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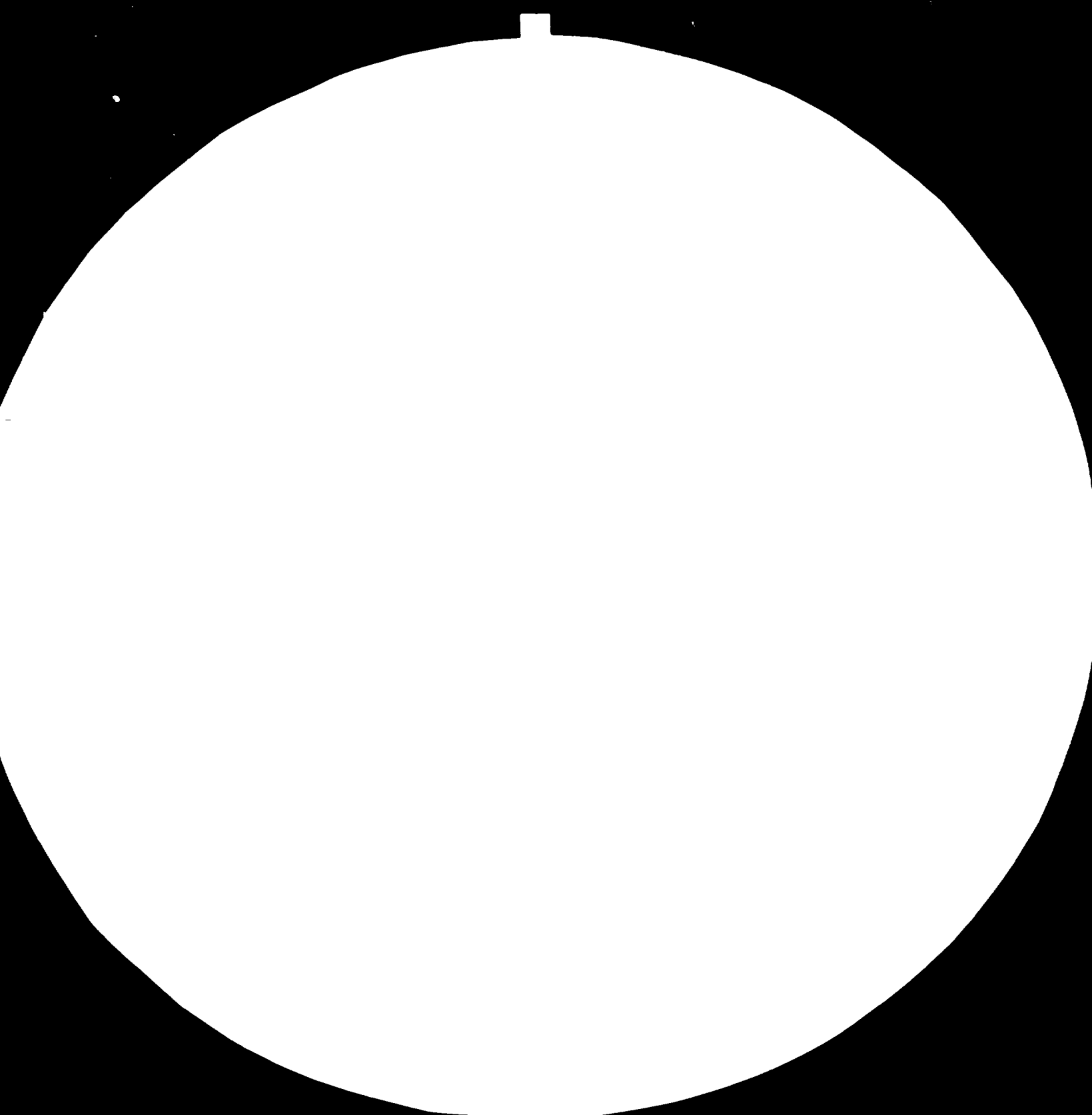

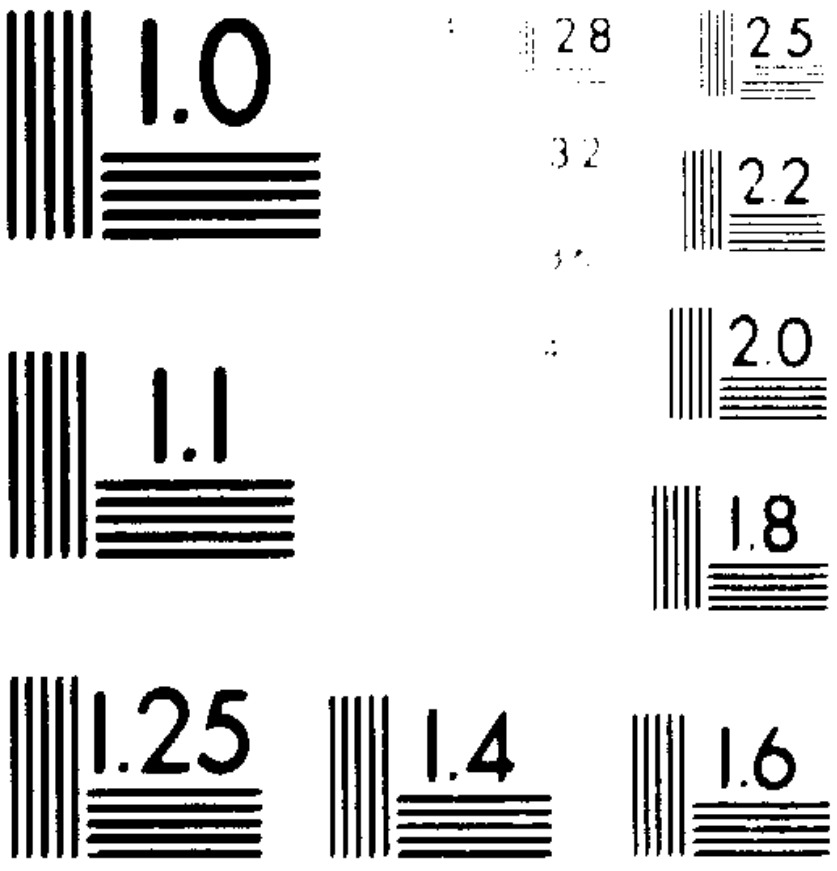

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ICME's Consulting Divisions

- enterprise management
- marketing and technology
- industrial engineering
- informatics

Background

Founded in 1954, ICME was one of the first private Swiss management consulting companies. ICME is a founding member of ASCO (Swiss Association of Management Consultants) and sponsors a foundation for research in enterprise management.

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Professional Consultants

The ICME Group has about 50 professional consultants whose average age is 41 years. All ICME consultants are graduate engineers or economists, many of whom have doctoral or MBA degrees. ICME project managers have long, practical experience in management.

Experience

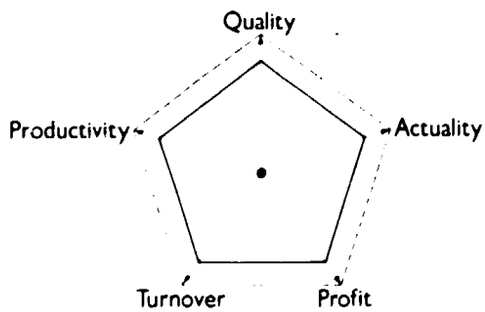
Since 1954, ICME has performed over 1100 assignments in all areas of management consulting, averaging 3 mandates per client.

Clientele

350 European and overseas clients in all branches of business as well as governmental and international organizations.

Origin:	
Switzerland	60%
Europe	20%
Overseas	20%
	100%
Size of firms: (employees)	
less than 250	22%
250–1000	33%
over 1000	28%
diverse (governmental and international organizations)	17%
	100%
Activity:	
Industry	74%
Commerce	8%
Other services (including governmental and international organizations)	18%
	100%

ICME's Philosophy of Growth



We aim at balanced growth.

ICME

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PDR Yemen.

TRAINING WORKSHOPS IN MAINTENANCE PLANNING AND MANAGEMENT IN THE PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

FINAL REPORT
Project No.: UC/PDY/82/093

April 11, 1984

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CONTENTS

INTRODUCTION

This is the final report on ICME's work in the People's Democratic Republic of Yemen where the consultants were charged with delivering two seminars on industrial maintenance planning and management and with coaching participants in the seminars in their respective factories.

Part A of the present report covers preparatory work and the first training seminar and follow-up. The first seminar started on April 17, 1983, and was followed by three weeks of follow-up work by two consultants. ICME's "Intermediate Report" of July 4, 1983 included four attachments 1) for the attention of UNIDO which are not given again with the present report. References to these attachments are made, however.

Part B covers the second training seminar and follow-up, which started on October 22, 1983 and concluded on December 10, 1983. The final version of the training manual developed for the seminars is included in this report as the separate document "Attachment 1".

The overall conclusions and recommendations for the two missions are given immediately following, before the presentation of Part A.

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1) Documents previously provided to UNIDO with ICME's Intermediate Report of July 4, 1983:

   Attachment 1: Maintenance Handbook; Attachment 2: "Unitary Maintenance Instruction"; Attachment 3: Candidacy forms of the participants; Attachment 4: Organization charts submitted by the participants

OVERALL CONCLUSIONS

- Design of the missions

The three weeks budgeted for each seminar was optimal. While the first follow-up period could have been more fruitful with about an extra week (two consultants), the second follow-up period was entirely adequate. Thus, the time required for follow-up is just a function of the particular problems of the set of factories to be visited and cannot be planned exactly.

The method of working closely with general managers of factories has proved very effective.

- Assimilation by the participants

While both groups were able to absorb most of the concepts presented in the seminars, the second group's assimilation appeared to be greater than that of the first group.

One can conclude that the "level" of the seminars was entirely appropriate to the capacities of the participants.

- Management support

A very positive result of the two missions is the change of attitude toward maintenance on the part of several general managers, who now appear keen on systematic maintenance and on receiving further assistance.

The managers have promised to lend their trainer-advisers (see Part B, Chapter 6) to other factories for assistance.

Overall Conclusions

- Prospects for the participants to transmit their new knowledge to the factories

The participants of the two seminars were employed at levels high enough to allow them to participate in the implementation of maintenance systems.

In some cases the participants are going to be challenged soon to planning of systematic maintenance in new or expanded factories.

In general, the "environment for maintenance" in the PDRY appears to be more favourable as a result of the project, enhancing the prospects of the participants to contribute.

- Prospects for the team of "trainer-advisers" to assist factories having poor maintenance

Since the managers have given their support to this team, the prospects really depend on the:

. ability of the trainer-advisers

. acceptance of their recommendations.

On the first point, we feel that the Ministry has available in this team enough ability for most tasks that the team will face. Of course, the Ministry must try to choose the right man in each case.

The general managers' acceptance of recommendations should present no particular problems. However, the trainer-advisers may encounter some resistance to their work at lower levels in a factory's organization. Solutions will probably be found in most cases.

Overall Conclusions

- Prospects for having maintenance plans and adequate maintenance staff for new or expanded factories

  Where the seminar participants are not involved or need assistance in planning for maintenance in new or expanded factories, the team of trainer-advisers will be available. A typical planning schedule has been designed (see Part B, Chapter 6).

  The prospects depend much more on organization. ICME has stressed to the Ministry that it must use the new team of trainer-advisers for planning for new factories and that there is plenty of time before start-up for planning.

  For plant expansions, the existing management has a key role in planning, including the choice of equipment. The managers present at the second seminar for managers were made aware that the seminar participants were trained in dealing with new equipment and that the team of trainer-advisers is available as well.

  Indeed, it seems that prospects are good for using the trainer-advisers: at the seminar for managers the team got its first job, and a trainer-adviser accompanied the manager of the dairy to help with a new compressor.

  There remains the problem of having an adequate maintenance staff for a new factory. Not only must properly trained personnel be found, but they must be hired in time for them to participate in the maintenance planning process (see Part B, Chapter 6).

OVERALL RECOMMENDATIONS

- To those managers not present at the two seminars for managers, the Ministry of Industry should announce the availability of the team of trainer-advisers.

- Further follow-up missions should be organized. As agreed in the closing meeting with Mr. Daiban, Assistant Deputy Minister of Industry and Mr. James Dee of UNIDO on December 8, 1983, at least two missions of one consultant for 6 weeks are necessary 1). The first should start early in 1984, because the Ministry would find the consultant very useful in keeping up the momentum of the new group of trainer-advisers.

  The consultant would:

  . accompany at least two or three trainer-advisers on visits to factories, coaching them and at the same time helping them to gain support for their recommendations

  . participate with at least one trainer-adviser and the maintenance manager of a new factory in planning the maintenance system, ideally with the consultant arriving just before machine installation

  . assist the Ministry in identifying and securing technical specialists in existing factories for assistance to factories having difficulties in overcoming particular technical problems in such areas as boiler water treatment

  . continue coaching of factories visited during the second follow-up program as well as some of those of the first follow-up.

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1) No formal request has been made on the part of the Government, and no commitment has been made by UNIDO.

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CONTENTS

PART A: PREPARATORY WORK AND FIRST TRAINING SEMINAR AND FOLLOW-UP

1. PRELIMINARY FIELD SURVEY

The team leader arrived in PDRY on March 15, 1983 and spent 10 days consulting with Ministry of Industry officials and advisors and visiting factories, with the objective of determining the actual state of maintenance planning and management in the PDRY.

An important finding was that a maintenance handbook 1) and a standardized system of maintenance records had been developed by advisors to the Ministry and had been distributed to the factory managements. Copies were given to the team leader, and these were examined and evaluated in the consultant's home office. Copies of the standardized system of maintenance records are included in Annex 1.

An equally important finding was that for several years most of the larger factories have had maintenance plans. These had been developed with the assistance of the Ministry until 1983 when most of the larger factories developed their plans with only a minimum of assistance from the Ministry. A copy of the annual plan for the Al Gundi Plastics Company was made available to the team leader. A reduced copy is presented as Annex 2.

Visits were made by the team leader to the following factories:

- Al Gundi Plastics Company
- Aluminium products
- Flour mill (wheat flour)
- Soft drinks
- Tomato paste
- Cigarettes
- Brewery
- Dairy
- Textiles.

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1) Copy provided to UNIDO as "Attachment 1", Intermediate Report of July 4, 1983
2) "Attachment 2", same report

1. Preliminary Field Survey

During the visits the team leader met, when possible, with the general manager and the maintenance manager or supervisor, as well as with employees who were to participate in the first seminar.

Maintenance records (in Arabic) were seen by the team leader in several factories, and he got the impression that such records did exist in several other factories. The value of the records could not be judged.

In summary, the preliminary visit was extremely productive with the exception of the erroneous assumption by the team leader that more or less complete maintenance records existed, at least covering a few years, in several factories.

2. PREPARATION OF TRAINING MANUAL AND COURSE MATERIALS

The training manual (first draft) and course materials were prepared at the consultant's home office after the return of the project leader from the preliminary mission.

The sources used for the manual were:

- articles and papers gathered by the team leader at UNIDO headquarters
- articles and papers in the consultant's files
- past projects of the consultants
- maintenance reference books covering a broad period: 1936 to 1980 (under the hypothesis that the factories in the PDRY are not ready for the latest ideas in a doctoral thesis).

The emphasis of the manual was on setting up the maintenance system.

The manual was developed as a first draft to allow the team to develop more appropriate materials in the field after having worked with the participants for a few days.

It is important to state here that after working a while with the participants, it became apparent that the true state of maintenance planning and management was quite lower than the team leader had thought from his preliminary visit.

3. THE PARTICIPANTS

The ages, types of theoretical training, and practical experience of the participants varied widely. The "spectrum" can be definded as: on one end, those participants with theoretical training in only one country and with limited practical experience; while, at the other end, a few with theoretical training in several dissimilar countries and practical experience outside of PDRY. One participant had worked in Italy for ten years, for example.

The participants' job types varied less: from maintenance supervisor to maintenance manager.

The Ministry had all participants complete UN training candidate forms. These were given as the separate Attachment 3 to the Intermediate Report of July 4, 1983.

The participants had widely varied capabilities to understand the English language presentations. It can be said that about one third of the participants did not really require the simultaneous translation into Arabic. Three or more of the participants were able to offer suggestions for improvements to the Arabic translations.

The names of the participants and the factories in which they work are listed in Table 1.

3. The Participants

Table 1: Participants in the Maintenance Seminar

1. Adel Mohammed Ba-Wazeer, National Aluminium Factory
2. Gamal Nagi Ali, Carpentry Company
3. Nasser Husin Alala, Al-Gundi Plastic Factory
4. Mohamed Awadh Ahmed, Cigarette factory
5. Hussein Radman Mohamed, Dairy
6. Ali Mahmood Raweh, Perfume Factory
7. Khaled Ali Saeed, Oil Mill
8. Saeed Abdorabo Hameed, Tomato Paste Factory
9. Mubarak Awadh Maree, National Foam and Steel Furniture Co.
10. Anis Ramadan Ibrahim, National Brewery Corporation
11. Ali Mohamed Radman, Athora Spares Factory
12. Sadek Awadh Ali, Textile and Spinning Factory
13. Dilshair Ali A. Rahim, Match Factory
14. Saleh Saeed, Tomato Paste Factory
15. Waheeb Abobaker Hasson, Yemen Auto Batteries
16. Hashim A. Rahman Gawi, Textile and Spinning Factory
17. Fadel Salem Gaber, Nat. Organization for Bottling Canada Dry
18. Yousuf Bin Yousuf Ahmed, Nat. Org. for Bottling Canada Dry
19. Saeed Mohsen Awadh, Flour Mill
20. Tofik Saeed Al-Aswadi, Knitting factory

Delegate of the Ministry of Industry:

21. Mahfood Mohamed Nooman, Ministry of Industry

Interpreter:

Hussain Awadh Al-Towei, College of Technology, Aden

4. SUMMARY OF INTRODUCTION TO THE FIRST TRAINING SEMINAR

The seminar opened on Sunday, April 17, with adresses by the Deputy Minister of Labour and the Assistant Deputy Minister of Industry. The UNIDO delegation to the Ministry was present. The event was video-recorded for the television news.

The introduction by the ICME project leader had the following elements:

- Description of the two missions of 3 weeks classroom training followed by 3 weeks follow-up in selected factories and supplemented by seminars for general managers and for training of trainers.

- Outline of objectives, namely:

  . to advance the participants' knowledge of maintenance with practical concepts

  . to work with the participants to find ways to set up maintenance systems in the factories

  . to train the participants in the elements of the maintenance system.

- Description of classroom method: it was stressed that listening and taking notes was more important that reading the manual.

- Description of the follow-up program: it was emphasized that the ICME team would try to find ways to free the maintenance supervisors and managers from doing maintenance work so that they would have time to implement the maintenance system. The conditions for success in starting up a maintenance system were noted:

  . support from management

    resources (money and people) to start the system

  . maintenance plan

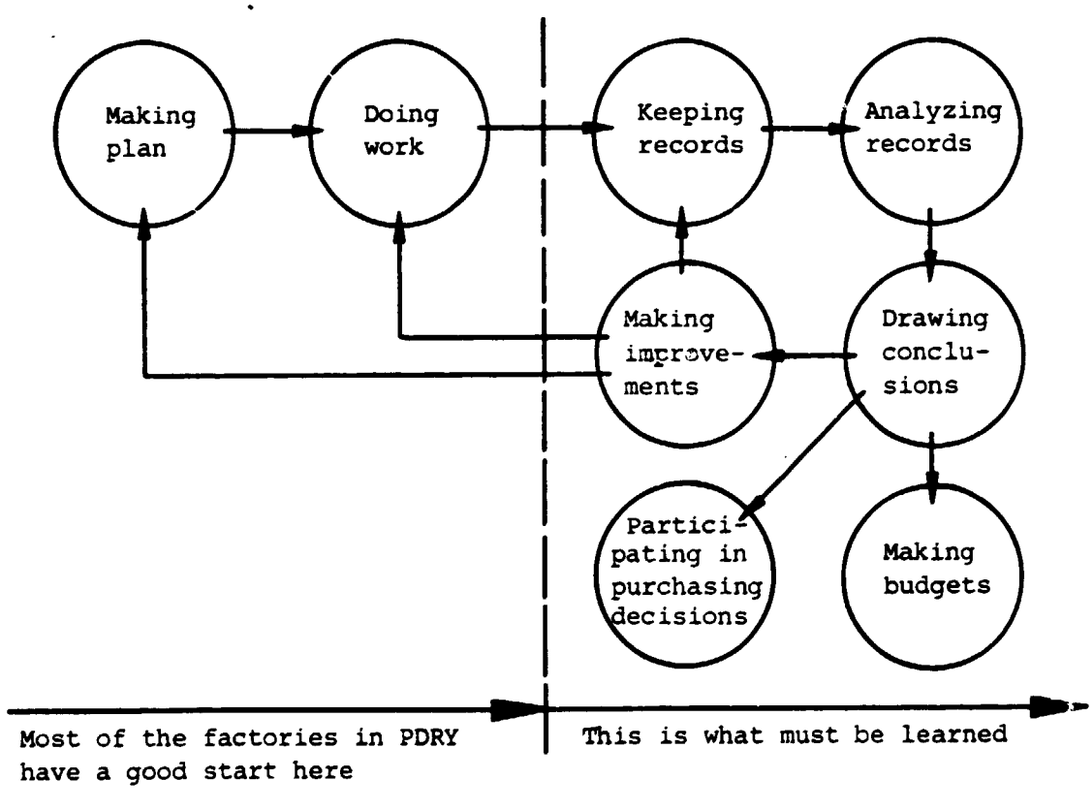
  . maintenance instructions

  . workers adequately trained in their maintenance functions as well as in the maintenance system.

4. Summary of Introduction to the first Training Seminar

- Description of the maintenance manager's main tasks once a maintenance system is in operation:
  - . supervising maintenance work
  - . organizing maintenance records
  - . controlling maintenance records
  - . analyzing maintenance records
  - . making conclusions
  - . making plans for improvements
  - . analyzing costs/making budgets.
- Presentation of a schematic of the elements of the maintenance system:

Systematic Maintenance



Reference was made frequently to this diagram during the seminar.

4. Summary of Introduction to the first Training Seminar

- Discussion of the limitations of the mission. It was stressed that the seminar must focus on reinforcing basic maintenance knowledge and on training the participants in systematic maintenance to the point where each could play a key role in the setting-up and execution of the maintenance system in his factory.

- Discussion of the objective of training of trainers. The participants were made aware from the start that many of them would be called upon to train subordinates.

5. EVOLUTION OF THE FIRST TRAINING SEMINAR

The presentation was given in order of the chapters in the manual. In general, the procedure was to budget the time so that the maximum possible time was spent on the critical chapters, namely:

- Chapter 7: Setting up a Maintenance System
- Chapter 8: Budgeting and Calculating the Costs of Maintenance
- Chapter 9: Analysis.

The time budgets were respected, and the ICME team was able to concentrate on these chapters.

Each day, the planned chapters were discussed using examples illustrated on the blackboard. The last hour of each day was spent defining the terms in the Glossary of the manual and recording them in Arabic. This method allowed enough time to discuss each term fully and to give practical examples.

At the end of each session, the translator was briefed on the next day's presentation. This approach worked very well.

6. VISITS MADE CONCURRENTLY WITH SEMINAR

Visits by two ICME team members were made to the cigarette factory and the brewery, at the suggestion of the Ministry, in order to prepare a case study on analysis of maintenance records.

The visit to the cigarette factory yielded only sparse information, but it was useful as an example in the presentation on analysis in the seminar.

The absence of the maintenance manager of the brewery prevented the preparation of a case study on that factory's data. However, on the manager's return, the entire group of participants visited the brewery and examined the maintenance records in the manager's office.

Other visits were made to the leather products (shoes) factory and to the rubber sandals factory.

The ICME team leader made two visits to the Ministry of Industry's "Information and Documentation Centre", a well-stocked technical library the contents of which appear to have been chosen very expertly. Some particularly interesting works dealing with maintenance which are still in the library (most of the more well-known works are used on a day-to-day basis in the Ministry) are:

- Handbook of Industrial Loss Prevention, Factory Mutual System, second edition, Mc Graw-Hill, 1976
- Plant Manager's Handbook, Mc Graw-Hill, 1976
- Modern Wiring Practice, Stewart, 7th edition, Newnes Butterworth (2 copies)
- Electrical Wiring; Industrial, Smith, Van Nostrand, Reinhold.

6. Visits made concurrently with Seminar

Some of the participants expressed concern about not having adequate accessibility to this library, but the Ministry states that it is open on presentation of an official letter.

Messrs Rittenhouse and Ruffner also visited the Technical College and were shown the various labcratories and the library by the head of the Mechanical Engineering Department.

The purposes of the visit were to gain a better understanding of the theoretical training received by many of the participants and to make suggestions to the College on ways in which students could make some practical contributions to maintenance in the factories as part of their in-factory training.

The laboratories and library of the College were found to be suitably equipped for training technical personnel able to make practical contributions to the industrialization of the PDRY. 1)

The head of the Mechanical Engineering Department was enthusiastic about the ICME proposals for maintenance-related projects for students during their in-factory training. It was agreed that ICME would make specific proposals at the end of the project and would try to coordinate the effort with the Ministry of Industry.

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1) It appears, however, that the Technical College, at least in the recent past, has veered in a "university" type direction which may be over-stressing theory.

7. RESULTS OF THE FIRST TRAINING SEMINAR

- Participation

Attendance averaged 17 of 21 enrolled, 81 %, and probably would have been higher except that several participants were kept away temporarily while they tended to urgent maintenance problems.

Classroom participation was excellent. There was no hesitation to ask questions. Note taking appeared to be more than adequate, because the participants were able to refer to their notes of previous sessions when required.

Discussions on problems in individual factories were enlightening for the participants as well as the for ICME team. On several occasions, after the session, Mr Ruffner was able to offer some practical solutions to maintainability problems and to make some design changes (match factory).

- Assimilation

The technical level of the seminar was kept to correspond to the average of the participant's capabilities to absorb. In this way, the more advanced participants were not unduly restrained. However, all of the participants confirmed that most of the subjects were new to them.

The concepts of costs of maintenance and of analyzing maintenance records in particular were very new ideas for them and were the least well assimilated.

The over-all rate of assimilation was more than adequate. Approximately half of the participants absorbed nearly all of the concepts presented in the seminar.

7. Results of the first Training Seminar

- Training of trainers

  The ICME team was able to identify readily those participants having the background required for taking on the role of trainer. Most of the participants expressed some discomfort with the idea of their training others, only because of their own lack of knowledge. They generally expressed interest in training, rating it as a very desirable task.

- Role of maintenance/organizational constraints

  Perhaps the most striking constraint is that there are nearly no real plant managers in the public and mixed sector enterprises. Instead, the production manager usually runs the plant, and there is a communications void between him and the general management. The results are that, very predictably, maintenance does not have a high enough status and the "maintenance point of view" is not (adequately) considered. For example, while the various maintenance departments have accumulated a great deal of knowledge on machines and equipment, this knowledge is not really considered in making decisions on new purchases.

  The participants were asked to draw up the organization structures of their plants. The results 1) were ready on the following day. There are three cases in PDRY for the organization of maintenance:

  - Plant manager/technical manager has the additional job of production manager and the maintenance manager reports to him. This is the case for the following factories:

    - Aluminium products
    - Batteries (auto and truck)
    - Soft drinks
    - Plastics (Al Gundi).

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1) The organization charts drawn up by the participants of the first seminar were provided to UNIDO as "Attachment 4" to the Intermediate Report of July 4, 1983.

7. Results of the first Training Seminar

- Plant manager exists and a maintenance manager and production manager report to him. This is the case for:

  - Cigarettes
  - Sponge (foam rubber)
  - Spare parts ("Revolutionary Spares").

- General manager supervises directly separate managers for maintenance and production. Examples of this system are:

  - Oil mill
  - Perfumes
  - Rubber sandals.

- Use of previously-developed maintenance handbook and standardized maintenance records

  It was found that none of the factories which sent participants use the handbook or full set of maintenance records forms previously developed by the Ministry and its advisors. However, many of the factories use some of the records forms, usually adapted for the particular factory's needs. In particular, the use of equipment record cards is rare.

  The cigarette factory has a basic records system suited to its particular needs and is very strong in spare parts control. Is has studied the Ministry-developed record system and will probably adopt it gradually, with some changes.

  The Brewery has its own system which was set up under the management contract with the foreign partner and which has been elaborated by the maintenance manager using UNIDO publications on maintenance.

8. SEMINAR FOR GENERAL MANAGERS

Following the training sessions, a one-day seminar was given for general managers. Taking the form of a "briefing" rather than a training session, the seminar aimed principally at encouraging management's support for the installation of maintenance systems at the various factories. Of a total of about 40 managers invited, 17 were able to attend. These are considered by the Ministry to be the more active and cooperative managers.

The benefits of adopting truly systematic maintenance were stressed, while special attention was given to the costs involved.

A summary of the ideas presented in the training seminar was given, and emphasis was placed on the questions raised by the participants.

It was made clear to the general managers that their maintenance personnel now have the knowledge necessary, for making (monthly) reports to management and that, indeed, management's requiring of such reports might accelerate the process of implementing the maintenance system.

Few questions were raised by the general managers; one manager had some special questions on spare parts ordering.

9. FIRST FOLLOW-UP PROGRAM

Two ICME team members each visited four factories in order to:

- assist the factories in the setting up of maintenance systems
- verify the assimilation by participants of ideas presented in the seminar
- start to find ways to upgrade the training of maintenance personnel
- sollicit still more support from general management for the introduction of systematic maintenance.

A summary table of the findings and special accomplishments of the visits is presented in Table 2.

The participants in the seminar were asked during the seminar to start gathering together the various maintenance documents (particularly maintenance instructions supplied with machines) in order to prepare for the visits of the ICME team members. This was a major task for one of the factories visited. Only one factory was not able to assemble maintenance instructions. Another case, the aluminium products factory has forty-year old second-hand equipment and was not even expected to have such documents.

With only one exception, the visits of the follow-up period were very effective. The seminar participants were keen to start to set up a maintenance records system where it did not exist or to complete and improve the existing systems. Support from management was good in most cases.

During this program, the ICME assistance evolved into two different forms:

- the first, for factories which had partially to fairly well developed maintenance systems: in this case, the assistance focused on the seminar participants directly, working with them on:

Table 2: Results of the follow-up program

Factories visited during Follow-up Period	Public Sector	Mixed	Year Established	Degree of maintenance planning	Completeness of maintenance instruction (production equipment)	Qualifications (average) of maintenance personnel	Equipment available to maintenance	Spare parts management	Use of maintenance records	Effectiveness of maintenance of production equipment	Remarks
Flour mill	X		1975	Good	50 %	Very good	70 % of needs; average condition	Very good	Lack monthly reports	Very good	Expandir Seminar understo knowledg Weak po of funds
Aluminium products	X		1942	Good	None	Medium	Adequate; medium condition	Poor	None	Poor	Starting parts in systema will be factory.
Cigarettes		X	1975	Very good	Complete	Very good	Adequate average	Average	Own system	Very good	Product directly maintena cigarett Have a analysis reports. in spare
Plastic products (Al Gundi)	X		1971	Very good	Complete	Good	Adequate average	Good	Lacked equipment cards	Very good	Safety me lent. Co of worke plant ma
Soft drinks		X	1979	Weak	Complete except for boiler	Weak	Inade-quate	Poor	None	Average	Rely on for mai maintena Lack ma No plac ance in Some sa
Brewery		X	1981	Very good	Complete	Good	Adequate	Adequate	Complete System	Average	In proc spare p Mainten in part Lack pr came wi
Tomato Paste	X		1974	Poor	(None in evidence)	Inade-quate	Inade-quate	Good	None	Poor	Establi mainten new.
Oil mill	X		1976	Very good	Complete and well organized	Average	Inade-quate	Very good	Lacked some types of records	Very good	Ideas p very w

›llow-up program

Completeness of maintenance instruction (production equipment)	Qualifications (average) of maintenance personnel	Equipment available to maintenance	Spare parts management	Use of maintenance records	Effectiveness of maintenance of production equipment	Remarks	Result of Follow-up programme
50 %	Very good	70 % of needs; average condition	Very good	Lack monthly reports	Very good	Expanding use of records. Seminar participant understood how to apply knowledge gained in seminar. Weak point is availability of funds.	Made some changes to existing maintenance records forms; worked on designs for some inexpensive maintenance equipment.
None	Medium	Adequate; medium condition	Poor	None	Poor	Starting system of spare parts inventory control; systematic maintenance will be applied to new factory.	Spare parts manager visited spare parts store of the flour mill; counselling in spare parts coding, organization.
Complete	Very good	Adequate average	Average	Own system	Very good	Production personnel are directly involved in maintenance (usual for cigarette manufacture). Have a system of breakdown analysis with monthly reports. Some key weaknesses in spare parts store.	Recommended that spare parts manager visit flour mill. Manager starting to expand use of records, following briefing by the two seminar participants.
Complete	Good	Adequate average	Good	Lacked equipment cards	Very good	Safety measures are excellent. Continuous training of workers. Good overall plant management.	Started to use equipment cards after seminar. Set up a system for calculating maintenance costs; management has given instructions to use system.
Complete except for boiler	Weak	Inade-quate	Poor	None	Average	Rely on service contract for maintenance. Building maintenance neglected. Lack maintenance personnel. No place to store maintenance instructions. Some safety problems.	With general management and maintenance/production managers, planned the introduction of systematic maintenance/records system.
Complete	Good	Adequate	Adequate	Complete System	Average	In process of re-organizing spare parts stores. Maintenance system adapted in part from UNIDO handbook. Lack prices of spares which came with factory.	Worked with maintenance manager (not present at seminar) to evaluate existing system and to find ways to upgrade training in maintenance personnel.
(None in evidence)	Inade-quate	Inade-quate	Good	None	Poor	Establishment of organized maintenance department is new.	Not clear whether maintenance department accepts ideas presented in seminar.
Complete and well organized	Average	Inade-quate	Very good	Lacked some types of records	Very good	Ideas presented in seminar very well absorbed.	Seminar participant completed records system since the seminar. Helped clear up spare parts problems.

9. First Follow-up Program

  - evaluating the existing system and finding the "holes" in it
  - proposing ways to complete the system
  - designing records and making sure that the participants understood how the records would be used for analysis
  - giving assignments to be completed by the time of the second follow-up program.

- the second, for factories which had a much lower degree of organization of maintenance: here, it was necessary to work with the general managements as well as with the participants in order that the proper infrastructure for maintenance be set up.

In this second case, the ICME team members had quite a different basic task: to encourage general management to firmly make the decision to practice maintenance systematically. The participants contributed to the discussions with management and outlined the steps which would be needed to create the basic infrastructure on which to build a maintenance system. The infrastructure needs included such basic items as an office for the maintenance manager in one factory.

In five of the factories, it will be necessary during the second follow-up period to control the progress which will have been made by that time.

10. CONCLUSIONS (FIRST TRAINING SEMINAR AND FOLLOW-UP)

- Design of the mission

  An appropriate manual for such a mission can be elaborated only partially away from the field. The finished form of the manual can be assembled during the first mission if adequate secretarial/graphical support is available. If not (as was the case here), the finished form of the manual can be expected only after several weeks after the consultants return to their home base.

  More time is needed at the follow-up stage to do a proper job of initiating maintenance systems in several factories. However, the time budgeted for this project was sufficient for making a good start.

  The 3 weeks's time budgeted for the training seminars is considered optimal for this case. More time would have led to problems in the assimilation of new ideas (too much to absorb), while less time would have resulted in an ineffective seminar.

- Prospects for the training of trainers

  The participants now feel more comfortable with the idea of training others in their roles in carrying out a system of maintenance. However, progress in ICME's training of trainers will be partially handicapped by the following:

  . The recruitment system for maintenance workers allows semi-qualified workers to assume important maintenance positions. It is clear that the maintenance supervisor cannot spend time (which is needed to implement the system) to coach an electrician, for example, in the plant's circuitry. The extent of this problem varies from plant to plant.

  . The maintenance supervisors in some factories have very little time to spare. The ICME team recognized this problem early and stressed to the participants that by installing a system, more time would be made available to the supervisor, at least in the long run. The problem is that during the setting up of the system, even more burdens will be placed on the supervisors. However, ICME can work with the supervisors to try to solve enough chronic problems to allow them more time. This again shows the need for longer follow-up times.

10. Conclusions (First Training Seminar and Follow-up)

On the positive side, there appears to be great enthusiasm both for establishing the maintenance systems and for training workers in executing the systems. Moreover, it can be said that in almost every factory there is at least one maintenance supervisor capable of training his subordinates.

- Management support

The capabilities of general manager vary widely, and, thus, so does the support for maintenance. The seminar for general managers achieved its goals, but the audience was made up only of the better managers. More such seminars are needed in order to widen the audience.

- Assimilation by the participants/method employed

Very little needs to be changed from the method employed for the first seminar. The success of the second seminar will depend very much on the translator engaged by the Ministry, and, ideally, the translator for the first seminar should be retained.

- Prospects for the participants to transmit their new knowledge to the factory

Most of the participants are employed at a high enough level that they will be involved directly in the implementation process, once the decision is made to implement a system. In general, the factory managements are encouraging the implementation, but they probably need to become more aware of the costs and benefits of adopting a maintenance system.

In those factories where management stands firmly behind the new maintenance system, the participants should be able to make valuable contributions to the implementation, running, and improvement of the systems.

However, change will be slower in the area of making decisions on new purchases of plant and equipment. Here, the participants must wait to apply their knowledge until maintenance departments have some voice.

10. Conclusions (First Training Seminar and Follow-up)

- Adequacy of the previously-developed system of standardized maintenance records

  ICME finds that this system can be adopted with only very few changes and additions to make it more useable for the particular cases of analysis and spare parts control.

  Modifications were developed in the field and presented during the seminar. These changes were kept simple and to a minimum in order to facilitate the adoption of the system. They are shown in Annex 3.

- First follow-up program

  More time is needed for follow-up. The shortage can be compensated by the sending of extra missions to the field after the termination of this project (see "Recommendations").

  The follow-up program was well organized by the Ministry and no major change in approach is required for the second follow-up program. However, for those factories having a lower degree of organization of maintenance (see Chapter 9), it might be more appropriate to make one-day or even half-day follow-up visits at prescribed intervals (minimum 3 to 4 days). Between visits, the seminar participants would execute specific tasks set out by the consultant.

  The benefits would be twofold:

  . oblige the participants to do the work themselves

  . allow time for the consultants to make visits to more factories.

  This was the type of organization of the follow-up program originally envisaged.

11. RECOMMENDATIONS (FIRST TRAINING SEMINAR AND FOLLOW-UP)

- The manual should be translated into Arabic. Funds from various international sources are probably available should the Ministry not take on this job.

- The Ministry should retain the translator, Mr Hussain Awadh Al-Towei, for the second training seminar.

- Printing of maintenance record cards could be centralized to reduce costs and to promote uniformity. The best way might be to encourage a private printer to take on the printing/selling of the cards. (It appears that the Ministry has no means for undertaking this operation).

- Another seminar for general managers should be held in order to broaden the audience. More advanced notice should be given.

- Additional follow-up will be needed after the second mission of this project. Such follow-up should be effected by a team of two consultants in several missions each of 4 to 6 weeks. The objectives of the missions would be to:

  . Control the work scheduled to be done at each factory for implementing its maintenance system

  . Involve management in the process

  . Work with the maintenance supervisors to find ways to accelerate the process of implementing the system

  . Recommend improvements to data recording

  . Start the process of analyzing the maintenance records (after 6 months initiation of system).

  Detailed recommendations will be included in the final report for this project.

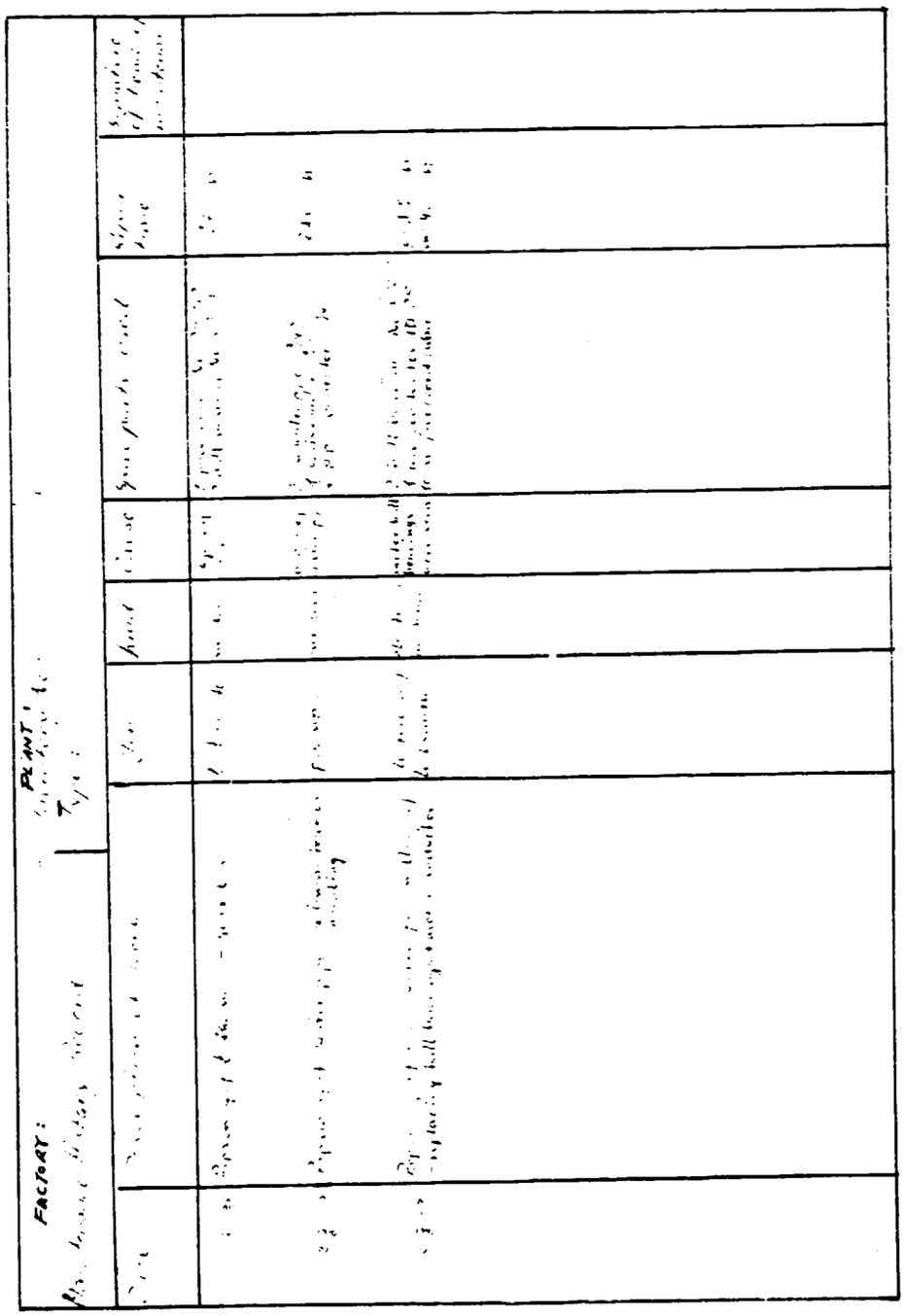
* * *

Special Note:

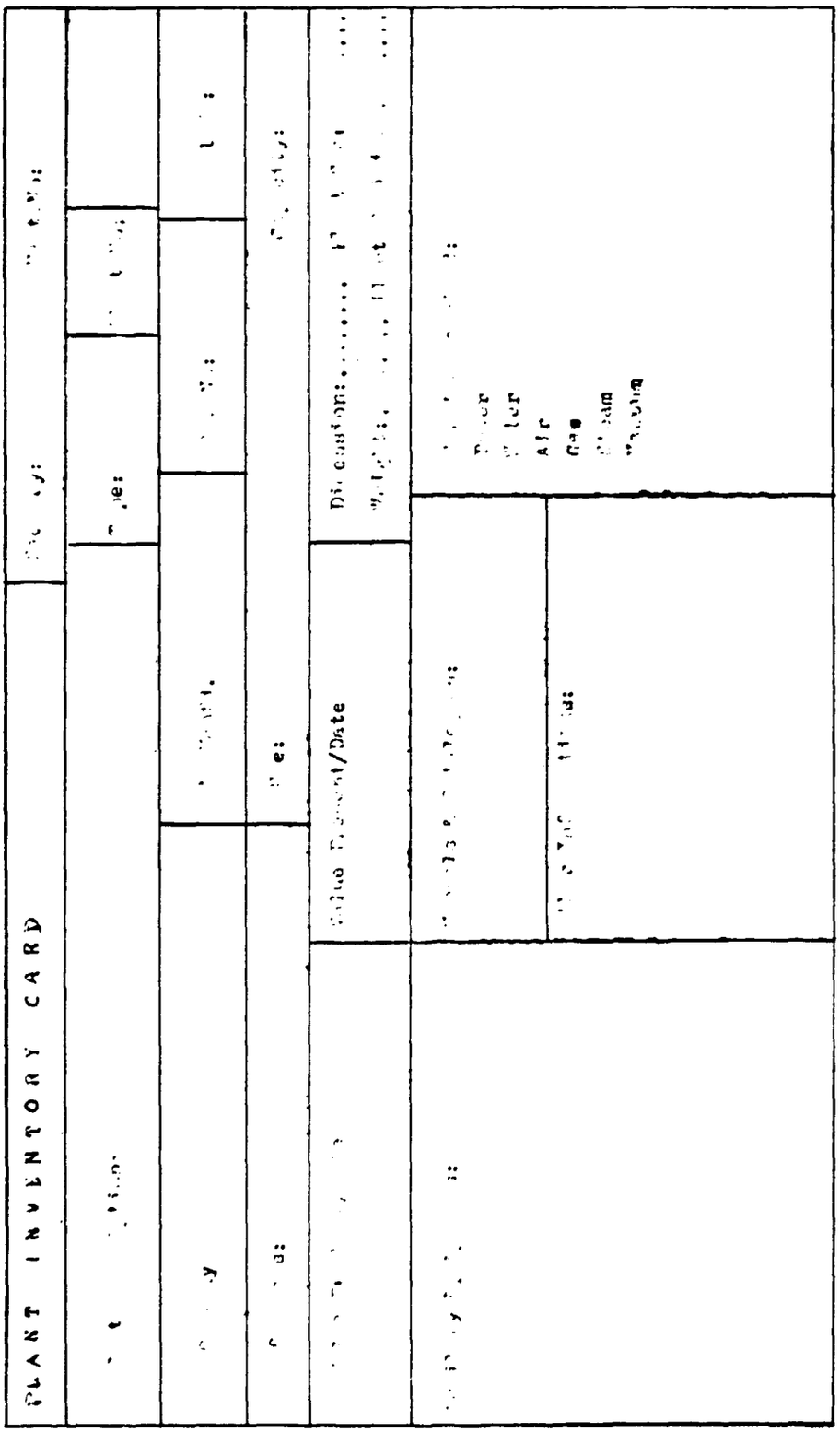
The PDRY urgently needs training assistance in steam-boiler operation and maintenance and in industrial feed-water treatment. A national expert, attached to the Ministry of Agriculture, is so sollicited that he is rarely available to industy. In the past, he has supervized some emergency boiler repairs, but his recommendations (and warnings!) have not always been heeded. The ICME team feels that now an outside expert would be very well received by industry. Such a mission would relieve the Ministry of Industry of one of its more thorny problems.

ANNEX 1: "Unitary Maintenance Instruction":
Maintenance Records

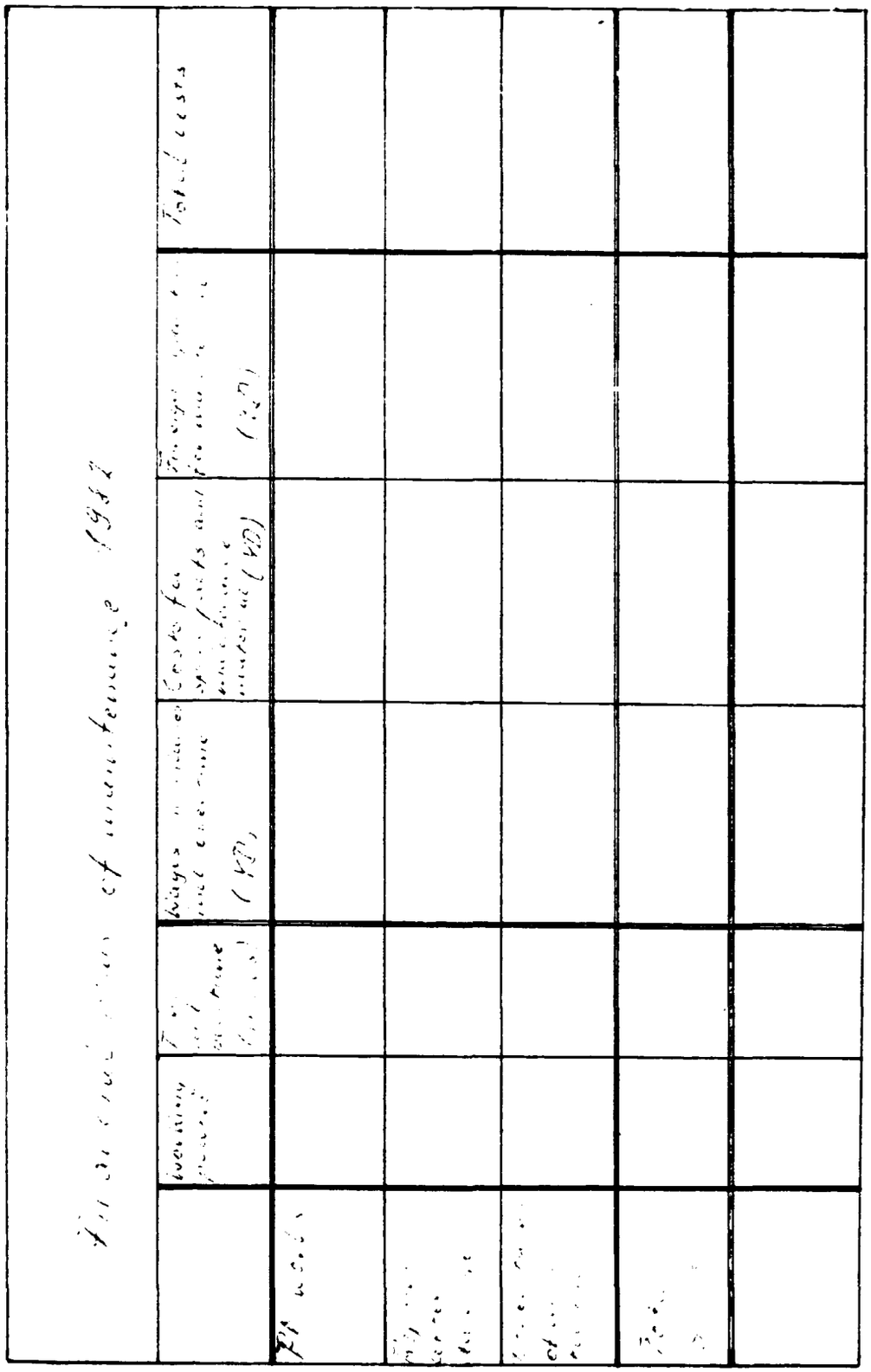
Annex 1: Maintenance history record



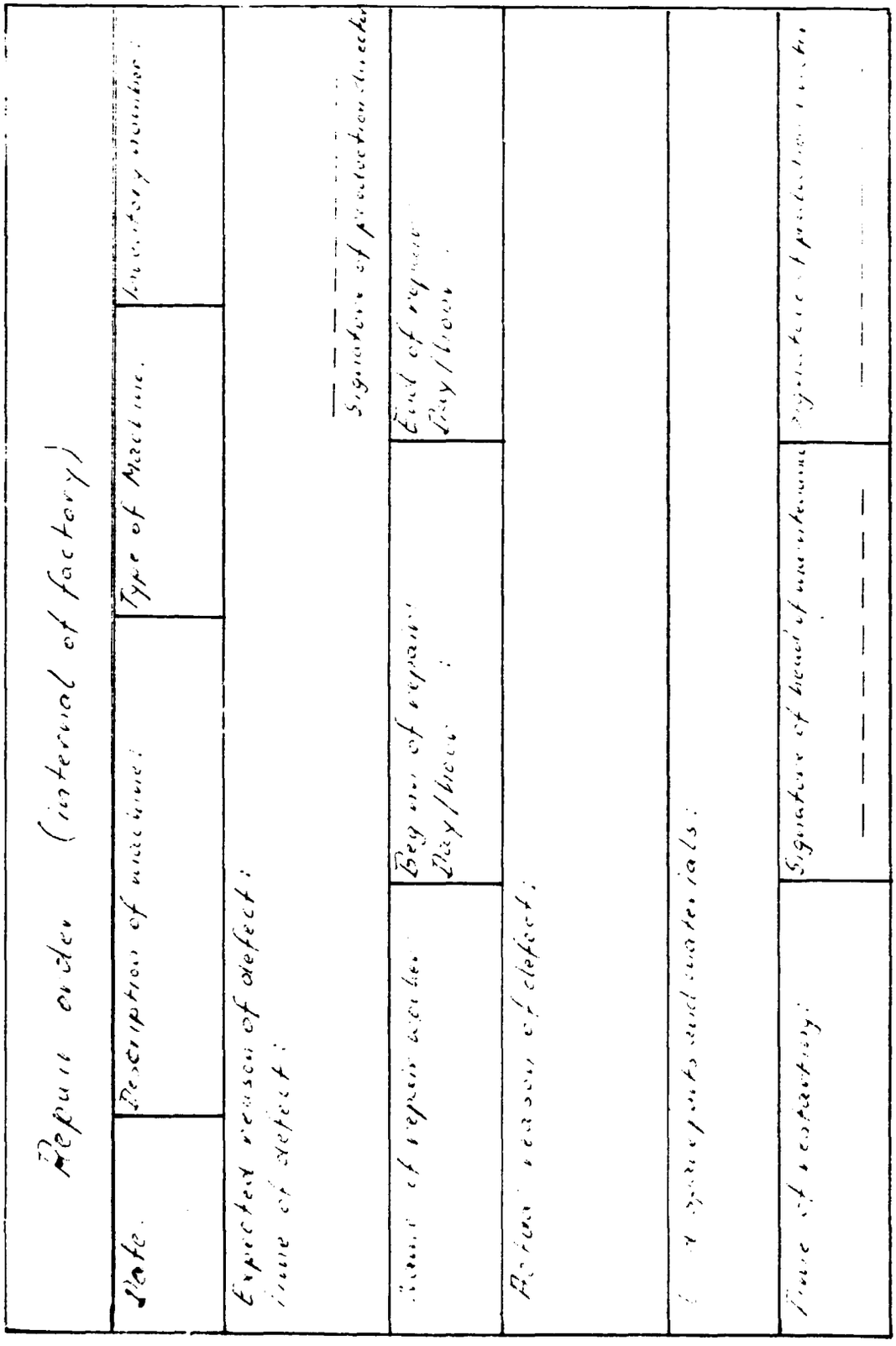
Annex 1: Plant inventory card



Annex 1: Financial plan of maintenance 1982



Annex 1: Repair order (internal of factory)



ICME

Annex 1: Annual plan of preventive maintenance 1982

Annual plan of preventive maintenance 1982

Description of machine	Inventory number	January weeks 1 2 3 4	February weeks 1 2 3 4	March weeks 1 2 3 4	April weeks 1 2 3 4	May weeks 1 2 3 4	June weeks 1 2 3 4	July weeks 1 2 3 4	August weeks 1 2 3 4	September weeks 1 2 3 4	October weeks 1 2 3 4	Nov weeks 1 2 3 4	Dec weeks 1 2 3 4

E = electrical work = ϟ
M = mechanical work = □
L = Lubrication = ○
I = inspection = △

Annex 1: Monthly plan of preventive maintenance

Monthly plan of preventive maintenance

Description of machine	Inventory number	1st week							2nd week							3rd week							4th week							5th week			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

E = electrical work = ↯

M = mechanical work = □

L = lubrication = ○

I = inspection = △

Annex 1: Spare parts inventory list

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

FACTORY:.....

SPARE PARTS INVENTORY LIST

ITEM	DESCRIPTION OF SPARE	TYPE	QUANTITY	UNIT VALUE
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Annex 1: Tally card

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

TALLY CARD

ARTICLE..... BIN NO.....
VALUE/UNIT..... SHELF NO.....
STOCK MAX..... STORE.....

DATE	RECEIPTS	ISSUES	BALANCE	INITIALS

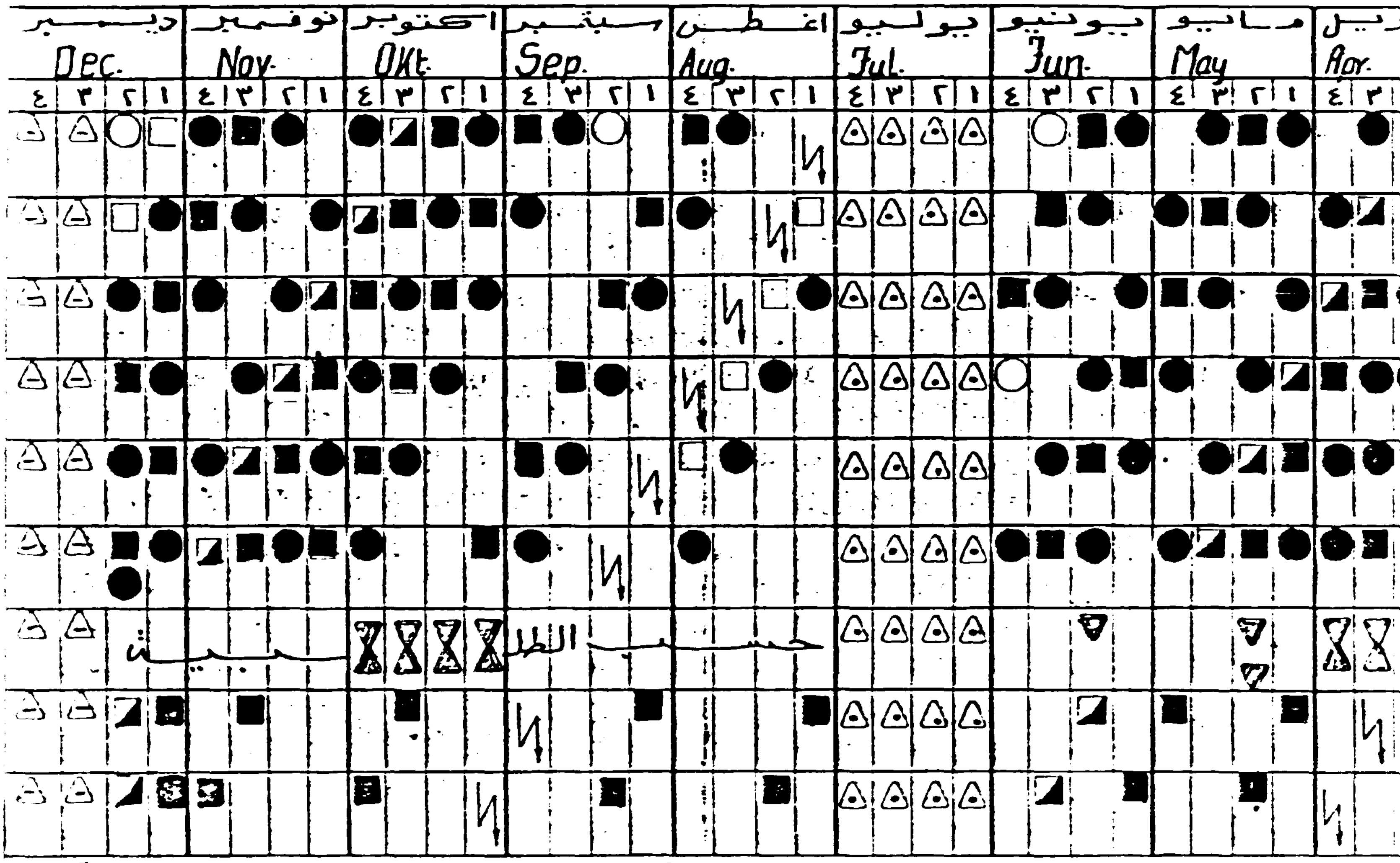
ANNEX 2: Annual Plan for Preventive Maintenance 1983:
Al Gundi Plastic Factory

Annual Plan For Preventive Maintenance 1983

Algundi Plastic Factory Aden P.D.R.Y.

١٩٨٣

عدن ج.ي.د.ش



Inspections (1x per month).

Controlling electrical parts [Motors, switches, contacts]

Checking of damages...

Checking all protection parts.

Checking all operation functions

Checking all screw Connections

Electrical Inspections (2x per year).

Control all electrical parts.

Cleaning contacts.

Checking the wire connections.

Lubrication (1x Per month)

Mould carrier / Column guide.

Cross closing member / sliding foot

Strip for the support of the longitudinal parts plates

Guidance gear slide

Support points of the back stroke limitation

Lubrication (after 1000 working hours)

Screw drive gearing

Drive motor for protection door.

Lubrication (after 3500 w.h.)

Air filter.

Screw drive gearing.

Drive motor for protection door.

Oil vessel hydraulic driving unit.

Scheduled repairs (2x per year)

Checking: cleaning; fixing, repairing of:

- Hydraulic system including pipes, hoses and valves
- Screw connections.
- Hydraulic cylinder
- Gear boxes are to open and all gear parts are to check
- Plain gearings and guide ways
- Heating system.
- Control system [switch boards], instruments, pressure gauges.
- Water cooling unit including all hoses, valves and connections.

(مرتين في السنه)

General maintenance

Party maintenance and checking

B. moulds.

S. moulds.

SECTION 1

Group of Maint. M. of. Ind.	Maintenance Plan	Algundi Plastic Factory.
1983.1.15	Nasser Hussein Alola	83-1-1

983 لعام ١٩٨٣

ب البلاستيك عدن ج.ي.د.ش

Annex 2: Annual Plan for Preventive Maintenance 1983: Al Gundi Plastic Factory

الشهر Months / الالات Machine	يناير Jan. 1	٢	٣	٤	فبراير Feb. 1	٢	٣	٤	مارس Mar. 1	٢	٣	٤	ابريل Apr. 1	٢	٣	٤	مايو May 1	٢	٣	٤	يونيو Jun. 1	٢	٣	٤	يو.. 1	٢
كوازي ٣٢×٢٥ Kuasy 25x32	●	■	●		●	■	●	ϟ		■	●	●	■	◪	●		●	■	●		●	■	○		△	△
كوازي ١٠٠×٢٥ Kuasy 100x25		●	■	●		●	■	●	ϟ		■	●	●	■	◪	●		●	■	●		●	■		△	△
كوازي ٢٦٠×١٠٠ Kuasy 260x100	●		●	■	●			■	●	ϟ		■	●	●	■	◪	●		■	■	●		●	■	△	△
كوازي ٥٥×٢٦٠×١٠٠ Kuasy 250x100-55	■	●			■	●		●	■	●	ϟ		■	●	●	■	◪	●		●	■	●		○	△	△
كوازي ٢٥٠×٦٥٠ Kuasy 650x250		■	●			■	●			■	●	ϟ		■	●	●	■	◪	●		●	■	●		△	△
كوازي ٤٠٠٠×١٠٠٠ Kuasy 4000x1000			■	●		●	■	●		●	■	●	ϟ		■	●	●	■	◪	●		●	■	●	△	△
القوالب Moulds			▽		▽			▽	▽			▽	⧗	⧗	⧗	⧗		▽ ▽				▽			△	△
التبريد Cooling		■				■			■				■		ϟ		■			■		◪			△	△
الات الطحن Crashers			■				■			■				■		ϟ		■			■		◪		△	△

■ التفتيش شهريا
فحص و ... كل الأجهزة ... (المولدات ...)
فحص الحرارة أو ...
التأكد من كل الأجزاء الموقفات
التأكد من كل العمليات الجارية في الآلة
التأكد من كل الموصلات (المكاريب)

ϟ التفتيش الكهربائي (مرتين في السنة)
فحص وضبط كل الأجهزة الكهربائية
تنظيف الموصلات
التأكد من كل الموصلات (الوائرات)

● التزييت شهريا
حامل القالب / موجه العمود
عمود ... / قدم ...
موضع ... في الأجزاء ...
... المسير ...
أماكن ... للحركة ...

● التزييت (بعد ١٠٠٠ ساعة عمل)
المسير ...
موتر ... لباب الحماية

● التزييت (بعد ٥٠٠ ساعة)
مرشح ... (فلتر ...)
المسير المولسي
موتر التشغيل لباب الحماية
وحدة التحريك ... لغطاء ...

◪ جدول الأصلاح (مرتين في السنة)
فحص - تنظيف - تثبيت عند الاصلاح
. ... على التريلة ...
. و الأنابيب و ...
. الموصلات (المكاريب)
. ...
. فتح كل أجزاء ...
. ... وطرق ...
. ...
. ...
. وحدة ... على كل الأنابيب و ...
و الموصلات

△ صيانة عامة
△ صيانة جزئية ومفاقدة
▽ قوالب كبيرة
⧗ قوالب صغيرة

(... 500 w.h.)
... unit.
(2 x per year)
... of ...
... pipes, hoses and valves
... and all ... parts
... ways
... rds],
... yes
... ing
... nections
... ance
... ce and checking

SECTION 2

الجهة مصنع الجمندي للادوات البلاستيكية	برنامج الصيانة عام ١٩٨٣م	شعبة الصيانة وزارة الصناعة
١-١-٨٣	نامر حسين ...	١-١-١٩٨٣م

ANNEX 3: Proposed modifications to the maintenance records of the "Unitary Maintenance Instruction"

Annex 3: Propsed modifications to the maintenance records of the "Unitary Maintenance Instruction"

Four modifications are recommended:

1. The "Plant Inventory Card" should include financial data and service schedules as shown in the training manual on pages 31 and 32.

2. The "History of Maintenance" card might be incorporated as the reverse side of the "Plant Inventory Card". It should include, for each spare part used, the name of the manufacturer and the part number.

3. A "Stores Issue Voucher" should be used for all spare parts and should have the form shown on the following page (model taken from the Cigarette factory in Aden and revised).

4. The "Financial Plan" should be replaced with the "Dual purpose form", which follows, in order to allow for both cost reporting and budgeting. This new form is used in the revised version of the training manual.

Annex 3: Stores issue voucher

STORES ISSUE VOUCHER

No 951

To: Store Keeper ..... Factory: ORIGINAL

From: (Section) ..... Date: .....

A/C. Code .....

Store Code	Item No.	Description of item	Destination of item: Equipment no. and description	Unit	Quantity		Rate	Value	
					Requir.	Suppl.		Y.D.	File

Requested By: ..... Issued By: .....

Approved By: ..... Received By: ..... Date .....

Annex 3: Dual purpose form: 1) Maintenance cost report
or 2) Budget for maintenance for 19..

	Manpower category -	Time incl. overtime hours	Salary per hour Y.D.	Labor costs Y.D.	Costs for spare part +material Y.D.	Costs for tools and main.equip. Y.D.	Costs for outside work Y.D.	TOTAL COSTS Y.D.
ROUTINE OR PREVENTIVE MAINTENANCE								
REPAIRS AND OVERHAULS								
IMPROVEMENTS OF MAINTAINABILITY								
OTHER TASKS BY MAINTENANCE PERSONNEL								
TOTALS	X	hours	X	Y.D.	Y.D.	Y.D.	Y.D.	Y.D.

icme

CONTENTS

PART B: SECOND TRAINING SEMINAR AND FOLLOW-UP

1. CONTROL OF PROGRESS AT THE FIRST SET OF FACTORIES

In the second mission, the consultants first checked progress at the eight factories coached on the first mission.

The findings at each factory are given separately below:

- Flour mill

  The leaving of the production manager allowed the maintenance manager to fill the position. He was then able to start solving maintenance problems by his solutions, which had been opposed before. Management has accepted his views, and some equipment judged inappropriate by the former maintenance manager will no longer be ordered.

  The maintenance system is now complete. Cost reports are done, and enough information will soon be available to allow for "analysis" along the method of Chapter 9 of the manual.

  Stores organization has improved.

  Alternative equipment suppliers are being evaluated.

  Some difficulties in applying an incentive system for maintenance workers were encountered, but a solution offered by ICME will be tried.

  The former maintenance manager has appointed a replacement who will report to him.

- Aluminum products

  The participant in the first seminar has taken a job at the power station, and his post has been filled by a capable man with 18 years' experience. Some positive results were a major cleaning-up of the factory and a more orderly stocking of raw material.

  The progress in spare parts inventory control stopped with the leaving of the seminar participant.

1. Control of Progress at the First Set of Factories

- Cigarettes

Costs of spares, materials and maintenance manpower hours are better kept.

History records now include parts and materials used.

The participant in the first seminar, now in training in England, will become operations and maintenance manager reporting to the plant manager under a reorganization. His training in England is to include:

. maintenance procedures in planned maintenance
. keeping systematic records
. "machinery/material interface"
. maintenance of specific machines
. engineering spares (stock levels, planning, special tools and gauges)
. recording of mechanical faults
. overhauls.

Another technician is being trained in England in boiler maintenance.

Of the three divisions "Tobacco", "Matches", and "Cigarettes", the latter is viewed by management as requiring more improvements to maintenance, especially in organization.

- Plastics (Al-Gundi)

At the time of the control visit, the General manager and the head of maintenance were in Austria at a course organized by UNIDO.

Investigation by the ICME consultant revealed that the system for calculating maintenance costs, set up at the first follow-up program, was not really being used.

However, maintenance reports are done every day. As suggested by the consultant, the maintenance office now has a telephone.

A new building for a new line is to house a bigger (and much-needed) spare parts store.

1. Control of Progress at the First Set of Factories

- Soft drinks

The seminar participant, an assistant production supervisor, has been appointed head of maintenance and has an assistant and a few maintenance workers. He has started a records system and now has a separate office. It now appears that the General manager has started to make real commitments to raising the quality of maintenance.

- Brewery

The West German partner continues to be responsible for maintenance as well as production. The maintenance manager has adopted the partner's system with some additional ideas borrowed from UNIDO's manual. Maintenance appears to be entirely under control, and the different workers are able to explain their work quite easily.

However, as the brewery continues to enjoy at least satisfactory financial performance on low-cost equipment, it has no pressing incentives to measure exactly its cost of maintenance. It probably could do so with existing information, but presently all efforts are aimed at expanding plant capacity by 40 %.

The brewery's spare parts pricing problem has been largely solved.

- Tomato paste

The old equipment has been scrapped and a new factory designed. Some of the new equipment is in place, and the bulk of it is to arrive in early 1984. Management is now very keen to have planned maintenance, and the participant from the first seminar is in Italy for training by the suppliers of the new equipment. The supplier is to be responsible for production and maintenance, although it is not clear whether he will be allowed to choose the local personnel for maintenance.

- Oil mill

This factory is going to be closed temporarily and overhauls will be done before closing. The former maintenance manager will be part of the team of trainer-advisers.

2. VISITS TO THE SECOND SET OF FACTORIES

On the second mission, ten more factories were visited, bringing the total for the project to eighteen. Details of the visits are given below.

- Foam factory

  A new line for making foam rubber mattnesses had been installed recently and showed some problems in throughput apparently resulting from mismatched machines as well as from some installation mistakes. Solutions to some of the latter were offered by the ICME consultant. Since the Ministry was giving daily attention to this factory, it was decided to focus the consultants' work elsewhere.

- Agricultural implements

  This Chinese-built factory functioned for a few years until most production was halted because of lack of sales. A UNIDO project provided an expert who coached the maintenance and tool shop personnel in cleaning and protecting the unused machines. Production of chain-link fencing continued. A UNIDO study has led to the ordering of some new equipment, but until it arrives most of the staff has little to do. Two of them were participants in the second seminar.

- Revolution Workshop

  Originally built to make spare parts, this workshop is under complete re-organization and re-equipping based on a study made by a UNIDO expert attached to the workshop. The participant in the first seminar has been able to introduce some maintenance measures; but since he is doing production work as well and new equipment has been arriving for six months, maintenance of existing equipment is not the highest priority.

2. Visits to the Second Set of Factories

- Rubber Sandals Factory

  The management was concerned mainly with steam boiler problems. The ICME consultant advised on the possibility of changing the water treatment method and put the management in contact with other factories in PDRY which have solved their treatment problems. The two workers who were to participate in the second seminar were interviewed briefly. A newly installed pneumatic line for punching and assembling sandals was examined. Its maintenance requirements -- mainly for the compressor -- were discussed.

- Gas factory

  The general manager (an engineer) of this factory was keen on having the seminar participant work with the maintenance manager (in France for training on new equipment) to improve preventive maintenance and to set up a maintenance system for the new NO2 plant, not yet built. In the existing oxygen and acetylene plants, records of hours spent on maintenance and of spare parts and materials costs were being kept, while there were no machine history cards.

- Salt works

  Most of the equipment here is for handling, such as earth movers and conveyors, much of which is broken and unuseable. Problems in maintenance at the works appear to come from:

  . inappropriate equipment

  . poor qualification of maintenance workers

  . lack of a maintenance system.

  The maintenance workshop is adequate, but the workers soon see their work devastated by the environment.

  A new sacking facility has proven to have been poorly specified, and the conveyor belts were attacked by salt and out of commission before installation. Some solutions were offered by the ICME consultant.

2. Visits to the Second Set of Factories

- Textile mill

The visit took place during a period of overhauls, and the ICME consultant observed that perhaps some of the maintenance work, especially electrical, should be centralized. In investigating steam boiler problems (mainly corrosion in an economizer), the consultant recommended purchase of a new boiler rather than rebuilding the old one (with the services of the oil refinery). Feedwater treatment was also investigated.

Plans for the installation of a new ventilation system were reviewed.

- Auto battery factory

In this factory, only assembly is done. The only machine requiring attentive maintenance is the air exhausting equipment. The maintenance instructions on this machine were translated from German to English by the ICME consultant.

A completely new factory is already in advanced planning. The feasibility study was read by the consultant, who offered some questions on maintenance to be put to the designers. The latter visited the plant manager, who received satisfactory answers to the questions.

- Clothing factory

Comprising a cutting machine and numerous sewing machines, the equipment of this factory poses "no maintenance problems", the consultant learned. Each sewing machine is oiled every day by its operator, and spare parts for the cutting machine are "cannibalized" from several identical broken machines. The spare parts catalogues are in Japanese. No real contribution could be made here by the consultant, other than to suggest that, eventually, an English-language catalogue be obtained.

- Dairy

The consultants had visited the dairy during the first mission and concentrated this time on explaining the advantages of systematic maintenance to a somewhat unreceptive audience. Examination of new yoghurt making equipment revealed that some maintenance problems probably were caused by poor design.

3. PARTICIPANTS IN THE SECOND SEMINAR

The second group had a better comprehension of English, and participation in discussions was broader than during the first seminar. The translator's excellent work contributed to the group's ability to absorb the more difficult or technical subjects.

On the follow-up visits, it was found that several of the participants were able to start setting up maintenance systems on their own initiative. Two of them have been chosen to be "trainers" and participated in the seminar for trainers.

Overall, the group was able to nearly fully absorb the greater part of the concepts presented in the seminar.

The list of participants is given as Table 1.

3. Participants in the Second Seminar

Table 1:

Participants in the second maintenance seminar

1.	Mohamed Abdul Bari Saleh	Ministry of Industry
2.	Ahmed Ali Salem	Ministry of Industry
3.	Mohamed Saif Shaibani	Milk Factory
4.	Mohsin Saleh Salem	National Brewery Corporation
5.	Kaiser Hussain Ismail	Flour Mill
6.	Kaiser Mohmood Mohamed	Vegetable Oil Factory
7.	Atta Mahmood Khan	Cigarettes and Match Industry
8.	Aref Ali Sonidy	Nat. Foam and Steel Furniture Company
9.	Afif Ahmed Ali	Tomato Paste Factory
10.	Abdo Alim Mohad Ali	Clothes Factory
11.	Gihad Ali Ateek	Yemen Rubber Manufacture Comp.
12.	Moh'd Abdul Gabbar Hageb	Yemen Rubber Manufacture Comp.
13.	Moh'd Othman Khalifa	Yemen Auto Battery Company
14.	Gamal Mahfood Awad	National Aluminum Industry
15.	Ibrahim Kassim Sufyan	National Bottling Organization
16.	Yousef Ahmed Aboodi	Agriculture Implement Factory
17.	Anwer Yassin Ghazi	Al Gundi Plastic Factory
18.	Abdo Mohamed Abdu Al Naggar	Emulsion and Paint Factory
19.	Alawi Ali Mashoor	Textile Factory
20.	Hassan Saeed Kassim	Textile Factory
21.	Mounir Ismail Mohamed	Agriculture and Metal Products Factory
22.	Mahmood Othman	Salt Factory
23.	Aftab Suleiman Adbul Rehman	Gas Factory
24.	Hassan Karama Hamdan	Match Factory
25.	Mohamed Yehia Nashir	Ministry of Industry

Interpreter:

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4. SECOND SEMINAR: RESULTS AND EVALUATION

The Minister of Industry opened the second seminar on November 5, 1983.

The seminar followed the order of subjects as given in the manual which included two new sections, boiler and electrical maintenance, as well as a glossary of maintenance terms in English and Arabic.

Two chapters of the manual, "Costs" and "Analysis/Budgeting", had been rewritten before the seminar to include improvements and additions developed during the first seminar.

Three other chapters were developed between the two seminars in order to allow for treating the specific conditions in PDRY. These were:

- Managing
- Training
- Planning of Maintenance in a New Industrial Facility.

Visits to the Brewery and the Dairy were made during the seminar by the entire group. At the Brewery, the participants were shown the system of maintenance records, the workshop, spares store, boilers, production- and quality control facilities. A boiler maintenance worker explained proper procedure for maintaining boilers.

The Dairy visit showed the participants a contrasting case, where still much work was needed to develop the maintenance system. Discussions were held with the General Manager and head of maintenance and proved very instructive.

Having gathered appreciable experience from the first seminar and all the factory visits, the consultants were able to conduct a more efficient second seminar. More of their time was spent on conveying ideas and less on learning about problems in PDRY.

4. Second Seminar: Results and Evaluation

The revised manual made it easier to treat the more difficult subjects such as costs and analysis/budgeting.

An excellent interpreter made a significant contribution to the quality of the presentations, while the participants' good knowledge of English made assimilation easier than for the first seminar.

Counterparts from the Ministry evaluated the second seminar as having more successfully conveyed the concept of systematic maintenance than the first.

5. SECOND FOLLOW-UP PROGRAM

Descriptions of the work done during the follow-up visits follow.

- Foam factory

  The consultant concentrated on coaching the seminar participant in setting up a maintenance plan. The solutions offered by the ICME consultant for correcting equipment installation mistakes were not effected.

- Agricultural implements

  The consultants reviewed the feasibility study with the two seminar participants in order to set out the steps for a maintenance system for the planned upgrading of the factory. As one of the participants is to be part of a new design group, the responsibility for maintenance planning is likely to fall on the other participant, who is somewhat less qualified.

- Revolution workshop

  Much of the equipment for the new facility has arrived and is stored still packed in wooden shipping crates in one of the existing buildings. The foundations for the new equipment have not been started.

  The UNIDO expert attached to the Workshop gives his assurance that the General Manager would be open to receiving trainer/advisers to assist in setting up a maintenance system for the new facility, especially since no work has been done yet in this area, and the participant in the first maintenance seminar is currently doing production work.

- Rubber Sandals Factory

  The follow-up visits concentrated on reviewing the system of maintenance records and on working with the General Manager and Technical Manager to see that a start was made in the planning of maintenance for a new production line, tyre recapping (six machines and auxiliary equipment worth $ 600'000).

5. Second Follow-up Program

A plan for investigating alternative boiler feedwater treatment was made.

- Gas factory

The seminar participant explained to the General Manager and the ICME consultants how he had already started to set up the new maintenance records system for the existing plants and for the new NO2 facility. His understanding appeared excellent. The General Manager remained open to assistance from the team of trainer/advisers if needed.

- Salt works

The maintenance manager, who had attended the second seminar, had further investigated solutions to the problem of inappropriate conveyor belt materials and was working with the Ministry to purchase new belts. Some advice on maintaining the new line was given by the consultants.

The main problems remain to be solved. Until qualified people can be attracted by good salaries, maintenance will probably continue to be substandard. However, the seminar did appear to have motivated the maintenance manager.

- Textile mill

With the agreement of the Ministry, the consultants omitted a follow-up visit, because the mill already had a maintenance system. It is not known whether the consultant's recommendation on buying a new boiler will be followed.

The participant in the seminar was interviewed and then chosen to attend the seminar for trainer-advisers.

5. Second Follow-up Program

- Auto Battery Factory

  The seminar participant discussed with the consultants his ideas for setting up systematic maintenance in the planned new battery factory. His excellent grasp of the work of the seminar and his enthusiasm prompted his selection as a participant in the seminar for trainer/ advisers.

- Clothing Factory and Dairy

  The Ministry saw no reason for follow-up, and advised the consultants to concentrate their efforts on the other factories.

6. SEMINAR FOR TRAINER-ADVISERS

6.1 In-factory training

After much discussion on how training of maintenance workers should be done, especially considering that the main objective of the Ministry is to install and perfect maintenance systems, the consultants recommended that:

- the participants be trained to train workers and assistants in performing the tasks necessary to install records systems while trying to instill in the trainees enough basic appreciation of maintenance so that they understand the goal toward which they would work

- the training method in the factory would involve no classroom-type lectures, but would instead be based on the assignment of daily tasks with explanations of what the tasks were designed to achieve.

This approach has been used by the maintenance manager of the flour mill since the first seminar. It works, and the Ministry agreed that this was the way to proceed for the factories where training was the most needed. The seminar participants confirmed the validity of this method.

Structuring the in-factory training method was done in consultation with the participants and took the following form:

6. Seminar for Trainer-Advisers

1. Prepare the trainees

- Explain what is expected of them
- Explain why the factory is going to the trouble of installing a system for maintenance
- Inform them that their performance will be assessed and that good results will be rewarded.

Since workers are sent abroad sometimes for training, the participants suggested that the "preparation" of such trainees be particularly rigorous.

2. Convey basic concepts of systematic maintenance

Here, the trainers would refer to the manual prepared by the consultants for the project. This manual has already been translated into Arabic by the Ministry. At maximum, one and a half hours in any given day should be taken for this training, emphasizing:

- aims
- costs
- records
- use of records.

3. Prepare daily tasks for each trainee

The aim is to install the records system. Each day, the trainee has a simple task to carry out. On the following morning, progress is reviewed, and, when satisfactory, subsequent tasks are assigned.

This process is not easy. Tasks must be simple and must follow a logical progression. The trainer must be available for daily coaching. He must also convince the trainee to perform satisfactorily.

6. Seminar for Trainer-Advisers

4. Follow-up the work for the trainees

At the end of a given week there should be some measurable progress. A simple, step-by-step approach that works is better than a short, intense effort.

When the trainer perceives great obstacles, he should consult the General Manager. The other members of the team of trainer-advisers are available for assistance.

The incentive systems in all of the factories were reviewed by the participants so that they were all aware of options which have proven effective in PDRY. The participants recognized the importance of incentives for providing the motivation required for undertaking training in the factories.

6.2 Assistance to factories other than the trainer's own

Technical assistance between factories has been tried before in PDRY and has been only partially successful. ICME believes that the reason for the unsuccessful attempts was the lack of training in how to provide assistance. For this reason, a method was elaborated for the new team and includes a different way of attacking the problem.

First, a trainer-adviser (or technical specialist, depending on the problem) would be sent from one factory to another under the auspices of the Ministry. An official from the Ministry's Maintenance Department would "clear the way" for the trainer-adviser in order to minimize resistance to the latter's recommendations.

6. Seminar for Trainer-Advisers

In an assignment to assist a factory in setting up a records system, for example, the trainer-adviser and Ministry official would meet for about one hour to explain how the former would proceed, and a method would be decided. Only then would the trainer-adviser start his work. His first visit, for isolating problems, would be limited to a few hours. He would then set out a program for initial tasks and for his controlling of them. For example, he would first ask that all documentation on machines be collected and then return to review it.

In this way, the trainer-adviser uses the same method as used by the consultants in this project on their initial- and follow-up visits to factories, and is free to spend most of his time in his own factory.

When the trainer-adviser encounters technical problems outside his competence, he will find a specialist in consultation with the Ministry.

6.3 Assistance in planning maintenance systems for new factories

Two cases can be isolated:

1. A factory is established in an industry for which there is no existing factory in the PDRY

2. A new facility is designed to replace an existing factory or to expand it.

In the first case, there is no experience which can be drawn upon. The team of trainer-advisers could lend valuable assistance, but outside experts may have to be consulted. The Ministry must make sure that there is a maintenance manager recruited for the new factory in time enough to collaborate with the trainer-adviser assigned for helping in elaborating the maintenance system.

6. Seminar for Trainer-Advisers

For replacements, upgradings, or expansions of existing factories, the management and technical- and maintenance supervisors have experience which should be tapped in drawing up new maintenance plans or in integrating new equipment into existing plans.

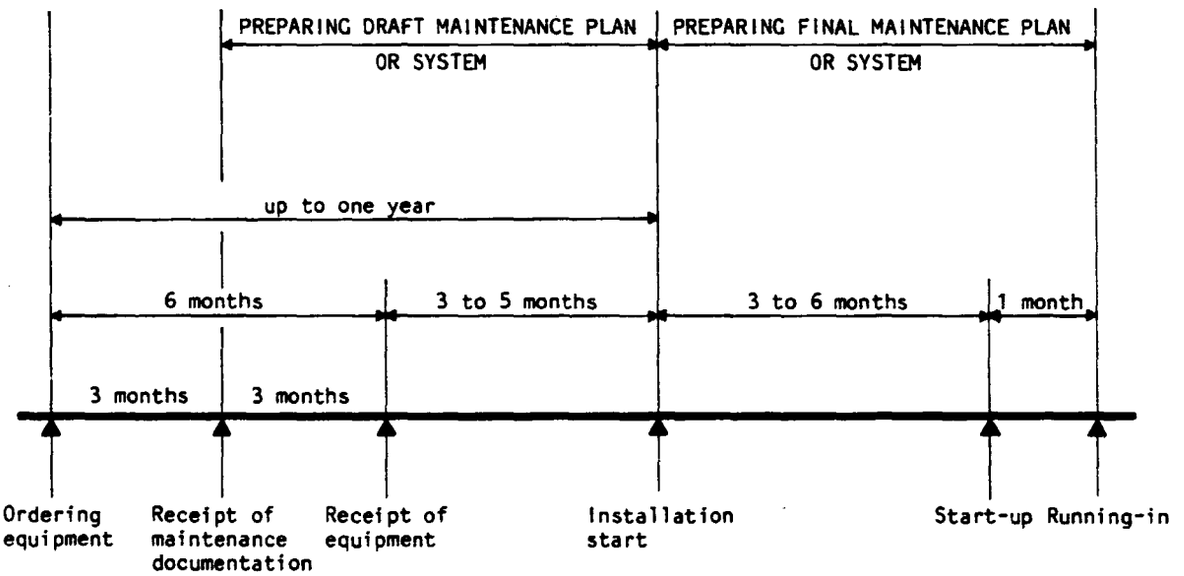
In this case the trainer-adviser may not be needed, but would be available.

The participants and consultants determined a general time schedule to be followed for both cases (Figure 1), which shows that there is always plenty of time to start planning before the equipment is installed.

Figure 1 shows that:

- There are from 10 to 15 months to arrive at a final plan or system for maintenance from the time maintenance documentation is received
- About 6 to 8 months are available for preparing a draft maintenance plan or system before installation
- From 4 to 7 months for preparing a final maintenance plan or system are available after completion of the draft.

Figure 1: Time-frame for preparing maintenance plan or system for new equipment



6. Seminar for Trainer-Advisers

ICME feels that there is only one real obstacle to using the team of trainer-advisers here: having a maintenance team (manager and workers) available at the proper time. However, it was noted that production workers in an existing factory in PDRY are often keen to be trained as maintenance workers in a new or expanded factory.

The participants were trained in examining feasibility studies for information pertinent to maintenance. The example of a well-written study on new bakeries was taken. Each chapter was examined for maintenance information, and then a general guide was made for extracting such information from a feasibility study. The UNIDO feasibility study manual was also used.

It was pointed out by ICME that for existing factories having maintenance difficulties, some of the solutions might be found on reading the original study.

7. SEMINAR FOR GENERAL MANAGERS

The seminar was organized as follows:

1. Arguments for management to give its support
2. Results of the seminars
3. Results in the factories
4. Remaining needs
5. The proposed team of trainer-advisers.

Nine general managers attended the seminar along with the participants in the second seminar and the team of trainer-advisers. Four factories had general managers and trainer-advisers present.

The principal outcomes of the seminar were that the general managers present:

- Gave their accord to making the members of the trainer-adviser team available to "outside" factories, under the conditions set out in Chapter 6.2 of the present report.
- Welcomed the use of the proposed team; in fact, the first assignment came at the end of the seminar when the general manager of the Dairy requested help in training his workers to operate and maintain a new compressor. A volunteer accompanied him to the Dairy after the seminar.
- Accepted the concepts taught in the maintenance seminars. Reservations were expressed about the separation of maintenance from production. They agreed that it was a reasonable goal to work toward, but that better qualified maintenance workers were a prerequisite.
- Expressed concern that the maintenance manager must lead a team and not just sit in an office; that he must also "get dirty" and set an example for getting things done.

7. Seminar for General Managers

Participation in the discussions of the seminar came from all groups represented and showed that maintenance is a major concern and quite well understood by many of the general managers. The weaknesses in the factories in maintenance were confirmed by this seminar to be more a function of:

- uneven distribution of technical talent among the factories
- poor qualifications of maintenance workers in general
- little access to, or poor knowledge about the availability of, assistance in solving maintenance problems.

The present project made a significant contribution to resolving these causes of maintenance problems.

8. PARTICIPATION BY THE MINISTRY OF INDUSTRY

The Ministry did an exemplary job in supporting the project.

Organization was very effective. Above all, the tremendous effort in translating the manual into Arabic and having copies ready for distribution at the managers' seminar show the strong degree of commitment of the Ministry to the project and to its responsibilities to the country's industry.

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- programmes d'amélioration de la rentabilité
- mandats de gestion temporaires

Domaine d'intervention 2: marketing
- stratégies produits/marchés
- études de marché et analyse de la concurrence
- réseau international de vente
- recherche de partenaires à l'échelon mondial
- expansion aux USA/Japon
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- diversification
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- logistique

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