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A MAINTENANCE STRATEGY FOR THE SCIENTIFIC EQUIPMENT IN THE MOROCCAN UNIVERSITY

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Abstract - The scientific equipment pool in the Moroccan universities has suffered from the lack of maintenance policy. This is why the LIS has built an appropriate strategy of maintenance, constructed on 3 main pillars: i) The knowledge of the current state of the existing equipment and human resources. So, according to the inventory, launched by LIS since 1998, in average, 19 % of the scientific equipment is out of use. This percentage is higher than 50 % for complex instruments. Only less than 1 % of the equipment have maintenance contract, 4 % have technical manuals and 14 % with maintenance manuals, etc. ii) The consolidation of the capabilities in maintenance is based on 3 types of training. Accordingly, since mid 1999, more than 100 technicians were trained on maintenance methods, electronic integrated circuits, maintenance and repair of NMR spectrometer, repair and work of laboratory glassware. Surface Mount Technology (STM) repair is also concerned. iii) The creation of a national network of maintenance cells is scheduled to start in 2003, in cooperation with the France Embassy in Rabat. This network will be created, organised and supervised, by LIS, the national unit of maintenance.

Keywords: Maintenance, training, organisation

1. INTODUCTION

The 3rd millennium will also continue to be focused on more technological progress including more integration and sophistication. This progress will also continue to be fully profitable only for the industrialized countries, except if the non-industrialized ones invest some efforts to sustain their development through a rational utilization based on an appropriate strategy of maintenance of their purchased equipment patrimony.

The situation at the universities is not better than in the other sectors. It's also suffering from the lack of maintenance policy. Being aware of this reality, the Moroccan Ministry of Higher Education and Scientific Research has charged, in 1997, the LIS to make a relevant proposal in order to overcome this handicap. Then, after investigations and audit, the LIS has proposed a maintenance strategy based on 3 axes. The axe one consists, first and foremost, of a thorough knowledge of the existing situation, through the achievement of enquiries to collect relevant and updated information and, through the establishment of a database, to ease and speed up the data processing. The axe two deals with the consolidation of maintenance capabilities through 3 relevant types of training (methods, techniques and actions). The third and ultimate axe consists of creating a network of university maintenance cells

The merits of this maintenance strategy and procedures reside in a realistic and pragmatic approach to the problem and the newness of the experience, which is being, for the first time, implemented in the sector of higher education and scientific research in a developing country in the African Continent. Its success will be an example, which could maybe adopted and adapted by other similar countries.

The contents of the following sections are short and non-exhaustive presentations of the implementation procedures and of the practical achievements accomplished under the above mentioned strategy, developed in the framework of the "Programme de Maintenance des Matériels Universitaires (PROMASUP)", which is dedicated for the maintenance of the scientific equipment of the 14 Moroccan universities.

2. SOME INTERESTING RESULTS AND DIFFICULTIES

The maintenance strategy for the scientific equipment in the Moroccan universities is built on 3 main types of activities, and providing 3 types of results, relevant to the existing situation, the manpower training, the organisation and structure.

2.1. Knowledge of the existing situation

This activity is a sine qua non condition for identifying the needs, defining the tasks and prioritising the implementation steps. It consists mainly of knowing the exact current state of the universities equipment pool, its maintenance environment, the dedicated human resources, what eventually was and/or is being done to ensure this maintenance. In fact, no significant thing was practically done before, except some occasional meetings recommendations, which have never been translated into real implementation.

Thanks to the inventory of scientific equipment, which is being carried out under the watchfulness of LIS since 1998, interesting information was and is being collected and stocked, for easy and rapid processing, in a database.

The recent analysis of this database shows that, for 8000 apparatus inventoried, 20 % of the 3000 computers and related accessories are out of use, and in average, 18 % of the research and pedagogic apparatus are not working. In addition, the more complex equipment is combined with higher percentages of out of order, which may jump up sometimes to 70 %.

Also, this situation is more critical because of:

- The absence of the framework and the adequate maintenance budget estimation. Only less than 1 % of the 8000 apparatus have maintenance contract.
- The lack of technical documentation (only 4% of the apparatus have technical manuals and 14% are equipped with maintenance manuals).
- The difficulties of acquiring special spare parts (lack of anticipation and expectation)
- The lack of qualified manpower and qualified after sale services.

Indirectly of course, the quality of the university education can only suffer from its inappropriate internal environment, contributing contrariwise to the rise of the unemployment of the university graduates. The situation can then become more than dangerous, because a failing equipment could be thrown out and replaced, even with bitter sacrifices, but it's not easy to throw out and replace a failing generation due to a failing education system because of the absence of maintenance.

2.2. Training of the maintenance manpower

Based on the comprehensive study of the existing situation, 3 relevant types of training dealing with methods, techniques and actions were defined:

- Concerning the maintenance methods, 5 one-week training sessions have been organised between May 1999 and October 2002, and 105 technicians have been trained, on maintenance methods, for 68 higher schools and faculties.
- The technical training is aiming at upgrading the education level of the technicians. For instance, 17 technicians are trained on electronic logic integrated circuits
- The training/action consists of organising workshops on the effective use, maintenance and repair of complex materials. This type of training is also opened to interested teachers and researches. Three examples can illustrate this type of training:

i) Organisation of a one-week workshop on the effective use, maintenance and repair of Bruker NMR spectrometers, knowing that 70 % of them where out of use and 60 % are obsolete

ii) Organisation of 2 one-week workshops on repair and work of laboratory glassware for education and research. 8 technicians are now trained. They are able and qualified to satisfy the demand of all the universities in the matter of laboratory glassware repair and construction of devices for specific applications. However, some of the existing workshops are well equipped and some efforts are still to be done in completing the equipment of the others.

iii) Organisation of workshops on Surface Mounted Devices (SMD) in cooperation with the international Atomic Energy Agency (IAEA), in the framework of the African Regional Cooperative Agreement (AFRA). 15 engineers and technicians were trained at LIS, from 13 to 17 November 2000, for the benefit of 13 AFRA members' countries.

The training is necessary but not sufficient alone. Indeed, it's necessary for upgrading and consolidating the national capabilities for the maintenance of the scientific instrumentation. However, without appropriate working conditions, the result expected from the training, whatever its quality level is, will still not enough and cannot reach the expected impact. Therefore, there is an other obvious necessity for an appropriate organisation and administration of the human resources, working in an adequate and motivating frame endowed with the needed infrastructure and facilities.

There's why the implementation of the next step of the LIS maintenance strategy is of a prime importance. It will consist of setting up, organising and maintaining a national network of maintenance cells, covering all the Moroccan universities

2.3. Organisation and set up of maintenance cells

The third and last main pillar of this maintenance strategy is going to deal with organisation and structures, taking into consideration the local and the national dimensions of the PROMASUP programme. Approved by the heads of the higher education institutes in June 2000, the organisational side of the strategy is a sort of pyramid with three main levels:

- Level I. This is a wide national network of maintenance manpower and specialists, belonging or not to a university maintenance cell , constituting thus a suitable organisational framework for the interested persons to exchange experiences, make proposals, express and defend their point of view, develop horizontal and collective actions, etc.

- Level (1-2). It's an intermediary level, gathering teachers having particular competencies on the maintenance and the effective use of given equipment. The objective is to strengthen the principle of the mutualisation of the existing capabilities.

- Level II. It's represented by the university level, which indeed, is a structural level aiming at endowing each region or university with its proper maintenance cell and manpower. Each regional cell is composed of dedicated workshops, according to the local needs and particularities.

- Level III. This is the central or national level. It's ensured by the LIS, which is then responsible of the coordination and the supervision of the other levels. More especially, the LIS has in addition to deal with special tasks, demanding particular considerations and/or having national dimensions like:

  - The organisation of seminars and collective training on special and selected topics,
  - The set up of an infrastructure for calibration, test and quality control

- The administration and the improvement of the relationships with the main suppliers and manufacturers,
- The acquisition and the storage of expensive special spare parts,
- The cooperation with national, regional and international organisations and institutes, etc.

One interesting task that should be highly considered consists of endowing the national level, LIS, with the appropriate facilities for carrying out important tasks of calibration and quality control.

-Level IIIp. This level is added to represent the private sector which is requested to improve its after sale service and then to play its proper role in this maintenance strategy which is based on the principle that all the partners, private and public, having the required qualification in the maintenance of scientific instrumentation, must take part in the success of this national programme of maintenance and in its sustainability.

From now, the next step in the implementation of the PROMASUP programme will deal with the level II. Indeed, the set up of the first maintenance pilot cell is scheduled to start up in 2003, at the Cadi Ayyad University in Marrakech. Once the Marrakech cell will be successfully implemented and working as expected, the next steps will easily consist of repeating or copying the same pilot structure in the remaining universities, throughout the country.

2.4. Other interesting results

The data cumulated by LIS during 17 years of practices in the domain of maintenance shows in average that:

- The in house annual maintenance and repair cost is roughly 5%. However, there is no way to estimate this cost for external repair.
- The percentage of failure due to the improper use is round 50 %.
- The percentage of failures, which can be easily repaired, is about 75 %.
- The failures of electronics based instruments are the most difficult to deal with in both public and private sectors.

These results illustrate, on one hand, the urgent need for training in the public and private sectors. They confirm, on the other hand, the merits of our diagnosis and maintenance strategy.

2.5. Some difficulties

All the vital sectors (education, health care, small and medium sized industries, agriculture, transportation, etc.) were suffering from the lack of maintenance policy in many African counties. Accordingly, the acquisition of the existing equipment pool has been done in the ignorance of the purchase rules and procedures recommended by the maintenance function. There why, many difficulties are still braking the efficiency of the maintenance. The most limiting factors are the following:

- Lack of technical documentation (maintenance and calibration procedures, drawings, etc.)
- Special components and spare parts acquisition.
- Absence or Inappropriate maintenance budget.
- Absence of incentives frame for motivating and retaining (qualified) maintenance technicians.
- Absence of maintenance culture

In order to optimise the benefit expected from the PROMASUP programme, the LIS, having a national prerogative, will have to find out the appropriate way to deal with these difficulties.

3. CONCLUSION

Without appropriate strategies of maintenance and instrumentation services, non-industrialized countries cannot sustain their development and maintain the quality of their education and production systems.

Our maintenance strategy, even at the beginning of its implementation, has provided a real photography of the exiting situation at the universities where, for instance, 19 % of the scientific equipment is in a failure state. For the first time, the technicians of maintenance are being considered and more than 100 of them were trained according to identified needs and weaknesses.

Concerning the organization and the infrastructure sides, the future creation of a national network of maintenance cells will complete our strategy and will constitute a motivating framework for the maintenance manpower.

Technically, the first maintenance tasks are starting with reactive and routine preventive actions. The next step should include quality control and calibration activities, necessary for research and medical equipment. A final step may deal, if justified, with proactive maintenance.

The merits of this maintenance strategy reside also in the availability of a suitable decision tool at the service of the managing authorities of the higher education systems. The philosophic side of this strategy is to consider the university as a complex system like an industrial manufacture equipped with diversified and sophisticated instruments. To satisfy the need of the market, this “manufacture” is committed to produce a “product” with the required quality. To meet this requirement, the maintenance must be the leitmotiv of today and tomorrow.

The success of this experience, in the under-developed world, may encourage other similar countries to adopt and adapt the Moroccan maintenance strategy.

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