

On the open sharing and promotion strategy of large equipment in colleges and universities

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Abstract: With the continuous large-scale investment of education resources by the country, as well as the deepening implementation of policies for the open sharing of major scientific research infrastructure and large-scale scientific research instruments, large-scale instruments and equipment have continued to realize resource sharing, and the capacity for technological innovation and social services has been improved to a certain extent. Large scale instruments and equipment are the core tools for scientific research exploration and an important reflection of the scientific research strength of universities. Under the traditional management mode of large scale instruments and equipment, it is particularly important to improve the scientific management level of large scale instruments and equipment and enhance the efficiency of open sharing of large scale instruments and equipment. The author takes a certain university as an example to conduct an in-depth analysis of the use and existing problems of large-scale instruments and equipment. SWOT analysis method is used to analyze the internal strengths and weaknesses of the university, thus external policies and regulations as well as factors affecting the open sharing of large-scale instruments and equipment are thoroughly understood. It is proposed to establish an open sharing management mechanism, a university level open sharing platform for large-scale instruments and equipment, as well as a three-level management model for talent experts, experimental crew members, and graduate students, and implement full lifecycle management for large-scale instruments and equipment. This will enable open sharing of instruments and equipment, create interdisciplinary and interactive innovative research service platforms, and meet the needs of talent cultivation in universities.

Key words: large scale instruments and equipment; open sharing mechanism; full lifecycle management

1 Introduction

With the continuous opening up of major scientific research infrastructure and large-scale scientific research instruments to society, as well as large-scale investment in educational resources, large-scale instruments and equipment continue to achieve resource sharing, and technological innovation and social services have also been improved to a certain extent. Major scientific research infrastructure and large-scale scientific research instruments and equipment are important technological foundation resources for scientific and technological innovation. Continuously promoting open and shared work is of great significance for enhancing the overall efficiency of national innovation and serving the major scientific and technological innovations in the country. Therefore, scientific management of large instruments and equipment and improving the efficiency of open sharing of large instruments and equipment are particularly important [1]. The author

takes a certain university as an example to deeply analyze the usage and existing problems of large instruments and equipment, and attempts to propose a full lifecycle management model for large instruments and equipment, providing guarantees for the development of disciplines and the improvement of scientific research and innovation capabilities [2].

2 Current status of utilization of two large instruments and equipment

Under the traditional management mode of universities, each secondary college acquires large instruments and equipment based on its own disciplinary characteristics and professional construction. We will take the annual data of a university for the year 2021 as an example.

From the analysis of the original value of large instruments and equipment, there are 125 large instruments and equipment with a cost of over 500,000 yuan, 49 large instruments and equipment with a cost of over 1 million yuan, and 6 large instruments and equipment with a cost of over 5 million yuan. The data show that high-precision and cutting-edge equipment accounts for 39.2%, mainly providing data support for scientific research. There is still room for improvement in the configuration of high-end scientific research equipment. At the same time, major scientific research projects will also be limited due to the shortage of high-end equipment, which will affect scientific research efficiency and innovation. The data show that there are differences in the number of devices within different value ranges, such as 76 devices within the range of 500,000 to 1 million yuan. The distribution of funds is uneven, and excessive investment in medium value devices occupies a certain amount of scientific research space, squeezing out educational space, and also affecting the improvement and breakthrough of scientific research level.

From the perspective of the age of large instruments and equipment, there are 4 large instruments and equipment that are over 20 years old and 65 large instruments and equipment that are over 10 years old. Data show that outdated equipment accounts for 52%. Although these devices are still useful in teaching demonstrations and some testing and analysis, they will affect the quality and efficiency of teaching and scientific research due to outdated technology, increased maintenance costs, and decreased accuracy. At the same time, the innovation and competitiveness of scientific research capabilities are affected, which is not conducive to the development and sharing of large instruments and equipment.

From the analysis of instrument and equipment utilization rate, 125 large instruments and equipment have an annual operating time of 228,500 hours, of which 14,600 hours are for external service. 25 devices with an annual working hours of over 2,000 hours, including 10 devices with a working hours of over 3,000 hours, each with an original value of over 1 million yuan; 71 devices with annual working hours less than 1,600 hours, of which 40 devices have been purchased for more than 10 years. The data show that the overall utilization rate of shared machines for large-scale instruments and equipment is relatively low, with a higher utilization rate and external service duration for large-scale instrument and equipment priced over 1 million yuan, which can meet the needs of both campus use and external sharing. At the same time, some popular devices wear out faster due to their high frequency of use, resulting in equipment damage. However, instruments and equipment that have been used for less than 1,600 hours may experience a decrease in usage due to aging and performance degradation, resulting in increased maintenance costs and difficulty in obtaining funding for updates and maintenance.

3 Open and sharing strategy for large instruments and equipment

The SWOT analysis method is used to analyze the internal strengths and weaknesses of a certain university, gain a deeper understanding of external policies and regulations, as well as the factors that affect the open sharing of large instruments and equipment. It is not difficult to see from the above analysis and Table 1 that the open sharing of large-scale instruments and equipment cannot be separated from high-precision and cutting-edge instruments and equipment, professional talent teams, and advanced management mechanism models.

Table 1. SWOT analysis of open sharing of large- scale instruments and equipment (2021)

	Internal advantage-S	Internal disadvantage-W
	<ol style="list-style-type: none"> 1. national key laboratories and provincial and ministerial-level key laboratories 2. scientific research ability and comprehensive strength of academicians, talents and other scientific research teams 3. characteristic and professional social service influence 	<ol style="list-style-type: none"> 1. old large instruments and equipment 2. insufficient number of experimenters 3. no training system for large instruments and equipment
External opportunity-O	SO strategy	WO strategy
<ol style="list-style-type: none"> 1. State funds are invested in equipment upgrading in the field of education. 2. Encourage enterprises and regions to jointly build, share and open up. 3. Establish open and sharing platforms for large instruments and equipment at all levels. 	<ol style="list-style-type: none"> 1. Combine the characteristics of disciplines and majors, give play to their own advantages, and closely integrate research with enterprises. 2. Give full play to the professional and industrial influence, and pay attention to the transformation of scientific research achievements. 3. Guided by the needs of enterprises, give full play to the professional characteristics, and explore new methods of cultivating applied talents. 	<ol style="list-style-type: none"> 1. Relying on policies, fully demonstrate the feasibility of newly purchased large instruments and equipment and the iterative update of equipment. 2. Increase the skill training of professionals and key personnel, and pay attention to the training of graduate students' practical operation ability. 3. Expand cooperation opportunities.
Outside threat -T	ST strategy	WT Strategy
<ol style="list-style-type: none"> 1. The experimental data can accurately meet the market demand. 2. Open, sharing and publicity of large instruments. 3. There are many instruments and equipment of the same type. 	<ol style="list-style-type: none"> 1. Scientifically establish a three-level audit management system, pay attention to experimental process management, experimental data verification and experimental equipment maintenance. 2. Establish a university-level open and sharing platform for large instruments and equipment, and build an open and sharing management mechanism. 3. Create a data analysis model with professional characteristics. 	<ol style="list-style-type: none"> 1. Classify and manage instruments and equipment, maintain, update, and purchase equipment, and allocate teaching and research time reasonably. 2. Establish a three-level management model consisting of talent experts, experimental crew members, and graduate students to achieve intergenerational transmission and maintain the continuity of scientific research. 3. Increase sufficient demonstration of newly purchased equipment, control the number of similar equipment, and coordinate resource planning.

3.1 Build an open sharing management mechanism and establish a school level open sharing platform for large-scale instruments and equipment

A school level sharing platform should be built to achieve open sharing of laboratory resources between disciplines and stimulate innovation vitality. An open and sharing management mechanism can be established to motivate excellent large-scale instrument and equipment units and management units, and focus on talent cultivation and open sharing effectiveness assessment, so as to provide good services for further promoting disciplinary research and development. It is necessary to regularly evaluate the usage of equipment, monitor and analyze the usage of equipment when it is open to the outside world, and propose targeted measures to improve the effective utilization of resources.

3.2 Establish a three-level management model consisting of talent experts, experimental crew members, and graduate students

It is necessary to form an experimental team composed of talented experts, who can scientifically formulate experimental plans, establish experimental data verification and review processes, and regularly maintain the safe operation of experimental equipment. At the same time, the experimental crew pays attention to training and cultivating master's and doctoral students in instrument and equipment operation and data analysis skills, achieving intergenerational transmission and maintaining the continuity of scientific research.

3.3 Implement full lifecycle management of large instruments and equipment

The whole life-cycle process for large-scale instruments and equipment should be established, including feasibility study, procurement and storage, operation management, equipment efficiency, and disposal etc., so as to realize real-time monitoring of large instruments and equipment, and improve the efficiency level of shared management, reasonably allocate resources, and avoid idle and wasteful resources.

4 Conclusion

Large scale instruments and equipment are important means to achieve scientific research results and also an important reflection of the scientific research strength of universities. It should further optimize the traditional management method of large scale instruments and equipment, continuously improve the scientific management method of the entire lifecycle of large-scale instruments and equipment, so as to realize the open sharing of instruments and equipment, the effective utilization of resources, provide a service platform for interdisciplinary interaction and innovation research, meet the needs of talent cultivation in universities, and provide strong support for serving the major scientific and technological strategic needs of the country.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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[1] The 20th Academician Conference of the Chinese Academy of Sciences, the 15th Academician Conference of the Chinese Academy of Engineering and the 10th National Congress of the Chinese Association for Science and Technology, 2021.5.28.

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