

## SUPPORT SERVICES OF MEASUREMENTS FOR QUALITY

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*Abstract: The participation of the developing countries in the international commercialization put even stronger emphasis to the operation of the quality systems throughout their whole economy (industry, agriculture, scientific research, public health services, higher education, etc.) The operation of these systems need ever more sophisticated and expensive instruments. These instruments also are a sizable part of national wealth.*

*The stable operation of measuring instruments, which has essential importance in the performance of the quality systems, needs support (background) services and in the developing countries there is a considerable shortage in these services.*

*This paper summarizes the elements of the technical background of the instrumentation support services which are essential in the safe operation of the quality systems and presents the latest experience gained in the application of the Hungarian method (Systems Approach) in different countries, introduces the conception for the efficient establishment and provides information on the sustainability of such services.*

*Keywords: instrumentation, support services*

### 1 INTRODUCTION

Globalisation presents opportunities and risks for the national economies. With international production across borders, it is apparent that many economic activities do not only belong to one organisation in one country. Productive activities and functions can be physically separated- while remaining organisationally integrated - and located anywhere in the world. The developing country can generally gain competitiveness by adoption of developed technologies if they put emphasis on the establishment of the necessary infrastructure and technical background services, too.

In this context special emphasis should be put to investigate and analyse methods and necessary actions

- to upgrade local competitiveness,
- to develop local quality systems with the necessary technical support services,
- to develop the human resources

in order to use the advantageous effects of globalisation in the developing countries while decreasing the risks, such as marginalisation, difficulties in competing with international players, cheap import, lack in operation of quality systems at the same time.

Regarding the programs for development of quality management and metrology infrastructure in the developing countries we can inform you on the results of our new action which have been carried out in the selected countries of the South African Development Community to survey the missing technical background services and to work out a conception of the development of these services on sustainable basis.

The limited quantity and the large variety of the measuring instruments in most developing countries cannot justify the establishment of necessary efficient services by the manufacturers. In this way the safe operation of quality systems is strongly hindered by the poor condition of measuring instruments. As a result of the cooperation between Physikalisch- Technische Bundesanstalt (PTB, Braunschweig, Berlin, Germany) and MTA-MMSZ Ltd. Budapest, Hungary, financed by Germany through PTB a step-wise conception was worked out on the basis of the site conditions of selected SADC countries (Kenya, Malawi, Tanzania, Zambia) in 1999. In this program also the National Metrology Laboratory of Republic of South Africa can be involved to elaborate the most efficient way of the transfer of technology.

As a result of the standardization programs and the adaptation of ISO 9000 proposals the Quality Schemes are established in the selected countries. All those companies and firms need instrumentation support services on contractual basis which started to operate the quality management

according to these proposals and take part in international trade both in export and in import activity. They need such partner which can provide continuous services necessary for their quality management on preventive maintenance, calibration of their measuring equipment consultancy, etc., (i.e. instrumentation support services) to be able to carry out reliable, repeatable measurements.

## **2 ELEMENTS OF NECESSARY TECHNICAL BACKGROUND**

The instrumentation support services provide services which are necessary for the safe operation of the precision measuring instruments. The main elements of the technical background of the instrumentation support services are the repair instruments, instruments which are necessary for the control of the repair work and the calibration of the instruments, technical documentation of the precision measuring instruments, expertise of repair and maintenance, spare parts and accessories.

### **2.1 Measuring instruments**

In the developing countries the measuring and controlling instruments which are needed for the operation of Quality Schemes and Quality Systems are imported or donated through different Aid Programs or single actions without considering the necessary support services. Purchase of instruments is usually done indigenously. In this way no instrumentation policy could be implemented through the acquiring procedure. For that reason the in-depth training on the use of equipment is missing and the professional putting into operation is not carried out in several cases. In most cases the quantity of these instruments does not justify the feasible establishment of the After Sale Service for the manufacturers. Large number of instruments are not functioning due to the lack in proper training and repair and maintenance services.

There are a lot of companies in the local markets which can be contacted in the procurement procedure, however, these firms are in most cases not specialized either in instrument purchase or in repair and maintenance. In this way the technical expertise necessary for the efficient instrument investment is not available. No co-ordination of instrument investments and actions for solving the problems in operation of instruments neither on country level nor on regional and company level was notified. The import of the instruments are liberalized and it is eased by Policy incentives, too, such as foreign exchange controls have been relaxed; ceiling on payment of royalties and technical fee have been abolished, etc.

In the surveyed countries like most of the developing countries the up-to date instruments necessary for the repair and those instruments which are necessary for the control of the repair work and calibration of instruments are missing.

The wide variety of the equipment/instruments being used by the various institutions in the country limits the institutions' capabilities and capacities in maintaining and repairing them. Mostly the equipment which is not used is faulty, i.e. it has been broken and has not yet repaired. Large number of the equipment is obsolete and cannot be serviced. If an instrument goes wrong there is only seldom choice to continue the work through a co-operation with a neighbouring institution. Mostly this kind of co-operation is depending on personal relationship.

In this way a great number of suppliers can be detected without knowing any priorities of the institutes or the country. For that reason the importance of the establishment of a data-base on the precision measuring instruments owned by different institutes to be serviced and maintained is essential. This gives the possibility to analyse the priorities on the basis of which the first actions can be focused according to the needs of priorities to enable to carry out an efficient and useful work. The selected institutes started their work to establish or develop their instrumentation support services. They started to collect the measuring instruments in their countries which are used or which are out of order in the testing and quality control laboratories, research institutes, universities, medical institutes, etc. The priorities in need are also analysed. In this way the first action can be focused according to the problems selected manufacturers which meet the priority requirements of the users.

### **2.2 Qualified staff**

Because of lack in funds only very limited technical service can be get for the users of instruments and these limited services can only be provided through marketing representations and strongly delayed in time. The expertise for repair and maintenance consultancy for the use of equipment are lacking in these representations. When the instruments are found to be defective they have to be shipped back through the authorized dealer to the manufacturer abroad to repair them if it is possible. Sometimes direct services from the manufacturers are required by the user for repair. Both of the solutions are expensive and time consuming.

Before installation of any equipment the users don't have hands on training. Further, during the putting into operation procedure the expert of the user does not get in depth training in use and

preventive maintenance, etc. of instruments. The unnecessary changes in the models of equipment is only aimed at promoting sales and many times these additional features are not required, however, the maintenance problems are increased through this action. The maintenance personnel, if any, are not familiar with the requisite procedures for handling modern equipment or their present technical skill is not up-to-date. The systematic upgrading of knowledge of maintenance engineers is not provided for the interested clients, as required. The suppliers of equipment did not provide back up and servicing of equipment. No sufficient calibration services are available. The maintenance engineers are facing great difficulties in their regular work in monitoring and calibrating of measuring instruments in the quality control laboratories of the industry, where they often meet more up-to-date measuring instruments than those they have in the institute.

The cooperation between the user expert and the maintenance engineer which is essential in the trouble shooting and identifying the fault is missing because of lack in technical expertise.

### 2.3 Technical documentation

During the procurement procedure there is not paid enough attention to the careful safekeeping of the technical documentation in this way in many cases the documentation is later not available. There is no responsible person for the technical documentation appointed. In case of equipment, donated the documentation is not complete or the service documentation is missing. In many cases only the operational manual is available.

### 2.4 Spare parts and accessories

In many cases spare parts, accessories and consumables worn out during the measuring procedure, they are also missing. The missing parts and consumables cannot be purchased in the local market. The spare part supply is not organized, the possible sources of spare parts, accessories and consumables are not known. In case of obsolete equipment the necessary spare parts are not available. Because of lack in information on similar equipment in the country the occasionally existing but not used spares cannot be activated. The lack of service documentation hinders the identifying of the faulty part and proper specification of the spare parts. The expertise necessary for the detailed specification of the faulty parts is missing.

## 3 STEP-WISE APPROACH

It is clear that no outside service can solve the problem of missing instrumentation support services. The only solution is if the local service units can be organised which can provide the necessary complex support services in their countries. It is also evident that without outside support it is impossible, however, in this case after the donor support there is a possibility to continue the operation on a sustainable way. With consideration of the urgent need for instrumentation support services in the Region and also the single local needs in the sites which differ of each other because of the large varieties in manufacturers of instruments a step-wise implementation of such services is needed.

### 3.1 Phase 1

As a start the problems with the safe operation of the measuring instruments have to be identified. First of all the measuring instruments of the co-operating institutes, firms or if possible in the whole country have to be collected. If the measuring instruments are collected the priorities in use have to be analysed to be able to outline in which technical field the first support is mostly needed. The analysis should be the result of the co-operation between the local unit (which has to be formed as a working group in a host institute if it is not existing now) and the users of the measuring instruments.

To be able to carry out a successful work the appointment of the manager of the working unit and a technician, responsible for the collection of the instruments is necessary. The responsibilities of the manager and the data officer is expeditious to be outlined. In this way the operation of the working group (consisting of a manager, data officer and repair technicians) can start. At the beginning they can use their existing measuring instruments in the laboratory which is provided for the working unit by the host institute.

The handling of the measuring instruments can be carried out with a database (e.g. Computer-based Instrument Registry, CIR) developed for this purpose. During the implementation of the software using the generally existing personal computer the adaptation of the software according to the site requirement is needed with the sponsorship of the donor. Before the adaptation the finalisation of input and output data has to be carried out using an outside expert. The collection of data has to be implemented through using a registration form which meets the site requirements. The fellowship training of the data officer needs also the donor's sponsorship. After the putting into operation of the adapted

software and fulfill it with data collected the regularly updating of data is needed. This database is the basis of the further priority analysis and later the basis of the consultancy activity.

Before working out a special training for the repair technicians the cooperation of the analytical expert of the testing department has to be organised which is essential in the trouble shooting activity. Without the involvement of the analytical expert of the user of the measuring instruments like spectrophotometers, chromatographs, etc. into the work no success can be achieved. This fact, particularly, has to be considered at the selection of the host institute which will be discussed later (see Chapter 4.1).

As a result of the evaluation of priorities the technical specification of selected measuring instruments (e.g. heating elements, sensors/physical, chemical/, optical equipment /spectrophotometers, spectrometers, colorimeters, refractometers, etc./ chromatographs) with the data of manufacturers can be identified. In this way an efficient training program supported by a donor can be elaborated. The training has to be organised for the repair technicians together with the analytical experts (operators) who are the users of the selected instruments and it has to be carried out in the laboratories, where the selected measuring instruments are put into operation. The first part of the training must teach and practise the details of the preventive maintenance of the selected measuring instrument for the operators together with the necessary theoretical information. The second part of the training has to provide instructions for the repair technicians and the operators on the parts or units of different type or groups of selected instruments most likely to be damaged with the clarifications of duties of the repair technicians and the operators. The third part of training has to assist in the maintenance and repair of the selected measuring instruments focusing to the activities of maintenance, calibrations, trouble shooting and repairs which is also the joint work of the repair technicians and the operators. The fourth part of the training has to instruct the repair technicians on the necessary administration of maintenance and repair activity, documentation (records on repair activity, etc.), knowledge on proper specification of faulty and spare parts, accessories, consumables, possible sources of parts and accessories and communication possibilities where advice can be found in the course of the repair work. During the design of such training it has to be considered, that because of the continuous development of the measuring instruments the information provided for the trainee has to be updated. Further, to carry out a successful transfer of know-how, at least, once the training course has to be repeated.

Using the information on measuring instruments collected in the country the first instrumentation support services can be provided for the clients, immediately:

- advice on use of unused spares,
- simple repair activity,
- possible use of obsolete equipment, etc.

After the training the repair technician can provide services for the clients in cooperation with the operator, if necessary.

It is expedient to evaluate the activities during the Phase 1, i.e. in which extent the sustainability of the local unit has been increased. The successful result of the evaluation is the necessary basis of Phase 2.

### 3.2 Phase 2

The successful result of the evaluation on the Phase 1 or proper evidence on the successful operation of an existing local repair unit is the necessary basis of Phase 2. The operation of the local repair unit can be evaluated as successful, if the income of it can cover the considerable part of its costs.

The implementation of the Phase 1 provides for the local unit the necessary information to be able to evaluate the local priorities. On the other hand a successful local repair unit either has detailed technical information on the measuring instruments in the country or not. If it is only familiar with the measuring instruments of its close surroundings the Phase 2 must start with collection of information on measuring instruments and constructing a data-base according to Phase 1 which provides the possibility to be able to evaluate the local priorities of serving to determine the required local services in order to extend to sustainability of the local unit.

Using outside consultancy financed by a donor as one of the result of the evaluation the technical data (name of manufacturer, model No., etc.) of the most important measuring instruments can be identified. Based on these technical data the most important repair and calibration instruments which are necessary for a correct repair and maintenance activity and for checking the quality of the repair activity can be specified. After controlling the existing instruments of the local unit and their condition the missing repair and calibration instruments can be specified the supply of which needs donor's support.

In this way the most important activities of the Phase 2 are, as follows:

- development of consultancy unit,
- delivery of the missing repair and calibration equipment,
- consecutive training of the staff (based on the training of the Phase 1 and at the same time the progression and updating of the first training),
- providing advanced training in co-operation with manufacturers,
- providing consultancy in management and marketing of services and concluding contracts with manufacturers (using outside consultant)
- construction of a technical advisory information E-mail network to support the identification activity of the faulty parts in trouble shooting procedure of the local units with donor's support.
- analysis of the need for the establishment of further module(s) of instrumentation support services according to the site requirement (using outside consultant)

In order to develop the complexity of the instrumentation support services needed in the local market it is necessary to evaluate the increase of the sustainability of the local unit in Phase 2. The positive result which has been achieved can be the basis for the Phase 3.

### **3.3 Phase 3**

Considering the development in sustainability, if successful it can be advocated in order to develop the complexity of the instrumentation support services, provided by the local unit. The increase in income during the Phase 2 may also serve for the extension of sources contributed by the donor to develop these services with those modules which are identified and justified according to the analysis in Phase 2.

The most important activities of the Phase 3 are, as follows:

- consecutive training of the technical staff (based on the training of the Phase 1-2 and at the same time the progression and updating of the previous training),
- implementation of support service modules which are identified and justified during the Phase 2
- updating of the manufacturers' training

The result of this program is an operational Instrumentation Service Centre (ISC) providing complex instrumentation support services, locally. Such ISCs can work on sustainable basis after the donor's support. As the last action it is expeditious to construct a consultancy and support unit which can provide services for more ISCs in identifying, purchasing and delivering faulty and spare parts, accessories and consumables with donor support and operating on commercial basis.

## **4 MANAGEMENT ASPECTS**

### **4.1 Selection of host institute**

In the selection procedure it has to be considered that the host institute must have deep contact with the industry, agriculture, public health and services (trade, water-, and energy supply) both in the private and the government sector. To be able to organise proper management and to provide reliable monitoring activity the host institute has to have stable operation. It must have Testing Departments where the operators of analytical measuring equipment can also be found and involved into the work if necessary and one of its laboratories can be used for the local instrumentation support service unit.

E.g. the standardization institutes have endeavoured to ensure continued smooth functioning of the manufacturing and service sectors of the industry in their countries by developing standards and offering testing and inspection facilities and carrying out the independent qualifying activity needed by the industrial, agricultural production and the importation of goods into the countries. They also try to improve choice, safety, quality and compatibility in purchased and produced goods and services. These institutes continuously have worked towards the facilitating of trade by specifying minimum requirements for products and services for local and foreign markets, they are providing calibrating services linked to National Standards for the quality control laboratories of the production firms and are aimed at educating industrialist on how to develop standards and how to carry out quality control measurements. In this way these institutes have deep contact with the industry, agriculture, etc. in their countries.

### **4.2 Appointment of responsible persons**

As in any organisation it is essential to appoint the responsible persons of each important task like collection and updating of data of measuring instruments, repair activity, administration of repair operation, etc. Any incentives may have their effect only in that case if the responsibility operational.

### 4.3 Marketing of services

One of the most important task of the manager of the local unit to inform the possible clients on their services in the framework of a carefully prepared marketing work. Considering the needs of the clients arising both from the safe operation and the prescriptions of Quality Schemes established in the country according to the proposals of ISO 9000 service contracts can be concluded with the clients. These contracts will increase the income of the local unit which is the way to reach the sustainability. In Phase 2-3 the service contracts with instrument suppliers can be initiated on one hand to reach the continuous upgrading of know-how of technical staff on the other hand to use the possible contribution of the manufacturers.

## 5 SUMMARY

In order to improve the bad situation in providing instrumentation support services in the developing countries, the only solution is if the local service units can be organised which can provide the necessary complex services in their countries. Considering the privatisation procedure in these countries, there is the need for these services both in the Government and the private sector. After an initial support these local units under suitable management could work on sustainable basis. The already existing and operating and to be organised local units need outside support in their management, collecting and analysing the priorities in needs for support services, establishing and developing their technical expertise and they need "first aid" in identifying the faulty parts, spare parts, accessories and consumables.

The clients both in the Government and the private sector are ready to pay for the local units if providing flexible, suitable instrumentation support services if the problems in performance can be discussed and eliminated also after the payment (in this way the guarantee for the service is also provided). The universities, public health institution, agricultural research and testing stations and laboratories are calculating cost for repair and maintenance, advanced training in use of measuring instrument which sums can be increased, to be able to pay for the services provided by a local unit, however, not enough to finance country -wide services and other necessary instrumentation support services from abroad. The private companies are also interested to have steady partners in calibration, monitoring and maintenance of their measuring instruments used in the technology line of the production and their quality control laboratories. Because of not functioning measuring equipment the clients have to subcontract their measuring activity necessary for the quality control of either the input or output product and paying extra costs. In several cases their measuring activity depends on their single measuring instrument which is without support services and in this way they are daily facing the possible breakdown of the whole production. Moreover the operation of Quality Schemes implemented in these countries demand the organised contacts, that is contracts have to be concluded for the provision of preventive maintenance and monitoring the technical parameters of measuring instruments according to the prescriptions of Quality Schemes and their technical documentation. On long term basis enough sources for the self sustainability can be found for services provided by local engineers/ technicians. This approach needs the step-wise implementation of a program of more phases.

In the Phase 3 the local units can start co-operation with selected manufacturers in order to develop advanced technical service in their countries in a co-operation with the manufacturers which may extend the host capability of the local market for the products of the manufacturers, whereas the manufacturer becomes interested in developing the expertise of the local engineers/technicians and supporting the extension of such services.

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