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Qingdao University has explored the construction of an open sharing mechanism for large-scale instruments and equipment based on "joint management and common use, specialized management and common use, and specialized management and dedicated use"

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Abstract: The open sharing of large-scale scientific instruments and equipment represents a fundamental requirement for national university management standards, essential for the "Double First-Class" initiative, and a crucial measure to resolve resource allocation challenges in Chinese higher education. Qingdao University has consistently prioritized establishing a first-class resource support system. Through continuous institutional reforms, it has developed two-tier public sharing platforms at both university and college levels, optimized research team support systems, and created an integrated management framework encompassing administration, service, supervision, and incentives. The university has pioneered an open-sharing mechanism featuring "shared access, co-management, and paid utilization," effectively promoting sustainable operation of these facilities while continuously enhancing their operational efficiency.

Key words: Open sharing of large-scale instruments and equipment, system construction

1. Introduction

With the advancement of our university's "Double First-Class" initiative, we have acquired substantial large-scale instruments to support talent cultivation, scientific research, and social services[1]. However, the utilization efficiency of these resources remains suboptimal, with the growing scale of major equipment clashing with outdated sharing mechanisms. Key challenges include: 1) Lack of shared awareness and incomplete safeguard systems. While state-owned assets fall under institutional management, the concept of shared use has not gained widespread acceptance. Maintenance protocols for equipment remain underdeveloped, causing operators to hesitate about sharing equipment. 2) Overcapacity and inefficiency. Some devices provide service hours far exceeding academic needs, with many instruments underutilized — below national education standards—leaving resource potential untapped. 3) Unclear responsibilities and chaotic management. Responsibilities among administrative departments, faculties, and operators remain ambiguous. Unreasonable revenue distribution for sharing and inadequate protection of operators' interests hinder operational motivation. 4) Outdated platforms and shortages. Inadequate physical and digital platforms for equipment sharing, coupled with poor information dissemination channels and cumbersome reservation/costing procedures, result in both idle equipment and researchers struggling to access resources[2]. How to effectively manage these large-scale instruments and maximize their support for institutional development has become a critical governance challenge.

2. Work philosophy and ideas

Guided by practical needs, Qingdao University has established a four-pronged management system integrating "administration, service, supervision, and incentives" to maximize the utilization of scientific equipment resources for teaching and research[3]. Through comprehensive research on institutional realities and operational challenges, the university has developed an open sharing mechanism featuring shared access, collaborative management, and fee-based utilization. The implementation strategy focuses on four key areas: First, refining three-tier management frameworks at the university, college, and laboratory levels, including shared funding allocation, maintenance protocols, performance evaluation systems, and merit-based rewards/punishments

to ensure institutional guidance. Second, enhancing university-level platforms like analytical testing centers while expanding secondary platforms across colleges, optimizing large-scale equipment networks, establishing a university maintenance fund, and improving service support. Third, conducting quarterly equipment performance reviews and annual evaluations to enhance supervision feedback. Fourth, implementing preferential policies for procurement, excellence awards, maintenance funding, and training programs to incentivize outstanding sharing units.

3. Measures taken

(1) Improve the Open Sharing System for Large-Scale Instruments and Equipment, Strengthen Institutional Guidance[2]. The university has successively issued the "Interim Measures for the Management of Open Sharing of Large-Scale Instruments and Equipment at Qingdao University", "Implementation Measures for Improving the Utilization Rate of Large-Scale Instruments and Equipment (Trial)", and "Interim Measures for the Management of Paid Use of Large-Scale Instruments and Equipment (Trial)". Supporting systems such as the maintenance fund management measures for large-scale instruments and equipment open sharing, reward and punishment mechanisms, and other supporting regulations have been improved to provide institutional guidance for open sharing.

(2) Build a Two-Level Public Platform System at University and College Levels, Optimize Research Team Platforms, and Establish a "Three-in-One" Platform Framework. Construct university-level public platforms including the Analytical Testing Center and Biomedical Center. Achieve integrated development between the State Key Laboratory of Bio-polysaccharide Fiber Forming and Eco-textile and its Analytical Testing Center, continuously enhancing the functionality of university-level public platforms. Gradually advance the construction of college-level public platforms, improve the operational mechanisms of college-level public platforms, strengthen the open sharing system for college-level public platforms, and establish open sharing frameworks for colleges such as the School of Chemistry & Chemical Engineering, School of Materials Science & Engineering, School of Life Sciences, and School of Textile & Apparel. Prioritize allocation of laboratory space and funding to public platforms, guiding new purchases of large-scale equipment into university and college-level public platforms for shared use, thereby improving equipment utilization efficiency. Optimize research team platforms by prioritizing the procurement of small-scale, specialized common equipment while restricting single-purpose monopolized equipment, achieving complementary support across university, college, and research team platforms.

(3) Accelerate the Construction of Large Instrument Sharing Platforms and Improve Service Support. Enhance the integration of large instruments into the sharing platform by systematically connecting all equipment valued over 300,000 yuan from the asset inventory to the platform. Actively process network access for eligible instruments that meet sharing requirements. Update existing instrument information in the sharing management system to improve search functionality, reservation processes, and collaborative utilization. Enforce the "Three Simultaneities" policy (simultaneous acceptance, asset registration, and network integration) for major equipment. Implement digitalized management covering reservation, authorization, monitoring, and billing processes for shared devices. Collaborate with financial departments to develop fee management modules, streamlining billing procedures for enhanced service efficiency. As of June 2025,692 large instruments have been incorporated into the sharing program, with 686 hardware units connected. Our university has actively supported the Shandong Provincial Department of Science and Technology in instrument sharing initiatives. To date, 674 instruments are registered on the provincial open-sharing platform, 603 equipped with IoT sensors, and 71 awaiting installation when conditions permit. We will coordinate with engineers to complete remaining installations, further improving operational convenience.

(4) Conduct Performance Evaluations and Feedback Mechanisms. Publish quarterly reports analyzing common challenges in instrument sharing across departments, propose actionable recommendations, and maintain regular communication with relevant colleges. The annual performance assessment of large-scale instruments and equipment is carried out to continuously improve the assessment index system of large-scale instruments and equipment. The assessment scope includes machine time utilization, personnel training, service income and sharing, so as to realize the assessment from machine time to performance output.

Since the implementation of performance evaluations for large-scale instruments, the number of shared equipment sets and machine hours has shown consistent annual growth. In 2020, with 235 large devices, the evaluated machine hours reached 503.63. This figure

increased to 707.16 in 2021,1,710 in 2022,2,223.44 in 2023, and finally 2,422.24 in 2024. During this period, 620 large instruments across the university underwent evaluation, averaging 1,868.24 hours of usage. The total machine hours grew from 503 in 2020 to 1,868.24 in 2024, representing a 3.71-fold increase. External service revenue rose from 621,400 yuan in 2020 to 3,642,140 yuan in 2024, marking a 5.86-fold increase. Additionally, the number of shared instruments grew from 235 in 2020 to 620 in 2024, achieving a 2.64-fold expansion compared to the initial count[4].

Comparison of five consecutive years of sharing data

(5) Enhance the application of assessment outcomes for large-scale instruments and equipment to establish effective incentive mechanisms. Integrate evaluation results with procurement decisions, maintenance fund allocations, and operator training programs to maximize practical implementation. Align maintenance fund support ratios with assessment performance, prioritizing units demonstrating high utilization efficiency and shared benefits to boost operational incentives. Establish a dedicated fund for laboratory team capacity development through special grants, providing subsidies for professional training of operators who excel in equipment sharing initiatives.

(6) Incorporating Open Sharing of Large-Scale Instruments into Annual Assessment System for University-Level Units To advance the implementation of development goals outlined in the university's strategic plan, and to fully leverage the guiding role of performance evaluations in stimulating internal motivation and innovation across the institution, Qingdao University has integrated the open sharing of large-scale instruments into its annual assessment system for secondary units. The evaluation criteria for these units now include three sub-indicators under state-owned asset management: 1. Registration of large-scale instruments in fixed asset inventory and shared management platforms (sub-indicator name), with a weight of 0.2. Institutions failing to register such equipment will receive zero points for this indicator. 2. Annual usage hours of large-scale instruments (sub-indicator name), with a weight of 0.6. Equipment showing zero annual usage hours will receive zero points. 3. Revenue from equipment sharing and technical services (sub-indicator name), with a weight of 0.2.

(7) Transitioning from Single Procurement Review to Comprehensive Project Evaluation Implementing unified procurement planning across academic disciplines, specialized review panels will be established for similar disciplines to conduct comprehensive evaluations of large-scale instrument acquisitions. This reform replaces the previous "individual allocation" approach, where user units submitted requests independently. Instead, all equipment purchases will undergo coordinated reviews aligned with institutional development plans covering academic programs, teaching initiatives, research activities, and laboratory infrastructure. Essential evaluations will assess the necessity, rationality, cost-effectiveness, technological advancement, forward-looking potential, sharing capacity, and avoidance of duplication in large-scale instrument procurement.

4. Achievements and prospects

Through nearly five years of efforts, our university has achieved notable progress in the open sharing of large-scale instruments and equipment[5]. Various departments have begun prioritizing resource accessibility, establishing relevant regulations and assigning dedicated administrators to oversee the initiative, which has shown initial success. Moving forward, the university will intensify development of university and college-level public platforms, optimize research team support systems, and build a tripartite sharing platform framework integrating university, college, and research teams. Key priorities include: 1) Enhancing the

analytical testing center's social service capabilities; 2) Planning college-level shared network and physical platforms to integrate 100,000-300,000 instruments into these systems; 3) Guiding research teams to incorporate major equipment under unified management, while addressing challenges like insufficient operational funding and maintenance budgets to maximize equipment efficiency. The open sharing of large-scale instruments serves as crucial support for talent cultivation, scientific research, and community services, while optimizing resource allocation. This initiative directly impacts asset utilization efficiency and faculty-student productivity. Centered on core objectives, the university will continue implementing resource optimization projects, enhancing precise asset allocation, establishing long-term mechanisms, and building a first-class resource support system to provide robust backing for developing a comprehensive research university.

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