

Research on Management and Updating Strategies of Laboratory Equipment in University

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DOI: <https://doi.org/10.5281/zenodo.10792731>

Published Date: 07-March-2024

Abstract: This article deeply discusses the management and update strategy of university laboratory equipment, and puts forward a series of effective improvement measures in view of the existing problems in the current equipment management. This paper first analyzes the current situation of equipment management, reveals the lack of equipment purchase planning, improper use and maintenance, and then emphasizes the importance of updating strategy. On this basis, a detailed equipment update plan was developed, including needs assessment, goal setting, fund raising, training and technical support of the updated equipment, etc., to ensure the orderly progress of the update work. At the same time, the key strategies such as the whole life cycle management, rational allocation and layout are put forward to improve the efficiency of equipment use and prolong the service life. Finally, the article looks forward to the future development trend of equipment management, such as intelligence, information and environmental protection. The research results of this paper not only provide valuable reference for the management of laboratory equipment in universities, but also contribute to the optimization and development of laboratory equipment, which is of great significance for improving the level of teaching and scientific research.

Keywords: University laboratory equipment management, equipment update, whole life cycle management, rational allocation, intelligent, information.

I. INTRODUCTION

With the rapid development of science and technology and the deepening of education reform, laboratory equipment plays an increasingly prominent role in scientific research and teaching. They are not only an important tool to improve the quality of teaching, but also a key factor to produce scientific research results. However, the management of laboratory equipment in colleges and universities is faced with many challenges, such as low efficiency, aging of equipment, rapid technological update and uneven quality of management personnel. These problems seriously affect the efficiency and life of the equipment, and restrict the smooth development of scientific research and teaching.

Therefore, it is particularly urgent to study the daily maintenance and update plan of laboratory equipment in universities and explore ways to improve the efficiency of equipment use and extend the service life (Zhang Zhe, 2019). Aiming at these problems, this study aims to put forward effective management strategies and provide theoretical and practical guidance for laboratory equipment management in universities. By optimizing equipment allocation, improving use efficiency and extending service life, the optimal allocation and efficient use of educational resources can be promoted, and the overall level of scientific research and teaching in universities can be improved (Xu Anqi, 2023). At the same time, this study will also focus on the scientific and standardized management of laboratory equipment to promote the sustainable development of higher education resources. This will not only help to cultivate innovative talents and improve the overall level of our higher education, but also contribute to the development of our higher education. It is expected that this study can provide strong support for the improvement of laboratory equipment management in universities, and make positive contributions to promote the progress of higher education in China.

II. RESEARCH ON EQUIPMENT DAILY MANAGEMENT STRATEGY

At present, there are many problems in the management of university laboratory equipment, such as imperfect management system, unreasonable equipment configuration, insufficient maintenance and so on. These problems lead to inefficient use of equipment, and even frequent failures, shortened life and other situations. This not only affects the smooth progress of scientific research and teaching, but also increases the cost of equipment maintenance and update. Therefore, it is urgent to strengthen the daily maintenance of laboratory equipment and improve the efficiency and life of equipment (Cao Xiaomin, 2023).

Strengthen Preventive Maintenance

Preventive maintenance plays an important role in the routine maintenance of equipment. Preventive maintenance can detect and resolve potential problems in a timely manner, prevent equipment faults, and improve the service efficiency and service life of equipments. Preventive maintenance includes measures such as regular inspection, cleaning, lubrication and commissioning of laboratory equipment to ensure that equipment is always in good condition. Preventive maintenance is more cost-effective than traditional post-breakdown repairs, reducing unplanned downtime and repair costs.

University laboratory equipment management personnel should regularly perform preventive maintenance on equipment and develop a detailed maintenance plan. At the same time, equipment maintenance files should be established to record the operating status and maintenance history of the equipment in order to discover and solve potential problems in time (Wang Zhenglu & Guo Na, 2022). In addition, strengthen the daily inspection of equipment to deal with abnormal situations in a timely manner to prevent small problems from turning into major failures. Through preventive maintenance, the service life of the equipment can be effectively extended, providing stable and efficient support for university scientific research and teaching.

Equipment Daily Inspection and Maintenance System Establishment

The establishment of equipment daily inspection and maintenance system is the key link to maintain the good operation of equipment. First of all, it is necessary to develop a detailed inspection and maintenance plan to clarify the inspection cycle, maintenance content and operating procedures of all types of equipment. For key equipment, a regular inspection system is implemented to ensure that potential problems are discovered in time. Secondly, the establishment of equipment maintenance files, detailed records of equipment operating status, inspection and maintenance, in order to track management. At the same time, strengthen cooperation with equipment suppliers, obtain professional technical support, and improve maintenance efficiency. In addition, professional maintenance personnel are trained to upgrade their skills to ensure the professionalism and accuracy of inspection and maintenance work. Finally, improve the incentive mechanism, encourage teachers and students to participate in equipment maintenance work, improve the awareness of equipment management. Through the establishment of a scientific and standardized daily inspection and maintenance system, the service life of the equipment can be effectively extended, the use efficiency can be improved, and the university's scientific research and teaching work can be provided with a strong guarantee (Wu Zhongquan & Li Chaoming & Liu Feng, 2020).

Equipment Fault Prevention and Quick Response Mechanism

The mechanism of equipment failure prevention and rapid response is very important in the daily maintenance of equipment. First of all, it is necessary to carry out preventive inspection of the equipment regularly, discover potential problems in time, and take appropriate measures to prevent failures. Secondly, the establishment of a rapid response mechanism, once the equipment fails, the emergency plan is quickly launched, and professional personnel are organized for maintenance (Gao Zhiyang, 2018). This requires the University to have a skilled and experienced equipment maintenance team to ensure that problems are resolved quickly and accurately. At the same time, strengthen the communication and cooperation with equipment suppliers to ensure the timely supply of spare parts and shorten the maintenance cycle. In addition, the equipment failure database is established to analyze and classify the failure causes and provide data support for preventive maintenance. The maintenance strategy combining prevention and rapid response can effectively reduce the failure rate of equipment, improve the efficiency of equipment use, and provide stable support for university scientific research and teaching.

Training and Responsibility Implementation of Maintenance Personnel

The training and responsibility of maintenance personnel is essential to ensure the effective maintenance of equipment. First of all, universities should regularly carry out training courses related to equipment maintenance to improve the skill level and professionalism of maintenance personnel, so that they can accurately judge the operating status of equipment and take

corresponding measures (Shi Yanqin & Yang Jintao & Chen Si, 2019). In addition, the implementation of the responsibility system, clear the scope of responsibility and work requirements of each maintenance personnel, to ensure that equipment is timely and professional maintenance and repair. At the same time, encourage communication and cooperation between maintenance personnel, share experience and skills, and improve the maintenance level of the whole team. In order to motivate the work enthusiasm of the maintenance personnel, a corresponding reward mechanism should be established, and certain material and spiritual rewards should be given according to the work performance. Through the dual guarantee of training and responsibility implementation, the quality of equipment maintenance can be effectively improved to ensure the normal operation and use of laboratory equipment.

III. EQUIPMENT UPDATE STRATEGIES DEVELOPMENT AND EXECUTION

There are many aspects involved in making and executing equipment update strategies. First, it is necessary to assess the equipment update needs to ensure that the update strategies meets the actual needs of research and teaching. Then, make a detailed update plan, including financing and management, project implementation and supervision. Financing for update is key and can be raised through a variety of channels to ensure proper use. Supervision should be strengthened during the implementation of the project to ensure that it is carried out as planned. After the update, it is also necessary to conduct equipment training and technical support to ensure that the new equipment can fully play its role.

Evaluation of Equipment Update Needs

Equipment update needs assessment is a key link to ensure that laboratory equipment and technology remain advanced. The evaluation process takes into account the performance of existing equipment, frequency of use, maintenance costs, and relevance to teaching and research needs. At the same time, research on new technologies and equipment in the market to understand industry development trends and potential upgrade directions. Based on the evaluation results, make a reasonable equipment update plan, including equipment selection, purchase and replacement. In addition, consider the economy, technological advancement and sustainability of equipment update, avoid blindly pursuing the latest technology and ignoring the actual needs. The university shall set up a special evaluation team or committee to regularly evaluate and review the equipment update needs to ensure that the equipment is always in the best condition to meet the needs of scientific research and teaching. Through scientific and reasonable equipment update needs assessment, the use efficiency of equipment can be improved, the service life can be extended, and the continuous optimization and development of university laboratory equipment can be promoted.

Development of Update Strategies: Objectives, Principles, Standards, and Processes

When making a strategy for equipment update, it is first necessary to clarify the objectives of the update, such as improving equipment performance, reducing maintenance costs, or meeting new research needs. In principle, the update strategy should be forward-looking, considering the future development of the technology and the long-term planning of the laboratory. In terms of criteria, not only the performance parameters of the equipment must be considered, but also its impact on the environment and compatibility with existing facilities must be assessed. In terms of process, we first conduct demand analysis, then market research, compare equipment from different suppliers, and consider budget and return on investment. Finally, the updated equipment list and schedule are determined through collective decision-making, and adequate resources and technical support are ensured during the implementation process. In addition, update plans should remain flexible in order to respond to unforeseen technological changes and demand adjustments. By developing a scientific and reasonable equipment update plan, the university can ensure the continuous optimization and development of laboratory equipment, and provide strong support for scientific research and teaching.

Funding Raising and Management for Updates

The financing and management of update funds is an important part of equipment update plan. First, the university needs to clarify the total budget for equipment update and develop a detailed funding allocation plan based on priority and urgency. In order to ensure sufficient and timely funding, funds can be raised through a variety of channels, such as government grants, scientific research funds, school-enterprise cooperation projects, etc. At the same time, a special fund for equipment update will be established to ensure a long-term and stable source of funds.

For the management of funds, a special management team or committee should be set up to be responsible for the approval, use and supervision of funds. Ensure that funds are used in accordance with the plan to avoid abuse and waste. The use of funds is regularly audited and evaluated to ensure its rationality and effectiveness.

Implementation and Supervision of Update Projects

The implementation and supervision of the update project is the key to ensure the smooth implementation of the equipment update plan. In the implementation phase, it is necessary to strictly follow the plan to ensure the smooth progress of equipment purchase, installation and commissioning. At the same time, strengthen communication and cooperation with suppliers to ensure that the quality and performance of equipment meet expectations. For critical equipment, strict acceptance testing should be carried out to ensure that its performance is stable and meets the requirements.

In terms of supervision, the university should set up a special supervision team or committee to track and supervise the whole process of the implementation of the equipment update project. Ensure reasonable use of funds, equipment quality standards, installation schedule in accordance with the plan. The problems arising in the implementation process should be found and solved in time to avoid affecting the progress and effect of the update.

In addition, a project progress report system was established to regularly report the progress of the project to relevant personnel. Through effective implementation and supervision, ensure the smooth progress of equipment update projects, improve the performance and efficiency of equipment, and provide better support for university scientific research and teaching (Wu Zexing, 2020).

Usage Training and Technical Support for Updated Equipment

The training and technical support of the updated equipment are of great significance to give full play to the performance of the equipment and improve the use efficiency. After the installation and commissioning of the equipment, the university shall organize professional personnel to conduct training on the use of the equipment to ensure that the operators are proficient in the operation procedures, precautions and maintenance requirements of the equipment. The training content should include theoretical explanation, practical operation demonstration and simulation exercise to ensure that the operator has the ability to operate independently.

At the same time, establish a technical support system to provide timely technical support for the problems encountered in the use of equipment. Set up a dedicated technical support team or contact point to provide a variety of consultation methods such as telephone and email to ensure that operators can quickly obtain solutions. For complex problems, equipment suppliers or professional and technical personnel can be invited to provide on-site guidance to ensure that the problem is effectively solved.

In addition, regular exchanges on equipment use and maintenance are carried out to encourage operators to share experience, find problems, and jointly improve the use of equipment. Through the dual guarantee of training and technical support, the use efficiency of the updated equipment can be effectively improved.

IV. STRATEGIES TO IMPROVE EQUIPMENT EFFICIENCY AND EXTEND SERVICE LIFE

The strategies to improve the use efficiency and extend the service life of the equipment include: reasonable configuration and layout of the equipment to ensure that the equipment can fully exert its performance; Make use of the standard and operation procedures, standardize the operation behavior, reduce the damage caused by misoperation; Apply energy-saving emission reduction and environmental protection measures to reduce equipment operating costs and reduce the impact on the environment; Plan equipment maintenance and transformation, repair faults in time, and improve equipment performance; Establish a full life cycle management mechanism to monitor and manage the whole process from equipment purchase to scrap.

Reasonable Allocation and Layout of Laboratory Equipment

Reasonable allocation and layout of laboratory equipment is an important means to improve the efficiency and prolong the service life of equipment. First of all, according to the function of the laboratory and the direction of scientific research, the type and quantity of equipment should be reasonably planned to ensure that the needs of scientific research and teaching are met. Secondly, the university should pay attention to the layout of the equipment, and arrange the placement of the equipment reasonably according to the experimental process and operating habits to improve the experimental efficiency. At the same time, it is necessary to ensure that the spacing between the equipments is reasonable to avoid too dense or too sparse equipment, which affects the experimental operation and heat dissipation effect. In addition, the energy needs of the equipment should be considered, and the power supply and ventilation facilities should be reasonably configured to ensure

the normal operation of the equipment. For large or high-value equipment, special operation and maintenance areas should be set up to reduce equipment damage and safety risks (Zhang Wei & Zhang Yinzhu & Sun Yi, 2019). Through the reasonable allocation and layout of laboratory equipment, the use efficiency of equipment can be improved and the service life can be extended.

Equipment Use Specifications and Operating Procedures

The establishment of equipment operating standards and operating procedures is the key to ensure the safe and effective operation of equipment. For different types of equipment, the university shall formulate clear use specifications and operating procedures, including the basic parameters of the equipment, operating procedures, precautions, safety requirements, etc. These specifications and procedures should be presented in writing and posted near the equipment so that operators can refer to them at any time (Liwen Zhao, 2022).

In the use specification, the scope of application, performance parameters and safety standards of the equipment should be clearly defined to avoid overload or improper operation. The operating procedure should detail the operating steps, including opening, running, closing, etc., to ensure that the operator follows the correct procedure. In addition, in view of possible abnormal situations, emergency handling measures are developed to improve the ability of operators to deal with emergencies.

Through the formulation and implementation of equipment use specifications and operating procedures, equipment failures can be effectively reduced, service life can be extended, and the safe and stable operation of laboratory equipment can be ensured. At the same time, it also helps to improve the skill level of operators and cultivate their good operating habits.

Energy Saving, Emission Reduction and Environmental Protection Measures

The application of energy saving, emission reduction and environmental protection measures is of great significance in laboratory equipment management. With the increasing of scientific research and teaching activities in universities, the problems of energy consumption and emissions of laboratory equipment have become increasingly prominent. In order to reduce energy consumption, the university should take a series of energy-saving measures, such as selecting high-efficiency and low-energy equipment, rationally allocating power supply lines, promoting energy-saving technology and energy-saving management mode. At the same time, strengthen the maintenance of equipment to ensure its normal operation and reduce unnecessary energy waste.

In terms of environmental protection, universities should pay attention to the emission of laboratory equipment and take effective measures to reduce emissions. For example, the separation of waste treatment, the establishment of waste recycling system, the promotion of environmental protection technology and cleaner production mode. In addition, the University has strengthened cooperation and exchanges with environmental protection organizations to jointly promote the environmental protection work of laboratory equipment. Through the application of energy conservation, emission reduction and environmental protection measures, not only can reduce energy consumption and reduce emissions, but also help to improve the use of equipment efficiency and extend the service life.

Reasonable Planning of Equipment Maintenance and Transformation

The reasonable planning of equipment maintenance and transformation is the key link to ensure the efficient operation of equipment. For the faulty equipment, maintenance should be carried out in time to eliminate the fault and restore the performance of the equipment. For old or backward performance equipment, it should be reformed or upgraded to improve its efficiency and performance (Yang Shasha, 2017).

In terms of maintenance, the university should establish a sound maintenance system, equipped with professional maintenance personnel, and provide sufficient maintenance spare parts. At the same time, the establishment of equipment maintenance files, record equipment failure, maintenance process and results, in order to evaluate the performance and reliability of the equipment.

In terms of transformation, the university should upgrade the equipment or carry out technical transformation according to the needs of scientific research and teaching. This may involve improvements in the hardware, software or control systems of the equipment. The transformation should focus on the advancement and sustainability of technology to ensure that the transformed equipment can meet the needs of future development. The reliability and performance of the equipment can be

improved and the service life of the equipment can be extended through reasonable maintenance and reconstruction planning.

Establish a Lifecycle Management Mechanism for Equipment

The establishment of the whole life cycle management mechanism of equipment is an important guarantee to ensure the efficient and sustainable operation of equipment. Lifecycle management covers the whole process of equipment planning, procurement, use, maintenance, and scrapping.

In the planning stage, the equipment needs should be comprehensively evaluated and a reasonable procurement plan should be formulated. In the procurement process, it is necessary to ensure that the equipment has good performance and meets the needs of scientific research and teaching. First of all, in the use phase, regular maintenance should be carried out to ensure the stable operation of the equipment. At the same time, strengthen the training of operators to improve their operational skills and safety awareness. Secondly, in the maintenance stage, a perfect maintenance system should be established to deal with equipment failures in a timely manner and extend the service life of the equipment. Finally, in the scrap stage, scientific treatment should be carried out to ensure that the equipment exits the operation safely and environmentally (Zhang Weiming, 2018).

Lifecycle management can effectively improve the use efficiency of equipment, reduce maintenance costs, and achieve sustainable use of equipment. This helps to improve the quality of university research and teaching, and promote the modernization of laboratory equipment.

V. CONCLUSION

Through the analysis of the current management status of university laboratory equipment, this study comprehensively discusses the importance of university laboratory equipment management and update and its realization path. We have made clear the core objective of equipment management, that is, to improve the efficiency of equipment use and extend the service life, and put forward the key strategies such as the whole life cycle management, the reasonable allocation and layout of equipment, and the formulation of operation procedures. This study provides a concrete and feasible improvement scheme for university laboratory equipment management.

While summarizing the research results, we also see the great potential and challenges of university laboratory equipment management. In the future, continuous innovation and improvement will become the core of equipment management (Liu Zhengwang, 2019). Intelligent management, information integration, environmental protection and energy saving, as well as international cooperation and exchange, will be an important direction of equipment management. By continuously improving the equipment management system, the university will be able to provide more stable and efficient support for scientific research and teaching, and promote the modern development of laboratory equipment.

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