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From 'Cooperation' to 'Symbiosis': Reconstructing the Mechanism of Industry–Education Integration in Vocational Undergraduate Education

Haoyun Zhang*

Sichuan University of Architectural Technology, Deyang 618000, Sichuan, China

***Corresponding Author:** Haoyun Zhang, 294947646@qq.com .

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Abstract: Industry–education integration in vocational undergraduate education has long remained at a shallow level such as "contractual cooperation" and "order-based training", and the structural contradictions of "enthusiastic schools and cold enterprises" and "cooperation without depth" have not been substantially alleviated by the growth in the number of communities. The crux of the problem does not lie in the absence of willingness to cooperate, but in the failure of the relational structure of cooperation to undergo a qualitative change: the school-enterprise relationship is still an "additive relationship" in the sense of resource exchange, rather than a "symbiotic relationship" in the sense of mutual embedding of competencies. Taking symbiosis theory as its analytical framework and drawing on the recent practices of institutions such as Nanjing University of Industry Technology and Henan Polytechnic Institute, this paper proposes that moving industry–education integration in vocational undergraduate education from "cooperation" to "symbiosis" requires the completion of a threefold mechanism transformation: in terms of the motivational mechanism, a shift from emotional drive and administrative push to the endogenous production of interests, so that enterprises obtain a sustainable reason to participate through the formulation of community rules, resource investment and benefit sharing; in terms of the governance mechanism, a shift from loose liaison to substantivized operation and the separation of powers and responsibilities, using council-based decision-making, a points-based management system and a flexible teaching–production coordination system to transform "joint cultivation of talent" from an intention into operable rules; and in terms of the knowledge mechanism, a shift from one-way resource extraction to the two-way transformation of technology and teaching, so that enterprises' real technical problems become the living source for curriculum and teaching renewal. The convergence point of the three mechanisms is that vocational undergraduate institutions transform from "resource consumers" into "competency producers", thereby forming an irreplaceable symbiotic value in the industry–education relationship.

Keywords: Vocational undergraduate education; Industry–education integration; Symbiosis mechanism; Substantivized operation; Endogenous interest

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1. Problem statement

The policy supply for industry–education integration in vocational undergraduate education can hardly be called sparse. The construction of city-level industry–education consortia and industry-specific industry–education integration communities has unfolded across various regions, and many institutions have accumulated considerable "quantitative results" in cooperation agreements, platform plaques and order-based training. But quantitative growth does not automatically convert into a qualitative leap. Some studies have pointed out that existing industry–education integration practices generally suffer from deep-seated contradictions such as "enthusiastic schools and cold enterprises" and "mismatch between supply and demand". A sharper judgment comes from the front line of practice: after signing agreements, hanging bronze plaques and taking group photos, "when students come, enterprises find them troublesome; when enterprises have needs, schools cannot take them on". This situation points to a question relatively neglected by existing discussions: the difficulty of industry–education integration is mainly not a question of attitude, namely "whether one is willing to cooperate", but a question of relational structure, namely "in what manner one cooperates" [1].

The distinction between a "cooperation" and "symbiosis" is precisely where its analytical value lies. Cooperation can be built on short-term calculations of resource complementarity, with the cooperating parties each maintaining their boundaries, and the relationship tending to loosen once the exchange is completed; symbiosis requires each party to be functionally embedded in the other, with the growth of one party's competency depending on the other's continued investment, such that withdrawal or estrangement would cause substantive damage to one's own function. In the terminology of symbiosis theory, cooperation remains the juxtaposition of "symbiotic units", whereas symbiosis requires the "symbiotic pattern" to move from punctate, intermittent association towards a stable structure of mutual benefit. The bottleneck that industry–education integration in vocational undergraduate education must break through is precisely the move from juxtaposition to mutual embedding [2].

This paper does not intend to discuss in general terms the necessity of "deepening industry–education integration", but focuses on a mechanistic question: what kind of institutional arrangement can enable the school-enterprise relationship to leap from the form of "cooperation" to the form of "symbiosis"? The following sections elaborate on three dimensions—the motivational mechanism, the governance mechanism and the knowledge mechanism—and analyze them in light of recent practice cases of vocational undergraduate institutions.

2. The motivational mechanism: From emotional drive to the endogenous production of interests

The attenuation of the momentum for industry–education integration is often attributed to enterprises' insufficient awareness of social responsibility or to inadequate policy incentives. This attribution obscures a deeper fact: within the existing cooperative framework, the "interests" of enterprises participating in industry–education integration are mostly external—tax preferences, priority in recruitment, and social reputation—and these interests lack an organic connection with the actual operation of the teaching process. Once external incentives weaken or enterprise personnel change, cooperation becomes difficult to sustain.

The approach of Nanjing University of Industry Technology provides a turn worth examining in detail. The university explicitly proposed that "industry–education integration is not the school 'asking enterprises for resources', but the two parties 'growing together'", and that the key to breaking the impasse

is to let enterprises change from “guests” into “hosts”, “not in name only, but by jointly setting rules, investing resources and sharing benefits”. Beijing Jingdiao Group has invested more than 20 million yuan in equipment on campus, with over 20 engineers stationed at the school year-round; engineers participate in teaching, enterprise orders enter student practice, and enterprise standards are incorporated into course materials. The essence of this arrangement is to move the interests of enterprises forward from “end-benefits at the employment end” to a “mid-process embedding in the cultivation process”: enterprises no longer merely select students in the graduation season, but continuously shape the competency structure of the future workforce during the teaching process, while simultaneously obtaining technical feedback and clues for process improvement. In 2025, the university undertook commissioned projects from enterprises and institutions with funding of 59.16 million yuan and achieved technology transfer of over 8 million yuan, which also indirectly shows that when enterprises regard cooperation as part of their own technical activities, their investment acquires an endogenous character.

The key to the endogenous production of interests lies not in the school “conceding benefits”, but in enabling enterprises to have claimable rights and predictable returns in the process of talent cultivation. Some studies, from the perspective of value co-creation, point out that one of the core cruxes of the current predicament is “imbalance of interests”, and that a feasible direction is “community-based governance, substantivized platforms, project-based talent cultivation, and digitalized evaluation”. This judgment corroborates the above practices: only when enterprises can participate in decision-making at the level of community rules, hold property rights or a share of returns at the resource level, and obtain genuine technical and human-resource returns at the operational level, will participation no longer depend on “whether the relationship is good” [3].

3. The governance mechanism: Substantivized operation and the separation of powers and responsibilities

The transformation of the motivational mechanism needs to be carried out by the governance mechanism. Without an operable governance structure, interest symbiosis can only remain at the level of intention. At present, the governance form of many industry–education integration communities is a “soft connection”: there are charters but no decision-making power, liaison but no accountability, activities but no organizational foundation for sustained operation. Some scholars criticize that research on city-level industry–education consortia mostly remains at the normative advocacy of “what should be built”, with little analysis of the allocation of powers and responsibilities and the interest games after substantivized operation.

The core of substantivized operation does not lie in whether a legal person has been registered, but in whether decision-making power, executive power and resource-allocation power have been institutionally distributed. The three industry-specific industry–education integration communities led by Nanjing University of Industry Technology have all established a governance architecture of “council decision-making, secretariat coordination, and execution by special working departments”, supported by a “member points management measure” that uses the annual cumulative points as the core basis for selecting outstanding members, with units ranking at the top of the points list enjoying priority in technical cooperation, recruitment, training and other aspects. The significance of the points system goes beyond the level of management technique: it makes “contribution” measurable, comparable and redeemable, thereby providing multiple actors with a quasi-market coordination mechanism in the absence of direct administrative subordination. Similarly, Henan Polytechnic Institute has implemented “posting problems to recruit talent and competitive project approval”, formed “dual”

school-enterprise course development teams, and established a closed loop of "project construction—process monitoring—enhanced application—continuous diagnosis and improvement", simultaneously delegating the responsibility and resources of course development to joint school-enterprise teams.

Another governance detail that is easily overlooked but crucial is the management of the conflict between the teaching rhythm and the production rhythm. The approach of Nanjing University of Industry Technology is "off-peak and batched internships, diversion and undertaking by member enterprises, and flexible segmented work-study alternation", the principle of which is summarized as "teaching arrangements led by the school, production management led by enterprises, and major matters deliberated on an equal footing by the council". This principle of "separation of powers and responsibilities" may seem plain, but it is in fact the operational precondition for maintaining a symbiotic relationship: it acknowledges that the school and the enterprise each possess a core logic that cannot be ceded (educational logic and production logic), does not pursue the annexation of one by the other, but rather achieves flexibility at the interface on the basis of clear boundaries.

4. The knowledge mechanism: Two-way transformation between technical problems and teaching resources

If the interest mechanism and the governance mechanism answer "how to sustain", the knowledge mechanism answers "what symbiosis actually produces". The deep value of industry–education integration in vocational undergraduate education should not stop at students obtaining internship positions or enterprises obtaining recruitment channels, but should lie in the two-way transformation between industrial technical problems and the school's teaching knowledge. One-way "resource extraction"—the school asking for equipment, positions and part-time teachers—can only reproduce a relationship of dependence; only two-way transformation can generate the knowledge foundation of symbiosis.

The "platform—team—project" trinity of the science and innovation system of Shunde Polytechnic provides the prototype of this mechanism: it connects schools and enterprises through real industrial technical problems as a bond, and then systematically builds a transformation and incubation chain of "achievement—product—commodity". The practice of Henan Polytechnic Institute more directly demonstrates the path of "technology feeding back into teaching": teachers participated in 57 enterprise projects of "intelligent transformation and digital upgrading", and all project results were transformed into teaching cases and brought into the classroom, forming a cycle in which "industry guides the curriculum and the curriculum supports industry". The key to this cycle is that teachers, in school-enterprise cooperation, are not escorts who "take students on visits", but participants in technical breakthroughs; curriculum renewal does not rely on enterprise surveys to "collect needs", but on the first-hand experience that teachers continuously acquire in productive technical practice.

This mechanism has special typological significance for vocational undergraduate education. The "academic nature" of vocational undergraduate education requires its teachers and students to possess the ability to handle complex engineering problems and to optimize processes, and such ability cannot be obtained merely by introducing a few enterprise courses or a few part-time teachers. It requires the school itself to become a knowledge node in the regional industrial technology ecosystem, capable of generating new teaching content in the process of solving enterprises' practical problems. When the knowledge-production capacity of a vocational undergraduate institution is embedded in the regional industrial chain, enterprises' demand for it is no longer "help me absorb interns", but "help me solve problems I cannot solve

myself". This irreplaceability is the most solid foundation of a symbiotic relationship.

5. Conclusion

Moving industry–education integration in vocational undergraduate education from "cooperation" to "symbiosis" is not a process that can be completed merely by increasing the number of agreements or raising the frequency of meetings. It requires qualitative changes in three mechanisms simultaneously: in terms of motivation, letting enterprises' interests shift from external incentives to endogenous gains in the cultivation process; in terms of governance, letting the operation of the community shift from soft connection to substantivized rules with the separation of powers and responsibilities; and in terms of knowledge, upgrading the school-enterprise relationship from resource exchange to the two-way transformation of technology and teaching. The three are not in a parallel relationship, but form a mutually supporting structure—without the endogeneity of interests, governance rules lack the basis of willingness to execute; without substantivized governance, knowledge transformation lacks a stable organizational carrier; and without irreplaceability in knowledge, the advantages of interest and governance are also difficult to maintain over the long term.

For vocational undergraduate institutions, the substantive meaning of this turn is a reconstruction of roles: from a party accustomed to "asking for resources" in industry–education integration, to a party that is "needed" in the enterprise technology capability system. Only when the school itself becomes an organic part of regional industrial knowledge production and skill accumulation will "symbiosis" be not a rhetorical upgrade of cooperation, but a true description of the relational structure.

Disclosure statement

The author declares no conflict of interest.

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