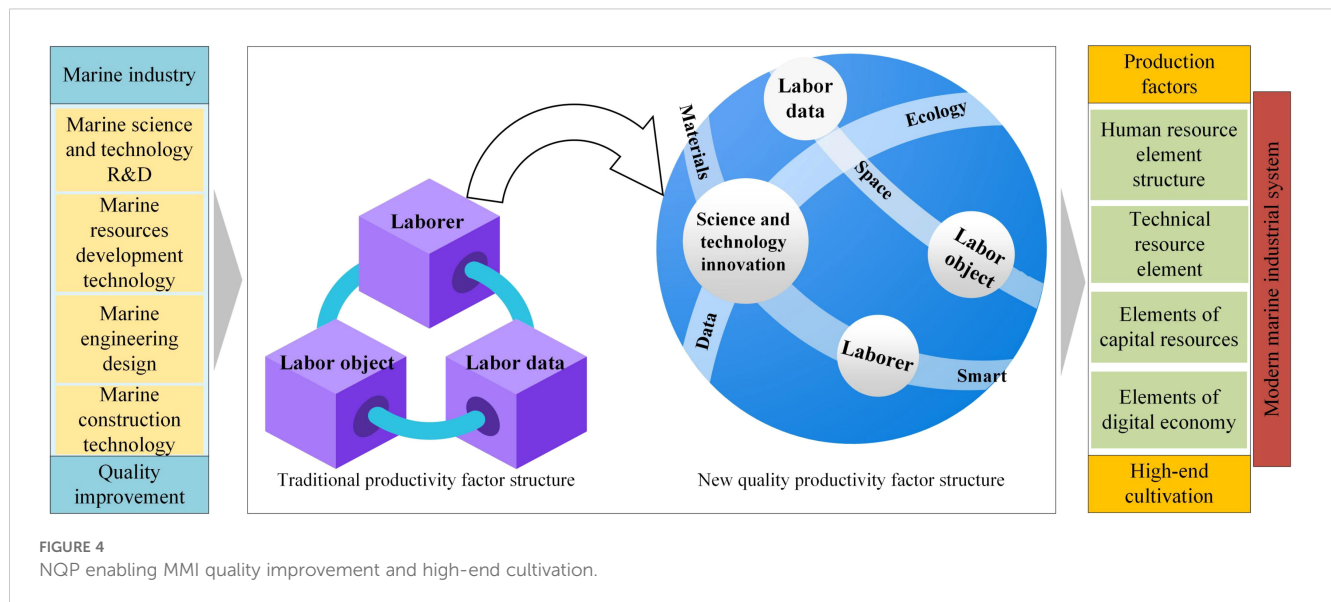
As the core driving force to promote the iteration of modern MMI, NQP plays an increasingly prominent leading role in the four dimensions of “production - distribution - exchange - consumption”. This lead is not only an upgrade of the traditional marine industry model, but also a comprehensive innovation of the entire industrial ecology. In the production link, the introduction of NQP has made the production mode of marine industry fundamentally change. With the help of advanced scientific and technological means, such as big data and artificial intelligence, the development and utilization of marine resources are more efficient and accurate. At the same time, the NQP also promotes the innovation of the production model of the marine industry, such as the emergence of new production models such as marine ranching and far-reaching marine aquaculture, which inject new vitality into the development of the MMI. In the distribution link, the NQP maximizes the value of MMI by optimizing the allocation of resources. With the Internet of Things, blockchain and other technologies, the traceability and tracking of marine products is more convenient, and the rights and interests of consumers are effectively protected. At the same time, the NQP can also promote the upgrading of the marine industry supply chain, so that marine products can be more quickly circulated to the hands of consumers, and improve the operational efficiency of the entire industrial chain. In the exchange link, the NQP promotes the innovation of the trading mode of the marine industry. With the help of e-commerce platforms, digital currencies and other emerging trading methods, the transaction of marine products is more convenient and transparent. This not only reduces transaction costs, but also

expands the scale of transactions, providing a broader market space for the development of the marine industry. In the consumption link, the NQP promotes the upgrading of the consumption model of the marine industry by meeting the diversified and personalized needs of consumers. With the help of big data analysis, the marine industry can more accurately grasp consumer demand and launch products and services that are more in line with market demand. At the same time, the NQP also promotes the deep integration of the marine industry with tourism, culture and other industries, providing consumers with a richer and more diverse consumption experience.

## 3.3 Factor matching: NQP enables the quality improvement and high-end cultivation of MMI

### 3.3.1 The key: improving the quality of production factors

The NQP plays an increasingly prominent role in the MMI, the core of which is to improve the quality of production factors. Under the background of globalization and informatization, the marine industry is undergoing unprecedented changes, and strengthening the research and development of marine science and technology and promoting the upgrading and transformation of marine industry is the key to improving the quality of production factors of MMI (Figure 4). First of all, marine science and technology research and development is an important cornerstone for improving the quality of production factors in MMI. Marine science and technology as an important support for the development of Marine industry, its research and development level directly determines the speed and direction of the development of Marine industry. After investing more resources and efforts in the field of Marine science and technology, more sophisticated ocean exploration devices can be developed, such as high-precision ocean measurement tools and deep-sea exploration equipment. These advanced devices contribute to a more comprehensive grasp of the distribution of marine resources and detailed information of marine ecological environment, so as to provide solid scientific support for the sustainable development of marine industry. Secondly, improving marine resources development technology is one of the key factors to optimize the quality of production factors in MMI. In view of the gradual shortage of global resources, countries have turned their attention to the development and utilization of marine resources, and competed to explore and master related technologies. Through continuous technological innovation, more efficient marine resource development technologies have been developed, such as deep-sea mineral mining technology and marine biological resource farming technology, which will greatly improve the utilization efficiency of marine resources and promote the rapid development of marine industry. In addition, environmentally friendly marine engineering design and construction technology is also the key to improving the quality of MMI production factors. With the increasing awareness of global environmental protection, how to protect the environment



while developing and utilizing marine resources has become an important topic for the development of marine industry. Therefore, it is necessary to pay attention to the environmental protection of marine engineering design and construction technology, adopt more environmentally friendly materials and processes, reduce the damage to the marine ecological environment, and achieve the sustainable development of the marine industry.

### 3.3.2 Necessary conditions: high-end cultivation of production factors

In the process of exploring how to develop high-end marine modern industry, NQP is crucial in the cultivation and aggregation of production factors of MMI, including human resources, technological innovation, capital and digital capability. First of all, human resources are the core of MMI. Marine industry as a highly specialized field, the need for talents is particularly urgent. Therefore, it is necessary to strengthen the cultivation and introduction of marine talents in the process of enabling MMI with NQP. At the same time, we should also attract overseas high-level talents through generous treatment and good working environment to inject new vitality into our MMI (Li and Yu, 2023). Secondly, technological innovation is of vital significance to promote the sustainable development of high-end MMI. It advocates deepening cooperation between scientific research institutions, universities and enterprises, with the goal of jointly researching and developing core technologies with independent intellectual property rights, so as to enhance the competitiveness of the entire industry. At the same time, the importance of transformation and application of technological achievements is emphasized to ensure that scientific and technological innovation can be effectively transformed into a powerful driving force for promoting industrial development. Third, the investment of funds is the basis for the development of high-end MMI. It is necessary to raise funds through multiple channels such as policy guidance and social capital to ensure the steady development of the industry. At the same time, improve the efficiency of the use of funds and

promote the high-quality development of the marine industry. In addition, promoting the intelligence and digitalization of the marine industry is the key to enhancing industrial competitiveness. With the rapid development of science and technology, the marine industry is ushering in a wave of digital transformation. Making full use of modern information technologies such as big data, artificial intelligence, and the Internet of Things to promote the intelligent development of the marine industry can not only improve production efficiency and reduce costs, but also provide strong support for the rational development and utilization of marine resources.

## 3.4 Integrated development: the NQP enables the MMI to blend inside and outside and to embed the digital reality

### 3.4.1 Internal and external integration: paradigm shift of integration within and between marine industries

In the MMI, integration has become its distinctive feature. With the free flow of production factors, the boundaries between industries are becoming increasingly blurred, and the integrated development of industries is becoming a new trend in the MMI (Figure 5). To build a MMI, we must further promote the deep integration of industrialization and information technology, strengthen the close connection and coordination between manufacturing and service industries, promote the mutual support and complementarity between digital industry and real industry, and achieve the extensive integration and common development of science and technology and the whole industry. The integration of industry and elements will have a huge multiplier effect and inject strong impetus into the expansion of the MMI. The rapid rise of NQP is the core driving force to promote the integration and development of MMI. It not only helps the deep integration of digitalization, green and innovation in traditional industries, further releases the industrial



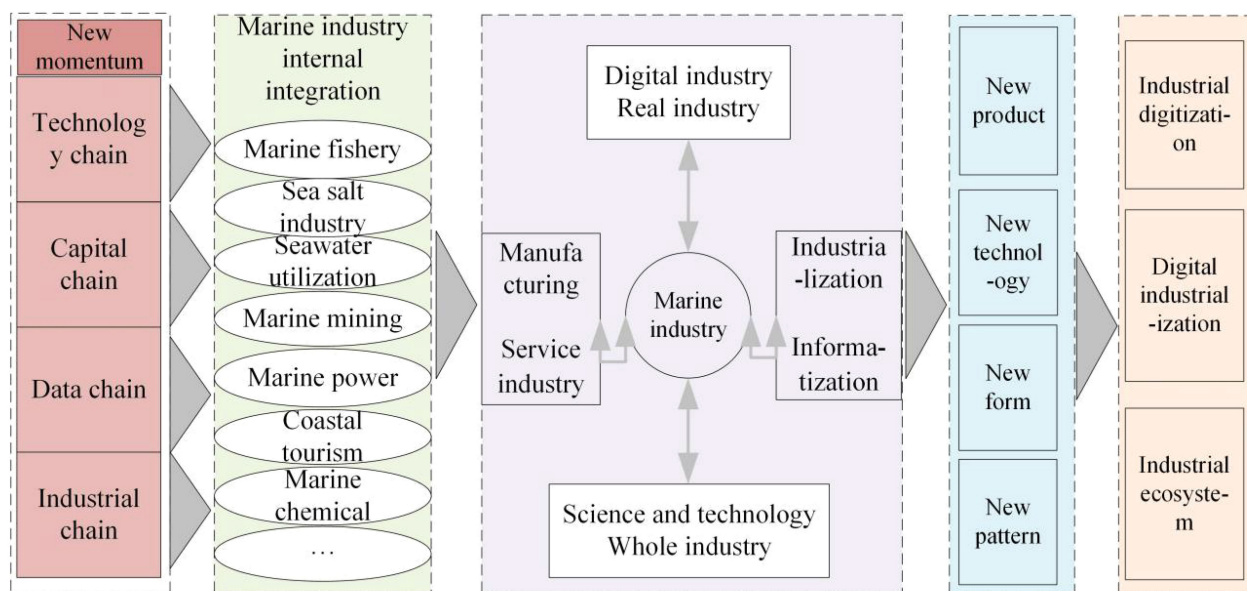


FIGURE 5

The NQP enables the internal and external integration of MMI and the mutual embedding of data and reality.

potential, spawns new industrial forms and models, and improves the overall industrial production efficiency, but also promotes the mutual integration of different industries and breeds new industries and future industries. This change will open up new development space and competition track for China's MMI, and comprehensively reshape the new momentum and new advantages of the MMI. Under the framework of the new development pattern, the NQP plays a crucial role in promoting the integrated development of the industrial system. By promoting the deep integration of emerging industries and traditional industries, it can effectively stimulate the vitality of the industry, innovate the form of the industrial chain, and optimize the entire industrial system. This process has far-reaching significance for promoting the construction and improvement of MMI.

### 3.4.2 Digital and real interpenetration: the integration of digital economy and real economy

The real economy is the foundation and pillar of the MMI. The full play of the potential of NQP is inseparable from the deep integration of the digital economy and the real economy, and the NQP can promote the integration of digital entities through three levels of industrial digitalization, digital industrialization and industrial ecosystem. In the process of promoting the integration of digital entities, industrial digitalization is a key link. With the continuous development of information and communication technology, digitalization has penetrated into all areas of the real economy, including the marine industry. Through digital technology, the marine industry can achieve more efficient and intelligent production methods, improve product quality and market competitiveness. For example, through digital technology, marine resources can be accurately monitored and managed to improve the efficiency of resource utilization; At the same time, digital technology can also be applied to marine engineering,

marine transportation and other fields to enhance the overall technical level and innovation ability of the industry. Digital industrialization is another important aspect to realize the integration of digital entities. In the process of digital industrialization, digital technology has become the core driving force of emerging industries and promoted the upgrading and transformation of marine industrial structure. The application of the new generation of information technology in the marine industry has promoted the rapid development of emerging industries such as marine information services and marine e-commerce, and injected new vitality and impetus into the marine industry. Finally, the industrial ecosystem is an important guarantee for the integration of digital entities. In the process of integrated development of the digital real economy, it is necessary to build an open, collaborative and inclusive industrial ecosystem to promote cooperation and exchanges between various enterprises and institutions. By building an industrial ecosystem, resources can be shared, advantages can be complementary, and efficient and coordinated development of the digital real economy can be promoted. At the same time, the industrial ecosystem can also promote innovation and entrepreneurship, promote the continuous emergence of new technologies, new models and new business forms, and inject new vitality and impetus into the sustainable development of the marine industry.

## 3.5 Supply and demand adaptation: NQP enables the potential release and dynamic adaptation of MMI

### 3.5.1 Potential release: the key areas of the construction of a MMI are fully stimulated

The potential of the MMI is gradually being released, becoming a new driving force for economic and social development (Figure 6).

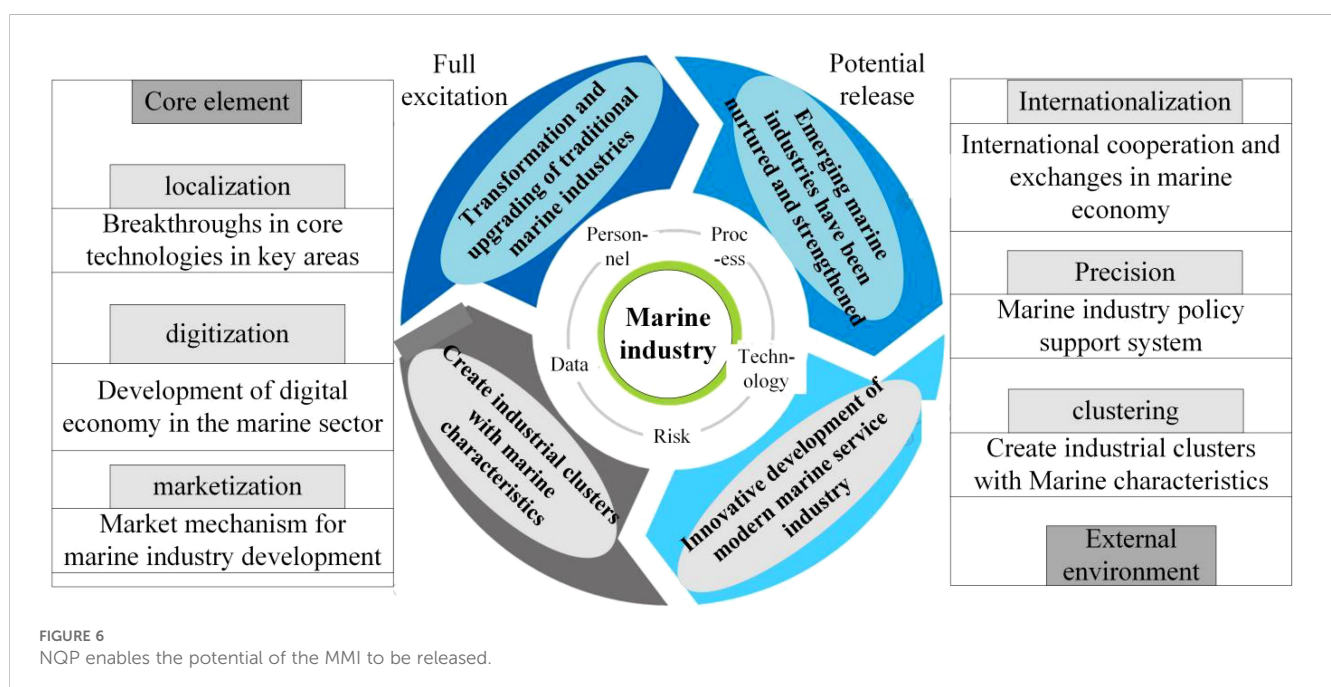
The NQP plays a positive role in promoting the construction of MMI, which is manifested in three aspects: marine industry, core elements and external environment. By giving play to the synergistic effect of factor endowment and improving the external environment, the NQP can effectively promote the development of MMI, and then realize the high-quality development of marine economy. As an important part of the MMI, marine industry covers marine fishery, marine transportation, marine tourism and other diversified fields, and is one of the important fields in which NQP plays a role. With the continuous progress of science and technology and people's in-depth understanding of marine resources, NQP promotes the marine industry to gradually realize the transformation and upgrading from traditional to modern, optimize the efficiency of resource utilization, create rich employment opportunities, and inject new impetus into the steady growth of the marine economy. In the overall layout of MMI, the core elements play a decisive role. Marine resources, with their diversity and richness, form a solid material foundation for marine industry. With the continuous progress of NQP, significant breakthroughs have been made in key technological fields of the marine industry, which has effectively promoted the pace of transformation of scientific and technological achievements into industrialization. The rise of NQP has injected new vitality into the development of the marine economy, promoted the close integration of marine industry elements and the digital economy, realized the digital transformation and upgrading of the industry, and built a new pattern of smart oceans. In addition, the continuous development of NQP plays a positive role in improving the market mechanism of the marine industry. By unblocking the flow channels of marine production factors, improving the market-oriented allocation efficiency of factors, further enhancing the market openness of the marine economy, and laying a solid foundation for the sustainable and healthy development of the

marine industry. The external environment is also crucial to the construction of the MMI. The NQP promotes the government to strengthen its support for the marine industry, formulate and optimize relevant policies and regulations, and ensure a solid policy foundation for the vigorous development of the marine industry. Enhance the driving force of supply-demand side policies for the marine industry, and stabilize the support of fiscal, tax and financial policies for the marine industry. The growth of NQP also helps build marine characteristic industrial clusters and build a platform for cluster development, thus improving the whole industrial chain of marine economy.

### 3.5.2 Innovative development: traditional transformation - cost reduction - quality cultivation - emerging cultivation - multi-dimensional drive of industrial integration

Through in-depth exploration of the core development potential of MMI construction, it is found that the sustainable development of MMI can be effectively promoted by giving full play to the synergistic effect of factor endowments and constantly improving the external environment. With the help of new productivity, it has become an urgent and important task to promote the dynamic adaptation of the MMI between the supply side and the demand side (Figure 7).

Specifically, in order to achieve the coordinated balance between the supply side and the demand side of the MMI, it is necessary to drive the NQP and promote the MMI to make breakthroughs in the aspects of factor innovation and process reengineering. At the same time, the NQP also needs to enable the MMI to make progress in configuration breakthroughs and digital reality interoperability. In this way, the transformation and upgrading of the MMI itself can be promoted, so as to realize the docking of the market side and the demand side with higher



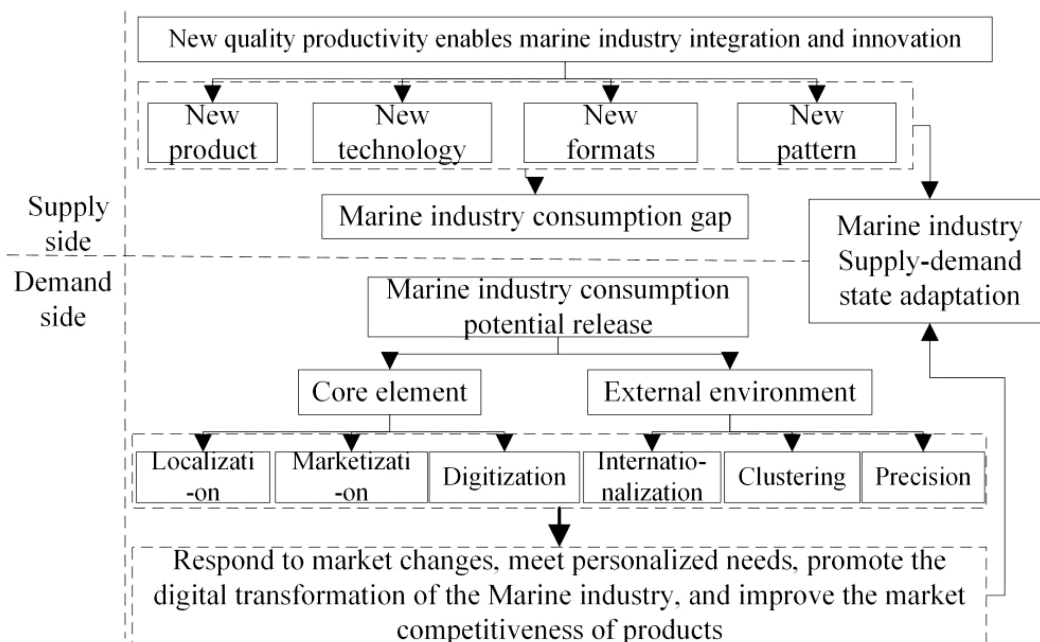


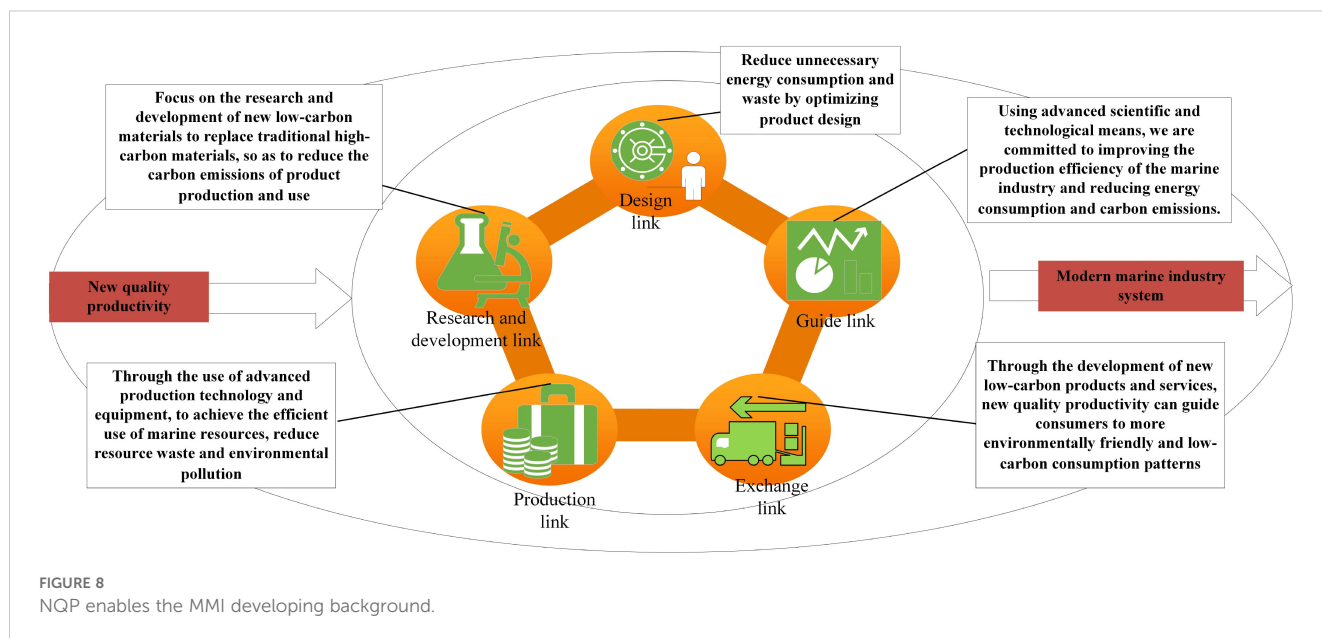
FIGURE 7  
NQP enables MMI to balance supply and demand.

efficiency (Zhao and Wang, 2024). First of all, the NQP drives the factor innovation and process reengineering of MMI. In the marine industry, the optimal allocation and efficient utilization of various resources, technologies, talents and other elements are of great importance. The NQP will promote the more efficient and accurate matching of these elements, and thus promote the innovative development of the marine industry. At the same time, the promotion of NQP will also help the marine industry to realize the digitalization and intelligence of production processes, thereby improving production efficiency and product quality, spawning new products, business forms and development models, and making up for the gap in consumer demand in the marine industry. Secondly, the NQP enables the MMI configuration breakthroughs and numerical reality interwoven. In the MMI, diversity and flexibility of configurations are essential to respond to market changes and meet individual needs. The NQP will promote the diversification and personalization of the marine industry configuration to meet the needs of different customer groups. At the same time, the NQP will also promote the marine industry to achieve digital transformation, the deep integration of digital technology and the real economy, to achieve the digital upgrading of the marine industry. Finally, the NQP will promote the MMI to achieve more efficient market docking. Through digital technology, digital infrastructure, data information and other technical means, the NQP will help the marine industry achieve more accurate market positioning and product promotion, and improve the market competitiveness of products.

### 3.6 Green and low-carbon: NQP enables low-carbon transformation and green growth of MMI

#### 3.6.1 Low-carbon transformation: the development background of MMI construction

The development of NQP has injected new vitality into the green and low-carbon transformation of the marine industry. NQP, with its distinctive green and low-carbon characteristics, leads the marine industry to a more environmentally friendly and efficient direction. Its core philosophy is to promote low-carbon innovation, design, investment and product development, and strive to achieve a comprehensive low-carbon transition in every link. Through the use of advanced technology, NQP aims to improve the productivity of the marine industry and reduce energy consumption and carbon emissions (Figure 8). For example, in the marine fishing industry, the use of intelligent and automated fishing equipment can greatly reduce human input, improve fishing efficiency, and reduce fuel consumption and carbon emissions. In addition, NQP also focuses on the development of new low-carbon materials to replace traditional high-carbon materials, thereby reducing the carbon emissions of product production and use. The design process is the key to realize the green and low-carbon transformation promoted by NQP. NQP advocates that environmental protection factors should be fully considered in the product design stage, and unnecessary energy consumption and waste should be reduced by optimizing product design. For example, in ship design, NQP focuses on improving the



energy efficiency of ships, reducing fuel consumption, and using environmentally friendly materials and technologies to reduce the pollution of ships to the marine environment. In the production process, the NQP pays attention to the concept of integrating scientific and technological innovation and resource recycling. Through the use of advanced production technology and equipment, NQP can realize the efficient use of marine resources, reduce resource waste and environmental pollution. NQP also plays an important role in the conversion of products in the marine industry. Through the development of new low-carbon products and services, NQP can guide consumers to more environmentally friendly and low-carbon consumption patterns.

### 3.6.2 Green growth: the inevitable requirement for the construction of MMI

The traditional productive forces pursue the expansion of economic scale, while the NQP serve the high-quality development with the unity of economic, social and ecological benefits (Ni, 2010). The NQP can promote the green growth of MMI through three aspects: green labor means, green labor object and green energy structure. First of all, the NQP provides a strong support for the green process of labor means. With the help of new tools with green, automatic and other characteristics, actively lead the production mode to green and low-carbon direction. The core field of NQP involves the deep application of advanced technology and digital technology, which not only optimizes the composition, structure and operation mode of labor materials, but also promotes the innovation of traditional manufacturing processes and the transformation and upgrading of equipment, effectively breaks the bottleneck of high energy consumption and high pollution in the traditional growth path, and injects new vitality into the MMI. Secondly, the NQP provides an unprecedented opportunity to expand the practical space of the object of labor. With the virtual and real coexistence of new materials and the increase of categories, the transformation of production resources to the direction of green

utilization is promoted. The field of human research and exploration is gradually focusing on more material new objects of labor, so as to promote the rational and efficient use of natural resources. At the same time, the development of NQP has spawned a new field of digital research, in which massive data has become an important and universal non-material new object of labor. This transformation not only helps to reduce excessive interference with the natural ecological environment, but also provides strong support for the MMI. Finally, NQP is committed to achieving the goal of energy saving and low carbon, and strive to improve the quality of resource conservation and intensive use. Actively assist in promoting the greening of the energy structure, by supporting and promoting the development of green and low-carbon core industries such as digital industry, energy conservation and environmental protection industry, and new energy to improve the quality of energy conservation and environmental protection products and services. NQP also helps to overcome key technologies of new energy and improve the green level of energy utilization in traditional manufacturing industries.

## 4 NQP enables the realization path of MMI

In the construction of the MMI, it is necessary to take the system and linkage as the principle, and strive to stabilize and enhance the competitiveness of traditional advantageous industries, at the same time, closely follow the core driving force of industrial optimization and upgrading, and actively cultivate and develop emerging industries and future industries. Scientific and technological innovation is the cornerstone of the development of NQP. Therefore, establish the strategic position of NQP in the MMI, deeply explore and analyze the challenges it faces in the development process, formulate a clear path for NQP to empower the MMI, and accurately grasp the core fields of MMI construction.



To find a key breakthrough for the sustainable and healthy development of the MMI, so as to promote the high-quality growth of the marine economy.

#### 4.1 Unleash the energy of traditional industries with NQP, and look ahead to strategic emerging industries and future industries

In order to promote the development of MMI, it is necessary to lay out strategic emerging industries and future industries from a forward-looking perspective, and stimulate the internal energy of traditional industries with the help of NQP. As the solid foundation of the national economy, the steady development and continuous innovation of traditional industries are of indispensable importance to the marine economic system. However, under the background of the new era, the operation mode and production mode of the traditional industry are facing many challenges. Therefore, it is necessary to actively introduce NQP and use modern scientific and technological means to promote the comprehensive innovation of traditional industries in technology, management and mode to release its huge potential. The development of NQP not only involves the upgrading of traditional industrial production tools, but also profoundly affects the production relations of marine industries. Through the extensive use of the new generation of information technology, to achieve the intelligent transformation of traditional industries, improve production efficiency, reduce costs, optimize resource allocation, so as to promote its transformation and upgrading. This strategic initiative aims to inject new vitality into traditional industries through the injection of NQP to meet the challenges of the new era, while promoting the MMI to a higher level and wider fields.

It is important to forward-looking layout of strategic emerging industries and future industries. These industries, with their excellent innovation and growth, have become the core driving force for future economic development. In order to realize its rapid development, it is necessary to use digital technology, policy guidance, capital investment, personnel training and other multiple strategies and means. This will help the MMI to explore new paths, explore new drivers, breed new advantages, and shape new competitiveness. The growth of emerging industries cannot be separated from the strong guidance of the government and the support of market supervision. Therefore, it is necessary to strengthen the enabling of NQP, optimize the top-level design of regional leading industries, advantageous industries and basic industries, and build an industrial echelon of upstream and downstream linkage and horizontal coupling of the industrial chain. The government should increase its support and enhance the integration capacity of the whole industrial system through tax incentives, special subsidies, the construction of regional industrial platforms, and the strengthening of industrial management. While promoting the upgrading of traditional industries, we should pay attention to the coordination with emerging industries to achieve the harmonious coexistence and prosperous development of

traditional industries, emerging industries and future industries, so as to comprehensively build a MMI.

#### 4.2 Enhance marine science and technology innovation innovation power, the new drive productivity can assign the MMI

The continuous optimization of the marine science and technology innovation system is the core driving force of NQP and is crucial to the construction of a MMI in China. In view of the double background of the continuous growth of the global economy and the increasing tension of marine resources, the marine industry has become a key field of international competition. As a major maritime country, China has unique advantages in marine resources and vast sea space, and the development of marine industry is of irreplaceable value to the overall progress of the national economy and society.

In order to promote the comprehensive development of MMI, we must unswervingly strengthen the construction of marine science and technology innovation system, and strive to improve its innovation ability and level to meet the needs of national development strategy and economic and social development. The primary task is to strengthen the basic research of marine science and technology innovation, and deeply explore the formation, evolution, distribution and utilization of marine resources, so as to provide solid scientific support for the sustainable development of the marine industry. At the same time, it is also necessary to strengthen the applied research of marine science and technology innovation, promote the transformation and application of scientific and technological achievements, in order to enhance the competitiveness of the marine industry and sustainable development capacity. In addition, it is also key to improve the flow mechanism of innovation factors and promote the agglomeration of innovation factors.

Strengthen the training of marine science and technology innovation talents, build a high-level marine science and technology innovation team, and provide a solid talent guarantee for the development of marine industry. The improvement of the marine science and technology innovation system needs the joint participation and efforts of the government, enterprises, scientific research institutions and the whole society. The government should increase investment and support for marine science and technology innovation, and formulate more favorable policies and measures to stimulate the innovation vitality of enterprises and scientific research institutions. Strengthen the publicity and promotion of marine science and technology innovation, and improve the awareness and attention of the whole society to marine science and technology innovation.

#### 4.3 Optimize the marine industry development environment, drive NQP and enable MMI

NQP, as a powerful engine to promote economic and social development, is optimizing the development environment of marine

industry in its unique way and leading the construction of MMI. Comprehensively deepening reform plays a vital role in this process.

First of all, by creating an orderly, efficient and fair market competition environment, stimulate market vitality, provide a fair competition platform for the marine industry, so that all kinds of market players can give full play to their own innovation ability and competitive advantages; By reducing administrative approval, lowering the threshold of market access and other means, we will give emerging industries and future industries greater space for development. We will continue to improve the mechanism for scientific and technological innovation, optimize the evaluation system for scientific and technological achievements, promote the effective supervision of scientific research funds, build a platform for industry-university-research collaborative innovation, support the popularization and diffusion of common technologies, and gather the impetus for innovation. Increase investment in scientific research, promote the transformation and application of marine scientific and technological innovation results, and provide strong technical support for the development of marine industry.

Second, strengthen the foresight of the future marine industry and establish and supply high-level planning and design guidelines. It is necessary to establish clear development goals for marine strategic emerging industries, determine key development areas, set priority development directions, and formulate supportive policies to form a group of marine strategic emerging industries clusters with international leading technology levels. At the same time, it is necessary to improve the guarantee mechanism for all types of marine talents, stimulate the innovation potential of marine science and technology talents, and provide a solid talent foundation for the development of marine strategic emerging industries and future industries.

Finally, strengthen the construction of the ecological environment of the marine industry chain, promote the collaborative evolution of the innovation chain and the industrial chain, cover the technical elite of the scientific research line, the main body of the production, operation and sales service of the marine industry, and promote the development of the marine industry to the high-end, intelligent and green direction through continuous research and development of new technologies and new products. Improve the core competitiveness of enterprises, improve product quality, reduce costs and expand the market through technological innovation, management innovation and mode innovation. Strengthen cooperation and collaboration among enterprises, form industrial alliances, and jointly cope with market risks and challenges. We will increase support for research and development of key technologies and core equipment in the marine industry.

#### 4.4 Accelerate the integration and penetration of industry, data and reality, drive NQP and empower the MMI

Deepening the integration and penetration of marine industries through NQP can not only enhance the overall competitiveness of

the marine economy, but also provide strong support for the construction of a MMI. In the process of promoting the integrated development of marine industries, attention should be paid to the integration of traditional marine industries, such as the integration of fisheries and marine tourism. Through the development of marine recreational fisheries, marine fishery resources and tourism resources should be combined to form a positive interaction between fisheries and tourism. At the same time, the integration of marine transportation industry and marine manufacturing industry is also an important direction, which provides strong support for the development of marine manufacturing industry by optimizing logistics and reducing transportation costs. The integration of emerging marine industries and traditional marine industries is equally important. Emerging industries such as marine new energy and marine biomedics have great development potential. Through the integration with traditional marine industries, they can promote the transformation and upgrading of traditional industries and realize the sustainable development of marine economy. For example, the application of marine new energy in the field of fisheries, the development of solar energy, wind energy and other clean energy, to provide sustainable energy support for fishery production.

We will deepen the integration of the digital economy and the real economy. Mainly through accelerating the promotion of digital industrialization and accelerating the promotion of industrial digitalization, it reflects the new quality of productivity and enables the MMI. Digital industrialization includes the research and development of digital technology, the research and development of digital products and the provision of digital services. By strengthening the innovation and application of digital technology, it can promote the rapid development of the digital industry, and then drive the transformation and upgrading of the entire economic system. In the field of marine industry, the application of digital technology can improve the utilization efficiency of marine resources and promote the development of marine economy. For example, technological means such as satellite remote sensing and big data can be used to more accurately monitor changes in the marine environment and provide a scientific basis for the rational development of marine resources. Industrial digitalization refers to the application of digital technology to transform traditional industries and improve the production efficiency and service level of industries. In the field of marine industry, industrial digitalization can promote the transformation and upgrading of traditional industries such as marine fisheries, marine tourism, and marine transportation. For example, through the application of Internet of Things technology, the real-time monitoring and management of fishing vessels, fishing nets and other fishing facilities can be achieved to improve the efficiency and safety of fishery production. Promoting the deep integration of the digital economy and the real economy is the key to promoting the development of a MMI. By accelerating the promotion of digital industrialization and industrial digitalization, the enabling role of NQP can be better played, and the transformation and upgrading of

the marine industry and high-quality development can be promoted.

## 4.5 Improve green industries, technologies and policies to drive NQP and empower the MMI

In order to promote the transformation of China's marine industry to realize green low-carbon transformation, we must grasp the opportunity of rapid development of green technology and green industry under the NQP. Through the effective use of green development policy tools, we can jointly solve the huge pressure faced by the marine industry in the process of low-carbon transformation, and at the same time make up for the shortcomings in the development of green industry, and strive to break through the bottleneck of green core technology, and accelerate the construction of MMI. First of all, the application of green technology is the key to promote the green and low-carbon transformation of the marine industry. In the fields of marine fishing, marine farming, and marine transportation, we actively introduce and apply advanced green technologies, such as energy-saving fishing equipment, ecological farming models, and low-carbon transportation technologies, in order to reduce energy consumption, reduce emissions, and achieve industrial greening. Secondly, the development of green industry is the core link of building a MMI. To this end, we actively encourage and vigorously support the rapid development of green industries such as marine clean energy, marine biomedicine and Marine new materials. At the same time, we will promote the transformation and upgrading of traditional marine industries to high-end, intelligent and green, so as to build a MMI with global competitiveness. Through these measures, a solid foundation has been laid for the sustainable development of the marine economy. Finally, the formulation and implementation of green development policies is an important guarantee for the green and low-carbon transformation of the marine industry. The government should introduce a series of policies, such as financial subsidies, tax incentives, financial support, etc., to encourage enterprises to increase green investment and promote the green and low-carbon transformation of the marine industry. At the same time, supervision should also be strengthened to ensure that enterprises comply with environmental regulations and prevent pollution of the marine environment.

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## Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

## Author contributions

XC: Investigation, Writing – review & editing, Resources, Project administration, Methodology. QD: Formal Analysis, Funding acquisition, Data curation, Writing – review & editing, Conceptualization. ZW: Writing – review & editing, Supervision, Validation, Visualization, Software.

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