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Primary Discussion on Standardized Management of Purchasing Large Equipments for Measurement Technology Institution

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Abstract

In view of current situation and existing problem on purchasing equipment for measurement technology institution, this paper analyzes key factors that affect the standardization of equipment procurement and it proposes a set of scientific and standardized solutions for equipment procurement based on actual work.

Keywords:Measurement technology institution, large equipment procurement, use efficiency, evaluation mechanism

1. Introduction

As the business of measurement technology institution continuously expands in recent years, the demand and input of large equipments rise rapidly. But due to the lack of relative experiences, many institutions encountered problems such as decentralized management, failure mechanism, unclear duties, lack of communication and ineffective supervision in the course of purchasing equipment, which greatly affect the quality and efficiency of the equipment procurement. Thus, to strengthen the standardized management of large equipment procurement becomes the top priority. The paper strives to raise the rate of return on investment of equipment and achieve the purpose of reducing error and making it transparent through a series of practical management modes.

2. Problems and causes

At present, the problems encountered by measurement technology institution in equipment procurement are as follows:

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- Lack of scientific and sufficient discussion before purchasing;
- Lack of standard operating procedures, resulting in the problems of communication between departments;
- Blindly pursue high-tech products, but ignore their practicability, which does not conform to the actual situation of the enterprise and leads equipment to be kept in idle;
- Lack of resource sharing mechanism and result in repeated purchase of equipment;
- Lack of strict criteria for acceptance of equipment and result in mutual shuffle;
- Lack of appraisal mechanism for the rate of return on investment and utilization rate of equipment, and the economic and social benefits created by equipment do not comply with its value.

3. General

The general principles of measurement technology institution for purchasing large equipment are summarized as forward-looking, practical and avoiding repetition. The emphasis is put on feasibility studies and evaluation in early stage, equipment acceptance and standardization of data management, evaluation of yield rate and supplier in later stage.

According to the above principles, the standardized management of large equipment procurement can be divided into five stages, and specific processes are as follows:

3.1 Establishment of institutions

Due to particularity of measurement technology institution in purchasing equipment, it is necessary to establish the following institutions:

1) Evaluation committee composed of technical experts

This evaluation committee, composed of technical experts from the local institution, other local units and other provinces (cities), is mainly responsible for making objective and impartial evaluation of equipments to be purchased and completing "Technical Experts' Opinion Score Sheet". The committee will propose the alternative for the inappropriate equipment and explain the reason; the committee will attend the relative meetings and answer the relative questions.

2) Equipment procurement evaluation committee

This evaluation committee, composed of responsible persons of institution and departments, is mainly responsible for hearing investigation & verification report of application for equipment procurement and technical experts' evaluation report; carrying out comprehensive evaluation for the market prospect of project to be developed, advanced performance of equipment, compliance with regulations and the institution's long-term strategic conformance; verifying the operating costs, site and environmental requirements; completing the evaluation form and calculating the final score by weight.

3) Equipment procurement evaluation committee

This acceptance committee, composed of the persons from purchase department, management department and relative testing room, is mainly responsible for joint acceptance of equipment and dealing with the problems occurring in the course of acceptance. The Acceptance of equipment with value exceeding 500,000 Yuan should be led by the principal leader, and the acceptance of equipment with value exceeding two million Yuan, the superior discipline inspection and supervision department should be invited for joint acceptance.

3.2 Subscription, the government centralized purchasing project declaration and feasibility report

1) Equipment purchase plan

Each testing room proposes purchase intent and fills in the equipment purchase application form. Equipment Procurement Evaluation Committee will discuss the approval of declared equipment and complement and improve the undeclared items according to institution's long-term planning and business development needs, thus form an annual purchase application plan. The discussion should be in line with following principles:

- The principle of maximizing use of existing resources: for those who have conditions to achieve resource sharing, the repetitive purchase is not allowed in principle;
- The principle of meeting the actual demand and having leading performance regarding indicators: on the premise of guaranteeing reasonable price performance ratio, priority should be given to the domestic and overseas famous and advanced products characterized by high level of precision, high degree of automation and stable performance. It should be avoided to purchase those equipments with immature technology;
- The principle of optimizing return on investment;
- Fully consider the requirement of equipment required by the site, environment conditions, safety protection, technical talents, etc. Cautions must be given to the declared equipment that does not meet the above conditions in long-term.

1) Research and demonstration of equipment

As for the procurement plan that has been determined, the related testing room should have a sufficient argumentation over the current objective and subjective conditions and predicative situation and finally result in a research report. The form of investigation consists of consultation with manufacturers, experts and counterparts, site demonstration, short term trial, field investigation, service object, collection of relative administrative departments, investigation of similar equipments possessed in surrounding areas and research of potential client group. The research should be proceeded among three different brands equipments known at home and abroad, and over two inspectors are required to join in the research. The content of research report includes:

a) Testing room's revenue in recent years, the reasons and purpose for purchasing equipment, and influence to the institution's business development;

b) Is it possible to make use of the existing resources, or reach a cooperative agreement with other units?

c) The similar equipments possessed by other local institutions and their market share, brand, model, manufacturer, purchase price, usage, input and output as well as problems found in the use;

d) Available verification and calibration items, the corresponding charge standard, [1]certification, accreditation, administrative licensing and the corresponding number of certified companies; [2]

e) Conditions of existing staff; installation site, the environment and the safety of the ancillary facilities. If existing conditions can not meet the requirement, improvement measures should be proposed;

f) Risk analysis, especially the equipment purchased needs to be processed by manufacturers, and the reason for consigned processing and existing equipment that cannot meet the need should be fully explained. It is necessary to formulate a strict acceptance criterion;

g) Predicative analysis of workload and business revenue. The revenue evidence for the equipment that is required to be renewed should be provided and the evidence should include the use frequency (times / month), annual quantitative, charge standard, annual revenue, annual expenditure, annual profits and investment recovery period. Annual expenditure, namely the maintenance costs including labour, water and electricity fees, management, material cost, and maintenance cost.

h) Make comparison of similar equipments but different brands. The comparison content should include the following:

- Equipment information includes the name of host machine, manufacturers, model specification, measuring range, accuracy class, conformance with the regulations/specification, measurement

instruments available for calibration, data processing method, other technical indicators, accessories name, manufacturers and technical indicators of accessories, price of host machine, price of accessories, and the total price.

- Manufacturer information includes business certificate, quality assurance system built by enterprise, leading degree of industry, market share, and after-sales service commitment;
- Application includes units, users and contact phone number, overall evaluation, advanced evaluation, stability evaluation and main problems;
- Environmental conditions include site requirement, environmental requirement (temperature, humidity, vibration, and shock)

i) Equipment users, technical experts and relevant departments evaluate the on-site demonstration;
j) Carry out on-site application investigation and investigation of research report.

2) Examination of research report

The examination of research report includes online information search; related thesis and reference check, talk with technical personnel manufacturers, consultation with similar equipments of other institutions and consultation with technical expert. The key points of the examination for research report:

- The provision of the complete research report;
- Whether the equipment is repetitively purchased.
- Whether the site demonstration report and field investigation reports are submitted as required;
- Whether the equipment is proved to be the one with immature technology or the one at the stage of technological updating;
- Whether the investigation report of two or more brands products that meet application requirement is provided;
- Whether measuring instruments acquire CMC production license;
- Whether manufacture is in the list of unqualified suppliers;
- Whether the quotation of equipment exceeds the online average market price;

After examination, the relevant departments report non-consilient items to the testing room timely, and testing room should make written explanation and provide the suggestion for the rectification. Where the rectification is not carried out or the rectification fails to meet the standard, the equipment procurement procedure shall be terminated.

3) Equipment on trial

Testing room that applies for equipment procurement can reach a written agreement with the equipment manufacturer regarding the short term trial of equipment. The period for trial of equipment is generally not more than six months. After the trial a trial report should be submitted and the contents of report should include equipment repeatability, stability, comprehensive evaluation of equipment, equipment using frequency, and the social and economic benefits. [3]

3.3 Confirmation of project procurement

Project confirmation is divided into 4 stages including experts' comprehensive marking, centralized appraisal marking, project collective discussion and determination of project bulletin marking:

1) Experts' comprehensive marking

The approved research report will be sent to technical experts randomly selected in related field，and these experts mark the research report one after another and put forward the suggestions for rectification.

2) Centralized appraisal marking

Equipment Procurement Evaluation Committee hears the evaluation of rate of return on investment of the equipment and report of statistics of the rate of equipment in good condition of each testing room in last year, the report of business development focus and investment direction in the current year. Evaluate and mark the research report in manner of questions on site, expert Q & A and consulting manufacturer

and publicize evaluation result according to the research report of the equipment required to be purchased by each testing room and the technical experts' evaluation report.

3) Project confirmation

Report centralized appraisal marking to the highest manager of the institution, who will make decision on procurement project and raise new requirement according to strategic arrangement and business development.

4) Project bulletin

The project bulletin can be divided into the bulletin inside institution and bidding bulletin online. The former aims to make each testing room have a clear understanding of the equipment to be purchased in the year, and report the existing problems, whereas the latter aims to provide the convenience for the equipment users, personnel of equipment procurement department, experts assigned by technical expert evaluation committee and technical representative of party responding to bidding to discuss about configuration list of the equipment to be purchased, technical data and business conditions, and to determine the parameters, technical specifications, supplier qualification, reference price and terms of service commitments and claims by referring research report.

5) Financial budget preparation

Through the publicized equipment, the relative testing room can compile the financial budget according to the research report.

6) *Confirmation of procurement quota*

Equipment procurement department summarizes all financial budget applications to form an "Application Approval Form for Government Procurement Project" which will be distributed to each testing room to confirm the technical indicators with signature, and attention should be paid when confirming the technical indicators:

- The integrality of host machine's technical indicators
- The integrality of optional parts and its technical indicators.
- For the attached test software, the manufacturer must be required to conduct the software test, especially the test certificate for the correctness of the processed data is required.
- Standard material must be included in the national standard directory

7) *Feedback of procurement results*

To solve the problems that occur in time, the relevant testing room should be informed with the equipment purchased by the government in writing timely.

3.4 Installation & debugging

The pre-service training should be carried out before installation and debugging of equipment, the purpose of which is to enable operators to get familiar with the basic principle of equipment. Only when operators are able to expertly operate the equipment can they be permitted to have debugging. In the meantime, the equipment operators should further get familiar with configuration principle and installation and debugging methods taking the opportunity that factory technician helps installing and debugging. If necessary, operators can consult the factory technician about technical details for maintenance. During the debugging, special attention should be given to the correctness of the attached test software in data processing and the problem how independent certificate system interconnects with the internal management system of measurement technology institution. The equipment operators should make records for installation and debugging used for the evidence of final acceptance. After installation and debugging, the equipment should be immediately started up for commissioning operation and during this period, the repetitive and stability test should be conducted on the equipment.

3.5 Acceptance

The acceptance of equipment is generally divided into five stages including preparation work before acceptance, unpacking inspection, data collection, filling data information and overall acceptance.

1) Preparation work before acceptance

a) After the completion of installation and debugging, the purchasing department should take the initiative to arrange the acceptance of equipment with equipment management department.

b) The purchasing department should deliver such information to equipment management department as investigation report, confirmation form of purchase quota, copy of purchase contract, copy of invoice, after-sale service contract, copy of business certificate, and copy of manufacturing license of measuring instrument. Apart from the above information, the imported equipment should also be provided with entrustment agreement, tax exemption certificate of customs, import and export registration form, technical term and invoice from foreign-owned enterprise.

2) Unpacking inspection

a) Inspection before unpacking. Count the quantity of containers and check the label on the packaging and packing appearance. If there is something wrong with the container such as collision crack, breakage, rain wet, slope, upside down and extrusion, it is necessary to keep a record one by one and make confirmation by both parties. The audio and video information should be available in case of claim for compensation in future. [5]

b) Inspection after unpacking. Count the items of host machine, accessories, assembly parts, spare parts and consumables with the machine one by one against the contract. Make record once there is something lost, lack of parts, or unqualified parts. Check whether the equipment, name of its assembly parts, measuring range, precision class and other technical requirement meet the requirement. Make record of the differences, which will finally become the standard of dispute from the contract. Check if there is breakage, scratching, distortion and corrosion on the appearance of equipment, and if there is oil stain and lack of assembly parts at the bottom of the equipment. If problems arise, the record of signatures by both parties should be available in case of claim for compensation.

3) Data collection

The equipment management department should check one by one and collect the following equipment information on the spot, which includes packing list, instruction manual, product qualification certificate, warranty card, service manual, attached measuring software, other attached documents, verification certificate, evaluation form of personnel training, installation and debugging record, repetitive record and stability record. The data should be numbered according to equipment and filed strictly for consulting at any time.

4) Data filling

Data filling includes equipment acceptance, equipment card and information input sheet of equipment.

5) Final acceptance

Final acceptance should be available after the equipment is unpacked and put into use for a period of time. With the condition of quantity, accessories and listing, equipment acceptance committee will assign experts to check the technical indicators of equipment item by item before acceptance in accordance with related acceptance standard. After the acceptance, personnel concerned will jointly sign the acceptance report. The equipment can thus be put into use after the report is filed.

4. General Statistics and evaluation

4.1 Statistics of the annual utilization rate of the equipment

When using the internal management information system of measurement technology institution to make certificate with auto-statistics, the equipment makes statistics by the times of selection and takes comparison. The equipment that with no use for long time and fail to provide rational explanation shall be recycled by equipment management department for further allocation.

4.2 Evaluation of annual rate of the equipment in good condition

Equipment management department should count the annual rate of the equipment in good condition on the basis of equipment maintenance record.

4.3 Evaluation of rate of annual return on investment of the equipment

Formula of the rate of annual return on investment of the equipment:

- RAR：Rate of annual return on investment of the equipment.
- AII: Annual investment income of the equipment. It can automatically calculate the selection times and the economic benefit it produced by the internal management system of the institutions when creating certificates. Where the selection times and the economic benefit it produced cannot be automatically calculated, the equipment users should make written explanation for the annual return and submit it to business responsible department for verification.
- ACU: Annual use cost of the equipment ≈ equipment depreciation cost + labor cost + management cost of rent, water and electricity fees ≈ total investment on equipment × 15% + annual return of the equipment ×10% + annual cost of water and electricity fees/total number of equipments.
- MP: Micro-profit. It is general in the range of 5%～15% of the annual investment income of the equipment according to the difficulty degree of the service and the level of the technology.

$$\mathrm{RAR}=\frac{\mathrm{AII}-\mathrm{AUC}-\mathrm{MP}}{\mathrm{AUC}}\ . \tag{1}$$

4.4 Deviation of annual expected return of equipment

Formula of deviation of annual expected return of equipment

- AED: Annual expected return deviation of equipment;
- AER: Annual expected return of the research report.

$$\mathrm{AED}=\frac{\mathrm{AER}-\mathrm{AII}}{\mathrm{AER}}\ . \tag{2}$$

4.5 Evaluation of supplier

Evaluation of supplier mainly focuses on the aspects of equipment quality and stability, delivery on time, evaluation of installation and debugging, evaluation of personnel training, response speed of after-sale, problem solving ability, communication ability, advanced performance of equipment, whether the software attached to machine is amended in accordance with requirement, service ability of after-sale.

The evaluation is made in form of questionnaire. The evaluation class consists of excellent, good, general, not good, and is filled by users of equipment and equipment management department. Suppliers unqualified in the comprehensive evaluation will be taken no consideration in the future purchasing. Manufacturers' evaluation database should be available for tracing and evaluating the manufacturers for long term, which can also act as the basis of investigating the manufacturers in the course of concentrated evaluation. [5]

5. Responsibility System

Establish three-class responsibility system. The first responsible person is a purchase applicant. The second is director of application test and the third is related approval personnel. Based on the principle of rewarding the good and punishing the bad, reward will be given to responsible person with positive equipment investment income. If the equipment is of no applicability and equipment investment income is negative, then punitive measures will be taken and the qualification for applying purchase equipment will be cancelled, which will be an item to appraise the professional ability of responsible person.

6. Conclusion and prospect

The quality of equipments in measurement technology institutions, especially the large equipments, has direct relation with the smooth progress of inspection, examination and scientific research, as well as the long-term strategy and sound development of institutions. Therefore, it is necessary to promote staff's consciousness of standardized management, actively adopt advanced management method, draw up rules and regulations conforming to the reality of the institution, and strictly carry out the rules.

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