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From Manufacturing to Intelligent Manufacturing: The Logic and Path of Educational Support in Dongguan's Science and Technology Talent Strategy

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Abstract: As cities undergo critical industrial transformation, the quality of science and technology talent directly determines the success of the shift toward "intelligent manufacturing." With "technological innovation + advanced manufacturing" as its defining characteristic, Dongguan is facing a structural shortage of digital and intelligent talent. Consequently, its talent strategy is transitioning from "policy-induced attraction" to "ecosystem-based cultivation." Based on an examination of Dongguan's science and technology talent strategy, this paper analyzes the pivotal role of education in integrating the talent chain with the industrial chain, reveals the "temperature gap" between current talent cultivation and industrial demand, and proposes pathways for constructing a new "industry-education symbiosis" paradigm. By incorporating case studies, policy analysis, and comparative insights, the study aims to offer actionable insights for talent governance in similar manufacturing-oriented cities.

Keywords: Science and technology talent strategy; Industry-education integration; Artificial intelligence education; Dongguan model; Talent ecosystem

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1. Introduction

As Dongguan enters a new phase of high-quality development as a "double-ten-thousand" city, a city with a GDP exceeding one trillion RMB and a population exceeding ten million, a central question has come to the forefront: Who will sustain the city's defining identity of "technological innovation + advanced manufacturing"? The answer lies in talent. From being the "world's factory" to striving for a "strong hub of technological innovation and manufacturing," Dongguan's industrial logic is undergoing profound restructuring. The era of simply replacing manual labor with machines has passed; the new imperative is enabling machines to "understand" the complexities of production processes, adapt to dynamic supply chains,

and collaborate with human intelligence [1]. In this process, the quantity and quality of science and technology talent are decisive factors in the depth and speed of industrial transformation.

However, significant challenges persist. Research indicates that Dongguan faces a substantial gap in digital talent, particularly in professionals who possess both technical expertise and a deep understanding of industrial processes. According to a 2025 survey conducted by the Dongguan Municipal Political Consultative Conference, the city's AI talent pool stands at approximately 45,000, which is insufficient to meet the surging demands of the industry [2]. The demand for AI-related roles alone is projected to grow at an annual rate of 25% over the next five years [3]. A structural mismatch is also evident: while there is a relative surplus of talent in traditional manufacturing sectors, there is a critical shortage of high-caliber professionals in emerging fields such as artificial intelligence, industrial software, digital transformation, and integrated circuit design. This "talent deficit" is emerging as a primary bottleneck hindering the deep integration of technological innovation and manufacturing.

The complexity is compounded by the fact that talent competition has long surpassed simple salary competition. As first-tier cities like Guangzhou and Shenzhen create a "siphon effect" through their extensive platform advantages, including top-tier research universities, multinational corporate R&D centers, and mature venture capital ecosystems, how can Dongguan attract and retain science and technology talent? The answer may not lie solely in creating a "policy lowland" with generous subsidies but rather in building a "talent ecosystem" where talent can grow and thrive in sync with the industry. Within this ecosystem, what role does education play? How can it transition from being a mere "logistics unit" for talent supply to a "frontline force" for technological innovation? This paper seeks to explore these questions by examining Dongguan's evolving talent strategy, analyzing the interface between education and industrial needs, and proposing pathways toward a more integrated and responsive system.

2. From policy-driven to ecosystem-building: The evolving logic of Dongguan's talent strategy

Tracing the evolution of Dongguan's talent work reveals a clear trajectory: a shift from early-stage efforts focused on "providing policies" and "allocating funds" toward deeper institutional reform and ecosystem cultivation. In the 2010s, Dongguan's talent policies were largely characterized by one-off subsidies, housing allowances, and household registration facilitation. While these measures succeeded in attracting a certain number of skilled workers, they often failed to create sustained retention or organic talent growth. The "Implementation Opinions on Promoting the Integrated and High-Quality Development of Talent and Industry," released in 2025, marked a significant step in this direction. For the first time, it explicitly established at the municipal level the principle that "managing industry necessitates managing talent," signaling a move from separate promotion to integrated development.

The underlying logic of this shift is that science and technology talent is not merely "recruited" but "cultivated." Only by embedding talent within the soil of the industry, allowing them to grow and learn in real-world production scenarios, can sustainable innovation capacity be developed. To this end, Dongguan has introduced a series of innovative measures. These include granting industry administrative departments greater authority in talent evaluation, encouraging criteria based on job performance, results, and competition achievements, a direct challenge to the traditional "four-only" (only papers, only education background, only titles, only awards) evaluation approach. Additionally, flexible employment mechanisms such as "university

hiring for enterprise use" and "university-enterprise talent sharing" are being promoted. Under these schemes, enterprises can engage university professors as "deputy chief technology officers," allowing academic researchers to work on real industrial challenges, while universities can employ corporate experts as "industry professors" to bring cutting-edge practical knowledge into the classroom [4]. The sophistication of these designs lies in their challenge to traditional talent evaluation metrics, emphasizing market-driven recognition and contribution-based value.

It is also important to note that Dongguan's talent strategy is not isolated but is deeply embedded in the broader context of the Guangdong-Hong Kong-Macao Greater Bay Area. Leveraging high-level platforms such as Songshan Lake Science City, home to the China Spallation Neutron Source, a major national scientific facility, the Great Bay University, and City University of Hong Kong (Dongguan), Dongguan is constructing an "innovation cluster" comprising universities, large-scale scientific facilities, research institutions, and leading tech enterprises. The strategic intent is clear: to create a closed loop encompassing fundamental research, technological breakthroughs, and industrial application, allowing talent to realize their value at every stage of the innovation chain. This ecosystem approach contrasts sharply with traditional "point-based" talent policies that focus on individual incentives without addressing the surrounding institutional and cultural environment [5].

3. The "Supply-Side Reform" of talent cultivation: How education responds to industrial change

If the talent strategy represents the overarching design, then education is the critical link that brings it to fruition. In response to the new talent specifications demanded by industrial evolution, Dongguan's education system is undergoing a profound "supply-side reform." This reform is multifaceted, targeting vocational education, higher education, and basic education simultaneously.

In the realm of vocational education, the focus is on achieving deeper integration between industry and education. As a world-renowned manufacturing hub, Dongguan has a vast demand for skilled technical talent. However, traditional vocational education models often remain disconnected from actual production practices, with graduates requiring "re-training" after entering the workforce. As one vocational educator noted, "Vocational education cannot be separated from production practice; collaboration between vocational schools and enterprises is more conducive to cultivating skilled talent." This "dual-subject" cultivation model aims to achieve a "seamless alignment" between talent development standards and job competency requirements. Furthermore, the city has launched a "modern apprenticeship" program that allows students to split their time between classroom learning and on-the-job training with wages, thereby reducing the transition friction between education and employment.

In the field of higher education, newly established research universities are undertaking a distinct mission. From its inception, the Great Bay University has embraced a "research for application" orientation, reforming its curriculum to tightly couple AI with industrial contexts. For instance, the CauchyNet algorithm developed by its faculty, derived from complex function theory, has the potential to propel industrial software from traditional computation toward AI-driven solutions. This positioning, pursuing cutting-edge research while remaining closely tied to industrial needs, exemplifies the unique value of this new type of research university. Similarly, the City University of Hong Kong (Dongguan) focuses on interdisciplinary programs such as digital medicine, intelligent manufacturing, and materials science, with a curriculum co-designed by faculty and

industry advisory boards comprising executives from leading local enterprises. This ensures that students are exposed to real-world problems from the start of their studies.

An even more forward-looking initiative is taking place in basic education. In March 2026, Dongguan released its "Artificial Intelligence + Education" Leading Plan for primary and secondary schools. The plan aims to achieve full coverage of AI literacy courses across the city, build "teacher-student-machine" integrated intelligent classrooms, and develop HarmonyOS-enabled smart campuses [6]. This signifies that AI literacy cultivation is no longer confined to higher education but is being extended to basic education, laying the groundwork for the city's "digital and intelligent" future. The practice of Songshan Lake Future School is illustrative: it has established a "dual-track, three-level" AI+X curriculum system, ensuring that every student can access, learn, and utilize AI in their studies. In this model, students in the "application track" focus on using AI tools to solve practical problems, while those in the "innovation track" are introduced to basic programming and algorithm design [7]. This strategic focus on nurturing talent from the "roots" is deeply insightful, as it creates a pipeline of digitally fluent young people who can either enter the workforce directly or pursue advanced studies in STEM fields.

4. The "Temperature Gap" and "Chasm": Real challenges in the educational support system

Despite the clear direction of reform and the impressive initiatives underway, the construction of the educational support system faces several practical challenges. The most prominent is the "temperature gap" between talent cultivation and industrial needs, a gap that manifests in curriculum, faculty, and institutional alignment.

Curriculum lag is a primary concern. Technology evolves at a breathtaking pace, while curriculum updates often require lengthy cycles. As some political advisors have noted, "course content lags behind technological iterations, and students still need retraining after graduation [8]." This lag is not only about knowledge transfer but also about capability development. What companies need are not merely individuals who can use specific tools but versatile talents capable of solving complex, real-world problems that span multiple domains. For example, the rapid emergence of large language models has created an urgent demand for talent skilled in prompt engineering, model fine-tuning, and AI governance, topics that are rarely covered in conventional computer science curricula.

Structural shortcomings in the teaching workforce are equally significant. In emerging fields like AI and digital transformation, high-quality educators are themselves scarce. Those with technical expertise often lack pedagogical experience, while those with teaching experience may struggle to keep up with technological frontiers. Although Dongguan has introduced tiered training plans involving "scientist mentors," "lead teachers," and "seed teachers," building a capable backbone system covering all educational stages and disciplines will take considerable time. Moreover, the salary gap between academia and industry in high-tech fields exacerbates the challenge, making it difficult to attract and retain top talent in teaching positions [9].

Deeper obstacles lie at the institutional and systemic levels. Despite a broad consensus on industry-education integration, the phenomenon of "universities being eager while enterprises remain lukewarm" persists. Enterprises often lack sufficient incentive to participate in talent cultivation, primarily because the returns on such investment are unclear—the benefits of talent development are largely externalized, while the costs are borne by the enterprise. In the absence of clear intellectual property arrangements or tax incentives,

many firms prefer to hire ready-made talent rather than invest in long-term training partnerships. Designing institutional mechanisms that genuinely encourage enterprises to engage actively in the early stages of talent cultivation remains a key challenge to be resolved. Additionally, the current performance evaluation system for universities still prioritizes research publications over industry engagement, creating a misalignment of incentives for faculty members who might otherwise be interested in collaborative education projects [10].

5. Toward an "Industry-Education Symbiosis": Pathways for optimizing educational support for science and technology talent

Addressing these challenges requires moving beyond the traditional "university-enterprise cooperation" framework toward a deeper "industry-education symbiosis." This is not simply about sharing resources but about aligning objectives and establishing shared institutional mechanisms that treat education and industry as mutually constitutive elements of a single innovation ecosystem.

First, establish a dynamic regulatory mechanism for "supply-demand alignment." Talent demand evolves rapidly; talent cultivation systems must be capable of responding swiftly. It is recommended to establish a systematic monitoring and release mechanism for industrial talent demand, akin to creating "talent maps" alongside industrial maps [3]. This would enable educational institutions to sense market changes promptly and dynamically adjust their curricula and programs. Drawing from the German "Fachkräftesicherung" (skilled labor security) model, Dongguan could establish regional skill forecasting councils that bring together government agencies, industry associations, and educational providers to produce quarterly talent demand forecasts. Simultaneously, universities should be encouraged to establish "industry colleges" in partnership with leading companies, transforming corporate technology platforms and real projects into educational resources, thereby aligning talent development with corporate needs. Such industry colleges could operate with greater flexibility in curriculum design, faculty hiring, and student assessment than traditional academic departments.

Second, create pathways for talent growth that integrate vocational and academic tracks. The development of science and technology talent should not be confined to a single track. As a renowned manufacturing city, Dongguan needs not only top-tier research talent but also a substantial number of highly skilled technical professionals. It is recommended to further bridge the gap between vocational and general education, constructing a "vertical integration and horizontal interconnection" system. This would allow students with strong technical skills to pursue advanced studies and those with academic potential to gain practical experience, fostering a diverse and inclusive talent development environment. For instance, the development of "vocational baccalaureate" programs that combine rigorous academic content with advanced technical training could provide a viable pathway to higher education for students from vocational backgrounds. Additionally, establishing credit transfer agreements between vocational colleges and universities would enable students to move between tracks without losing progress.

Third, cultivate a talent development ecosystem that is "attractive and nurturing." Ultimately, competition for talent is competition over the overall environment. This encompasses not only "hard conditions" like compensation and research platforms but also "soft power" aspects such as urban quality, cultural atmosphere, and public services [4]. Dongguan's goal of building a "high-quality, livable city" reflects its recognition of the crucial role soft power plays in talent attraction. In the educational domain, this means addressing the "small but critical" issues that matter to talent, such as the education of their children and the availability of

international education. Expanding the capacity of high-quality international schools and bilingual programs would make Dongguan more attractive to overseas-trained researchers and professionals. Moreover, creating lifelong learning opportunities, such as micro-credentialing programs in emerging technologies, would allow the existing workforce to upskill continuously, reducing the pressure on initial education to anticipate all future skill needs [10].

Fourth, foster a culture of experimentation and iterative improvement in education-industry partnerships. Not all collaborations will succeed, and it is important to allow space for pilot projects and to learn from failures. Dongguan could establish a dedicated "Industry-Education Integration Innovation Fund" to support experimental programs, with rigorous evaluation mechanisms to identify best practices that can be scaled. For example, a pilot program that allows vocational students to spend one full year in a paid industry placement before graduation could be tested with a cohort of students, with outcomes tracked over several years to assess its impact on employment rates and career progression.

6. Conclusion

The shift from "manufacturing" to "intelligent manufacturing" demands a fundamental transformation of a city's innovation paradigm. In this transformation, science and technology talent is the core driving force, and education is the wellspring of that force. Dongguan's experience demonstrates that a science and technology talent strategy cannot be limited to providing policies or funds; it must evolve toward building an ecosystem and shaping the future. When education is deeply integrated with industry, and when talent cultivation aligns with urban development, technological innovation can acquire a sustainable and endogenous source of momentum.

This is not merely a developmental issue for a single city but a timely question for manufacturing cities across China as they navigate the transition to intelligent manufacturing. Within the strategic vision of "strengthening the nation through talent," every manufacturing city must ask: how can education become a "frontline force" for technological innovation? How can talent achieve its value in symbiosis with industry? The answers Dongguan is formulating—through its embrace of ecosystem thinking, its commitment to education reform across all levels, and its willingness to experiment with new institutional forms—merit close attention from policymakers, educators, and business leaders alike. As the city continues to refine its approach, it has the potential to serve as a model not only for other Chinese cities but also for manufacturing regions around the world facing similar challenges of digital transformation and talent development.

Disclosure statement

The authors declare no conflict of interest.

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