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Research Article

Research On The Construction Of Makerspace Ecosystem In Applied Universities From The Perspective Of Full-Chain Incubation: Reflections Based On The Practice Of Eagle Makerspace At Pingdingshan University In China

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ABSTRACT

Under the innovation-driven development strategy, maker spaces have become central to cultivating innovation and entrepreneurship talent, driving technological innovation, and incubating projects in Chinese applied universities. This paper, adopting the full-chain incubation perspective, proposes an ecosystem model for maker spaces tailored to the specific needs of applied universities. The model includes specific implementation plans such as a four-level progressive curriculum system, a multi-level incubation platform, a "four-in-one" innovation and entrepreneurship service system, and six industry docking platforms. This study aims to bridge the gap between entrepreneurship theory and practice in Chinese applied universities by using the practical achievements of the Yingxiang Maker Space at Pingdingshan University as a case study, thereby providing valuable insights and experiences for other applied universities.

Keywords: Full-chain incubation; Applied universities; Maker space; Ecosystem construction

1. Introduction

In the context of rapid globalization and the digital economy, technological advancements have profoundly impacted various industries. Universities, as crucial hubs for talent cultivation, play a central role in nurturing innovative talents and conducting scientific research. Particularly in China's applied undergraduate universities, makerspaces serve not only as essential platforms for students to engage in innovation and entrepreneurship but also as bridges linking universities to local economic development.

In 2015, various Chinese ministries issued directives to transition local universities into applied universities, integrating science and education with industry. The State Council's "Guidance on Developing Makerspaces to Promote Mass Innovation and Entrepreneurship" accelerated the development of entrepreneurial service platforms like makerspaces, creating a comprehensive environment for innovation and entrepreneurship[1] . By the end of 2021, China had 15,253 entrepreneurial incubation carriers, including 9,026 makerspaces—the highest number globally. These makerspaces supported 454,000 startups and teams, generating 4.983 million entrepreneurial and employment opportunities, including 500,000 recent graduates [2].

Despite this growth, university makerspaces face significant challenges. Establishing an entrepreneurial ecosystem that aligns with contemporary trends and integrates comprehensive talent cultivation is crucial for sustainable development. This paper adopts a full-chain incubation perspective to analyze the current status and challenges of makerspaces in applied undergraduate universities. It proposes a tailored construction framework, using Pingdingshan University as a case study to offer insights and guidance for other applied universities.

2. Current Research on University Makerspace Entrepreneurial Ecosystems

Research on university makerspace entrepreneurial ecosystems in academia primarily focuses on three aspects:

2.1Concept of University Makerspace Entrepreneurial Ecosystems

The concept of entrepreneurial ecosystems was first introduced by Moore (1993) , who expanded the concept from biology to business organizations[3]. Consequently, many scholars have studied entrepreneurial ecosystems metaphorically [4]. Over the past twenty years, academic exploration of this concept has deepened, resulting in three main perspectives:

Environment Perspective: This views the ecosystem as a dynamic community of interdependent actors, supported by institutional, informational, and socio-economic environments to foster the success of entrepreneurial firms [5].

Network Perspective: This perspective sees the ecosystem as a complex network of diverse individuals, institutions, and organizations, where the network's ability to provide resources and information aids firms in navigating the competitive environment[6] [7].

Comprehensive Perspective: This considers the ecosystem as a system formed by the intertwining of social, political, economic, and cultural elements within a specific geographic area, where coordination among these actors and factors drives entrepreneurial activities[8]. Chinese scholars further define it as a dynamic equilibrium system of interdependent and co-growing elements[9] or as a unified whole of innovation and entrepreneurial activities[10].

Defining the concept of an entrepreneurial ecosystem is crucial for entrepreneurial research and foundational for exploring deeper issues. Ecological theory views an entrepreneurial ecosystem as a symbiotic unity of internal actors and the external environment, a perspective widely accepted academically. However, due to the complexity and variability of the external environment and the diversity of internal actors, entrepreneurial ecosystems display diverse characteristics, and current research has yet to reach a consensus on its features [11].

2.2 Elements of University Makerspace Ecosystems

Scholars have extensively studied the elements of entrepreneurial ecosystems. Foster and Shimizu (2013) proposed an eight-pillar model including market, talent, universities, finance, culture, education, infrastructure, and mentors [12]. Kuratko et al. (2017) identified elements such as entrepreneurial firms, banks, venture capital, incubators, accelerators, universities, professional service providers, and government institutions[13]. Spigel (2015) introduced ten core elements divided into cultural, social, and material categories [8]. Chinese scholars like Xiang and Huang (2018) argue that maker space entrepreneurial ecosystems consist of makers, mentors, government, talent, technology, funding, services, policy, and marke[10]. Luo and Zhang (2019) included entrepreneurial spirit, maker ecosystem, resource ecosystem, and fundamental platforms and policies in their analysis [14] .

This paper posits that the diverse actors and system types within entrepreneurial ecosystems have led to a lack of consensus among scholars. Spigel's (2015) method of categorizing elements based on cultural, social, and material attributes provides a comprehensive framework for understanding and constructing entrepreneurial ecosystems, offering significant reference value.

2.3 Operational Mechanisms of University Makerspace Ecosystems

Scholars have proposed various operational mechanisms for entrepreneurial ecosystems in maker spaces. The knowledge spillover model promotes knowledge flow and enhances enterprise competitiveness (Autio et al., 2018)[15]. The capability enhancement model from the social capital perspective optimizes resource acquisition through collaboration, improving ecosystem efficiency (Theodoraki et al., 2018)[16]. The logic guidance model from the institutional perspective provides support by disseminating rules and values[17]. Tao and Huang (2021) categorize operational mechanisms into three layers: contextual (adaptive, dynamic entrepreneurship, and multi-level coupling), action (open innovation and self-organized renewal), and result (value creation)[18]

Despite significant academic progress in studying university makerspace ecosystems, several gaps remain. Theoretical research dominates with little practical guidance, focusing on qualitative analysis and neglecting synergies and dynamic evolution. Existing models overlook the unique characteristics of universities and lack detailed research. Conceptual models need practical verification. This paper constructs a Chinese application-oriented university makerspace ecosystem from a full-chain incubation perspective, using Pingdingshan University's Yingxiang Maker Space as a case study. It explores the connotation, elements, and

operational mechanisms, proposing specific construction strategies and implementation paths.

3. Theoretical Basis of Full-Chain Incubation in University Makerspaces

The theory of full-chain incubation originates from Henry Etzkowitz's Triple Helix theory, which emphasizes the integration of the industrial chain, entrepreneurial chain, and educational chain through the "government-industry-university" system [19]. This integration promotes knowledge production and transformation, creating a collaborative innovation mechanism.

Full-chain incubation integrates resources such as funding, technology, talent, market, and policy to provide comprehensive support for entrepreneurial projects. This approach enhances project success rates by providing both physical and intangible resources. Cooperative networks established through full-chain incubation foster interaction among various entrepreneurial entities, integrating knowledge and resources from multiple fields to boost overall innovation capacity. Furthermore, full-chain incubation is a dynamic process that continuously refines incubation services based on market demands and project developments.

The theory reveals the close connection and interaction between universities, industries, and governments in innovation activities, emphasizing the optimization of innovation capabilities at critical nodes of the value chain. Application-oriented universities should leverage their core role in the collaborative innovation of 'science-education-industry-education,' integrating various resources to build efficient innovation collaboration platforms. This approach aims to construct a comprehensive makerspace ecosystem, enhancing the competitive advantage of universities and enterprises in value creation.

4. Connotation and Characteristics of University Makerspaces

University makerspaces are distinguished by their public welfare nature. They provide basic functions like space services, resource sharing, and outcome transformation, alongside unique educational functions. They serve as shared, cross-disciplinary innovation and entrepreneurship service platforms with comprehensive operational mechanisms.

4.1 Educational Attributes

University makerspaces enhance innovative education by cultivating students' innovative awareness, providing continuous talent support. These spaces supplement traditional classroom education and play a crucial role in foundational innovation and entrepreneurship education, allowing students to engage in practical and simulated entrepreneurial environments, thus enhancing their skills and innovative capabilities.

4.2 Transformation Attributes

Universities' technological and research advantages can be translated into marketable technologies through makerspaces. They facilitate industry-academia-research collaboration, especially in engineering institutions, allowing students to leverage teachers' research outcomes to connect with industries and investment institutions. This alignment fosters students' entrepreneurial and innovative capabilities, enhances faculty and student innovation, and realizes the social value of knowledge achievements, thereby serving local economic development.

4.3 Cultural Attributes

University makerspaces foster a culture of innovation and entrepreneurship, creating an atmosphere that tolerates failure and celebrates innovation. They offer relevant courses, competition training, and practical exercises to develop students' entrepreneurial awareness and capabilities. The primary goal is to nurture entrepreneurial spirit and innovative abilities, instilling values of innovation and entrepreneurship in students, and enhancing their capacity for innovation.

5. Practical Experiences and Challenges of University Makerspaces

5.1 Practical Experiences of University Makerspaces

Yingxiang Maker Space follows principles of "integrated planning, distinctive development, relevance to majors, teachers, and students," using a "1+N" construction model. The "1" represents the innovation and entrepreneurship center, offering services like entrepreneurship venues, project assistance, training, applications, roadshows, and industry introductions. The "N" consists of specialized functional areas integrating resources from various disciplines and school-enterprise cooperative education, creating a comprehensive entrepreneurial ecosystem for students.

In the U.S., universities enhance student innovation through competitions, establishing a robust innovation and entrepreneurship ecosystem. MIT's system includes a curriculum, practical support, clubs, globalization, competitions, awards, and legal services [20] . German universities have the "Foundry for Entrepreneurs" plan, Japanese universities suggest starting companies with just one yen, and South Korea has 18 Creative Economy Innovation Centers, creating a "Dream Factory" for student entrepreneurship.

Chinese universities should consider national conditions and draw on international experiences to build a unique makerspace ecosystem, promoting sustainable national innovation and entrepreneurship education

and talent cultivation.

5.2 Challenges Faced by University Makerspaces

Chinese university makerspaces currently face several challenges:

Incomplete Curriculum System: Issues include unreasonable course settings, insufficient practical components, lack of professional guidance, and inadequate cross-disciplinary cooperation.

Insufficient Resource Integration: Inadequate external connections and low resource utilization lead to suboptimal allocation.

Inadequate Service System: Lacks tailored services for different entrepreneurial stages and sufficient professional services like technical guidance, market promotion, and legal consulting.

Lack of Collaborative Innovation: Insufficient cooperation depth among universities, enterprises, and government, resulting in less significant collaborative effects. Cross-disciplinary cooperation needs enhancement.

Low Internationalization: Limited connection with international resources, infrequent cooperation, and exchange, leading to a narrow global perspective among students and faculty.

Despite these challenges, Chinese university makerspaces hold significant educational, transformative, and cultural attributes. Their primary aim is to cultivate students' innovation and entrepreneurship spirit, achieve technological transformations, and promote regional economic development. Addressing these deficiencies through the full-chain incubation theory, which integrates resources, promotes sharing and collaboration, and provides comprehensive lifecycle services, is crucial for enhancing the efficiency and effectiveness of university makerspaces.

6. Model Construction of University Makerspaces from the Perspective of Full-Chain Incubation

This paper investigates the critical roles of educational supply, technological enablement, service enhancement, and industry demand from the full-chain incubation perspective, focusing on the characteristics of maker spaces in application-oriented universities in China. It proposes a model for the entrepreneurial ecosystem of these maker spaces (Figure 1). This model centers on student entrepreneurs, faculty entrepreneurs, research team entrepreneurs, and collaborative platform entrepreneurs, creating an internal circulation system within the maker ecosystem to support the dissemination and development of an innovation and entrepreneurship culture.

By integrating the education chain, technology chain, policy chain, and industry chain, the model optimizes the allocation of policies, markets, finance, information, technology, and human resources, providing substantial momentum for entrepreneurial projects. The internal and external dynamic circulation mechanisms utilize a four-tier progressive curriculum system, multi-level incubation platforms, an innovation and entrepreneurship service system, and multi-industry docking platforms to cultivate talents with innovative spirit and practical abilities in application-oriented universities. This comprehensive approach promotes the sustainable development of university maker spaces, facilitates collaboration between education and industry, and drives regional economic and social progress.

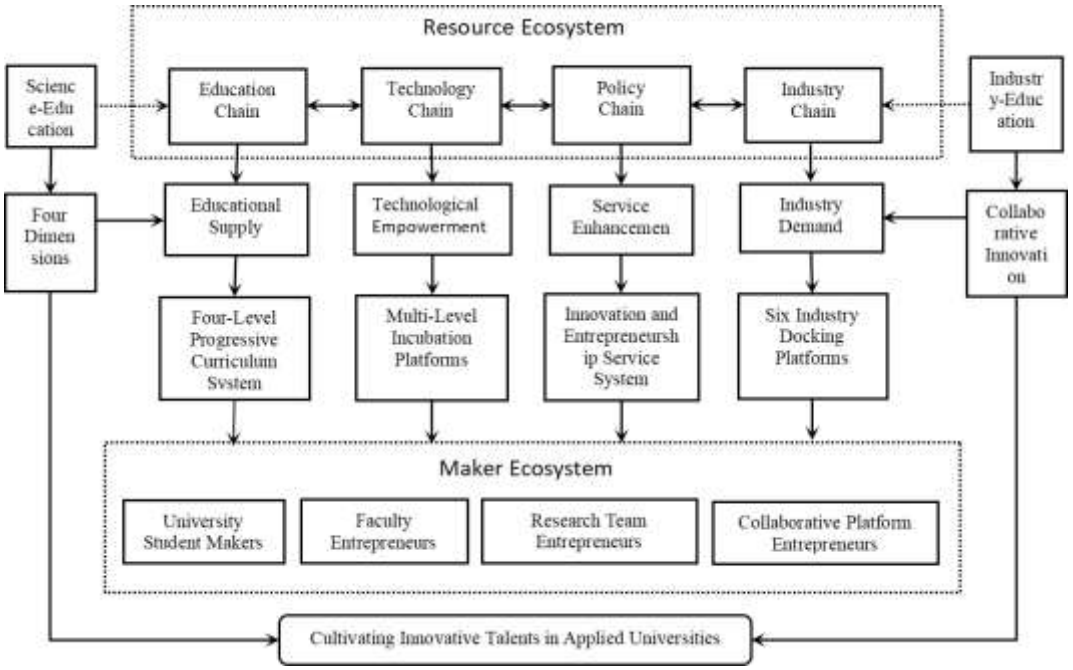

Figure 1 Ecosystem Model of Applied University Makerspaces from the Perspective of Full-Chain Incubation

6.1 Constructing a Four-Level Progressive Curriculum System for Innovation and Entrepreneurship

Constructing university makerspaces in China necessitates systematic construction and comprehensive planning to establish a complete "education chain." This approach should be student-centered, demand-driven, professionally grounded, and aimed at enhancing capabilities by integrating innovative thinking, entrepreneurial spirit, and business startup skills into the talent cultivation goals of various disciplines.

Chinese applied universities should draw from advanced international experiences, adhere to national entrepreneurship policies, and align closely with market demands to implement diversified, specialized, and gradient-based curriculum designs. Constructing a hierarchical and progressive curriculum system for innovation and entrepreneurship not only enhances students' abilities but also continuously revitalizes the entire innovation ecosystem. Taking Pingdingshan University's Yingxiang Makerspace as an example, this system comprises the following four levels:

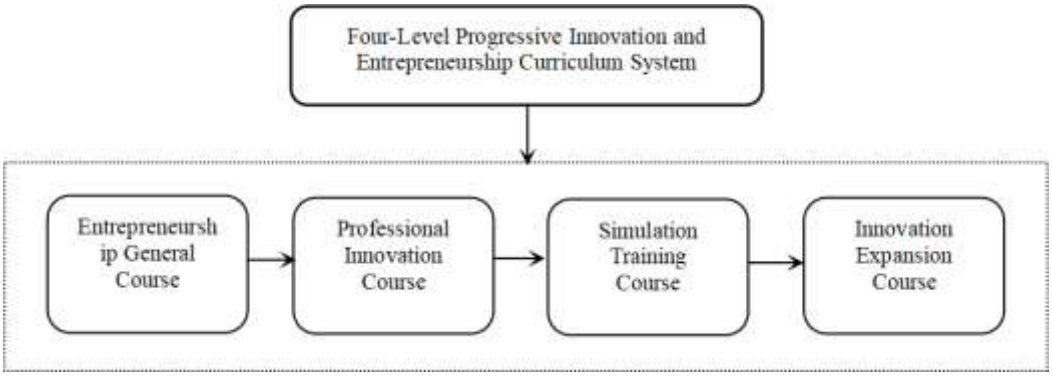

Figure 2 Four-Level Progressive Innovation and Entrepreneurship Curriculum System

6.1.1 Foundational Level: General Entrepreneurship Courses

General entrepreneurship courses provide students with fundamental concepts and theoretical frameworks in innovation and entrepreneurship. For instance, the "Fundamentals of College Student Innovation and Entrepreneurship" course utilizes systematic lectures, classroom instruction, group discussions, case analyses, and practical activities. This approach helps students grasp essential entrepreneurial concepts, cultivate entrepreneurial thinking, and enhance their awareness and practical experience in entrepreneurship. Yingxiang Maker Space's "Fundamentals of College Student Innovation and Entrepreneurship" course specifically uses case analyses and hands-on projects to help students understand market demands and the entrepreneurial environment.

6.1.2 Professional Level: Specialized Innovation Courses

Specialized innovation courses focus on integrating entrepreneurship with specific disciplines. Courses in fields such as information technology, mechanical design, and bioengineering cover advanced programming, mechanical design and manufacturing, and biotechnology applications. These courses aim to equip students with professional skills, enhance their technological innovation capabilities, and facilitate the practical application of research outcomes. For instance, the "Software Development and Entrepreneurship" course in information technology teaches students to apply software development technologies to real-world entrepreneurial projects. Through market research and product development, students learn to transform technological innovations into marketable products.

6.1.3 Practical Level: Simulation and Training Courses

Simulation and training courses integrate theory and practice through activities such as entrepreneurship sandbox simulations, competitions, and project-based training. These activities allow students to make decisions and manage operations in simulated business environments, accumulating entrepreneurial experience and enhancing their problem-solving skills[21]. For example, the entrepreneurship sandbox simulations organized by Yingxiang Maker Space enable students to simulate enterprise operations in a virtual business setting, covering aspects from market analysis to financial management. This approach provides students with firsthand experience in navigating the challenges and risks of the entrepreneurial process.

6.1.4 Advanced Level: Innovation Expansion Courses

Innovation Expansion courses target students with entrepreneurial experience and project foundations. These courses, employing a collaborative education strategy and utilizing maker spaces, innovation and entrepreneurship centers, and incubation parks as practical bases, offer interdisciplinary collaboration, international exchange programs, and high-level entrepreneurial activities to enhance students'

comprehensive skills and market competitiveness. For instance, the "Interdisciplinary Innovation and Entrepreneurship" course at Yingxiang Maker Space invites experts from various disciplines to co-teach, fostering interdisciplinary collaboration and entrepreneurial management experience through practical project operations.

By establishing a four-tier progressive innovation and entrepreneurship curriculum system, Pingdingshan University has achieved significant success in constructing an educational chain. From foundational entrepreneurship courses to specialized innovation courses, followed by simulated practical training and innovation expansion courses, the curriculum systematically addresses students' needs in fostering innovation and entrepreneurial abilities. This educational chain not only provides talent support for the maker ecosystem but also lays a foundation for the sustainable development of maker space ecosystems. It demonstrates the immense potential and broad prospects of constructing the ecosystem of maker spaces in Chinese applied universities from a holistic incubation perspective.

6.2 Constructing Multi-Level Incubation Platforms

From the perspective of full-chain incubation, constructing multi-level incubation platforms is crucial for developing the innovation and entrepreneurship ecosystem in Chinese applied universities' makerspaces. By integrating resources from innovation and entrepreneurship colleges, innovation studios, business incubation bases, and collaborative innovation platforms, these multi-level platforms support the maturation and development of entrepreneurial projects at various stages. They provide comprehensive support, from the inception of innovative ideas to their marketization.

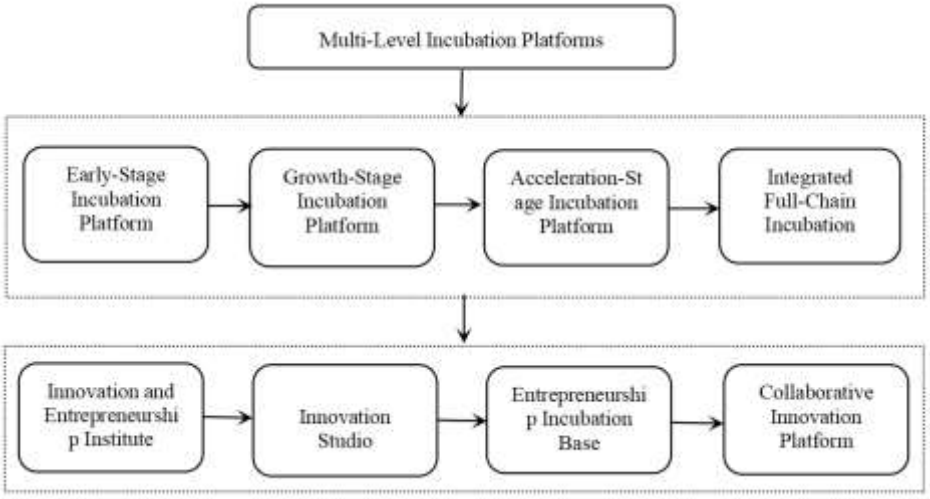

Figure 3 Multi-Level Incubation Platforms

6.2.1 Initial Stage Incubation Platform

In the nascent phase, startup platforms support newly established ventures by providing essential infrastructure and initial guidance. Pingdingshan University's Yingxiang Maker Space, through its innovation studios and entrepreneurship colleges, offers complimentary office space, basic equipment, and network support. Additionally, it establishes an entrepreneurship academy that delivers services such as business plan development, market research, and training in entrepreneurial knowledge. Furthermore, it hosts entrepreneurship salons and networking events, facilitating the establishment of fundamental entrepreneurial networks and access to resources.

6.2.2 Growth Stage Incubation Platform

The growth stage incubation platform supports projects that have progressed beyond the initial phase, helping to refine products and business models. Yingxiang Maker Space leverages resources like innovation studios and product experimentation centers to offer advanced technical support and consulting. For example, a health monitoring device team enhanced their sensor technology in the lab, improving product accuracy and user experience. Expert mentors provide professional guidance in market analysis, marketing strategy, and operations management. Entrepreneurial competitions and roadshows enhance market exposure and attract investments.

6.2.3 Acceleration Stage Incubation Platform

The acceleration stage incubation platform targets projects with an existing market foundation and customer base, providing high-level resource connections and market expansion services. Yingxiang Maker Space utilizes collaborative innovation platforms and business incubation bases to introduce venture capital and angel investment funds, addressing financing needs. For instance, a cross-border e-commerce company secured 1 million RMB in funding through the platform's venture capital connections. A brand promotion

center guides brand building and market promotion. For example, a new media team doubled its followers within six months with the center's assistance. By connecting with large enterprises and multinational companies, the platform helps expand market channels and partnerships, thereby enhancing market competitiveness.

6.2.4 Full-Chain Service Integration

Yingxiang Maker Space emphasizes the integration and optimization of full-chain services by leveraging resources from innovation studios, entrepreneurship colleges, incubation bases, and collaborative platforms. This comprehensive entrepreneurial service system covers project selection, technical support, market promotion, and financing, ensuring holistic support for each entrepreneurial project. For example, the "Taike Yingfu" smart detection project team received end-to-end guidance in technical support, market promotion, and financing, successfully launching an intelligent traffic management system and securing orders from multiple cities. Regular evaluations and feedback continuously optimize the incubation service content and model, enhancing both incubation efficiency and project success rates.

Pingdingshan University actively expands off-campus practice bases and collaborates with multiple enterprises to co-establish innovation and entrepreneurship collaboration bases and industrial colleges. Through multi-level incubation and nurturing platforms, Yingxiang Maker Space provides precise, full-chain support to entrepreneurial projects, significantly improving project success rates and market competitiveness. This multi-tiered, systematic incubation model demonstrates strong potential and broad application prospects, offering valuable references and practical guidance for constructing the ecosystem of maker spaces in Chinese application-oriented universities.

6.3 Constructing a "Four-in-One" Dual Innovation Service System

From the full-chain incubation perspective, establishing a "four-in-one" innovation and entrepreneurship service system is essential for the efficient operation of makerspace ecosystems in Chinese applied universities. This system integrates services across four dimensions: policy support, market promotion, technical support, and resource integration. It provides comprehensive and in-depth support to facilitate the smooth development and market success of entrepreneurial projects.

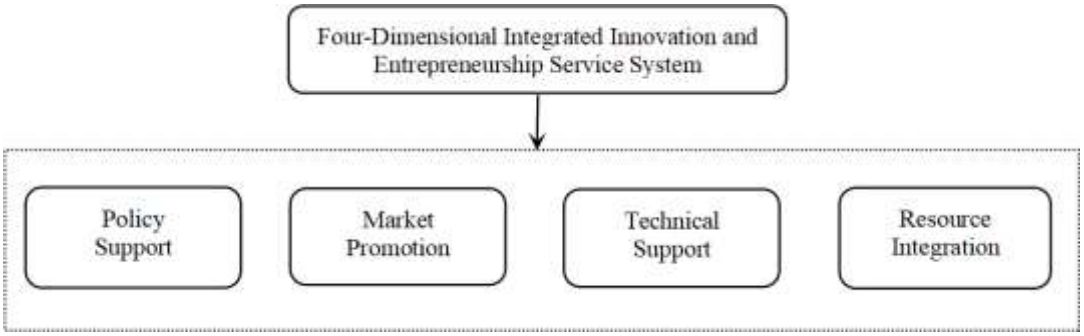

Figure 4 Four-Dimensional Integrated Innovation and Entrepreneurship Service System

6.3.1 Policy Support

Policy support is fundamental to the innovation and entrepreneurship service system. Pingdingshan University collaborates with government departments to secure policies and funding for entrepreneurial projects. The university has invested over 20 million RMB in infrastructure and equipment, establishing an innovation and entrepreneurship center with specialized functional areas. These facilities provide services such as startup space, project assistance, and entrepreneurial training. For instance, Pingdingshan University received 1 million RMB from the Pingdingshan Science and Technology Bureau for the "Pingdingshan University Innovation and Entrepreneurship Center Service Construction Project" and 300,000 RMB for the "Pingdingshan City Entrepreneurship Incubation Demonstration Base Construction." Additionally, the university has helped six startup companies secure a total of 2.2 million RMB in financing, provided interest-free loans for six companies, and assisted seven companies in obtaining a total of 465,000 RMB in startup subsidies.

6.3.2 Market Promotion

Market promotion enhances the visibility and competitiveness of entrepreneurial projects. Yingxiang Makerspace's market promotion center offers services in brand building, market marketing, and public relations activities. For example, a health management app team successfully attracted a large user base and secured funding through market research and positioning. A smart home team increased product exposure and sales by participating in exhibitions and product launch events. Additionally, a new media content creation team achieved a 50% user growth rate and secured 1 million RMB in financing through online advertising and public relations activities.

6.3.3 Technical Support

Technical support is a core element, providing technical training, development, and project management services. Yingxiang Makerspace's technical support center helps teams overcome technical bottlenecks. For instance, a smart home project team developed a high-voltage electrical wireless discharge positioning system, replacing similar foreign products at a quarter of the price, applied in major national projects. Additionally, the technical support team at the Lushan Porcelain Industrial Park developed 18 new ceramic products, widely adopted by multiple enterprises.

6.3.4 Resource Integration

Resource integration ensures comprehensive connectivity by leveraging internal and external resources. Yingxiang Makerspace has established specialized functional zones for holistic resource support. The Ceramic Creativity Zone supports design, research, and market promotion for ceramic-related projects, while the E-commerce Zone assists with market expansion and brand building. A biomedical team connected with renowned pharmaceutical companies and research institutions, gaining technical resources and market opportunities, facilitating project progression. Additionally, an interdisciplinary green energy project received dual support for technical improvement and market promotion, quickly establishing a market presence, with market share increasing by 30% through E-commerce Zone support.

In summary, constructing a "Four-in-One" innovation and entrepreneurship service system is essential for the efficient operation of the ecosystem in Chinese application-oriented university maker spaces. This system, encompassing policy support, market promotion, technical support, and resource integration, provides comprehensive backing and momentum for entrepreneurial projects, enhancing success rates and market competitiveness. It promotes the sustainable development of university maker spaces in China, significantly improving the quality and effectiveness of innovation and entrepreneurship education. For instance, the StartX accelerator at Stanford University has notably improved project success rates and market competitiveness through its collaboration with Silicon Valley tech companies, offering valuable insights for the construction of maker spaces in Chinese universities [22].

6.4 Constructing Six Industry Linkage Platforms

From the perspective of full-chain incubation, constructing industry linkage platforms is crucial for the efficient operation of ecosystems in Chinese applied university makerspaces. Close industry connections provide substantial support for entrepreneurial projects, facilitating their marketization and industrialization. Based on recent practical experiences, Pingdingshan University's Yingxiang Makerspace proposes constructing a "six-linkage" industry-education cooperation platform to comprehensively advance innovation and entrepreneurship education reform.

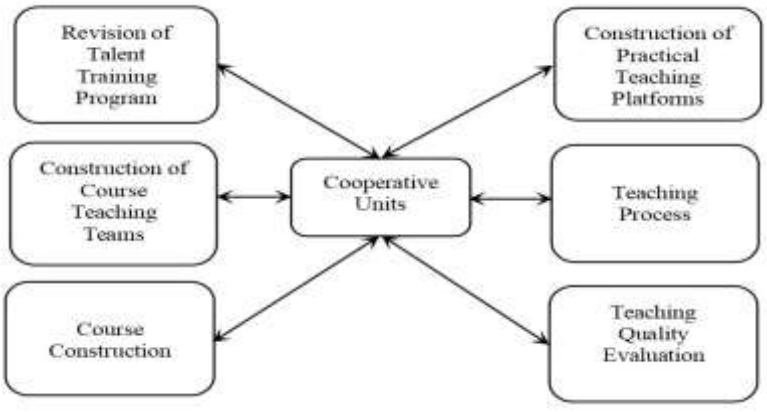

Figure 5 Six Industry Linkage Platforms

6.4.1 Revising Talent Training Programs

Talent development programs are fundamental to maintaining high standards in university education. Pingdingshan University has established a Professional Construction Advisory Committee, including academic experts from the university and specialists from government, other universities, and industry sectors. This committee ensures the curriculum remains relevant and aligned with industry needs. For example, collaboration with a leading local technology company has led to revisions in the information technology program, integrating the latest technological requirements and job specifications, thus enhancing graduates' employability.

6.4.2 Building Course Teaching Teams

High-level teaching teams are essential for ensuring educational quality. Pingdingshan University has developed a management framework to integrate industry professionals into academic teams. This approach

aims to create cohesive teaching teams blending academic knowledge with industry expertise. For instance, the E-commerce College collaborates with a leading e-commerce platform, inviting senior executives to contribute to course development and teaching, providing students with insights into the latest industry trends and practical skills.

6.4.3 Developing Courses

Course development is crucial for cultivating students' professional abilities. Pingdingshan University collaborates with enterprises to develop and reform courses, incorporating real enterprise projects and new industry developments into the curriculum. For example, the Ceramic Creativity Zone leverages the local ceramic industry's advantages to support ceramic-related entrepreneurial projects in design, development, and market promotion, ensuring that teaching content aligns with industry needs.

6.4.4 Building Practical Teaching Platforms

Practical teaching platforms are essential for enhancing students' practical abilities. Pingdingshan University collaborates with enterprises to create practice teaching platforms providing real vocational environments. For example, the university partnered with a biomedical company to establish a joint laboratory, allowing students to conduct experiments and gain hands-on experience with cutting-edge technologies and equipment, laying a solid foundation for future employment and entrepreneurship.

6.4.5 Integrating the Teaching Process

The teaching process is the implementation of talent training objectives. Pingdingshan University utilizes internal and external teaching platform resources to conduct industry technology applications, professional internships, production training, and graduation projects through school-enterprise cooperation. For instance, the Cultural Media Zone collaborated with a renowned media company, allowing students to intern and participate in media content production and distribution, thus gaining practical work experience and enhancing their overall competence.

6.4.6 Evaluating Teaching Quality

Teaching quality evaluation ensures the effectiveness of education. Pingdingshan University invites industry experts to participate in evaluating professional talent training quality, promoting external and market-oriented quality evaluation. By introducing industry standards and enterprise evaluation systems, the university ensures that graduates meet market demands. For example, technical managers from various companies participate in graduation project defenses and talent training quality evaluations, enhancing the objectivity and industry recognition of the evaluations.

Establishing industry integration platforms at Pingdingshan University's Yingxiang Makerspace effectively aligns innovation and entrepreneurship with industrial development, providing substantial support and growth opportunities for entrepreneurial projects. These platforms enhance technical capabilities and market competitiveness, facilitating successful implementation and commercialization. Collaborations with various industries offer students practical experience and development opportunities, strengthening their skills and promoting regional economic and industrial innovation. Pingdingshan University's experience demonstrates that these platforms provide comprehensive support for entrepreneurial projects, enhance the sustainability of maker spaces in Chinese application-oriented universities, and cultivate high-quality, innovative talent, showcasing the potential for building university maker space ecosystems from a full-chain incubation perspective.

7. Conclusion

Under the strategic initiative of "Mass Entrepreneurship and Innovation," exploring the ecosystem composition and its key factors for innovation and entrepreneurship holds significant practical and academic value. This study, using Pingdingshan University's Yingxiang Makerspace as a case, demonstrates how a systematic approach involving a four-tier progressive curriculum, multi-level incubation platforms, a comprehensive four-dimensional service system, and industry integration platforms can enhance the efficiency and sustainability of makerspaces in Chinese applied universities. These elements collectively improve the success rate and market competitiveness of entrepreneurial projects. The integration of policy support, market promotion, technical support, and resource integration fosters a comprehensive service ecosystem, with industry integration playing a crucial role in aligning innovation with industrial development.

The systematic full-chain incubation service at Yingxiang Makerspace has significantly enhanced the overall efficiency of makerspaces, cultivated numerous talented individuals with innovation and practical skills, and contributed to regional economic and social development.

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