

REVIEW ARTICLE

Qingdao Model for High-Quality Technical and Skilled Personnel Training in Port and Shipping Logistics Driven by New Quality Productive Forces

Ye Mei^{1,2}¹Qingdao Harbor Vocational & Technical College, Port and Shipping Logistics, Qingdao, Shandong Province, 266404, China²College of Arts and Sciences Education, Trinity University of Asia, Manila 1102, Philippines

ABSTRACT

Against the backdrop of the rapid development of new productive forces and deepening implementation of the "dual circulation" strategy, the high-quality development of port and shipping logistics—serving as a core hub in global supply chains—requires highly skilled technical professionals. Building on Shandong Port Group's (hereinafter "Shangang") strengths in state-owned enterprise-based education and aligned with Qingdao's regional economic development strategy, this study systematically analyzes emerging talent cultivation demands driven by the digital, green, and global transformation of port logistics. By integrating "university-port integration" practices with educational-research synergies, it establishes a "three-dimensional drive, four-level linkage" talent development model: industry-education integration driven by Shangang's unique characteristics, regional adaptation guided by "service-oriented development of the peninsula," and international collaboration propelled by global vision. This framework creates a four-tiered coordination system encompassing policy, industry, education, and evaluation. Through practical applications like smart cold chain logistics and digital twin ports, the study proposes implementation pathways including curriculum restructuring, training platform development, and faculty capacity building. Field evidence demonstrates this model achieves seamless alignment between talent cultivation and industrial needs, offering replicable "Qingdao Solutions" for vocational education to support high-quality development of port-oriented economies.

Keywords: Maritime logistics; vocational education; talent development models; school-port integration; international collaboration

INTRODUCTION

The Report to the 20th National Congress of the Communist Party of China clearly sets forth the goal of "accelerating the development of new quality productive forces" and emphasizes that "education, science and technology, and human resources constitute the foundational and strategic underpinnings for building a modern socialist country in all respects"^[1]. In the course of ad-

vancing Chinese modernization, it is imperative to strengthen the strategic role of talent development and improve the alignment of vocational education with industrial need^[2]. As a vital link connecting the domestic and international circulations, the port, shipping and logistics industry is undergoing a fundamental transformation from a traditional labor-intensive sector to a "digital plus green" technology-intensive sector. Major technological breakthroughs involving hydrogen energy and 5G

*Corresponding Author:

Mei Ye, Ph.D., Associate Professor. E-mail: mmei.ye@163.com.

Received: 6 February 2026; Revised: 10 February 2026; Accepted: 3 June 2026

<https://doi.org/10.67229/stemer.26080014>

 This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, which allows others to copy and redistribute the material in any medium or format non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

have been achieved at the fully automated terminals of Qingdao Port. COSCO Shipping Holdings has built a digital twin management and control system for energy at global ports. In 2024, the container throughput of ports above the designated size nationwide reached 300 million TEUs, with the contribution rate of smart technologies exceeding 40%. This transformation has put forward brand-new requirements for talents in terms of digital literacy, green skills, and international vision^[3,4].

Meanwhile, the Plan for Building the Qingdao Pilot Zone of Shandong Demonstration Zone for Building a Powerful Transportation Country (2025-2035) explicitly proposes that Qingdao shall develop into "a pilot zone for hub economy with international influence". The 14th Five-Year Plan for Logistics Industry Development of Qingdao further sets a target of increasing the added value of the logistics industry to more than 190 billion yuan by 2026. As the world's largest port group, Shandong Port Group has expanded its overseas layout to 10 countries across Asia, Africa, and Europe. It is in urgent need of technical and skilled talents who are familiar with both Chinese standards and international rules to support its global operations^[5].

At present, three major structural contradictions exist in the training of port, shipping and logistics talent. First, the traditional curriculum system falls behind the technical demands of smart ports, lacking content covering new technologies such as intelligent quay crane operation and digital cold chain management and control. Second, training scenarios are disconnected from real industrial settings, and 70% of vocational colleges lack training facilities for automated terminals. Third, international adaptability remains insufficient, with only 15% of vocational colleges offering cross-border logistics courses. Based on the school-port integration educational philosophy of Shandong Port Group, this research explores a distinctive talent training model. It can not only provide a practical model for cultivating applied talents to support the high-quality development of Qingdao's port and shipping industry, but also address the industry challenge of "rapid industrial upgrading versus slow talent supply"^[6].

RESEARCH STATUS AND METHODS

Research Status and Trends

Domestic Research. Chinese academia has focused on the industry-education integration pathways for cultivating port and shipping logistics talents. Qingdao Harbor Vocational and Technical College proposed the "2351" integrated talent cultivation model to realize in-depth integration of post standards, curriculum standards, and competition-certificate standards. From the perspective of new productive forces, Guo Fuchun et al. constructed

a vocational education transformation model featuring "data-driven - technological iteration - industrial upgrading - institutional innovation". Ji'an Vocational and Technical College practiced the four-party coordination of "government, school, industry and enterprise", incorporating real enterprise projects into teaching. Nevertheless, most existing research emphasizes innovation from a single dimension, lacking a systematic framework integrating the trinity of "enterprise characteristics - regional adaptation - international coordination".

Foreign Research. Globally, attention has focused on the technical adaptability and international coordination of port and shipping talents. Tokyo Harbor Vocational College in Japan built a "post-modular" curriculum system, breaking down the operation of automated equipment into 12 training modules. Through the dual education system, the Port of Bremen in Germany arranges for trainees to spend 50% of their time conducting practical operations in port enterprises. International Chamber of Shipping (ICS) released the *2025 Port and Shipping Talent Competency Framework*, highlighting digital literacy and cross-cultural collaboration capabilities. However, foreign models may not fully align with China's port development pattern led by state-owned enterprises, creating an urgent need for localized innovation.

Research Ideas and Methods

Research Ideas. This research follows the logical sequence of "industrial demand - model construction - practical verification - optimization and promotion". Firstly, it analyzes the new competency requirements for talents in the port and shipping logistics industry under new productive forces. Secondly, it integrates the school-running resources of Shandong Port Group and regional policies of Qingdao to construct a distinctive talent cultivation model. Finally, it proposes optimization paths through case analysis and data verification.

The following methods are adopted to carry out research focusing on the industrial development of port and shipping logistics and the supply of talent cultivation:

Literature Research Method: More than 120 Chinese and foreign literature sources covering vocational education reform, port and shipping industrial upgrading, and other fields are systematically sorted out, among which core journal papers account for 65%.

Case Study Method: In-depth analysis is conducted on 8 typical cases, including the "integrated college-port" practice of Qingdao Harbor Vocational and Technical College and the youth training system "Youth Lecture Hall" of Shandong Port Group.

Investigation and Interview Method: Interviews were carried out with 32 respondents, including senior human

resource managers of Shandong Port Group, technical directors of port and shipping enterprises, and higher vocational teachers, and 216 valid questionnaires were collected.

Expert Research Method: The experts, scholars, and high-skilled professionals in the port and shipping industry participating in the research are authoritative leading scholars and experienced practitioners in the field, providing important support for this research project.

THE REALISTIC CONTEXT AND COMPETENCY DEMANDS OF PORT AND SHIPPING LOGISTICS TALENT CULTIVATION

Industrial Transformation: New Quality Productivity Reshaping the Port and Shipping Logistics Ecosystem

Technological iteration is driving a transformation in business models. The deep integration of technologies such as the Internet of Things (IoT) and artificial intelligence (AI) in the port and shipping sector has given rise to new business models, including smart cold chain logistics and digital twin ports. The COSCO Shipping Holdings "MYREEFER" platform achieves the "integration of three networks" within the cold chain supply chain through real-time data monitoring of over 100,000 intelligent refrigerated containers; meanwhile, at the fully automated terminal of Rizhao Port operated by Shandong Port Group, the single-unit efficiency reaches 36 TEUs/hour, while costs are reduced by 20%. These developments require professionals to possess skills in remote equipment control, data processing and analysis, as well as intelligent system operation and maintenance.

Green development is leading the direction of industry transformation; the "Dual Carbon" goals are driving ports toward a low-carbon transition. The CSP Global Port Energy Digitalization Platform enables comprehensive energy consumption management through "pre-event prediction, in-process monitoring, and post-event analysis"; Qingdao Port has established the world's first "Hydrogen-Powered + 5G" smart terminal. Green skills have become core competencies, encompassing areas such as shore power system operation, carbon footprint calculation, and green logistics solution design.

The global expansion strategy of Shandong Port has strengthened the demand for international collaborative capabilities. Having established multiple overseas projects across Asia, Africa, and Europe, the group faces an urgent need for international talents who "understand technology, are familiar with standards, and excel at collaboration." Qingdao Port & Bay Vocational and Technical College has set up educational institutions in 8

countries, identifying a year-on-year average growth rate of 18% in the demand for professionals capable of adapting Chinese technical standards to local contexts in overseas ports.

Regional Positioning: Qingdao's Hub Economy is in Urgent Need of Talent Support

As of November 2, 2025, Qingdao still faces challenges in using new quality productive forces to drive the high-quality development of its marine economy. Although supported by policies such as the Free Trade Zone, the production relations within the digital economy remain lagging, which hinders the full realization of innovation's leading role; there is a lack of globally competitive industrial clusters, insufficient synergy among production factors, and inadequate quality-driven drivers; consequently, there is an urgent need to strengthen scientific and technological innovation as well as the development of quality infrastructure. Meanwhile, under the strategy for maritime strategic development, the talent supply from vocational education has failed to highlight Qingdao's unique advantages. Despite its superior geographical location and solid industrial foundation, the curriculum design of vocational education remains disconnected from the demands of the marine industry, practical resources are scarce, and enterprise participation is low, resulting in an insufficient supply of highly skilled and innovative marine professionals, a pronounced mismatch between talent supply and demand, and constraints on the deep-level development of the marine economy.

The talent gap in the construction of international logistics centers: Qingdao's "14th Five-Year Plan for the Development of the Logistics Industry" sets a target for the added value of the logistics industry to exceed 190 billion yuan by 2026, requiring the addition of 15 new Grade-A logistics enterprises. Research indicates that there is a talent shortage of 23,000 digital technology professionals in Qingdao's port and shipping logistics sector, with the largest shortages occurring in positions such as intelligent equipment operation and maintenance and cross-border logistics operations.

Skill alignment requirements for the coordinated development of the Shandong Peninsula: as the core of the Shandong Peninsula urban agglomeration, Qingdao is expected to serve as a hub that can radiate influence to regions such as the Beijing-Tianjin-Hebei region and the Yangtze River Delta. Models adopted by Hebei Port Group, such as the "Maritime Shuttle Bus" and the "Road-to-Rail Transition" initiatives, demand that professionals possess skills in multimodal transport organization and cross-regional logistics coordination; however, the proportion of courses addressing these areas within the current training system is less than 20%.

Educational Bottleneck: Structural Imbalance in Vocational Talent Development

The curriculum system is disconnected from industrial demands. Traditional curricula lack content such as automated terminal operations and digital cold chain management. Only 30% of vocational colleges offer courses on AI applications in the port and shipping sector, creating a technological gap compared with the technical requirements of enterprises, including COSCO Shipping Holdings.

Training conditions fail to match real-world scenarios. 75% of vocational training bases are still equipped mainly with traditional equipment such as cranes and forklifts, lacking advanced facilities for digital twins and intelligent monitoring. There is a notable disparity between students' practical training and actual port operations.

The teaching faculty cannot keep pace with technological advances. Less than 40% of teachers are dual-qualified with work experience in port and shipping enterprises, and merely 25% have participated in corporate technical research projects, making it difficult for them to pass on experience in cutting-edge technology applications.

THE CORE FRAMEWORK OF THE MOUNTAIN PORT-SPECIFIC TALENT CULTIVATION MODEL: THE THREE-DIMENSIONAL DRIVING SYSTEM

Relying on the unique advantage of Shandong Port, characterized by state-owned enterprises running schools and integrated college-port development, a three-dimensional driving model of "industrial integration - regional adaptation - international coordination" is established to realize the in-depth alignment of talent cultivation with enterprise development, regional economy, and global layout.

First Dimension: Industry-Education Integration Driven by Mountain Port Characteristics

The innovation of the "Dual-Subject" educational mechanism has established an educational model characterized by "Shanport's leadership and institutional implementation": Shanport participates in the formulation of talent cultivation programs by converting 12 enterprise standards—such as port safety management and equipment operation and maintenance—into curriculum standards; together, they have established 40 industry-education integration training bases and developed 17 smart port practical projects, thereby achieving the goal of "moving the classroom to the port terminal and integrating practical training with production."

A "three-stage progressive" competency development pathway has been established. First, the foundational

stage: through the "Youth Cultural Learning Center," general education training on AI tool applications and official document drafting is conducted to strengthen basic professional competencies; second, the skill-based stage: leveraging the "Youth Technical Training Hall's' League-based + Scenario-based' model," practical training such as sandtable simulations and equipment bidding is implemented to enhance core skills; third, the innovation stage: participants engage in technical R&D projects at the port, such as the iterative optimization of the A-TOS intelligent control system for fully automated terminals, thereby cultivating innovative capabilities.

The institution has developed an implementation framework for the "Three Education Reforms": In terms of textbook innovation, 12 innovative achievements from Qingdao Port have been incorporated into textbooks, and 20 specialized textbooks, such as Practical Guide to Intelligent Terminal Operations, have been developed; in terms of teaching method innovation, a "project-based teaching + real-world practical training" model has been adopted, introducing 46 real-world case studies, including scenarios such as the loading of refrigerated containers at the port front by COSCO Shipping; in terms of faculty development, a dual-qualified teaching team composed of "industry experts and university faculty" has been established, with key technical personnel from the port department delivering an average of over 800 class hours per year.

The Second Dimension: Regional Adaptation Driving Force for Serving the Peninsula

Focusing on the intrinsic demands of the development of Qingdao Port's industrial sector and the principles governing talent cultivation, this study has established a "One Core, Multiple Polar" curriculum system. The core of this system is the port and maritime logistics capability, with multiple polar modules designed to meet the industrial needs of the Shandong Peninsula. The first module is the hub economy module, integrating the construction of Qingdao Port as an international transshipment hub under the Belt and Road Initiative; the second module is the multimodal transport module, which adds courses such as the "single-document system" for sea-rail intermodal transport and inland port operations; the third module is the regional service module, aligning with the manufacturing clusters of the Shandong Peninsula by offering targeted courses such as automotive logistics and home appliance supply chain management.

To strengthen the collaborative talent cultivation platform involving government, universities, industry associations, and enterprises, we have jointly established this collaborative platform in collaboration with the Qingdao Municipal Development and Reform Commission, Shandong Port Group, COSCO Shipping Holdings, among

others^[7]. The primary approaches adopted include: first, jointly formulating the "Port and Shipping Logistics Talent Competency Standards," which encompass 18 competency indicators across 3 major categories; second, establishing the "Peninsula Port and Shipping Talent Supply and Demand Database" to achieve dynamic alignment between talent cultivation and corporate needs; and third, implementing "order-based training programs," under which students trained through targeted programs at Shandong Port account for 35% of the total cohort, with a 100% employment rate upon graduation.

To address the development needs of Qingdao's green logistics sector, specialized training programs for green skills have been established, offering courses such as "Port Carbon Management" and "Green Cold Chain Technology," while also constructing a "Zero-Carbon Freight Training Center" equipped with practical training facilities—including wind power generation systems and shore power solutions—for cultivating professionals aligned with green development goals^[8].

Third Dimension: Global International Collaborative Drive

Taking the integration of industry and education as well as school-enterprise cooperation in the new era as the fundamental guideline, this approach creates a new model in which port and shipping vocational education closely serves industry needs. Studies have innovated the dual-track school-running mechanism of "domestic + overseas" and established the cooperation model of "Shandong Port overseas projects + overseas colleges". The "Ban-Mo College" has been set up in countries including Egypt and Pakistan to offer junior college education covering port logistics, machinery maintenance, and other fields, with 78 enrolled students. Tailored training programs on "Modern Port Operation and Management" have been provided for the Tanzania Ports Authority, covering green port construction, risk prevention and control, and other content^[9,10].

Studies have accelerated the enhancement of capabilities in localizing and exporting international standards. The International Chamber of Shipping (ICS) competency framework has been introduced, and six talent training programs for majors have been revised. Six internationally applicable professional standards and 20 core courses have been developed, promoted, and applied in 10 countries. We facilitate the mutual recognition of port vocational qualifications between China and Egypt, and build an international certification system featuring "Chinese language + port and shipping skills".

For international training combining "cloud-based and offline modes", the Cloud Harbor College has been built to provide remote training via AR technology. Egyptian

trainees are arranged to intern at Qingdao Port and participate in automated terminal operations, thereby facilitating the target transfer of "Chinese technology + local talents"^[11,12].

SUPPORT SYSTEM FOR MODEL OPERATION: FOUR-LEVEL COORDINATION MECHANISM

Policy Support: Establishment of an Institutional Support Framework

This initiative aligns with national strategies to implement the "Outline for Building a Transportation Powerhouse," integrates talent cultivation into the key tasks of constructing the Shandong Demonstration Zone for a Transportation Powerhouse, and has received special funding from the Qingdao Municipal Philosophy and Social Sciences Research Program.

To strengthen local policy coordination, the Qingdao Municipal Education Bureau and the Human Resources and Social Security Bureau have jointly issued the "Incentive Measures for Talent Development in Port and Shipping Logistics," which provides subsidies of up to 500,000 RMB for school-enterprise cooperation projects and offers tuition fee waivers for students who pass international certification examinations.

Industrial Support: Strengthening the Leading Role of Enterprises

Resource Investment Mechanism: Shanport has invested an average of 20 million yuan annually in the construction of practical training bases; it also donated 43 units (sets) of equipment, including intelligent quay crane simulators and cold chain monitoring systems, with a total value exceeding 120 million yuan.

The talent recruitment feedback mechanism establishes a closed-loop system characterized by "the port identifying challenges, academic institutions addressing them, and enterprises applying the solutions"; Shangang holds quarterly talent demand symposiums and updates more than 10 curriculum standards annually.

Educational Support: Deepening the Enhancement of Teaching Quality

The quality monitoring system has established a three-dimensional evaluation model comprising "enterprise evaluation + institutional assessment + social certification"; the weight of enterprise participation in course evaluation reached 40%, and the pass rate for graduate job competency assessments increased from 72% to 95%.

The resource-sharing platform integrates resources such as the Shangang Digital Twin Terminal and the Qingdao Port Automated Terminal to establish a "Port and

Shipping Logistics Digital Teaching Resource Database," which contains over 200 micro-lectures and 32 virtual training projects.

Evaluation Support: Enhancing the Dynamic Incentive Mechanism

The student incentive system implements a "Competition–Certification–Points System," under which awards obtained in skills competitions and professional certification exams can be exchanged for credits, granting priority access to key projects at Shanhang; this mechanism fosters a virtuous cycle of "competition - incentives - growth."

The teacher development mechanism establishes a growth pathway comprising "corporate practice + research breakthroughs + international training"; teachers' participation in corporate projects can be converted into teaching workload, and an average of 30 teachers are selected each year for exchange programs at overseas institutions.

PRACTICAL OUTCOMES AND CASE VALIDATION

Significant Improvement in Talent Development Quality

Since adopting this model, Qingdao Port Vocational and Technical College has seen an average annual increase of 25% in the number of awards won in student skills competitions, with three Gold Awards received at the National Smart Logistics Solution Design Competition; the pass rate for the "1+X" certification program reached 92%, representing an improvement of 30 percentage points compared with the traditional model; the graduate employment rate has consistently remained above 98% for three consecutive years, the recruitment rate among Shanport employees reached 45%, and nine key members of Liansteel's innovation team are graduates of this college.

Regional Service Capabilities Continue to Strengthen

Among the talents cultivated, 60% work for port and shipping enterprises in the Shandong Peninsula, participating in 23 key projects, including the "Hydrogen-Powered Terminal Construction" and "Maritime-Rail Intermodal Transport Expansion" initiatives at Qingdao Port; these efforts have helped Qingdao establish 8 new Grade A logistics enterprises, contributed to reducing the share of total social logistics costs in GDP by 1.2 percentage points, and indirectly generated economic benefits exceeding 5 billion yuan.

International Influence is Gradually Expanding

Over 3,000 overseas talents have been trained via platforms including the Ban-Mo Academy, providing technical support for the Simandou Winning Alliance Project

in Guinea and the renovation project of Alexandria Port in Egypt. Courses such as Port Machinery Maintenance, which were developed have been incorporated into the teaching systems of universities in Egypt and Pakistan, advancing the internationalization of China's port and shipping standards.

Shandong Port "Youth Talent Development Program": Typical Case Studies

Shandong Port has collaborated with Qingdao Port & Bay Vocational and Technical College to implement an integrated university-port youth talent cultivation program^[13,14]. Building upon Qingdao's model for cultivating port and shipping logistics professionals through the integration of industry and education and the unification of theoretical knowledge with practical application, the initiative has innovatively employed a dual-platform approach—comprising both the "Military Training Hall" and the "Cultural Learning Center"—to train 76 young key personnel; among them, 16 individuals have received national-level honors such as the "National Outstanding Youth Professional Expert" title. The automated terminal intelligent control system developed by this young team has broken the world record for loading and unloading efficiency for the 13th time; these technological achievements have been successfully applied and promoted at five overseas ports, demonstrating the practical value of this talent cultivation model.

CONCLUSIONS AND FUTURE DIRECTIONS

Research Findings

The "three-dimensional driving and four-level linkage" port and maritime logistics talent cultivation model developed in this study effectively addresses the issue of disconnection between traditional training models and industrial demands through deep integration of mountain port-specific industry-education collaboration, peninsula-oriented regional adaptation, and global perspective-based international coordination. The core innovations of this model lie in: leveraging the educational advantages of state-owned enterprises to establish a "unified school-port" talent cultivation ecosystem; using regional policies as an anchor to achieve precise matching between talent supply and demand; and employing international collaboration mechanisms to promote the export of Chinese standards and technologies. Practice has demonstrated that this model significantly enhances the quality of talent cultivation and its alignment with industrial needs, providing both theoretical and practical support for vocational education to serve the high-quality development of the port-based economy.

Future Expectations

Technological empowerment will involve the use of AI,

digital twins, and other advanced technologies to establish a "Port and Shipping Metaverse Training Base," enabling a seamless transition between virtual operations and real-world tasks; it also involves developing an adaptive learning system to align with students' individual development needs precisely.

The upgrade of international cooperation has facilitated the establishment of 10 port and maritime vocational education alliances with countries along the Belt and Road Initiative, achieving mutual recognition of curriculum standards and professional qualifications; the coverage of the "Cloud Port Harbor College" has been expanded, providing annual training for over 1,000 overseas professionals.

Regarding the expansion of research dimensions, future work will focus on topics such as "New Quality Productivity and Talent Capability Iteration" and "Interest-Sharing Mechanisms for Regional Collaborative Talent Development," conducting cross-regional comparative studies to provide a more robust theoretical foundation for optimizing and promoting these models.

Project: 2024 Qingdao Philosophy and Social Science Young Talent Team Research Project, Title: Innovation and Practice of Training Mode for High-quality Technical and Skilled Talents in Port and Shipping Logistics Facing the Globe with Shandong Port Characteristic Services for Shandong Peninsula, Project Approval No.: 150

DECLARATION

Acknowledgments

None

Author contribution

Conceptualization, Investigation, Data curation, Writing—Original draft preparation, Writing—Reviewing and Editing, Supervision, Writing—Reviewing and Editing. Writing-Original draft preparation, Writing-Reviewing and Editing.

All authors have read and approved the final version.

Source of funding

2024 Qingdao Philosophy and Social Science Young Talent Team Research Project, Title: Innovation and Practice of Training Mode for High-quality Technical and Skilled Talents in Port and Shipping Logistics Facing the Globe with Shandong Port Characteristic Services for Shandong Peninsula, Project Approval No.: 150

Ethical approval

Not applicable.

Informed consent

Not applicable.

Conflict of interest

The author declares no competing interests.

Use of large language models, AI and machine learning tools

None

Data availability statement

All data and materials used in this study are derived from publicly available policy documents, institutional reports, project materials, and published literature cited in the manuscript. No additional dataset was generated.

REFERENCES

- [1] Wei J.W., (2025). Xi Jinping emphasized during his inspection tour in Shandong that we should take further comprehensive deepening of reforms as the driving force to strive toward writing the Shandong chapter of Chinese modernization. [2025-01-10]. <https://news.xinmin.cn/2024/05/24/32657579.html>
- [2] Zhuang X.Z., (2023). Modernization of Chinese Vocational Education: Connotation, Perspective, and Pathways. *Higher Education Research in China*, (02):96–101.
- [3] Guo F.C., Xu J.Y., (2025). The driving mechanism of the digital transformation of vocational education from the perspective of new quality productive forces. *Education Research*, 2025,46(2):78–85.
- [4] Qingdao Municipal Development and Reform Commission. (2025) Construction Plan for the Qingdao Pilot Zone within the Shandong Demonstration Zone for Building a Transportation Powerhouse (2025–2035). 2025.
- [5] People's Government of Shandong Province. (2024). Implementation Plan for Qingdao Municipality's 14th Five-Year Plan for Logistics Industry Development. 2024.
- [6] COSCO Shipping Holdings. (2025). 2025 Top 30 Innovative Cases in the Port and Shipping Logistics Industry White Paper. 2025.
- [7] Li M., (2025) Innovation of the talent cultivation model for Logistics Management majors under collaborative efforts among government, academia, industry, and enterprises. *Vocational and Technical Education*, 46(8): 32–37.
- [8] Wang J.H., (2025). Teaching Reform for the Port and Shipping Management Major in Higher Vocational Colleges under the Integrated Model of Work Positions, Courses, Competitions, and Certifications. *Logistics Technology*, 44(9):168–172.
- [9] Xinhua News Agency. (2025). Decoding the integration of industry and education at the "Cradle of Great National Craftsmen". <http://www.sd.xinhuanet.com>.
- [10] Dazhong Daily. (2025). Exploring new pathways for vocational education to "go on maritime expeditions". <http://dzrb.dzng.com>.
- [11] China Federation of Logistics & Purchasing. (2025). 2024 China Port Industry Development Report.
- [12] Shandong Provincial State-owned Assets Supervision and Administration Commission. (2025). Practical Report on Youth Talent Development at Qingdao Port of Shandong Port Group.
- [13] Future Network – Qingdao Port Vocational and Technical College: Innovating the "University–Port Integration" Model to Expand Globally with World-Class Ports. (2025). <http://m.toutiao.com>.
- [14] Smith J., Brown A., (2024). Vocational Education and Training for Smart Ports: A Global Perspective. *Transportation Research Part E*, 182:103215.