

Research on the Core Competitiveness of Higher Education in Hainan from the Perspective of the Diamond Model

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Abstract

As the construction of the Hainan Free Trade Port enters a critical period of preparation for island-wide customs closure operations, the core status of higher education as an engine for talent and a pillar for intellectual support has become increasingly prominent. However, current higher education in Hainan faces structural challenges, including insufficient accumulation of high-level elements and a misalignment between industrial demand and educational supply. This paper introduces Michael Porter's "Diamond Model" as a theoretical framework. Combining this with the dual attributes of higher education, it systematically deconstructs the four core elements affecting the core competitiveness of Hainan's higher education: factor conditions, demand conditions, related and supporting industries, and firm strategy, structure, and rivalry, as well as their interaction mechanisms. The study finds that Hainan's higher education suffers from systemic shortcomings, such as a scarcity of high-level leading talents, a disconnection between discipline layout and key industrial needs, high barriers to industry-university-research collaboration, and rigid internal governance mechanisms. Based on these findings, the paper proposes abandoning the traditional path of scale expansion. Instead, it suggests forming a "Tropical Science and Sustainable Development" collaborative innovation alliance to aggregate advanced factors, implementing a "Free Trade Port Distinguished Scholar Program" to optimize faculty configuration, and establishing a dynamic discipline-industry linkage mechanism based on big data. The aim is to build a higher education competitiveness system featuring a "Tropical, Marine, and Free Trade Port" trinity through differentiation strategies and institutional opening-up, thereby providing solid theoretical support and decision-making references for the high-quality development of the Free Trade Port.

Keywords

Hainan Free Trade Port, core competitiveness, higher education, Diamond Model

1. Introduction

Against the backdrop of increasingly intense global competition in higher education and the deepening of national major strategies, the core competitiveness of regional higher education has become a key indicator for measuring a region's comprehensive development capabilities. The Report to the 20th National Congress of the Communist Party of China explicitly states that "education, science and technology, and human

resources are the foundational and strategic pillars for building a modern socialist country in all respects”, emphasizing the need to “accelerate the construction of world-class universities and advantageous disciplines with Chinese characteristics”. As the only Free Trade Port in China under island-wide construction, Hainan shoulders the historical mission of creating a new highland of reform and opening up in the new era and building an important gateway opening to the Pacific and Indian Oceans. This places unprecedentedly high demands on higher education.

However, realistic challenges cannot be ignored: Hainan’s higher education overall remains a national “lowland”, suffering from systemic shortcomings such as a scarcity of high-level talent and an unbalanced disciplinary structure. This paper introduces Michael Porter’s “Diamond Model” as a theoretical analysis framework. By adapting its classic four elements to the educational context, this study systematically deconstructs the key factors and interaction mechanisms affecting the core competitiveness of Hainan’s higher education. The goal is to break through the limitations of “discussing education solely within education” and provide theoretical support and decision-making references for accelerating the construction of a strong educational province and supporting the high-quality development of the Free Trade Port.

2. The Main Connotation of Core Competitiveness in Higher Education

The Diamond Model, also known as the Diamond Theory or the Theory of National Competitive Advantage, was proposed by American strategic management scholar Michael Porter in 1990. It is a management theory used to analyze how a country or region forms an overall advantage in a certain industry to achieve strong international competitiveness. The model consists of four basic elements—Factor Conditions; Demand Conditions; Related and Supporting Industries; and Firm Strategy, Structure, and Rivalry—along with two auxiliary variables: Government and Chance. These elements interact to form a dynamic diamond system where the six factors influence each other, jointly constituting a dynamic ecosystem [1]. The model emphasizes that a region’s competitive advantage is not derived from a single resource endowment but is determined by the dynamic interaction among these elements.

The application of the Diamond Model has continuously expanded and improved, extending from analyzing national industrial competitiveness to regional economics, education, and other fields, demonstrating strong theoretical adaptability and explanatory power. According to the logic of the Diamond Model, and combined with the organizational characteristics of higher education as a knowledge-intensive, non-profit sector with public good attributes, the elements are redefined as follows:

Factor Conditions: These are no longer limited to natural resources or ordinary labor but focus on “advanced factors” necessary for high-quality education and research. This mainly includes high-level faculty with international vision and innovation capabilities, stable financial and research funding inputs, advanced teaching and research infrastructure, and a systematic knowledge accumulation system.

Demand Conditions: These are redefined as the structural and prospective demands placed on higher education by regional economic and social development. This includes not only the actual demand for composite, applied, and international talents by current leading industries but also the anticipated demand for professionals in emerging fields such as foreign-related rule of law, digital trade, cross-border finance, and public safety under the backdrop of the Free Trade Port’s customs closure operation. High-quality and forward-looking local demand can force universities to optimize professional layouts and reform training models, forming a benign interaction between educational supply and industrial evolution.

Related and Supporting Industries: In the context of higher education, this is manifested as the collaborative ecosystem between universities and local industrial clusters, research institutes, leading enterprises, and international partners. The core lies in whether a mechanized and project-based system for the integration of industry and education has been established, whether scientific research results can be effectively converted into productive forces, and whether universities are embedded in the regional innovation network.

Strategy, Structure, and Rivalry: This translates into the university’s own governance capability, strategic positioning, and development momentum. It includes the awareness and ability to actively serve national strategies; whether an internal talent evaluation and incentive mechanism oriented toward innovation value is established; whether the institution dares to introduce international standards and participate in global competition in an open environment; and whether a differentiated and specialized path has been formed.

Finally, the two auxiliary variables—Government and Chance—are equally critical. The government should not directly intervene in school operations but should shape the quality and interaction of the four core elements through institutional supply, policy design, and resource allocation, shifting its role from “managerial” to “service-oriented + strategic investor”. “Chance” manifests as external shifts such as major national strategies, technological changes, or regional cooperation agreements, offering historical windows for higher education in less developed regions to “overtake on the bend”.

3. Analysis of the Current Status of Hainan Higher Education Competitiveness Based on the Diamond Model

Examining Hainan Province’s higher education through the lens of Porter’s “Diamond Model”, it is evident that systemic shortcomings exist across the four dimensions—factor conditions, demand conditions, related and supporting industries, and strategic structure—which constrain the improvement of its core competitiveness.

3.1 Factor Conditions Dimension: Scarcity of High-Level Resources

Faculty are the subjects of knowledge creation and dissemination, directly determining the quality of higher education “products” (graduates and research outcomes), while educational resources form the foundation supporting this “production” process. The analysis reveals structural contradictions in both the “human” and “material” aspects.

In the “human” aspect, there is a shortage of high-level leading talents. Although parks like Yazhou Bay Science and Technology City have achieved results in introducing academicians and postdoctoral fellows, looking at universities province-wide, there is still a lack of leading figures and organized scientific research innovation teams. Teachers often operate in a state of “individual endeavors”, restricting the overall elevation of research levels. Compared with top domestic universities, Hainan universities have a significant gap in the total number of national-level talents such as “Changjiang Scholars” and “National Distinguished Young Scholars” [2]. Furthermore, the proportion of teachers with backgrounds from top overseas universities or long-term overseas research experience is not high, and the capacity for full-English instruction is relatively weak, making the internationalization level of the faculty insufficient to support the actual needs of the Free Trade Port’s internationalized education.

In the “material” aspect, the funding mechanism exhibits volatility. Although the average education funding per student in Hainan is on an upward trend, the growth rate fluctuates significantly. For instance, negative growth rates in education funding were recorded in 2021 and 2022. This instability in investment poses a potential constraint on the sustainable development of university teaching and research.

3.2 Demand Conditions Dimension: Misalignment between Talent Supply and Industrial Demand

High-quality local demand is the driving force leading universities to optimize talent cultivation models. However, facing the urgent needs of the Hainan Free Trade Port construction, higher education shows significant lag and misalignment in responding to “demand conditions”.

First, the discipline and professional layout is unbalanced relative to the industrial structure. Although Hainan has established an industrial system led by tourism, modern service industries, high-tech industries, and tropical characteristic high-efficiency agriculture, university discipline construction lags behind. The number of disciplines rated C- or above accounts for a very low proportion nationally, and A-class top disciplines are scarce. This results in talent output that struggles to precisely match the high-end demands of industrial upgrading.

Second, talent cultivation models are disconnected from real corporate needs. Except for a few cases of deep industry-education integration, such as the “Special Glass Class” at Hainan University, school-enterprise cooperation in most universities remains at a superficial level. Due to the lack of mature mechanisms for interdisciplinary integration and cross-disciplinary organizations, universities find it difficult to effectively integrate multi-disciplinary resources to solve complex practical industrial problems. The practical teaching system is not systematically embedded in the industrial chain, leading to insufficient practical innovation

capabilities among students. This not only fails to meet the Free Trade Port's demand for high-quality, composite, and international talents but also creates a structural contradiction where "high-quality students flow out" while "local talents are difficult to use".

3.3 Related and Supporting Industries Dimension: Obstructed Collaboration and Inefficient Transformation

Strong scientific research capabilities and smooth Industry-University-Research (IUR) collaboration mechanisms are the core drivers of a regional innovation ecosystem. Currently, Hainan higher education faces a dilemma where the "twin engines" of transmission are blocked.

On one hand, there are "barriers" to collaborative innovation. Constrained by the traditional departmental unit system and disciplinary culture, the development of cross-disciplinary organizations is slow, and multi-subject collaboration and resource integration are difficult [3]. This prevents the formation of efficient R&D communities within universities and between universities and enterprises. These mechanistic obstacles prevent the efficient flow of capital, talent, and knowledge factors.

On the other hand, a "Valley of Death" exists in the transformation of scientific and technological achievements. Hainan universities have a gap of several orders of magnitude in the number of patent applications and authorizations compared to developed regions (e.g., in 2022, Hainan had only 13,000 patents, while Guangdong exceeded 870,000). This reflects weak research output capabilities and low conversion efficiency. A large number of results stop at the laboratory stage and fail to translate into realistic productive forces supporting advantageous industries like tropical agriculture and deep-sea technology. Despite possessing national strategic resources such as the Nanfan Seed Industry and deep-sea exploration, research advantages in related fields have not yet been fully transformed into globally influential academic leadership and industrial support.

3.4 Strategy, Structure, and Rivalry Dimension: Rigid Governance and Insufficient Strategic Service Capacity

This element points to the governance structure and strategic positioning of universities. In the context of the Free Trade Port, Hainan universities demonstrate certain mechanistic inertia in internal governance and external competitive strategies.

First, internal governance mechanism reform is lagging. Traditional discipline organization management models still dominate, and the operating mechanisms for cross-disciplinary organizations are unclear. Lacking independent evaluation systems and resource allocation rights, cross-disciplinary research often becomes an appendage of traditional departments, failing to stimulate faculty innovation vitality. This rigidity in internal management weakens universities' agility in responding to external environmental changes.

Second, the capacity to serve national strategies needs improvement. In mainstream world university rankings, Hainan universities generally rank low, indicating weak international competitiveness. Facing the construction tasks of national-level platforms such as the "Nanfan Silicon Valley" and Wenchang International Aerospace City, local universities have not yet fully played the role of an intellectual engine. Their contribution to producing landmark research results and supplying high-end talent is insufficient. Meanwhile, social service functions appear superficial; in key issues such as tropical rainforest protection and marine ecological restoration, a systematic brand service with profound influence has not yet been formed, limiting the construction of unique advantages in regional competition.

4. Improvement Pathways: A Systemic Plan for Generating Core Competitiveness

4.1 Aggregating Advanced Factors

Hainan higher education should abandon the traditional path of "large and all-encompassing" scale expansion and instead achieve the agglomeration of advanced production factors through strategic alliances. According to the Diamond Model, the clustering effect of related industries is key to competitive advantage. Drawing on the successful experience of Australia's "Group of Eight" (Go8), university strategic alliances are

essentially development communities that share resources and risks through regulatory constraints around common strategic goals [4].

Core competitiveness should be rooted in the unique “Tropical Gene” and “Free Trade Port Mission”. Leveraging locational advantages and centering on the Free Trade Port’s “3+1” leading industrial system, Hainan should build a characteristic discipline group with irreplaceability. Taking the University of Hawaii at Manoa as an example, the school leveraged its location in the center of the Pacific to build marine science, tropical agriculture, and tourism management into top global disciplines, with its “Hawaii and Asia-Pacific Studies” group embodying its unique identity. Hainan should mirror this model by promoting full-chain collaboration of “basic research–applied development–industrial incubation” among Hainan University, the Chinese Academy of Tropical Agricultural Sciences, and Yazhou Bay Science and Technology City. A “Tropical Science and Sustainable Development Collaborative Innovation Alliance” should be established to coordinate resources and form an integrated development pattern of industry, academia, research, and application.

4.2 Optimizing Faculty Configuration

Advanced human capital is the decisive production factor in the Diamond Model, and a high-level faculty is the core support for the high-quality development of higher education. The experience of “pocket-sized” world-famous universities like Princeton University and Caltech shows that core competitiveness relies on first-class faculty and a “small but refined” educational philosophy [5].

As a Free Trade Port with Chinese characteristics, Hainan urgently needs to build a faculty allocation mechanism with global competitiveness through institutional opening-up. Regarding precise and international talent introduction, while Hainan currently implements a 30-day visa-free policy for personnel from certain countries, it should further optimize support policies for “migratory bird talents”, extend the visa-free stay period for foreign high-level talents, and strengthen policy fulfillment mechanisms. It is recommended to establish a “Free Trade Port Distinguished Scholar Program”. Benchmarking against international standards, this program should provide competitive compensation packages. Simultaneously, drawing on the mature “tenure-track” systems of universities like Shanghai Jiao Tong University, it should provide top scholars with long-term stable career development expectations and a relaxed academic environment to solve the problem of “difficulty in attracting and retaining talent”.

4.3 Reinforcing Dynamic Adjustment

Demand conditions are the driving force of industrial development. In the stage of high-quality development, higher education must shift from simply “adapting to demand” to “leading demand”, making the cultivation of high-quality applied innovative talents its core mission. This requires establishing dynamic discipline adjustment mechanisms and a deep industry-education integration system.

Deep integration of industry and education is the key path to resolving the structural mismatch between talent cultivation and industrial demand. Hainan universities should establish the six integration concepts of “ideological education, industry-education, science-education, innovation-education, general-specialized, and interdisciplinary” to cultivate future engineers and managers with cross-border integration capabilities [6], regarding training models, “order-based classes” and “dual-mentor systems” should be widely promoted. Taking the Hainan Bielefeld University of Applied Sciences as a benchmark, the “practice-embedded” talent training model should be deepened. As the first independent educational project by an overseas university of science and technology in mainland China, it originates from the German University of Applied Sciences (Fachhochschule) system, emphasizing the close combination of theoretical teaching and corporate practice. Universities should be encouraged to jointly develop “micro-degree” course modules with leading enterprises, focusing on emerging fields such as artificial intelligence, cross-border e-commerce, and green finance, providing short-cycle, highly focused, and certifiable skill training to achieve a rapid response to market demand.

Regarding demand orientation and forward-looking forecasting, there is an urgent need to build a scientific and dynamic talent supply-demand docking mechanism. It is suggested that the Hainan Provincial Talent Work Leading Group lead the integration of data resources from the Department of Human Resources and Social Security, the Department of Industry and Information Technology, and the Department of Education to build

a “Hainan Province Industry-Education Integration Information Service Platform”. This platform should regularly publish the “Blue Book on Talent Supply and Demand and Skill Trends in Key Industries of Hainan Province”, precisely identifying scarce occupations and core skills for the next 3–5 years. This report should serve as an important basis for universities to adjust professional structures, optimize enrollment plans, and revise training schemes, promoting a transformation in higher education from “supply-driven” to “demand-led”, truly realizing “customized education based on demand”.

5. Conclusion

The core competitiveness of higher education is not a linear superposition of single elements but a dynamic system where resource endowments, market demands, industrial ecology, and strategic governance are coupled. To achieve the leap from a “lowland” to a “highland”, Hainan higher education cannot simply copy the “large and all-encompassing” comprehensive development model of developed regions. Instead, it must base itself on its unique resource endowments and strategic mission, following a path of “specialized and refined” connotative development.

On one hand, Hainan universities need to strengthen the “systemic view” and break down the closed barriers of internal educational circulation. By opening up the flow channels of “talent-discipline-industry”, and utilizing the institutional dividends of the Free Trade Port (Chance) and the strategic guidance of the government (Auxiliary Factor), Hainan can activate the benign interaction of the four core elements—factor conditions, demand conditions, supporting industries, and strategic structure—to build a vibrant regional higher education innovation ecosystem.

On the other hand, a “differentiation” strategy must be adhered to, building core competitiveness by reshaping comparative advantages. Hainan should closely adhere to the triple genes of “Tropical, Marine, and Free Trade Port”, focusing on urgent national strategic needs and regional industrial pain points to form irreplaceable disciplinary peaks in fields such as deep-sea technology, tropical agriculture, and cross-border services. Only by deeply embedding the development logic of higher education into the construction logic of the Free Trade Port can unique locational advantages be transformed into significant development victories, ultimately building a high-level higher education system compatible with the Free Trade Port with Chinese characteristics.

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Conflicts of Interest

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