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Research on the Reform of Cultivating Interdisciplinary Industrial Talent at Haikou Vocational Colleges Under Internationalization Competence Requirements: A Case Study of Customs-Related Operations

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Abstract: The full-scale implementation of the Hainan Free Trade Port island-wide customs clearance system has leveraged the unique "First-Line Liberalization, Second-Line Management" customs supervision model to reshape a comprehensive open industrial ecosystem. The broadening of visa-free access for fifty-nine countries, the free flow of cross-regional goods, capital, and personnel, and deepened economic and trade cooperation with ASEAN have generated a substantial number of interdisciplinary industrial positions requiring four key international competencies: understanding of international rules, bilingual cross-cultural communication skills, practical transnational industrial expertise, and Free Trade Port compliance management capabilities. As the northern gateway hub of the Free Trade Port, Haikou hosts core industrial clusters—including cross-regional logistics, international cultural and tourism services, digital transnational trade, bonded processing, and offshore modern service industries—resulting in steadily growing demand for vocational education graduates possessing internationally oriented, interdisciplinary competencies. Currently, talent development systems at vocational institutions across Haikou face structural challenges: ambiguous international orientation, insufficient "Language + Industry" interdisciplinary curricula, limited transnational practical training platforms, inadequate reserves of internationally competent dual-qualified instructors, weak collaborative education mechanisms, and a lack of dynamic alignment between talent cultivation and evolving globalized industrial demands. This study uses four representative vocational institutions in Haikou as research samples and integrates theoretical frameworks—including Learning Theory, Outcome-Based Education Theory, Industrial Cluster Theory, and International Human Capital Theory—with field survey data collected from enterprises within the Haikou Port Authority Group, Fuxingcheng International Digital Port, Binlang Valley International Cultural and Tourism Zone, and the Comprehensive Bonded Zone. It defines four-tiered core international competencies for industrial professionals under the Free Trade Port customs closure policy and systematically analyzes six major existing challenges and their underlying drivers. Through six key dimensions—redefining international talent development objectives, implementing modular curriculum reform based on the "Language + Industry + Compliance" framework, establishing a transnational real-world training system, nurturing dual-qualified international teaching faculty, creating diversified international industry–education collaboration mechanisms, and dynamically adjusting strategies driven by industry needs—the study proposes a systematic pathway for cultivating interdisciplinary industrial talent tailored to the customs closure environment. Complemented by four supporting safeguard mechanisms—policies, funding, international cooperation, and diversified evaluation systems—the study provides theoretical insights and actionable implementation strategies to support vocational institutions in deepening their international education reforms and nurturing interdisciplinary technical and skilled professionals suited to an open economy.

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1. Introduction

The implementation of customs clearance operations has reshaped Haikou's industrial landscape for internationalization, with cross-disciplinary international competencies becoming a core requirement for talent recruitment [1]. The island-wide customs clearance framework has established a differentiated cross-border regulatory system, enabling the broad development of various international business sectors—including second-line goods clearance, bonded transshipment, bonded fueling for vessels, cross-border e-commerce under the 1210 bonded warehousing model, ASEAN cross-border multimodal transport, international duty-free retail, and comprehensive hospitality services for foreign visitors. Leveraging its status as the provincial capital, Haikou hosts 70% of the province's international business entities; the city's 77 international container shipping routes sustain ASEAN economic and trade exchanges, and the influx of visa-free international travelers has generated substantial demand for versatile, interdisciplinary jobs. Following the implementation of these customs clearance measures, corporate hiring standards have undergone a fundamental shift: workers possessing only basic domestic industrial skills can no longer independently manage cross-border transactions. Instead, enterprises now require employees to demonstrate four integrated competencies—bilingual communication ability, familiarity with international trade and economic practices, adherence to Free Trade Port customs requirements, and hands-on experience in cross-border project execution. As a result, internationalization literacy has evolved from an optional advantage into an essential core competency for job roles, compelling the vocational education sector to fundamentally adapt its talent development approach.

Provincial-level policies have clearly outlined strategic priorities aimed at advancing the internationalization of vocational education and cultivating interdisciplinary talent. The "Five-Year Action Plan for the Construction of a Skill-based Free Trade Port (2026–2030)" sets a target that, by 2030, Hainan will have developed 20 internationally oriented vocational and specialized discipline clusters, implemented a composite talent development model integrating Chinese language proficiency, vocational skills, and languages commonly used in Southeast Asia, and encouraged vocational institutions to collaborate with educational institutions and leading cross-border enterprises in Southeast Asia to establish international industry-education bases [2]. The "Several Measures to Promote High-Quality Development of Modern Vocational Education in Support of the Construction of the Free Trade Port," issued by the Hainan Provincial Department of Education, explicitly designates the Haikou Vocational Education Cluster as a pilot site for innovations in international talent cultivation, and calls for establishing a talent development mechanism with active involvement from cross-border enterprises, customs authorities, and foreign-related industry associations, thereby addressing the shortage of interdisciplinary, internationally competent skilled personnel. Simultaneously, Haikou City is advancing the establishment of a city-wide international industry-education consortium and has identified the enhancement of international competitiveness among interdisciplinary professionals as a key annual performance indicator for vocational education.

The current training systems at Haikou's vocational institutions are insufficiently aligned with the demands of the globalized industrial workforce. This preliminary survey covered four core institutions: Hainan Vocational University (Vocational Undergraduate Program), Hainan Vocational and Technical College, Haikou Tourism Vocational College, and Hainan College of Economics and Trade Vocational Technology [3]. The survey data reveal the following findings: only 23.6% of specialized courses incorporate international or globally oriented teaching modules; there are no on-campus practical training scenarios

for cross-border customs clearance, ASEAN cross-border operations, or bilingual hospitality services in the international cultural and tourism sectors; fewer than 10% of faculty members possess dual-qualified credentials—combining academic expertise with industry experience; school-enterprise partnerships are primarily limited to domestic mainstream enterprises, while collaborative talent development initiatives with institutions in Southeast Asia or with Haikou-based enterprises engaged in international trade remain rare; and enterprises express only 56.8% satisfaction with graduates' ability to perform international business operations. Therefore, there is an urgent need to enhance the international orientation of the talent cultivation system.

2. Core Concepts and Theoretical Foundations

2.1. Core Concept Definition

2.1.1. Talent Internationalization Competence in Customs-Bonded Operations

This denotes a four-tier integrated competency framework essential for professionals operating within the specialized customs clearance and regulatory environment across Hainan Island: First, cross-cultural bilingual communication proficiency (English plus foundational languages of ASEAN countries); Second, mastery of international regulatory standards and Free Trade Port requirements—including international trade agreements, secondary customs oversight, zero-tariff implementation, and cross-border data governance; Third, expertise in cross-border industrial operations—encompassing international shipping agency services, bonded customs procedures, ASEAN market engagement, and international cultural tourism services; Fourth, capabilities in international innovation coordination—including cross-border project design, global client relationship stewardship, and transnational risk mitigation [4].

2.1.2. Haikou Multidisciplinary Industrial Talent Pool

This program targets technical and skilled professionals serving in sectors including international logistics, cultural and tourism services, digital international trade, bonded manufacturing, and offshore service industries—equipped with both foundational domestic industry competencies and essential global capabilities to independently manage end-to-end international business operations following customs formalities. The program features a three-tier talent development pathway: entry-level international operational practitioners, mid-level international operational managers, and senior international industry coordinators.

2.1.3. Vocational Education Talent Development Reform

This initiative implements a systematic enhancement of the talent development framework to meet the increasing demand for internationally competent industrial professionals, featuring six integrated components: alignment of training objectives with global standards; redesign of modular curriculum frameworks integrating language proficiency, industry-specific knowledge, and regulatory compliance; development of cross-regional practice-oriented training platforms; advancement of faculty capabilities through dual-qualification development in both academic and industrial domains; promotion of multi-stakeholder collaboration among government bodies, enterprises, educational institutions, and ASEAN partners; and establishment of an adaptive mechanism responsive to evolving industrial needs [2].

2.2. Theoretical Basis

Outcome-Based Education (OBE) theory centers on cultivating four-tiered, internationally oriented practical competencies required by foreign-related enterprises. This framework supports a backward-design approach to defining talent development goals, structuring curriculum content, implementing cross-border practical training programs, and establishing an integrated international assessment and evaluation system—ensuring that graduate competencies fully meet the employment requirements of Haikou's internationalized industrial sector. The Industry-Education Integration Collaborative Governance model emphasizes that developing versatile, internationalized

professionals necessitates coordinated engagement among six key stakeholders: the Haikou Municipal Education Bureau, Haikou Customs, foreign-related industry associations, leading cross-border enterprises in the comprehensive bonded zone, ASEAN partner institutions abroad, and vocational colleges. These stakeholders jointly participate in internationalized professional planning, cross-border curriculum development, co-creation of real-world practical training initiatives, and diversified talent assessment [5].

Industrial Cluster theory indicates that Haikou's cross-border and international industries are highly concentrated around Haikou Port, Fuxing City, the Comprehensive Bonded Zone, and the Jiangdong Cultural and Tourism Area. Vocational institutions should therefore develop integrated, interdisciplinary professional clusters aligned with international industrial value chains, move beyond discipline-specific program silos, and enable comprehensive sharing of bilingual curricula, cross-border virtual simulation training platforms, and international industry mentor resources. Dynamic Adaptive Human Capital theory underscores that evolving customs clearance and regulatory policies within Free Trade Ports—as well as shifting ASEAN cross-border industrial standards—require corresponding updates to international competency benchmarks. Consequently, vocational institutions must institutionalize a continuous mechanism for monitoring industry demand and adjusting talent development systems, regularly refresh internationalized teaching content, and achieve sustained enhancement of human capital value.

3. The Internationalization Transformation of Haikou's Industry under Customs-Bonded Operation Models and New Characteristics of the International Competence Requirements for Multidisciplinary Talent

3.1. The Customs-Driven Transformation: Four Key Characteristics of Haikou's Industrial Internationalization

The internationalization of regulatory frameworks has made compliance in free trade ports a prerequisite for all cross-border business activities. Key practices—including paperless customs clearance for second-tier operations, dynamic management of bonded account books, traceability of zero-tariff goods, cross-border data transfer filing, and supervision of bonded fuel for vessels—all align with internationally recognized trade standards as well as Hainan's distinctive regulatory framework. Every position involving international operations requires expertise in customs compliance and the interpretation of international trade rules; non-compliant practices may directly result in the suspension of a company's cross-border business activities, making robust compliance and internationalization capabilities a mandatory baseline requirement for such roles. The market landscape is increasingly shaped by regional economic integration, driving heightened demand for multilingual and cross-cultural communication skills. Following adjustments to customs clearance procedures, Haikou now operates 38 direct foreign trade routes to multiple countries in Southeast Asia; among the 59 countries with visa-free entry policies, travelers from ASEAN member states account for over 60% of the total. Cross-border e-commerce, international cultural and tourism services, and bonded shipping enterprises are extensively collaborating with partners across the region; however, general English proficiency alone is no longer sufficient to meet operational demands [6]. The gap for bilingual professionals—fluent in languages widely used in ASEAN markets alongside strong industry expertise—is continuing to widen.

The cross-border integration of industrial ecosystems has led to the emergence of diversified, cross-sector employment roles as the dominant workforce trend. Customs clearance processes have facilitated greater connectivity among shipping, bonded warehousing, cross-border e-commerce, international cultural and tourism, and duty-free retail industry chains. A single role now frequently integrates multiple functions—such as bilingual customer service, cross-border customs clearance, international marketing, and compliance and risk management—meaning that workers possessing only domestic, single-domain competencies but lacking international and interdisciplinary capabilities

are gradually being phased out by market forces. Operational models are undergoing digital globalization, with cross-border digital operations becoming foundational professional competencies. Tools such as the International Trade Single Window, cross-border AI marketing platforms, smart port customs clearance systems, and regional cross-border live-streaming platforms have become widely adopted. Employers now expect talent to be proficient in operating international digital trade and customs clearance systems and to apply digital tools throughout the entire cross-border business lifecycle; thus, practical digital globalization capabilities have become a fundamental entry requirement for employment [7].

3.2. Four-Tier International Core Competence Standard for Multidisciplinary Industrial Talent in Customs Clearance Scenarios

Bilingual and cross-cultural communication skills: Proficiency in Business English; competence in at least one widely used language of the ASEAN region; ability to independently manage international client reception, cross-border business negotiations, bilingual product presentations, and foundational communication concerning international matters; familiarity with the folk cultures and business etiquette of all ASEAN member states [8]. **International trade frameworks and Free Trade Port operational compliance:** Thorough understanding of international trade terms, international shipping conventions, Hainan's Phase Two Customs Supervision Policies, Zero-Tariff Management Measures, and the Negative List for Cross-Border Data Transfer; capacity to independently complete bonded goods declarations, conduct self-assessments of compliance for cross-border transactions, and proactively identify internationally linked operational risks.

Cross-border Industry Practical Competence: Acquisition of field-specific cross-border operational competencies; for logistics professionals, proficiency in end-to-end international shipping agency services and secondary customs clearance procedures; for cultural and tourism professionals, capability to deliver immersive bilingual service experiences for international visitors; for digital commerce professionals, proficiency in operating ASEAN-oriented cross-border e-commerce platforms and conducting practical cross-border live-streaming activities; for bonded processing professionals, competence in managing bonded warehousing of imported raw materials [7, 8]. **International Project Coordination and Innovation Capability (Core Competency for Higher Vocational and Undergraduate Programs):** Capacity to independently design ASEAN-focused cross-border industrial cooperation initiatives, formulate international operational plans, coordinate multinational teams, and collaborate effectively with overseas partner institutions; evidence of innovative approaches to international market engagement and cross-border business process enhancement.

3.3. The Need for Tiered Internationalization of Industrial Talent Development Is Driving Educational Institutions to Implement Tiered Reforms in Their Talent Cultivation Systems

Entry-Level International Operations Role (Suitable for Secondary Vocational and Higher Vocational Programs): Bonded Customs Documentation Assistant, ASEAN Cross-Border E-Commerce Operations Specialist, International Cultural and Tourism Bilingual Guide, Port International Logistics Coordinator — emphasizes bilingual communication proficiency, foundational international operational competencies, and essential regulatory compliance awareness. **Mid-Level International Operations Role (Suitable for Higher Vocational and Professional Undergraduate Programs):** Cross-Border Supply Chain Coordinator, ASEAN Cross-Border Marketing Specialist, Bonded Zone Regulatory Compliance Officer, International Exhibition Operations Manager — emphasizes integrated cross-border project execution, regulatory governance, and multilingual business engagement [4]. **Advanced International Industry Coordination Role (Exclusive to Professional Undergraduate Programs):** Cross-Border Industry Project Lead, Overseas Partnership Development Director, International Corporate Regulatory Advisor — emphasizes alignment with international regulatory frameworks, design of cross-border

project solutions, and cultivation of high-level capabilities for multinational collaboration within the ASEAN region.

4. The Current State of International Talent Development for Multidisciplinary Industrial Professionals in Haikou Vocational Colleges and the Six Major Core Reform Challenges

4.1. Current Status of Basic Talent Development Research

This survey covered four leading vocational colleges in Haikou; the educational program design for majors related to four key industry sectors—international logistics, inbound tourism, cross-border e-commerce, and bonded zone operations—exhibits three prominent characteristics:

The academic program structures are highly homogeneous, with limited development of distinctive international specialty clusters; individual institutions independently offer majors in logistics, tourism, and e-commerce, yet fail to coordinate bilingual curricula or share cross-border practical training resources [3]. As a result, no integrated, interdisciplinary international specialty cluster has been established around Haikou's regional cross-border industries or bonded zone operational needs; moreover, most institutions adopt standardized domestic academic models without cultivating specialized international focus areas aligned with mid-tier customs facilitation services or regional cross-border operational requirements.

Talent development lacks clear stratification, and no standardized framework exists for tiered cultivation of international competencies; for applied undergraduate programs, advanced international capabilities—such as cross-border project coordination and international regulatory compliance—are insufficiently emphasized; international-oriented curricula show substantial overlap with those in higher vocational programs; employers report that undergraduate graduates do not demonstrate a distinct competitive edge in global employment contexts; higher vocational programs overemphasize theoretical instruction oriented toward domestic industry practices, with bilingual cross-border practical training comprising less than 12% of total instructional hours; secondary vocational schools provide only general English instruction, without sector-specific bilingual teaching content aligned with industry applications.

International collaborative talent development remains limited in scope, and structured cross-sectoral cooperation projects are rare; institutional international engagement is largely restricted to short-term faculty and student exchange activities; few joint initiatives exist to co-develop comprehensive talent cultivation programs with the Haikou Bonded Zone, vocational institutions in neighboring countries, or internationally active enterprises; additionally, customs administration bodies and international trade professional associations have not been systematically engaged in curriculum revision or internationalized program design, resulting in a weak alignment between global industrial demands and pedagogical implementation.

4.2. Six Major Core Challenges in the International Development of Multidisciplinary Talent

Educational objective challenges: The educational positioning remains largely localized, with insufficient clarity in defining objectives for cultivating internationally oriented competencies. First, talent development programs do not systematically incorporate the four-tier international competency framework; instead, they largely replicate generic industrial talent development models used in inland regions, treating foreign language instruction as a standalone foundational course without explicitly articulating core goals for bilingual proficiency, cross-regional practical application, or Free Trade Port regulatory alignment. Second, the internationalization orientation across undergraduate and vocational ZhuanKe programs lacks differentiation: vocational undergraduate programs omit advanced internationalization requirements—such as coordinated participation in cross-regional projects—blurring distinctions between these programs and the applied training offered in vocational ZhuanKe pathways. Third, the job-oriented design remains underdeveloped: no tiered, role-specific internationalization

objectives have been established for key international-facing positions—such as bonded customs clearance or ASEAN-related cross-regional operations—resulting in broadly distributed but insufficiently focused international competencies among students.

Curriculum system challenges: A persistent misalignment exists between monolingual instruction and industry-specific learning, alongside an absence of modular 'Language + Industry + Regulatory Alignment' curriculum components. Foreign language courses emphasize general linguistic competence without embedding instruction within industry-relevant bilingual contexts; professional courses focus exclusively on domestic industrial processes and omit essential content on international trade frameworks, second-line regulatory procedures, and ASEAN-related cross-regional business practices—leading to fragmentation among language acquisition, sectoral application, and regulatory literacy. There is a pronounced deficit in specialized internationalization-focused courses; foundational offerings—such as 'Practical Cross-Regional Customs Declaration for Hainan's Second-Line Procedures,' 'Bilingual Operational Guide to ASEAN Cross-Regional Industry Practices,' 'Cross-Regional Business Regulatory Management for the Free Trade Port,' and 'International Maritime Conventions and Bonded Operations'—remain undeveloped [3]. All existing case studies draw exclusively from conventional mainland port settings and fail to reflect Hainan-specific cross-regional business contexts involving customs facilitation. Integration of internationalization into employment preparation, course architecture, competency-based assessments, and certification pathways remains inadequate; assessment benchmarks for internationally recognized professional certifications—including those in international freight forwarding, cross-regional customs affairs, and ASEAN-related cross-border e-commerce—have not been harmonized with current curricular standards; and the substantive content of cross-regional industrial skill competitions has not been systematically incorporated into regular coursework, weakening the linkage between international skill development and classroom instruction.

Practical training infrastructure challenges: Cross-regional, authentic training environments are underdeveloped, and international practical initiatives often lack depth and operational authenticity. On-campus facilities consist solely of standard domestic industrial laboratories, lacking high-fidelity international training platforms—such as a simulated second-line customs facilitation center, an ASEAN cross-regional digital operations simulation environment, a bilingual international cultural and tourism service demonstration space, or a digital management system for bonded inventory tracking. Off-campus training bases are predominantly affiliated with domestic small and medium-sized enterprises, with limited partnerships established with internationally engaged entities—including Haikou Port, the Comprehensive Bonded Zone, and Fuxing City. Student internships are typically brief observational visits, precluding meaningful engagement in actual ASEAN-related cross-regional or bonded customs facilitation tasks—reducing international practical training to symbolic rather than substantive experience. **Faculty resource challenges:** There is a critical shortage of faculty possessing both international professional experience and pedagogical expertise. Over 89% of discipline-specific instructors lack frontline experience in bonded cross-regional or ASEAN-linked international enterprises and demonstrate limited familiarity with integrated international trade platforms—such as the Single Window system—or paperless second-line declaration workflows. Expertise in overseas academic programming, ASEAN-related cross-regional business operations, or instruction in less commonly taught languages is scarce. Furthermore, no institutionalized mechanism currently supports regular on-campus instruction by international industry mentors from internationally engaged enterprises. Both foreign language and discipline-specific faculty exhibit limited integration of industrial practice and bilingual international pedagogy, resulting in a marked absence of composite educators qualified across 'Bilingual Proficiency + Sectoral Application + Regulatory Literacy.'

Collaborative talent development challenges: The multi-stakeholder international collaborative cultivation framework remains loosely coordinated. Key actors—including

the Haikou Municipal Education Bureau, Haikou Customs, internationally engaged industry associations, bonded zone enterprises, ASEAN-based institutions, and vocational colleges—have yet to establish a formal, recurring consultative platform for joint talent development planning. Enterprises primarily offer short-term internship placements but do not contribute substantively to international program design, cross-regional curriculum co-development, or shared practical training infrastructure. Engagement with ASEAN-based institutions is largely confined to brief faculty and student exchange activities, with minimal co-development of integrated curricula or jointly operated cross-regional internship sites. Very few regulatory specialists or compliance professionals from internationally engaged sectors participate regularly in on-campus teaching, constraining the effective convergence of diverse talent development resources. Dynamic adjustment challenges: An industry-responsive, iterative mechanism for refining the international talent development system is absent. Educational institutions lack systematic, periodic surveys to gauge evolving international talent requirements among bonded zone enterprises and ASEAN-focused businesses. Neither industry stakeholders nor regulatory authorities participate in feasibility analyses for academic program internationalization. No standardized process governs the introduction of internationally aligned curricula or the phased retirement of outdated domestic industry content. The current adjustment cycle for the talent development system spans three to five years—significantly lagging behind the pace of regulatory evolution and the rapid transformation of ASEAN-related cross-regional industrial ecosystems.

4.3. Analysis of the Deep-Rooted Causes of Difficulties

Lack of a municipal-level, integrated strategic framework for international vocational education: Haikou City has not yet established a coordinated development plan for internationally oriented talent clusters aligned with its diversified industrial structure; consequently, individual institutions implement curriculum and pedagogical adjustments in isolation, without unified policy direction or systematic support for cross-border industry collaboration. Institutional perspectives on educational development remain insufficiently forward-looking; school leadership has not fully addressed the implications of industrial globalization, including evolving regulatory frameworks; there is an overemphasis on domestic foundational competencies at the expense of cultivating internationally applicable, interdisciplinary capabilities, and institutions demonstrate limited proactive engagement in advancing globally oriented talent development initiatives. Additionally, dedicated financial resources for internationalization efforts are inadequate; municipal and institutional vocational education budgets prioritize basic teaching infrastructure, while allocations for cross-border simulation training platforms, multilingual instructional materials for ASEAN languages, and targeted professional development programs for faculty overseas assignments remain insufficient [5].

The absence of a comprehensive collaborative incentive mechanism means that foreign-invested enterprises, ASEAN-based educational and training institutions, and customs-related specialists participating in talent development initiatives do not receive tax incentives, financial support, or preferential recognition; as a result, these stakeholders lack sufficient motivation to contribute educational resources and expertise. Moreover, pathways for developing faculty with international professional competence are constrained: structured opportunities for faculty to engage in industry practice across national contexts or participate in specialized overseas capacity-building programs—particularly those linked to enterprises in pilot free trade zones or ASEAN-based partner institutions—are limited.

5. Systematic Reform Pathways for the Internationalization of Multidisciplinary Industrial Talent Development in Haikou Vocational Colleges under Customs Clearance Operation Contexts

Building upon Haikou's ASEAN cross-border industrial cluster layout and the distinctive customs clearance and secondary customs supervision framework, this initiative implements six strategic approaches—namely, layered alignment of internationalization goals, redesign of a three-module internationalized curriculum, strengthening of cross-border applied training, development of internationally competent dual-qualified instructors, six-party collaborative talent development across borders, and iterative optimization of the industrial ecosystem—to establish a comprehensive, integrated talent development system tailored to the customs clearance environment of the Free Trade Port [5].

5.1. Reform Pathway 1: Hierarchical Restructuring of International Talent Development Objectives to Precisely Align Them with Positions Across Three-Tiered Foreign-Related Industries

The Professional Undergraduate Program (with a Specialization in Integrated International Industrial Management) is designed to cultivate advanced international competencies for professionals seeking roles in mid-level international management, compliance consulting, or cross-border project leadership within bonded zones and leading cross-border enterprises. Its core objective is to ensure comprehensive fulfillment of four-tier international capability requirements, with a focus on developing advanced, interdisciplinary skills—including cross-border compliance coordination for Free Trade Ports, design of cross-border industrial project solutions, international business negotiations, and engagement with overseas partner organizations. Graduates will demonstrate proficiency in the full suite of secondary-level customs regulatory rules, international trade conventions applicable across multiple regions, regional business etiquette, and communication in additional languages.

The higher vocational diploma program features a tiered, targeted cultivation approach designed to develop two distinct categories of internationally oriented practical professionals. The ****Bonded Cross-Border Compliance Practical Track**** focuses on entry-level positions—including second-line paperless customs clearance, bonded ledger management, and international port scheduling—aiming to strengthen participants' competencies in bilingual communication, customs compliance, and fundamental cross-border operational skills. The ****Cross-Border Operations Track**** is geared toward roles such as cross-border e-commerce specialists, bilingual hospitality services for international cultural and tourism sectors, and cross-border multimodal transport professionals, enhancing participants' capabilities in Business English, regional languages as secondary languages, cross-border platform operations, and international tourist service delivery. The ****Secondary Vocational Schools Entry-Level Cross-Border Practical Training Program**** targets roles such as bonded warehouse assistants, basic cross-border e-commerce customer service representatives, and bilingual scenic area guides; it equips participants with foundational Business English skills, basic regional daily communication phrases, fundamental bonded logistics processes, and basic international etiquette, thereby meeting the demands of frontline international-facing operational positions. A comprehensive, enterprise-specific international-oriented targeted training initiative is implemented across all sectors [6]. In collaboration with Haikou Port, Fuxingcheng-based cross-border enterprises, leading companies within the bonded zone, and regional cross-border partner institutions, customized international talent training classes are established. These enterprises are fully engaged throughout the entire process—including the formulation of tiered internationalization objectives, the delivery of bilingual cross-border curricula, and the provision of real-world practical training guidance—ensuring that students are seamlessly prepared for international-facing roles upon graduation.

5.2. Reform Pathway II: Developing a Three-Stage Modular International Curriculum System Integrating Language + Industry + Compliance

Establish a comprehensive, three-in-one modular curriculum framework: the International General Foundation Module (compulsory for all majors) — covering Free

Trade Port regulatory frameworks for cross-border operations, Cross-Border Business English, foundational ASEAN language competencies, Cross-Cultural International Business Etiquette, and core principles of international trade and economic cooperation; the Free Trade Port Customs Clearance International Specialization Core Module (customizable by institution according to disciplinary focus) — featuring applied procedures for customs formalities at Hainan's external customs checkpoints, digital management of bonded inventory systems, bilingual operational practices for ASEAN markets, compliance governance and risk mitigation in Free Trade Port contexts, and international logistics and bonded energy supply chain management; and the Cross-Border Career Development Module — supporting preparation for industry-recognized credentials including the International "1+X" Customs Clearance Specialist qualification, Cross-Border E-Commerce Operations certification, and International Freight Forwarding credential, alongside experiential learning through authentic cross-border projects with enterprises engaged in global markets [2].

Advance systematic integration of international dimensions across occupational role training, curriculum design, competency-based assessments, and professional certification pathways; align instructional content and evaluation criteria with internationally recognized vocational standards for freight forwarding, intelligent customs administration, and ASEAN-focused cross-border e-commerce; embed practical assessment components from these certifications directly into course delivery; incorporate pedagogical elements derived from national-level industry skills competitions into routine bilingual applied instruction; partner with Haikou Customs authorities, multinational enterprises, and ASEAN sector specialists to co-develop bilingual, institution-specific teaching resources grounded in real-world customs clearance requirements, superseding conventional domestic industrial case studies; build a regional digital platform for internationalized teaching resources to support the development of adaptable professionals in Haikou; produce virtual simulation micro-lessons on external customs checkpoint procedures, authentic bilingual video tutorials for ASEAN market operations, and online modules on customs compliance frameworks; and integrate bilingual instructional materials from ASEAN academic and training institutions to mitigate constraints in physical cross-border training infrastructure.

5.3. Reform Pathway III: Establishing a Cross-Border Real-World Practical Training System That Integrates Virtual and Real-World Elements, Replicating Full-Scale, Authentic Business Scenarios Involving Customs Clearance and Bonded Operations

The university-wide international practical training bases underwent standardized upgrading and renovation; each institution adapted its specialized training facilities in line with its respective international professional cluster positioning. These institutions uniformly added a Customs Clearance Simulation Hall, an ASEAN Cross-Border Digital Operations Simulation Center, a Bilingual International Cultural and Tourism Reception Exhibition Hall, and a Digital Training Lab for Bonded Account Management. These facilities were fully equipped with an International Trade Single Window Simulation System, an ASEAN Cross-Border E-Commerce Platform, and bilingual multimedia reception equipment, replicating at full scale the actual cross-border business operation scenarios encountered by foreign-related enterprises following customs clearance procedures. A municipal-level six-party collaborative public training platform was jointly established under the leadership of the Haikou Municipal Education Bureau, in collaboration with Haikou Customs, the Bonded Zone Management Committee, leading foreign-related enterprises, ASEAN partner institutions abroad, and industry associations, to create a municipal-level international industrial training public base. A two-way training mechanism — namely "foreign-related enterprises stationed on campus, teachers conducting internships at enterprises, and ASEAN faculty and students participating in exchange training" — was implemented. Students were organized to undertake project-based on-the-job internships lasting no less than six months at bonded zones, international ports, and cross-border digital enterprises, with comprehensive support provided

throughout the process for actual customs declaration and ASEAN cross-border operational activities.

An integrated cross-border practical training ecosystem encompassing "Bonded Zones + Ports + Digital Parks + ASEAN Overseas Training Bases" was established [7]. Leveraging the Haikou Comprehensive Bonded Zone, Haikou Port, and Fuxingcheng International Digital Port, regular on-campus cross-border practical training stations were set up; collaborations were formed with vocational institutions in Thailand and Malaysia to establish overseas cross-border training bases; and annually, outstanding faculty and students were selected to participate in hands-on business operations at ASEAN enterprises, thereby accumulating valuable international frontline practical experience.

5.4. Reform Pathway IV: Tiered Development – Building a Composite International Dual-Qualified Teaching Team Integrating Bilingualism + Industry + Compliance

Implement a structured faculty development system featuring cross-border enterprise engagement and international training opportunities; require all industry-focused faculty to complete no fewer than 60 days annually of hands-on practice at designated industrial zones or leading multinational organizations, actively participating in real-world cross-border operational initiatives—including customs clearance procedures and ASEAN-related business activities; allocate annual quotas to support selected faculty in undertaking 3–6 month professional development programs at partner institutions or enterprises in ASEAN countries; regularly organize specialized internationalization training led by compliance professionals from relevant customs authorities, operational specialists from ASEAN-based multinational enterprises, and foreign instructors proficient in less commonly taught languages, delivering bilingual instruction grounded in cross-border practice; broaden recruitment pathways for international industry mentors; simplify administrative procedures for bilingual technical experts, customs compliance professionals, and industry practitioners from enterprises operating in designated industrial zones to serve as university instructors; create dedicated academic positions for International Industry Professors and Bilingual Part-Time Lecturers; and introduce a collaborative teaching model integrating on-campus subject-matter faculty, bilingual language instructors, and international industry practitioners—where language instructors deliver bilingual instruction, industry practitioners lead applied cross-border training, and subject-matter faculty coordinate curriculum design aligned with industry needs—thereby cultivating a multidisciplinary, globally engaged teaching team.

5.5. Reform Pathway V: Establishing a Long-Term International Collaborative Talent Development Mechanism Linking the Education Bureau – Customs – Industry Association – Enterprises – Asean Institutions

The Haikou Municipal Comprehensive International Industrial Talent Development Guidance Committee has been established, comprising representatives from the Haikou Municipal Education Bureau, Haikou Customs, foreign-related industrial associations, the Management Committee of the Comprehensive Bonded Zone, partner institutions in ASEAN countries, academic program directors from various vocational colleges in Haikou, and HR directors from leading foreign-related enterprises. This committee is responsible for coordinating strategic planning, resource allocation, and cross-border university-enterprise collaboration for international talent development across the region. A regular six-party quarterly consultation mechanism is in place, facilitating specialized meetings on international talent development [6]. During these meetings, the Bonded Zone and foreign-related enterprises provide feedback on competency gaps; Customs updates its regulatory compliance training content; ASEAN partner institutions coordinate exchange programs and joint curriculum development; educational institutions adjust their international talent development programs and curriculum frameworks accordingly; and the government allocates dedicated funding and supportive policies to advance these initiatives.

Deepen cross-border joint talent development cooperation with vocational institutions in Thailand, Malaysia, and other ASEAN partner countries by implementing "2+1" and "3+0" joint training models; jointly developing bilingual international shared curricula, student exchange programs, and overseas practical training bases; collaboratively delivering "Chinese Language + Industrial Skills" training programs; building the "Study in Hainan" ASEAN vocational education brand; and facilitating two-way faculty and student exchange and study opportunities.

5.6. Reform Pathway VI: Establishing an International Talent Development Dynamic Iteration Mechanism Driven by Cross-Border Industries and Featuring Rapid Response Capabilities

A talent demand monitoring system for cross-border industrial activities has been established; the Steering Committee conducts quarterly specialized assessments of international competency requirements, engaging bonded area authorities, enterprises operating across ASEAN markets, and customs regulatory bodies, and publishes the *"White Paper on International Competency Requirements for Multidisciplinary Industrial Talent in Haikou Bonded Area Operations"*. This white paper delivers a precise analysis of newly emerging occupational roles and evolving international competency standards arising from ASEAN-oriented industrial collaboration and the updated regulatory framework governing customs operations. The standardized international competency training system has undergone optimization through an enhanced implementation process: this includes introducing specialized international competency pathways, phasing out obsolete domestic industrial training courses, and refining standardization protocols for bilingual training modules. Specifically, international competency course modules are revised annually based on the quarterly Industrial Demand White Papers; for traditional domestic industrial sectors exhibiting three consecutive years of declining enrollment or reduced demand from internationally engaged industries, enrollment quotas are progressively adjusted downward; and for emerging ASEAN-oriented cross-sectoral and intelligent customs management competency pathways, pilot classes are initiated within the current fiscal year, with enrollment capacity scaled up in the subsequent fiscal year.

6. Four Major Supporting Guarantee Systems for the Reform of International Talent Development Programs for Multidisciplinary Industrial Professionals

6.1. Policy and Institutional Support Framework

Haikou City has issued the "Detailed Implementation Guidelines for International Talent Development Programs for Multidisciplinary Industrial Professionals at Haikou Vocational Colleges and Schools in Customs-Related Contexts," establishing measures such as city-wide coordinated planning of international specialized clusters, incentive mechanisms for collaborative talent development among six stakeholder groups, cultivation of internationally competent dual-qualified instructors, and operational protocols for cooperation with ASEAN institutions; it has also updated management provisions for teacher practical training in enterprises abroad and overseas academic programs, as well as standards for dynamically adjusting talent development plans, thereby strengthening institutional foundations for vocational education internationalization; additionally, tax incentives, financial subsidies, and preferential evaluation policies have been introduced to encourage participation by foreign-invested enterprises, ASEAN-based organizations, and customs professionals in international teaching activities, effectively enhancing stakeholder engagement and initiative.

6.2. International Special Fund Support System

A special municipal fiscal fund will be established to support the international development of interdisciplinary industrial talent, covering renovation of overseas-integrated practical training bases, development of bilingual teaching materials for ASEAN cooperation, subsidies for faculty participation in international professional development programs, remuneration for international industry experts, support for

student exchange programs with ASEAN countries, and construction of a municipal-level international teaching resource platform; provincial-level special funds for digital vocational education and talent development in the Free Trade Port will prioritize undergraduate vocational programs focused on interdisciplinary international industrial management, especially those undergoing program enhancement.

6.3. Multidimensional International Collaboration Evaluation and Assurance System

Establish a diversified evaluation system for the international development of interdisciplinary talent; involve compliance specialists from Haikou Customs, operational managers from bonded enterprises engaged in global business, teaching experts from overseas institutions in ASEAN countries, and international trade industry associations in assessing the quality of institutional industry-aligned programs; designate graduates' bilingual cross-border operational readiness, employment satisfaction among multinational enterprises headquartered in ASEAN countries, effectiveness of internationally oriented curriculum delivery, and participation rates in transnational practical training as core indicators for refining talent development strategies; and provide institutions demonstrating exceptional progress in internationalization initiatives with enhanced annual enrollment quotas and priority consideration for provincial-level vocational education excellence recognition [6].

6.4. International Cooperation Organization Management and Support System

Each vocational college shall establish a dedicated Internationalization Work Group, with designated personnel responsible for coordinating with Haikou Customs, the Bonded Zone, and overseas partner institutions within the ASEAN network, to advance internationalized professional cluster development, conduct quarterly industry demand surveys, upgrade bilingual modular curricula, manage the operation and maintenance of cross-border practical training platforms, and oversee the administration of ASEAN exchange students. At the municipal level, a Municipal International Education Coordination Group shall be formed to conduct semesterly reviews of institutional progress in internationalization initiatives and to align talent development frameworks with the evolving industrial requirements of the bonded zone [4].

7. Research Findings and Future Directions

The full-island customs clearance operation of the Hainan Free Trade Port has fostered a new international industrial ecosystem characterized by second-tier digital customs supervision and the deep integration of ASEAN cross-border economic and trade activities. This environment has given rise to a large number of interdisciplinary, international-facing positions across sectors such as Haikou's bonded logistics, international cultural and tourism services, digital cross-border trade, and offshore service industries. As a result, the demand for industrial talent has shifted from requiring solely domestically skilled workers to seeking tiered industrial professionals who possess four-dimensional, internationally oriented competencies: bilingual and cross-cultural communication skills, Free Trade Port compliance expertise, cross-border operational capabilities, and international project coordination skills.

The current talent development system for interdisciplinary industrial professionals in vocational institutions across Haikou faces six major core challenges: the absence of clearly defined, tiered internationalization cultivation objectives; the fragmentation of language and industry compliance curricula; the scarcity of cross-border, real-world practical training platforms; the shortage of internationally competent dual-qualified faculty; the lack of a robust six-party, diversified international collaborative education mechanism; and the absence of a dynamic, industry-driven talent development iteration mechanism. The root causes of these challenges include the lack of a comprehensive municipal-level strategic plan for internationalized vocational education, outdated internationalization implementation approaches among institutions, insufficient dedicated funding for internationalization initiatives, the absence of incentive policies fostering collaboration between schools and enterprises, and limited channels for

cultivating cross-border faculty. This paper proposes a systematic pathway comprising six key dimensions—"tiered internationalization goal restructuring, three-module internationalization curriculum redesign, enhancement of cross-border real-world practical training, cultivation of interdisciplinary international dual-qualified teachers, six-party international collaborative education, and industry-driven dynamic iterative adjustment"—supported by four major safeguard systems: enabling policies, targeted funding, diversified internationalization evaluation frameworks, and international cooperation organizations. This approach can systematically address the core mismatch between the internationalization capacity of vocational institutions in Haikou and the evolving needs of domestic and foreign-related industries. Aligned with the Hainan Free Trade Port's role as a northern gateway and its positioning as an ASEAN cross-border industrial hub, this framework is highly practical and can serve as a standardized reference for talent development initiatives across all vocational institutions in Hainan Province.

This survey primarily targeted vocational schools located in the main urban area of Haikou; however, the investigation into the internationalization of industrial-oriented vocational programs at county-level secondary vocational schools was insufficiently covered. The talent development pathway proposed in this study has not yet undergone comprehensive, full-semester pilot implementation and follow-up tracking at educational institutions; future work could involve refining bilingual curriculum design and detailed guidelines for supporting overseas practical training initiatives in conjunction with institutional ASEAN cross-border joint cultivation pilot programs. Additionally, the cross-border industrial teaching modules covering multiple ASEAN languages could be further refined and enhanced.

Short-term implementation (within 1 year): Haikou City will coordinate all local vocational institutions to establish a differentiated spatial layout for interdisciplinary industrial internationalization specialty clusters; complete the renovation of the Second-Level Customs Clearance and ASEAN Cross-Border Digital Operations Simulation Training Laboratory; and fully integrate a modular internationalization curriculum framework encompassing "Language + Industry + Compliance." Mid-term development (3–5 years): Establish a unified, citywide bilingual teaching resource sharing platform for interdisciplinary international talent development in Haikou; refine a closed-loop mechanism for quarterly monitoring of international industrial demand and responsive talent cultivation adjustments; and build a distinctive vocational education brand for ASEAN cross-border interdisciplinary industrial talent development within the Hainan Free Trade Port. Long-term scaling (beyond 5 years): Deepen cross-border joint talent development partnerships with vocational institutions across multiple ASEAN countries; jointly establish a regional ASEAN cross-border industrial vocational education alliance; and develop a replicable Haikou-based talent development model for internationalized interdisciplinary industrial talent at vocational institutions, which can be adapted and implemented across all national pilot free trade zones.

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