



# Analysis of the Countermeasures for Improving the Management Level of University Laboratories Research Based on Externally Provided Products and Services

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**Abstract.** Improving laboratory testing ability is the basis for building an innovative country. Standardizing the management of external products and services is an important basis for improving laboratory testing ability. Based on the CNAS criteria and taking Xi'an Shiyu University as an example, this paper discusses the specific problems in the management of externally provided products and services in university laboratories, and proposes measures such as building an efficient management process for externally provided products and services, implementing the main responsibilities in management, establishing a supplier evaluation system, establishing a sound supervision mechanism, and improving daily work methods. To achieve the purpose of improving the quality of external products and services.

**Keywords:** CNAS · Laboratory Management · Externally Provided Products · Externally Provided Services

## 1 Introduction

Improving basic scientific research capacity is the basis of building an innovative country. To improve basic scientific research capacity, the country must improve laboratory testing capacity [1–3]. At present, university laboratories are mainly recognized by CNAS or CMA in China [4, 5] to improve their testing ability and laboratory management level. One of the key factors to improve laboratory testing capability is to strengthen the management of externally provided products and services, not all internal factors. The problem of inadequate and unsystematic management of externally provided products and services is increasingly prominent. CNAS Accreditation Criteria for the Competence of Testing and Calibration Laboratories (ISO/IEC 17025:2017) put forward requirements for externally provided products and services of the laboratory: the laboratory should ensure the suitability of externally provided products and services that affect the activities. It is of great significance to pass the CNAS certification to promote the management level of university laboratories.

The laboratories of petroleum universities involve many subject such as oil and gas field development, storage and transportation, refining and marketing. The problems

in laboratory management of petroleum universities are highly representative [6]. The Oil and Natural Gas Engineering Experiment Center of Xi'an Shiyou University passed the CNAS laboratory accreditation in 2018. This paper combines the characteristics of university laboratories, and takes the CNAS testing and calibration laboratory capability accreditation criteria as the basis for the requirements of externally provided products and services, taking Xi'an Shiyou University as an example, to discuss the management of externally provided products and services in the university laboratory, so as to promote the improvement of university laboratory management level.

## 2 Problems in Externally Provided Products Process Management

The university laboratory has a great demand for the variety of externally provided products, and the problems exposed in the actual management have increased, which are typically manifested in the following five aspects:

- (1) The procurement work is inefficient. The management of university laboratory externally provided products is cumbersome, the degree of informatization is low, the cycle from procurement to acquisition is long, and the procurement work is often inefficient [7].
- (2) The information of the requisitioners and purchasers is asymmetric. The information of the requisitioners and purchasers of laboratory products is asymmetric [8]. The purchasers do not fully grasp the performance, parameters, specifications and other information of the products to be purchased, resulting in the quality or parameters of some purchased products cannot meet the experimental requirements.
- (3) The management of corresponding materials for testing is ineffective. Due to poor transportation, storage and storage of consumable materials, the function of auxiliary consumable materials is reduced or invalid.
- (4) The approval process of purchased products is redundant. Most of the university laboratories are subordinate to the second-level departments, and the purchase of products needs to apply to the relevant management departments of the university, which is cumbersome and repetitive, thus also causing the problem of delayed supply of purchased products.
- (5) The safety management of relevant hazardous chemicals is poor. Toxic, harmful, flammable, explosive, corrosive and other articles are generally stored in university laboratories [9]. The specific problems are as follows: ①The procurement personnel purchase dangerous chemicals in excess in order to reduce the number of purchases [10]. ②The storage method does not conform to the specification, and the safety identification is not clear. ③The account records of hazardous chemicals are chaotic, the whereabouts of hazardous chemicals are unclear, and formalism is serious. ④The user does not follow the operating procedures, the use records are chaotic, and the safety awareness is weak.

### 3 Problems in Externally Provided Services Process Management

High-quality external service is the basic guarantee to improve the effectiveness and accuracy of laboratory test results. At present, there are five typical aspects in university laboratory management:

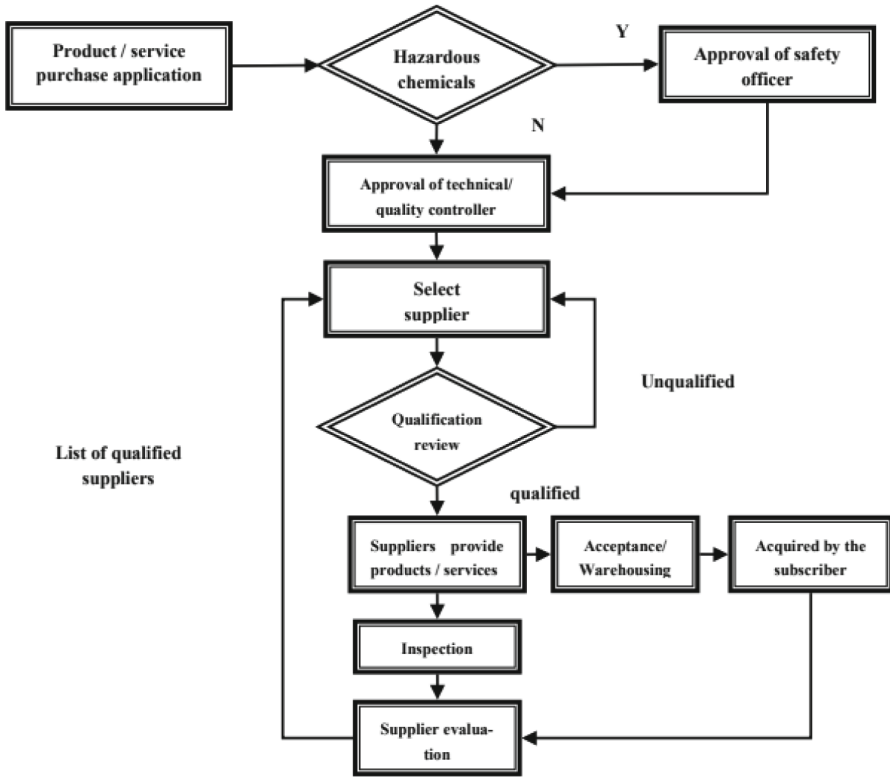
- (1) The supplier qualification review is not strict enough. The qualifications of calibration service institutions, testing service institutions and capacity verification service institutions are crucial to the effectiveness of their services. Due to the low probability of qualification problems, the reviewers are prone to be careless and fail to verify.
- (2) The services provided by some suppliers do not meet the requirements. Some professional instruments and meters require highly professional services, but the professional ability of the procurement personnel is insufficient, resulting in the problem that the service provided by the supplier is inconsistent with the actual needs of the laboratory.
- (3) The supplier evaluation system is missing. The supplier evaluation system of some laboratories is lack of work, or the formalism is serious, which can not truly and effectively evaluate the supplier's credit ability, quality assurance ability, response time and other capabilities.
- (4) The acceptance of procurement services is not up to standard. The quality requirements in the service contract are not fully implemented, and the acceptance is not carried out in accordance with the technical standards of the relevant national industry services.
- (5) The procurement process of procurement services is not perfect. Some procurement services have strict requirements on the professional competence of suppliers, requiring the procurement process to be refined and standardized to ensure service quality.

## 4 Thoughts on Improving the Management Level of External Products and Services

### 4.1 Build Efficient Management Process

After years of construction, the Oil and Gas Engineering Experiment Center of Xi'an Shiyou University has built a set of external product and service procurement management process suitable for university laboratories, as shown in Fig. 1. The experimental center has one director and two deputy directors, one person in charge of technology and one person in charge of quality, and a comprehensive management room, rock physics room, oilfield chemistry room, and oil analysis room.

- (1) Purchase of products or services. The applicant shall fill in the Purchase Schedule of Supplies and Services, clearly and accurately describe the purchase requirements, including name, model and specification, technical requirements and other information.



**Fig. 1.** Management flow chart of externally provided products and services

- (2) Approval of products or services. If the purchase of products or services does not involve hazardous chemicals, it shall be submitted to the General Management Office after being approved by the person in charge of technology and quality. If hazardous chemicals are involved, it shall be approved by the safety officer first, and then submitted to the person in charge of technology and quality for approval.
- (3) Supplier selection. The General Management Office selects qualified suppliers according to the application contents and requirements to purchase products or services from suppliers.
- (4) Delivery of products or services. The General Management Office and the person in charge of quality shall carry out the acceptance. After the quality is qualified, the warehouse keeper shall register for warehousing (if hazardous chemicals are involved, the safety officer shall participate in the warehousing), and the General Management Office shall notify the requisitioner to receive the requisitioned products. After the supplier provides the service, the comprehensive office and the person in charge of quality shall check and accept the service.
- (5) Evaluation of suppliers. After using the product, the applicant fills in the supplier evaluation form and submits it to the General Management Office. After the acceptance of external services, the General Management Office shall fill in the supplier

evaluation form. The General Management Office establishes the list of qualified suppliers through the supplier evaluation form.

In the above management process, the General Management Office organizes the purchase application department to inspect the product name, package, quantity, appearance, label and certificate of conformity, and to conduct sampling acceptance for some products. The selection of calibration service institutions shall meet the following requirements: external calibration service institutions have the qualification of calibration laboratories. The calibration and measurement conducted by the external calibration laboratory can be traced to the national system of units (SI). The external calibration laboratory can prove its corresponding measurement ability and traceability.

#### **4.2 Define the Main Responsibility**

Define the work responsibilities of the procurement related personnel and departments. The personnel of the experimental center are all in-service teaching staff. Ensure that the personnel have the corresponding qualifications and abilities and are supervised to ensure that their behavior is fair and open.

- (1) Technical controller. The experimental center has a technical controller who has more than 3 years of work experience in the testing field of the center and is proficient in the technical standards (specifications) and methods related to the testing work. Be responsible for the technical operation related work in the management of externally provided products and services.
- (2) Quality controller. The experimental center has a quality controller who is proficient in the relevant standards and methods of quality management, quality control and quality assurance. Responsible for supplier qualification review and product and service quality review.
- (3) Comprehensive management room. The comprehensive management room is equipped with several purchasers, warehouse keepers and safety officers. Among them, purchasers participate in the procurement process, establish complete forms and files for purchased products and services, and strictly control the procurement progress. The warehouse keeper shall keep the consumables and dangerous chemicals according to the storage method, and establish the corresponding account. The safety officer shall assume the safety responsibility for the procurement and storage of hazardous chemicals, propose and implement the rectification of potential safety hazards in a timely manner, and submit the rectification report. Comprehensive management room shall identify, collect, index and archive the documents, accounts and archives generated by the process of purchasing products and services.

#### **4.3 Establish Supplier Evaluation System**

The establishment of a supplier evaluation system improves the procurement efficiency, and ensures the quality of externally provided products and services by selecting qualified suppliers to promote the quality of externally provided products and services. The supplier evaluation includes: ① the supplier's credit ability. ② Supplier's quality assurance capability. ③ Price. ④ Delivery status. ⑤ Service conditions. ⑥ Whether the supplier

responds timely. For the suppliers that have been listed in the list of qualified suppliers, the qualification review shall be conducted regularly every year, and the evaluation shall be made according to the supplier evaluation table of the current year, and the elimination mechanism shall be established.

#### **4.4 Establish a Sound Supervision System**

Through the establishment and improvement of the supervision system, the scientific, planned and efficient supervision of the external products and services is carried out, and the unqualified factors in the operation process are found and eliminated in time to provide quality assurance for the testing of the experimental center. The experimental center has a director and a deputy director, who have the right and obligation to supervise the process of providing products and services externally, regularly and irregularly supervise the process of providing products and services externally, and review relevant materials. Put forward written rectification opinions for the problems found, after the supervision and rectification, the relevant responsible person shall submit the rectification report to the supervisor, and file the rectification materials.

#### **4.5 Improve Working Methods**

On the basis of ensuring the operation of the procedure documents and quality manual of the experimental center, reduce the procedure links and increase the management efficiency. For example, the experimental center approved the Purchase Schedule of Supplies and Services online, reducing the internal approval time. Unify the Purchase Schedule of Supplies and Services and the Acceptance Form of Supplies of the experimental center with the product information form of the Acceptance Form of Materials and Low-value Consumables of the SASAC to reduce the repetition of filling in the form. The experimental center also recommends and promotes the management experience of the experimental center to various management departments of the school, changes the original working methods, and optimizes the connection with the daily management of the school.

## **5 Conclusions**

This paper summarizes the typical problems in the management of external products and services provided by university laboratories. Based on the CNAS management system and taking Xi'an Shiyou University as an example, it lays a foundation for improving the quality of external products and services by building an efficient external product and service management process. Improve the operation quality of external product and service management procedures by clarifying and subdividing the main responsibilities of each link in the management of external products and services. Improve procurement efficiency and ensure the quality of external products and services by establishing a reasonable supplier evaluation system. Establish and improve the supervision system to effectively supervise the external product and service process. Through the improvement of the internal working methods of the experimental center, optimize the connection with

the school management, reduce the management procedures and improve the management efficiency. To solve the problems existing in the management of external products and services of university laboratories, and help improve the laboratory testing ability.

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