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Second Expert Group Meeting on Computerized
Maintenance System in Metallurgy
Cairo, Egypt, 6-12 March 1988

Report

The views expressed in this document are those of the experts and participants and do not necessarily reflect the views of the Secretariat of UNIDO.

Mention of names of firms and commercial products does not imply the endorsement of UNIDO.

Abbreviations

| | |
|-------|--|
| CMMS | computerized management maintenance system |
| EISCO | Egyptian Iron and Steel Company |
| UNDP | United Nations Development Programme |

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INTRODUCTION

1. The Second Expert Group Meeting on Computerized Maintenance System in Metallurgy was organized by the United Nations Industrial Development Organization (UNIDO) in co-operation with the Egyptian Iron and Steel Company (EISCO) and held at Cairo, Egypt, from 6 to 12 March 1988, under the auspices of the Ministry of Industry and National Wealth.

2. The main objectives of the Meeting were:

(a) To examine project activities and the current situation and trends in the development of the computerized management maintenance system (CMMS) in the iron and steel industry in developing and developed countries since the First Expert Group Meeting on Computerized Maintenance System in Metallurgy was held in 1985;

(b) To identify the most effective way of developing and implementing CMMS in the iron and steel industry in developing countries;

(c) To formulate practical recommendations and guidelines for the implementation of CMMS in developing countries;

(d) To discuss experiences in the development of human resources to support the application of CMMS to the iron and steel industry in developing countries;

(e) To propose follow-up activities for completed pilot projects and effective forms of disseminating know-how on CMMS.

CONCLUSIONS AND RECOMMENDATIONS

3. Based on the presentations of the papers and the ensuing discussions, the Meeting reached the conclusions and recommendations set out below.

Conclusions

4. With regard to the development and application of CMMS software:

(a) The Meeting concludes that in-house development of CMMS software, by the joint efforts of the electronic data processing and maintenance departments, is usually time-consuming and involves hidden costs and trial-and-error problems;

(b) The Meeting concludes that the development of CMMS software by an outside organization (software house, consultancy company) on a turnkey basis, and/or joint implementation, however, is usually expensive for developing-country enterprises;

(c) The Meeting concludes that the purchase of a suitable CMMS software package and its modification in co-operation with the supplier (software house, large end-user in a similar industrial sector, hardware vendor) to meet local needs could be considered as an alternative;

(d) The Meeting concludes that the purchase and adoption of a standard CMMS software package is particularly suitable for personal-computer-based CMMS for small-scale enterprises; this requires changing local procedures and organization to suit the requirements of the package combining the approaches referred to in sub-paragraphs (a)-(c) above, based on priorities, management objectives, pre-conditions and available financial resources;

(e) The Meeting concludes that an important prerequisite for CMMS application in developing countries, following one of the approaches indicated in sub-paragraphs (a)-(d) above, is the establishment of a manual maintenance planning and management system.

Recommendations

5. The integration of production (operation) and maintenance systems by the use of either standard or tailor-made software should also be considered by developing countries.

6. An important part of any CMMS project should be the evaluation of the techno-economic aspects of CMMS, including the impact of software functions, hardware configurations, and the benefits obtained by the application of CMMS.

7. The training of human resources should be a continuous process. New concepts in this field should be gradually introduced to support the implementation of CMMS, for example, the use of interactive training methods and computer-based learning.

8. With regard to follow-up activities for completed CMMS pilot projects, the following recommendations were made:

(a) Training programmes and demonstration workshops on CMMS for groups of 15 to 20 participants from developing countries should be provided to disseminate acquired experience and know-how further;

(b) Fellowships to enable trainees from developing countries to learn specific know-how from the experiences of pilot projects should be provided;

(c) Consultancy and expert services should be provided to enterprises at a national level; for example, the experience of EISCO in the use of CMMS should be disseminated to other industrial sectors and enterprises in Egypt;

(d) Consultancy and diagnostic missions and preparatory assistance should be provided to developing countries under arrangements established by UNIDO, for example, twinning arrangements, technical co-operation among developing countries (TCDC) and such like;

(e) Training and consultancy services should be provided on a subregional or regional basis under UNIDO auspices. For this purpose, the regional activities of EISCO in providing technical assistance in the field of maintenance to African countries should be strengthened.

9. With regard to general follow-up activities, it was recommended that UNIDO should:

(a) Organize an evaluation session in collaboration with the national project co-ordinators of several UNIDO projects in the field of CMMS (Algeria, Czechoslovakia, Egypt, India, Mexico, and the countries of the ASEAN region) so that they could present and analyse their experience in implementing CMMS in new and existing plants;

(b) Make an effort to bring together interested developing countries with the goal of establishing a regional and/or interregional society for maintenance, using existing maintenance associations in developed countries as a model;

(c) Consider the possibility of bringing software and hardware experts to future expert group meetings;

(d) Organize, within a two-year period, the Third Expert Group Meeting on Computerized Maintenance System in Metallurgy. The Permanent Working Group of Experts should meet at least once before then to prepare the agenda;

(e) Identify new CMMS projects and prepare follow-up activities with UNIDO as an executing agency, based on its extensive experience in the field;

(f) Prepare a publication describing the state-of-art of different CMMS projects of UNIDO, which would be circulated to all national project co-ordinators and other interested parties in developing countries;

(g) Strengthen its CMMS activities by spreading information technology to developing countries, in view of its direct impact on the implementation of CMMS;

(h) Strengthen the exchange of information between ongoing and pipeline projects, through its own activities or through twinning arrangements. In particular, a study on different software applications and the introduction of CMMS, and a glossary of CMMS terminology for use in developing countries, should be prepared and distributed;

(i) Investigate modern trends and concepts in CMMS, such as the use of expert systems for diagnostics and the use of fourth-generation system development languages;

(j) Prepare a model CMMS project to be used as a guideline for implementing CMMS in new and existing plants in developing countries. The model should describe in detail the different phases of organizing a project, from the feasibility study to the specification of requirements to meet current and future needs of CMMS, including system design; selection of software, hardware and contracting companies; system testing; input of data and training of various categories of personnel using CMMS.

I. ORGANIZATION OF THE MEETING

10. The following persons attended the Second Expert Group Meeting on Computerized Maintenance System in Metallurgy, held at Cairo, Egypt, from 6 to 12 March 1988: Girum Amare (Ethiopia), Jaime Ballesteros (Mexico), Saad Bourahla (Algeria), Zeng Cheng-Xiao (China), Florentino Cuasay (Philippines), Mourad Ghoulami (Algeria), Lies Goumiri (Algeria), Adel Hussein (Egypt), Bjorn Johannessen (Norway), Eliah Kapezi (Zimbabwe), Jan Krouzek (Czechoslovakia) Appolinary Makatu (United Republic of Tanzania), Costakis Panayioutou (Cyprus), B. N. Saha (India), German Surguchov (Union of Soviet Socialist Republics), Dia Tantawi (Egypt) and Francis Yamba (Zambia). The following organization was represented by an observer: Institute for Automation and Industrial Management (INORGA).

11. The Meeting consisted of the presentation of five papers by their authors, which were often supplemented by other contributions, and of plenary sessions, individual discussions, consultations, and visits to industrial plants and technical laboratories.

12. Copies of the papers presented were distributed to all participants at the Meeting. A synopsis of each paper is given in chapter two of the present report.

13. In the course of the opening session, a representative of the Metallurgical Industries Branch, Department of Industrial Operations, UNIDO, described the technical assistance activities of UNIDO in the field of CMMS in the iron and steel industry. Most of the projects, he said, had focused on group training programmes and workshops.

14. Adel Hussein (Egypt) was elected Chairman of the Meeting and J. V. Krouzek, Co-ordinator. The discussions were monitored, and final conclusions and recommendations were prepared for adoption by the Meeting by the Permanent Working Group of Experts. This Group, which was established in accordance with a recommendation of the First Expert Group Meeting on Computerized Maintenance System in Metallurgy, held at Prague in 1985, consisted of Lies Goumiri (Algeria), Bjorn Johannessen (Norway), Eliah Kapezi (Zimbabwe), Jan Krouzek (Czechoslovakia), B. N. Saha (India), and German Surguchov (USSR).

II. SUMMARIES OF PAPERS PRESENTED

The techno-economic aspects of CMMS in developing and developed countries: Jan Krouzek

15. In the introduction to the paper, the overall situation in the industrial maintenance field in both developing and developed countries and the role of UNIDO in the development and implementation of CMMS projects are characterized. The techno-economic aspects of CMMS justification are outlined, taking into consideration maintenance costs, the overall maintenance management cycle and the scope of CMMS. The justification for CMMS is based on a cost-benefit analysis and/or feasibility study, which compares the costs for computer hardware and for the acquisition, development and application of software, including training, and the hidden costs involved in implementing CMMS, as well as the tangible and intangible benefits over a period of time so that economic effectiveness can be assessed. The check-list for the evaluation of benefits given in the paper highlights those such as: increased availability of plant (5-15 per cent); better use of staff (8-20 per cent); reduced stocks of spare parts (2-20 per cent); increased manufacture of spare parts (10-25 per cent); energy savings (1-5 per cent); and improved financial and management control.

16. Case-studies and surveys of the benefits of CMMS in metallurgical and other basic industries in both developed countries (e.g. Czechoslovakia, Japan, Sweden, the United Kingdom of Great Britain and Northern Ireland and the United States of America) and developing countries (e.g. Egypt, India and Mexico) are referred to in the paper. Cost factors and requirements for CMMS are specified, which include an evaluation of various configurations of computer hardware, mainframe, mini and micro personnel computers and guidelines for their purchase. The requirements for CMMS software, possible approaches to its development and/or purchase, and rules for the appraisal of CMMS software packages, are dealt with in the paper. Particular attention is paid to the application of CMMS, based on personnel computer hardware and software, which plays an important role in the improvement of maintenance management and planning for small- and medium-scale industrial enterprises.

17. Pre-conditions for the successful introduction of CMMS are summarized, which include the introduction of preventive maintenance routines; the use of job descriptions, catalogues of equipment and spare parts, and of technical documentation; the availability of valid data, history and statistics on maintenance; the existence of a suitable organizational structure, and of basic planning functions and administrative procedures for work requests, work orders and the requisitioning of materials and spare parts; the promotion of positive managerial attitudes and a correct climate on the shop-floor; and the availability of basic skills in industrial maintenance and informatics, of Government support, and of access to financial resources etc. Some of those pre-conditions might be introduced with the assistance of the United Nations, in particular by regional and subregional activities whereby selected institutions or centres, so-called focal point institutions, have the requisite infrastructure, know-how, skills and facilities to assist smaller enterprises in the region that are linked to those focal points. Examples of such UNDP/UNIDO regional activities already exist.

18. The paper concludes by summarizing recommendations and/or guidelines for introducing CMMS, bearing in mind the multiple aspects of CMMS and the new trends and concepts related to the future application of CMMS in industry.

Pre-conditions for, and the introduction of, CMMS
in developing countries: Bjorn Johannessen*

19. The paper covers maintenance terminology; weak points, organization and costs of maintenance; and sequence of implementation when using CMMS. Attention is given to the increased importance of maintenance, and the practical possibilities for using computer technology to introduce modern maintenance techniques. The need to standardize maintenance terminology is underlined.

20. When equipment is purchased, approximately 80 per cent of future maintenance problems already exist owing to weak parts in design, production methods, equipment, raw materials and tolerances. An example of an attempt to solve or reduce such problems is that of the offshore industry and most of the processing industry in Norway, which has started to demand quality assurance manuals from the production companies, which, in turn, are hiring consultants to prepare such manuals and to check that the companies are acting in accordance with the manuals.

21. As for eliminating the weak points of a product line, a new strategy for maintenance has been proposed in some European countries that divides maintenance organization into two parts: one dealing with maintenance and the other dealing with the analysis of weak points. The costs of maintenance are also separated from the costs of analysing weak points.

22. The paper explains the need to train electronic data processing personnel in the use of maintenance management and in practical maintenance work by implementing CMMS. It also describes in detail the different phases of resource analysis, developing specific and suitable software, creating the specific data needed as an input to the system and implementing such a system, including the training of personnel.

The introduction of CMMS in developing countries:
a case study of India: B. N. Saha

23. CMMS was introduced into the Rourkela Steel Plant, under the Steel Authority of India Ltd., in April 1986 under a UNDP/UNIDO project. The system has the following modules: preventive maintenance and repair planning; capacity resource planning; materials planning, including inventory control and purchase; captive shops for the manufacture and reconditioning of spare parts; and maintenance monitoring. All the modules are to be integrated with each other.

24. Preventive maintenance, and repair and planning start with the inspection schedule, which results in a defect report. That defect report is then converted into a job, which will be kept as a backlog in the memory of the computer for execution on the shut-down day, and thereafter kept on file for maintenance monitoring. Capacity resource planning is also carried out for all departmental workers and the workers from the central organization to ensure their efficient deployment.

*The author concluded his presentation by describing the activities of the European Federation of National Maintenance Societies, which was an organization, he said, that would be willing to support the establishment of a similar one in African and Arab countries.

25. Material planning starts with the determining of the requirements for spares for the whole year. The corresponding budgetary requirements can be determined by computer in about one-fifteenth of the time taken by manual methods. Requisitions can also be prepared by computer, an innovation that greatly reduces the lead time, and thereby reduces the inventory level by 10 per cent. Orders from the fast-moving consumable items industry can also be carried out by computer.

26. The repair shop assures the availability of spares manufactured in the shop, by computer scheduling and the optimization of schedules, which ensures that raw materials are available before a job is started in the repair shop.

27. CMMS packages are being developed in-house. The software is being developed by 10 computer engineers and 10 maintenance engineers. The project will probably be completed in December 1989.

The introduction of a predictive maintenance system
in developing countries: German Surguchov

28. The effective introduction of CMMS in various industrial sectors depends on many factors. Those include the development of the sector itself, and the existence or development of information technology in the country concerned.

29. As a pilot sector for the introduction of CMMS, the iron and steel sector has made considerable progress in recent years. In 1987 global crude steel production was 737 million tonnes per annum, which was the second highest figure for production after that of 1979. The share of developing countries in world production is 20 per cent, which is close to the target of the Lima Declaration and Plan of Action on Industrial Development and Co-operation adopted by the Second General Conference of UNIDO, held at Lima, Peru, in 1975.*

30. The iron and steel industry was one of the first sectors in which computers were introduced in the early 1950s, which has led to it becoming one of the most computerized sectors and a pilot sector for other industrial sectors.

31. The development of information technology, however, which is essential for the introduction of CMMS, is slow in developing countries, despite the fact that many of those countries have introduced national plans for the development of information. One of the ways of overcoming the large gap between developed and developing countries is a regional approach. Several regional networks, which exchange technical, economical and scientific information, exist: Arab Satellite Communications Organization (ARABSAT), Pan-African Telecommunications Network (PANAFTEL), Pan African Documentation and Information System (PADIS) and Regional Informatics Network in South and Central Asia (RINSCA). The development of CMMS is one way of spreading information technology to different sectors of the economy.

32. Special efforts should be made to accelerate the development of information technology in developing countries. Positive examples are the establishment of the Club of Gali in Latin America, which discusses and recommends ways of developing information technology and establishing similar clubs in other regions and, in particular, in Africa.

*See ID/CONF.3/31, chap. IV, para. 28.

33. Maintenance technology is developing in accordance with the development of information technology. Starting as a manual method of managing breakdown techniques, it has developed into either (a) computer-assisted, time-based preventive maintenance and production scheduling or (b) time-based planned maintenance, based on priorities.

The development of human resources and of training schemes based on technical assistance in CMMS in selected African countries: Dia Tantawi

34. EISCO received technical assistance from UNIDO in early 1975 to introduce preventive maintenance system programmes. These programmes have recently developed into CMMS covering the entire plant. The successful implementation of such a system has encouraged EISCO to assist other industrial areas in Egypt by transferring its experience to selected companies from six industrial sectors.

35. When CMMS was started in different companies, however, problems were encountered relating to the lack of organization of maintenance technology; the lack of co-ordination between the local maintenance shops and the production superintendents; the lack of qualified maintenance staff; and the incorrect use of computers.

36. The first aim of maintenance activity is to minimize production down-time and improve maintenance. This is achieved by improving the organization of maintenance; organizing the relations between the maintenance department and the production department so that technical skills can be fully used; improving management techniques and training programmes; introducing a predictive maintenance system; and defining the responsibilities of the group responsible for maintenance.