

# Research on the DTF Educational and Teaching Model for Cultivating Compound Business Administration Talents: A Perspective of Digitalization and Greenization Synergy

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**Abstract:** In response to China's dual carbon and digitalization strategies, this study proposes the DTF (Dual-aspects synergy, Three-dimensional linkage, Four-chain integration) educational and teaching model to cultivate interdisciplinary business administration talents in science and engineering universities. Grounded in CDIO and OBE frameworks, the DTF model integrates digital and green competencies across curriculum design, practical training, and intelligent evaluation. It restructures the knowledge framework into a "triple helix" system, builds a layered "virtual-real" practicum platform, and establishes a data-driven quality control mechanism. Through "three-dimensional linkage" and "four-chain integration", the model forms a sustainable co-education ecosystem. Implementation results demonstrate improvements in curriculum relevance, student innovation capacity, graduate employability, and institutional reform outcomes. The model has been widely adopted across regional institutions, providing a replicable pathway for advancing interdisciplinary business education in the context of industrial transformation and new liberal arts construction.

**Keywords:** Interdisciplinary talent; Digital-green synergy; Business education; DTF model

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## 1. Introduction

In China, institutions offering business administration programs are primarily housed within comprehensive universities, science-and-engineering-focused universities, and specialized finance and economics universities. Among these, science and engineering universities constitute approximately 30% of the total — a significant presence that provides broad institutional coverage and considerable influence on industrial development. Given the current industrial revolution and technological advancements, these universities are essential in producing multidisciplinary management experts with combined knowledge of engineering, the humanities, and the social sciences.

To support industrial upgrading and talent reform, China has issued multiple policies since 2020, including the action plan in Higher Education. These call for universities to take a leading role in advancing research on green technologies and in cultivating talent for low-carbon management <sup>[1]</sup>. In addition, China government emphasized support for enterprises to modernize traditional industries through digital and green technological innovations, thereby promoting high-end, intelligent, and sustainable manufacturing <sup>[2]</sup>. It further stressed the urgency of coordinating advances in the digitalization and greening of knowledge, enhancing the ability to tackle complex management and engineering challenges arising from industrial transformation, and cultivating well-rounded professionals who are “interdisciplinary and well-versed in both liberal arts and science” <sup>[3]</sup>.

Against this policy-driven backdrop, business management education has been shifting away from a traditional “discipline-centered, classroom-based” approach and toward a more “competency-oriented, context-driven” model. Recent studies have developed holistic educational frameworks anchored in sustainable core competencies such as systems thinking, forward-looking vision, and collaborative governance <sup>[4-5]</sup>. These frameworks emphasize embedding competency objectives throughout curriculum design, hands-on practice, and assessment processes. However, empirical evidence indicates that most institutions have yet to fully institutionalize these collaborative approaches — including project-based learning, interdisciplinary integration, and Assurance of Learning (AoL) — in their programs <sup>[6]</sup>.

Meanwhile, in the context of China’s concurrent digital and green transformations, recent findings have revealed significant correlations between emerging competencies (such as digital literacy and AI-assisted decision-making) and students’ innovation intentions and employability <sup>[7]</sup>. At the same time, the rapid growth of “green jobs” driven by national dual-carbon goals has led to a structural shortage of multidisciplinary talent <sup>[8]</sup>. This shortfall is compelling universities to systematically revamp their educational philosophies, curricula, and industry–education collaboration models to better meet new societal demands <sup>[9]</sup>.

While progressive frameworks have been proposed, the literature notes a lack of fully closed-loop, data-informed training models that marry digital and green skill development with practical assessment. To address this gap, this study proposes the DTF (Dual-aspects synergy, Three-dimensional linkage, Four-chain integration) educational and teaching model for business schools in science and engineering universities. The DTF model combines engineering and liberal-arts perspectives under a CDIO+OBE framework, sets “digital + green” learning goals, and restructures the curriculum, practicum, and evaluation systems accordingly. It also builds a multi-stakeholder ecosystem. Below, this study details the model and presents evidence of its effectiveness in cultivating the next generation of interdisciplinary, digitally-literate, and sustainability-conscious business managers.

## **2. Cultivation challenges in science-and-engineering universities**

For an extended period, science and engineering universities in China have faced persistent challenges in cultivating compound business management talents. First, there is a misalignment between talent development and evolving social needs. Many programs remain rooted in traditional discipline boundaries and lag behind national strategic priorities. In particular, they under-emphasize courses in digital technologies and green transition, and often neglect the cultivation of a global perspective and social responsibility. As the CPC’s 2024 education reform resolution emphasizes, China must develop “discipline adjustment mechanisms to meet the needs of ... national strategies”, while boosting interdisciplinary fields and innovation capacity. In practice, however, many curricula still prioritize single-subject expertise over cross-cutting competencies.

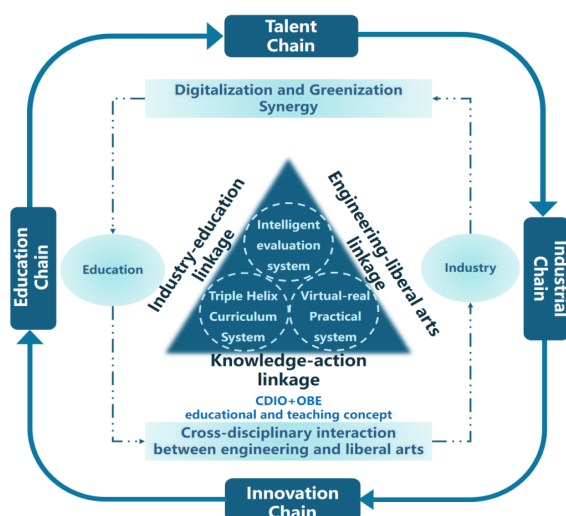
Second, the prevalent “mixed-plate” teaching approach is insufficient under China’s “dualization and

coordination” mandate. In this approach, technical courses and humanities courses are loosely combined without systemic integration. As a result, students receive little exposure to real-world digital or green problems during core instruction. Practical skill development is limited, and value-oriented education is often superficial. For example, very few programs require students to tackle projects that simultaneously involve engineering design, data analytics, and environmental sustainability. This gap undermines graduates’ readiness to address the complex, multi-dimensional challenges of modern business.

Third, existing talent cultivation mechanisms provide insufficient support for cross-sectoral resource integration, leading to an imbalanced development pattern characterized by the so-called “three hot, three cold” phenomenon: strong interest from business fields but limited uptake from industry partners, more engagement in research than in teaching, and uneven participation among different disciplines. In effect, the education-industry-government nexus is not yet fully coordinated. Recent reports on China’s new-energy industries underscore this need: industry leaders repeatedly call for deeper industry–academia collaboration as the solution to talent gaps. Until universities and enterprises co-design curricula and share training resources, a true collaborative ecosystem for cultivating interdisciplinary management professionals will remain elusive.

### 3. Definition of the DTF educational and teaching model

The DTF refers to “Dual aspects synergy, Three-dimensional linkage, and Four-chain integration.” This educational and teaching model follows the development demands of the country and local regions, and answers the “Four New” building deployment for the new liberal arts. It focuses on the bottleneck in the cultivation of compound business administration talents. This model takes CDIO and OBE as the educational and teaching concept, and aims at the demands of the intersection of engineering and liberal arts, establishing the goal of cultivating compound business administration talents with digitalization and greenization synergy. It reconstructs a talent cultivation system of “Triple helix curriculum system+Virtual-real practical system+Intelligent evaluation system”, strengthens the “three-dimensional linkage” cultivation mechanism of industry-education linkage, engineering-liberal arts linkage, and knowledge-action linkage, and creates a new “four-chain integration” environment that combines the chains of education, industry, innovation, and talent chain, as **Figure 1** shows.



**Figure 1.** The DTF educational and teaching model

## 4. Implementation path of the DTF educational and teaching model

### 4.1. Reconstruction of the knowledge framework of compound business administration talents

The knowledge framework of the compound business administration talents is updated, facing the “dual carbon” and digital construction strategies. With the goal of cultivating talents with “dual aspects synergy”, a “digitalization + greenization” business administration professional cluster can be established, for example, “smart tourism + sustainable development” tourism management, “digital marketing + green brand” marketing, “digital management + green governance” human resource management, “intelligent accounting + carbon accounting” accounting, and “intelligent finance + ESG” finance management. The industrial demands of interdisciplinary integration are introduced into the professional transformation and upgrading, and the thinking of science and engineering and advanced technologies are embedded in the management and governance innovation practices, exploring a new path for the knowledge reconstruction of compound business administration talents.

### 4.2. Reforming curriculum, practicum, and evaluation systems

#### 4.2.1. “Triple helix” curriculum system

Construct a “triple helix” curriculum system of “digital intelligence technology—management ability—green value” (Figure 2), achieving the cross-integration of multiple disciplines such as “information—management—environment”, and continuously enhancing the challenge, innovation, and high-level nature of teaching.

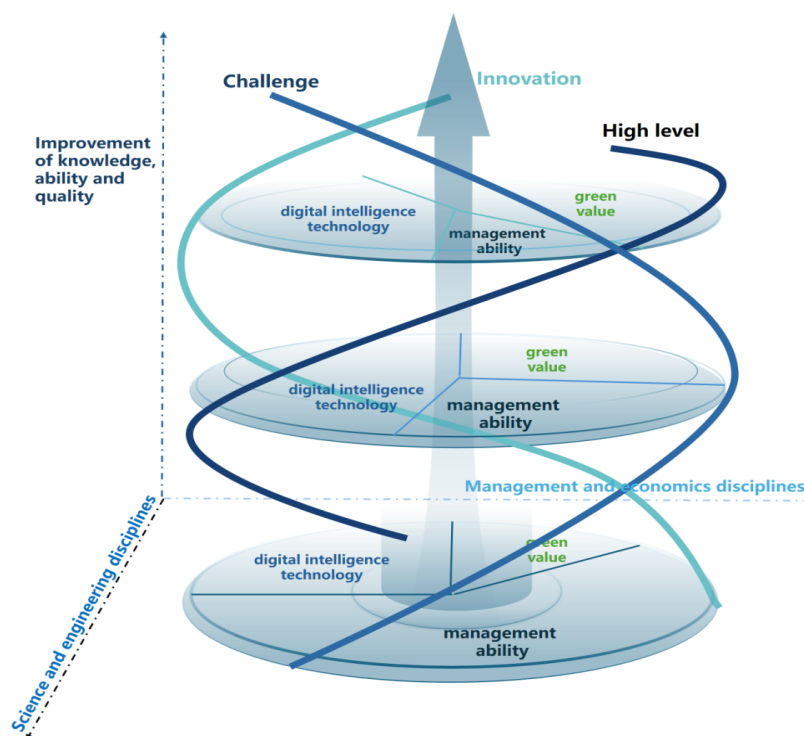


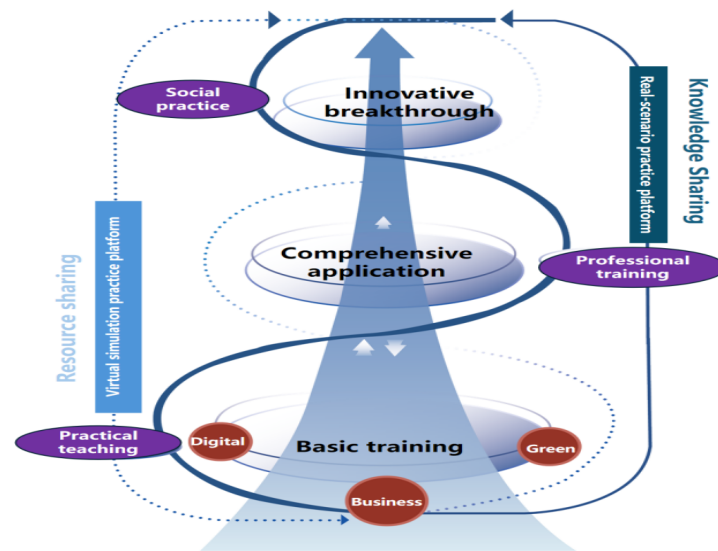
Figure 2. “Triple helix” curriculum system

#### 4.2.2. “Virtual-real integration” practical education system

Implement a “three-layer three-dimensional, virtual-real integration” practical education system, namely, three-layer progressive practical projects of “basic training—comprehensive application—innovative breakthrough”, and three-dimensional collaborative application scenarios of “practical teaching—professional



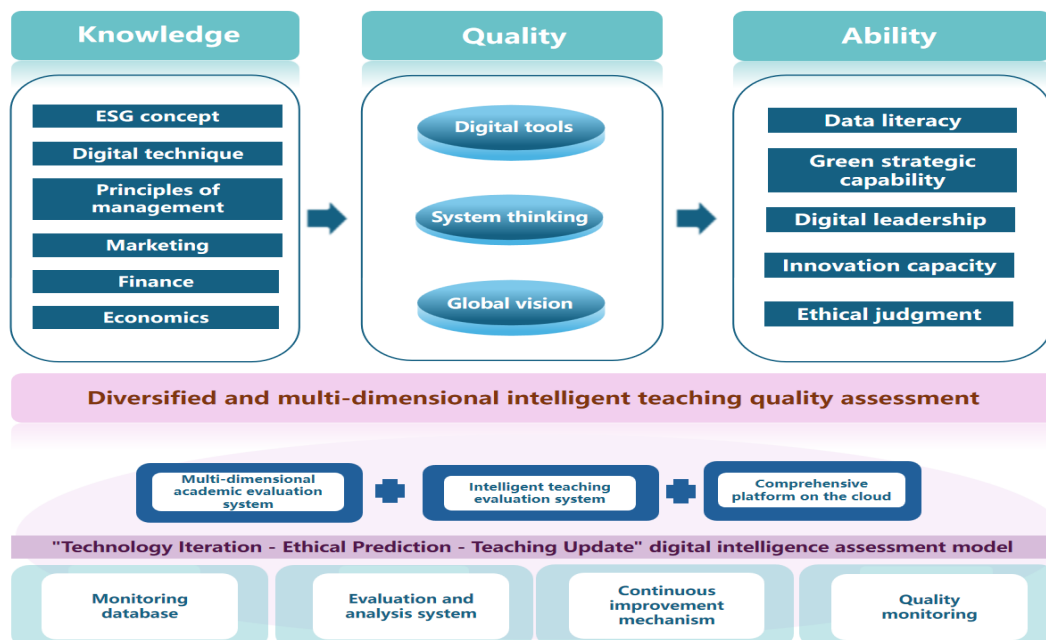
training—social practice”, as well as virtual-real integration practical platforms such as university-business collaborative research and development centers, outside-campus internship locations, on-campus labs, and virtual simulation experiment platforms (**Figure 3**).



**Figure 3.** “Virtual-real integration” practical education system

#### 4.2.3. Intelligent evaluation system

Build an intelligent evaluation quality control system (**Figure 4**), using a multi-dimensional academic evaluation system, an intelligent teaching evaluation system, and the Comprehensive Platform on the cloud, to construct a multi-dimensional evaluation model and dynamically optimize the training system according to industrial demands.



**Figure 4.** Intelligent evaluation system

### **4.3. Establish a multi-stakeholder collaborative education mechanism**

#### **4.3.1. Optimize the cultivating path through “three-dimensional linkage”**

The industry-education linkage complements the advantages of the education and industry. For example, the school has jointly built the “Ecological Environmental Innovation Governance School-Enterprise Joint Application Technology Innovation Base” with the Provincial Ecological and Environmental Protection Group, obtaining over 8 million yuan in research funds and jointly establishing a green management teaching case library. The school has also jointly established the “State-owned Enterprise Talent Training Center” with the Provincial Talent Group, undertaking the provincial educational reform project for “Digital and Green” business administration talent training. They have built the “Meteorological Tourism Research Institute” with the National Meteorological Bureau and obtained 3 million yuan in funds for the joint training of industrial talents. The industry-education linkage is driven by projects to build interdisciplinary science and education teams, such as jointly developing the “AI + business administration” course cluster with the School of Artificial Intelligence, jointly building the “Meteorological Tourism” course with the School of Atmospheric Sciences, and jointly establishing the provincial high-level social science research team for “Tourism Big Data Visualization Decision-making Research” with the information discipline group. The knowledge-action linkage strengthens the entire training process of “characteristic courses—cross-border projects—scene training—dual-teacher guidance.”

#### **4.3.2. Innovate the collaborative ecosystem through “four-chain integration”**

The education chain realizes course co-construction, the industrial chain provides real scenarios to enhance job matching, the innovation chain promotes knowledge application through technology transfer, and the talent chain strengthens feedback functions through alumni evaluations.

## **5. Innovations and achievements of the DTF educational and teaching model**

### **5.1. Innovations**

#### **5.1.1. Innovation of the DTF educational and teaching model**

Innovations are specifically manifested in the following aspects. First, a new concept is proposed, that is, the cross-integration of digital technology, management capabilities, and green value creation under the strategic drive of “dual carbon” and digitalization construction. Second, a new goal is set, which is to cultivate “dual aspects synergy” compound business administration talents that meet the needs of industrial “digitalization and greenization” transformation. Third, three new talent cultivation systems are reconstructed, including the “triple helix” curriculum system, the “three-layer three-dimensional, virtual-real integration” practical education system, and the intelligent evaluation quality control system. Fourth, a new multi-stakeholder collaborative education mechanism is constructed, including the optimization of the training path through the “three-dimensional linkage” of industry-education, engineering-liberal arts, and knowledge-action, and the innovation of the collaborative ecosystem by the convergence of the talent, innovation, industrial, and educational chains. Overall, a replicable and sustainable new model for cultivating compound business administration talents in science and engineering colleges has been constructed and improved.

#### **5.1.2. Innovation in the training system**

With the goal of cultivating “dual aspects synergy” compound business administration talents, the authors innovate the quality control, practical education, and curriculum teaching systems. Supported by the CDIO+OBE

educational and teaching concept, and guided by the demands of “digitalization and greenization” and new liberal arts talent cultivation, the authors construct a “triple helix” curriculum teaching system of “digital technology—management ability—green value.” The authors superimpose three-level progressive practical projects, three-dimensional collaborative application scenarios, and virtual-real combined practical platforms to form a new “industry-university-research-training-innovation” practical education ecosystem of “three levels, three dimensions and virtual-real combination.” The authors build an intelligent evaluation quality control system to form a continuously iterative quality culture. The authors shape the core competitiveness of talents by integrating the interdisciplinary knowledge structure and the innovation ability of industry-education integration, comprehensively improving the quality of compound business administration talent cultivation.

### **5.1.3. Innovation in the resource coordination mechanism**

Building a sustainable talent co-cultivation ecosystem through “three-dimensional linkage + four-chain integration.” The authors apply the stakeholder theory to the innovation practice of the resource coordination mechanism, promoting the transformation of business administration talent cultivation from single-discipline and single-subject supply to multi-discipline and multi-stakeholder mutual promotion. Based on the concept of complementary advantages, the authors built education and industry, science and liberal arts, knowledge and action linkage, effectively solving the “three colds and three heats” problem. The authors integrate the four chains, innovate the resource coordination ecosystem, and rely on the “institute—university—outside” three-level governance to make “problems into courses, data into databases, standards into tables, and achievements into applications” routine, significantly enhancing the effectiveness of compound business administration talent cultivation.

## **5.2. Achievements**

### **5.2.1. Improve the level of professional construction and achieve the results of teaching reform**

The implementation of the DTF model can drive the comprehensive transformation of the business administration major towards the dual carbon strategy and digital construction strategy, comprehensively enhance the faculty construction, and generate teaching reform achievements. This model can effectively promote the construction of first-class specialties, the establishment of modular course groups for interdisciplinary studies, and the development of the economic management experimental center.

### **5.2.2. Enhance students’ knowledge structure, innovation ability, and employment competitiveness**

Implementing the DTF model in the development of the novel curriculum, education system, practical education system, and quality control system can promote the comprehensive improvement of the knowledge structure, innovation ability, and high-quality full employment of students majoring in business administration. The proportion of students participating in various innovative practices has significantly increased, such as participating in the College Students’ Innovation and Entrepreneurship Training Program, various academic competitions at all levels, publishing academic papers, and participating in teachers’ scientific research projects.

### **5.2.3. Produce a radiation effect of the construction of the new liberal arts**

The DTF model has a strong radiation effect and can play an exemplary role in the construction of new liberal arts. The achievements can be adopted and promoted by other universities of science and engineering, and it is conducive to the relevant schools obtaining the special government subsidies for industrial talent cultivation.

Moreover, it can be reported by relevant media, thus significantly enhancing the social influence and brand recognition of the business administration talent major of the relevant schools.

## 6. Retrospect and prospect

By establishing and improving the talent cultivation model characterized by “dual aspects synergy, three-dimensional linkage, and four-chain integration”, science and engineering universities can break through the disciplinary barriers between engineering and liberal arts, solve the problem of disconnection between cultivation and demand, and build a new all-domain cultivation ecosystem from education to industry. This will enable the precise cultivation of “engineering-liberal arts cross-disciplinary” compound business administration talents who can apply what they have learned and integrate knowledge with practice, and who can adapt to the national and local strategies.

Looking ahead, there are still several aspects that deserve further exploration. First, how to integrate the disciplinary strengths of each science and engineering university with the cultivation of compound business administration talents to form a distinct feature oriented towards the application scenarios of a specific niche field. Second, how to deeply apply artificial intelligence to the DTF model to achieve a profound revolution in education and teaching in the new era. Third, how to achieve in-depth co-cultivation of talents through the dual-college system of business administration in both university colleges and industrial colleges; fourth, how to further explore the similarities and differences in the cultivation of business administration talents in the background of digitalization and greenization in different cultural contexts through international cooperation among universities.

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## Disclosure statement

The authors declare no conflict of interest.

## Author contributions

Xueqian Song conceived the idea of the study, proposed the theoretical framework, and supervised the overall writing. Guochao Wan and Jia Ma drafted the manuscript and designed the implementation methodology. Yingying Zhang created the figures and visual materials. Yonggui Qian and Juan Xu collected data and background information.

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