



**TOGETHER**  
*for a sustainable future*

## OCCASION

This publication has been made available to the public on the occasion of the 50<sup>th</sup> anniversary of the United Nations Industrial Development Organisation.



**TOGETHER**  
*for a sustainable future*

## DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

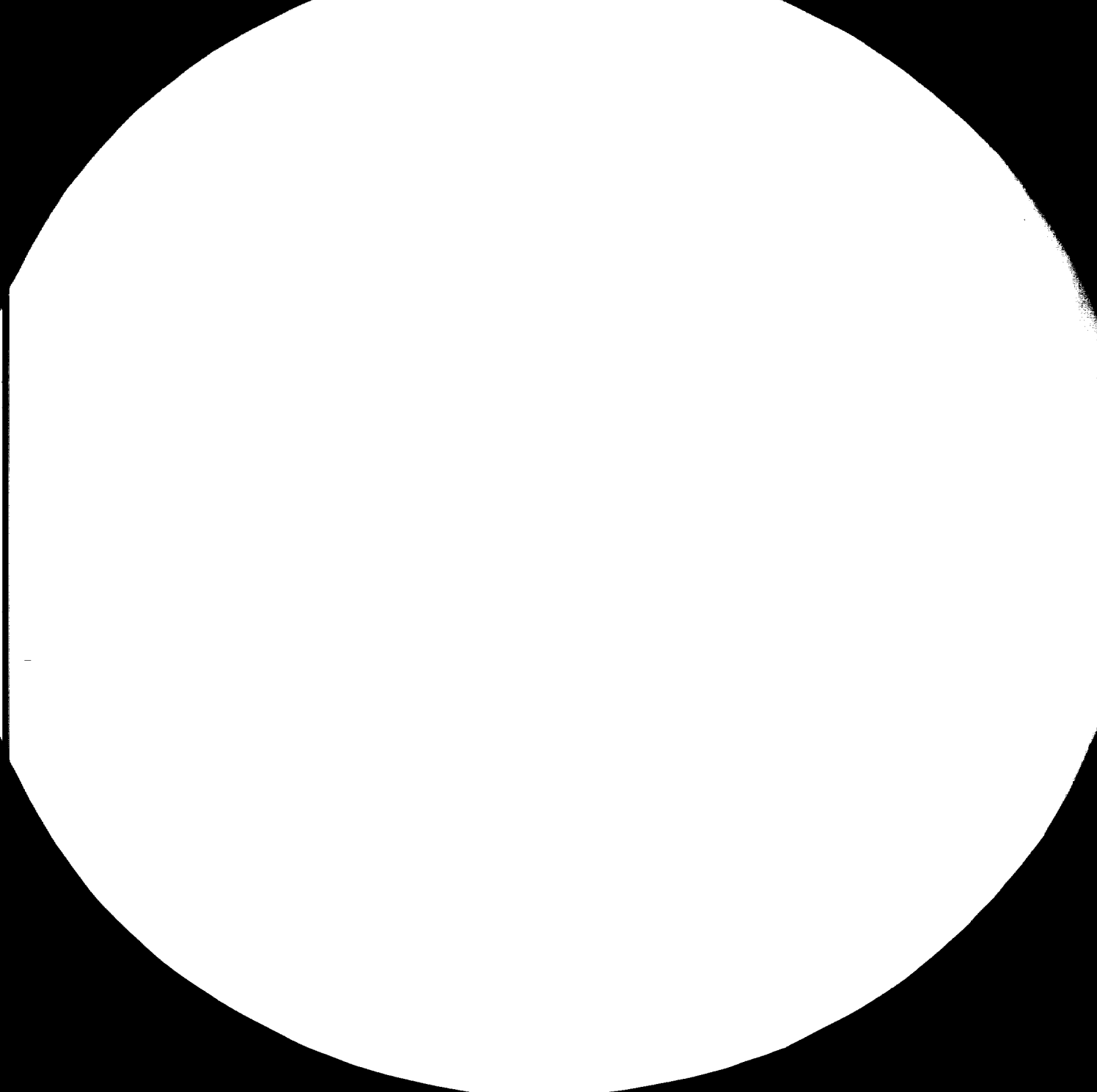
## FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

## CONTACT

Please contact [publications@unido.org](mailto:publications@unido.org) for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at [www.unido.org](http://www.unido.org)





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

09619

March, 1979

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

000071

UNDP PROJECT

AT

IAPMEI

INSTITUTE FOR HELP TO SMALL & MEDIUM INDUSTRY

Instituto de Apoio às Pequenas e Médias Empresas Industriais

PORTUGAL

DP/POR/77/019/11-02

PROJECT FINDINGS AND RECOMMENDATIONS

TERMINAL REPORT PREPARED FOR GOVERNMENT OF

PORTUGAL

by

Orvis J. Fairbanks, Expert. M.E.

United Nations Industrial Development  
Organization, HD'QTRS, Vienna, Austria

Executing Agency for UNDP

Distribution:

IAPMEI, Lisboa, Portugal ( 5)  
IIS - IOD UNIDO Vienna ( 5)  
FILE (20)

This report has not been cleared with the United Nations Industrial Development Organization, which does not therefore necessarily share the views presented.

## TABLE OF CONTENTS

Project DP/POR/77/019/11-02

	<u>page</u>
I. SUMMARY	1-2
II. INTRODUCTION	3-9
III. FINDINGS	10-12
IV. RECOMMENDATIONS	13-23
V. ADDENDUM TO REPORT (Relavant to one month extension)	24-46
SIGNIFICANT MEMOS	47-63
	<u>APP</u>
APPENDIX	1-14

## P R E F A C E

The author of this report wishes to take the opportunity at this time to extend his thanks to all the staff of, Instituto de Apoio às Pequenas e Médias Empresas Industriais, (IAPMEI) for their sincerity of purpose. Their daily efforts, with care and kindness has contributed substantially to the successful completion of my project, within the brief time allowed.

To those mentioned below, all valued counterparts, I extend special appreciation.

Eng <sup>o</sup> . Amadeu Augusto Pires	- President
Dr. Manuel Gonçalves da Fonseca	- Vice-President
Eng <sup>o</sup> . Jorge M. Guerra e Silva	- Vice-President
Dr. Luís Palma Fêria	- Dir. Serv.
Eng <sup>o</sup> Artur Cabral Sampaio	- M.E.
Eng <sup>o</sup> António A. Nogueira da Silva	- M.E.
Dr. Henrique J. Lucas Marçal	- Dir. SPIAP
Dr. Pedro Pina Manique	- Econ.
Ana Maria Araújo	- Sec.

- i. a list of books and periodicals for the library(s) (page 22-23);
- j. summary of costs for recommendations (page 13);
- k. pre feasibility & technology outlines, (app . pages 1-13) seminar, given to IAPMEI staff members;
- l. machine tool, (equipment) hourly cost reference (app . page 14).

4. All IAPMEI personnel engaged seem well placed for their assignments. Most are young and aware of their training needs. Ways must be provided for continuous upgrading, to provide a vibrant staff capable of assisting, as well training in specific areas needed by the enterprises.

A number of additional enterprise visits may have been useful. If time can be found, they should be included, to assure the best analysis of the problems facing the enterprises. A request for development of a heat treatment and materials technical assistance project, was not completed, due to insufficient time (15 days) for the research of data, enterprise visits and detail assembly.

5. The Project agreement (DP/POR/77/019/A/01/37), specified:

- a. recommendations for the reinforcement of IAPMEI services and technical assistance to enterprises;
- b. technical evaluation of IAPMEI project, indicating courses for personnel on overseas study assignments and scholarship;
- c. introduction of techniques to provide improvement for some  $\pm$  32000 units, i.e. metalworking, food, processing. Minerals extraction, chemical, textile, wood, cork, leather;
- d. stud means to promote investment, banking support and project evaluations.

## II. INTRODUCTION

1. Administration, counterparts and IAPMEI (Lisbon) personnel, are all located at Rua Rodrigo da Fonseca, 73, a convenient walking distance from several hotels. No serious problems of office assistance, guidance, translation, secretarial, or office space and supplies were encountered. Excellent cooperation by all staff and personnel was experienced. All plant and office visits were well arranged. The project however was an ambitious one and time was entirely too short for the amount of work necessary. Some language problems were encountered at shop visits, but such problems could be overcome without serious difficulty, or undue delays. IAPMEI, a division of the Ministry of Industry, has offices located as follows:

- |                     |            |             |
|---------------------|------------|-------------|
| a. Lisboa (hdqtrs.) | e. Açores  | i. Viseu    |
| b. Porto            | f. Madeira | j. Bragança |
| c. Coimbra          | g. Faro    |             |
| d. Covilhã          | h. Évora   |             |

Only the first three offices were in the experts program. About twenty enterprise (shop) visits, were made. Additional enterprise visits were requested by the Coimbra office. The shortage of time could not permit more visits at Coimbra, during the two month period of assignment.

2. A brief visit was made at the "SINES", Industrial Complex, where three Industrial Parks will eventually become operative in 1979, and during 1980. The industrial park areas are 75-200-30 hectare, respectively, and are located in strategic light industry sections. The area of SINES and adjoining, are major developing areas of the country. The potential for food processing and its equipment needs would seem highly promising. Pre-feasibility studies are recommended for "SINES", as well as other areas. The potential benefits for joint ventures, which can provide



expertise and management to join with some workshops would appear very useful. The visits made were chosen as exemplary of the type of workshops found nationally. Machine tools with the expertise to make them productive can be very expensive. Therefore each hour of the day and night has a cost value. I have prepared a chart to make this point more clear. It may be used for other than machine tools. The variables of the equipment life may change however, adjustments in that case must be allowed (see App. P 14).

- 2.1. At an early date, following initiation of the project. The expert requested from UNIDO, over 120 items of literature, (technological, management, economic, etc.) considered of most value to IAPMEI personnel. It will be a minimal addition needed for their library. As this report is being completed two packages have been announced, coming from Vienna. It is assumed the remainder of the request will arrive in due course.

VG - CLASSIFICATION

4. The fact that this group appears in relatively good standing is indeed remarkable. True they are long established and management has been stable. That of course is an important asset to any enterprise, especially so in metalworking, where long range plans are not easily changed, abandoned or canceled. Materials and other costs, may change in short term periods. These conditions could easily bankrupt an enterprise within a few weeks time, since his hourly costs are not flexible enough, to adjust to fast and unforeseen interruptions. In an effort to point out the hourly cost obligatory factor, I have prepared an hourly cost calculation. It is included as part of the appen. of this report.

NOTE

The clock and timer manufacturing enterprise "REGULADORA", at Famalicão, (rated VG), is an exception to all enterprises seen. It is a fine example, where much can be learned by IAPMEI personnel, as well others so interested. I found an outstanding tool and die shop, with expertise and equipment of excellent capabilities, doing a commendable job. The factory likewise was well organized and production lines, with quality control appeared in good order.

G - CLASSIFICATION

5. This group would most likely succeed to endure their present economic distress.

Their need for up-to-date data, also most modern technology, must be emphasized. Too often I find, a critical lack of media, that can assist a managers good intentions, to update his key staff in the latest technology. In this area IAPMEI can do much to supply such material. Some translation from German or English may be necessary, but in both these languages a high degree of technology can be found and freely existing. I would suggest such materials should be substantially increased,

at all IAPMEI offices. It is encouraging to note, that language lessons are now being provided to staff, at Lisboa.

All enterprises seen in this group require design and quality improvement. I am impressed by some managers for their persistence to carry on with their burdens in each enterprise. Ways must be found to help them. By offering prompt useful and worthwhile technical, as well some financial help, IAPMEI can soon establish a reputation with the enterprise. Assistance with evaluations, such as the following are needed:

- a. prefeasibility studies (possible mergers);
- b. evaluations for materials and/or substitution of materials;
- c. new product design and value analysis;
- d. equipment evaluation (technical);
- e. quality control techniques;
- f. training & seminars in all areas (items a-b-c-d-e).

#### NOTE

The G (good) classification for this group means they appear promising to reach that rating. It does not mean they are already there.

#### F - CLASSIFICATION

6. I consider this group has only a chance to survive the economic squeeze. Most need help for shop layout, technology & quality upgrading. Improved product design and management, marketing, seminars. The shops were all crowded into small areas with little chance for expansion. Land and space in most areas is at a premium. These shops would do well to be encouraged to make use of the New Industrial Parks, where renting of space, with adequate power & services are already available. Their investment costs with asset value would be substantially reduced. I feel IAPMEI can do a service to these shops, with a proposal and cost

savings calculations, some should merge, thereby encourage a new environment with suitable space layout, after further analysis with some pre-feasibility-ground-work. These shops and similar, should be encouraged to join with others, to merge with the "P", "F" or "G",\*classification. The costs of enterprise failures can be extremely high. No time should be lost to try to help the PME industry. It is my judgement that these shops will find it difficult to find other than IAPMEI assistance. But IAPMEI must first prepare its own Organization to be able to offer useful and constructive aid. The industry must be convinced that IAPMEI can, is willing to, and is capable of, such service. When this can be a fact, the industry will not hesitate to compensate for the service.

P - CLASSIFICATION

7. It is my judgement that the "P" classification should receive special treatment by IAPMEI, to try to salvage their assets, in other words prevent their likely failure. To this end, further studies are needed, with (computer) analysis, to show cost figures, with economic balance calculations, outlined clearly for use in encouraging these and similar shops to either merge, or form joint partner-ships, whereby a much more viable single enterprise can assert its effort to a level of profitability. They would pool their resources, management, technology, marketing, labor, machine tools and related equipment. Some additional machines could then be added, with the quality control equipment needed to improve the level of quality of products, to that required for export. Older machines can be sold or reworked for retrofit service.

Some companies may ultimately choose not to merge. They can only be encouraged to join efforts with each other. I feel that if a fair, presentable calculation is made, the effort can be successful. I believe that without a study to establish solid figures, it will be very difficult to convince the several managers to see the probably disaster ahead, if merging together shall be refused. A raw materials squeeze must not be excluded, it could be disastrous, to these (and other) shops.

\* The experts terms for means of analysis, with the workshop potential to avoid failure and/or bankruptcy.

8. Quality control was considerably lacking in most all shops. In this area, IAPMEI can do very much, by training seminars and literature on quality control technique. The implimentation of a degree of statistical analysis, with quality technique can be most helpful in selective cases, where production is of some volume.

### III. FINDINGS

1. It can be clear that all shops visited have a heat treatment problem. But the problem is complicated and not an easy one to resolve, for the reasons outlined, as follows:
  - a. all tool, die, mold, (high carbon, high alloys and most cutting tools are imported by Portugal);
  - b. a small amount (less than 5 tons) of these steels, if directly imported, would be at exorbitant cost to a small workshop;
  - c. to properly set up and operate a heat treatment department, for most shops in the sample of twenty, (page 5 ) would cost not less than, 2.4. million Escudos, (US\$50,000.) a figure considered far out of range, for the limited amount of heat-treatment in each workshop;
  - d. the problem was resolved, in part at least, by several steel service centers, whereby larger quantities of these alloys were imported, small-cut-sizes are then sold to the small tool, die and mold, workshops, as ordered;
  - e. a serious unresolved problem is an added cost, as well time delays, to the small tool, die and mold, workshops, since they must return their finished mold, tool, or die, to the steel service center for heat treating. A second shipping cost is added, again to the workshop for final grinding, polish and lapping as necessary, by the tool maker, before delivery of the finished product can be made.
  
2. A definite plus seen by the foregoing outlined procedure, is that the, alloy steel certification, becomes a far lesser problem to the toolmaker. Certification of alloying elements is required in order to properly heat treat these steels.

The steel service center therefore, retains a good measure of responsibility in the process, since he supplies, as well heat treats his certified alloys, sold to his customer.

3. Considerable further study and analysis is needed to provide a convenient location to the tool making workshops for other, smaller, but more strategically located steel service and heat treat centers. The small and medium, (PME) enterprise is not equipped financially to do such study except to spot check and confirm to his own satisfaction that the study is a viable one. After all it is his money also responsibility, to see his enterprise profitable. But it has been my experience that the entrepreneur with 5+ employees, is really not too well equipped to make the kind of study needed for a good tool and die workshop. Then to also learn his export potential. Such study work, belongs with personnel having the support and facilities, as may be found at IAPMEI, or with an expensive consulting firm.
4. I find a considerable potential awaits investors, both local and/or foreign. To engage in small and medium industry, at the SINES area, ( $\pm$  140 km) south of Lisboa. The complex is a large one, situated as it is, at a deep water portside. The project is supported by the Government of Portugal. It has a refinery, petro-chemical, steel making, billet and rolling mill, facilities are with warehousing and storage areas. At present some  $\pm$  7000 are employed at the site. By 1985, employment is expected to reach  $\pm$  60000, labor force.
5. If my judgement can be useful, prefeasibility studies, for small and medium industry, at the new industrial parks located in a number of cities should be made now, by IAPMEI, with investor participation if possible. At the same time studies are required to better utilize the existing workshops, or to persuade them to merge.

IV.

RECOMMENDATIONS

(Cap-sheet)

Summary

Cost

	<u>Escudos/Dollars (US)</u>	
Seminar training	605 000\$	\$12,100.
Transport and subsistence	1 232 000\$	\$24,640.
Motion picture and slide projectors and equipment	227 500\$	\$ 4,550.
Technical library supplement (management-engineering-economic)	95 850\$	\$ 1,917
TOTAL -----	2 160 350\$	\$43,207.

calculated conversion - 50\$00 (escudos) = 1 dollar (US)



#### IV RECOMMENDATIONS

##### IAPMEI ORGANIZATION

1. The Institute is a relatively new Organization employing  $\pm$  175 personnel in the various offices, (8) around the Country. Its main objective, is to help the small and medium industry. An industry employing more than 5, but less than 400 employees, are legally within this group. The weakest arm of IAPMEI, can be its restrictions of real useful (practical) managerial and technological assistance, to the average metalworking enterprise.
2. The needs of IAPMEI in my judgement, are as follows:  
A new department of metals industry advisors & trouble-shooters
  - a. enterprise management advisors (2);
  - b. engineers, ME analysis (2)
  - c. engineer, ME foundry (1)
  - d. engineer, ME tool & die (1)
  - e. engineer, ME production (2)
  - f. engineers, ME quality control (3)
  - g. engineer , EE electro-mechanical (1)
  - h. engineer, (ME) (IE) broad industry background (1)
  - i. economist industrial (2)
  - j. industry financier (analyst) (1)
3. This group should be employed, full time, to work with the industry on (agreed-upon) specific trouble areas, of the enterprise requesting assistance. If such expertise is not available in Portugal, then I recommend UNIDO, or other assistance, should be requested. The group should begin without delay. In the meantime the industry must continue to, "LIMP-ALONG" as best it can.

TRAINING

6. There is a need, as well the desire by IAPMEI, to engage in training courses and seminars, that relate specifically with its assistance to small and medium industrial (PME) enterprises. The Institute covers within its scope multidisciplines, over a broad range of industry. Information indicates there are now some 500,000 employees, in the PME group, which represents  $\pm$  50% of the labor force. The percentage of the labor force, in the metals, (PME) industry is judged to be  $\pm$  25%, of the 500,000 as shown above. The majority of enterprises visited were sincere and frank to state, that apprentice type training was just not working well. As a result employers are finding a much greater need to employ lesser skills, thereafter seek to provide training, (non-apprentice) in alternate ways. But good training just does not "happen", it takes time and expertise. Here would seem most logical, for IAPMEI to expand its activity to provide such expertise with training, as a real contribution to improve the industry, as well, one of the country's most important assets, its labor force. The trend of the metals industry has over the years placed much greater emphasis upon less costly, specialized types of training, while reducing emphasis upon apprenticeship training.
  
7. The training recommended, to be provided by IAPMEI, is for the more specialized areas of the metals industry, such as:
  - a. pre feasibility study;
  - b. consultancy;
  - c. management improvement;
  - d. design improvement;
  - e. design for quality assurance;
  - f. product design improvement;

- g. value analysis;
- h. tool design (patterns, molds, press, forging, forming dies, cutting, finishing, burnishing, honeing tools, fixtures, jigs);
- i. quality control (metrology, gaging, tolerance, statistical, manual, air gaging);
- j. productivity (materials, tools, speeds & feeds, motion economy, fixtures, jigs, production control, heat treatment);
- k. plant layout (material flow, production flow).

8. To permit IAPMEI to undertake such training the following equipment is needed:

	<u>Est. (US\$)</u> <u>Cost</u>
a. motion picture projector 220 volt 50 cycle	800
b. slide projector	250
c. plate projector (photos diagram etc.)	350
d. technical-management films (with available loans)	2 500
e. metallurgical slides (american society for metals or equal)	500
f. glass - bead projection screen 1,5 x 1,5 m	<u>150</u>
	(US) \$4 550

9. The use of seminars and fellowships are required, on a continuing basis to assure the most up-to-date technology with management technique, that is possible. When such training shall become, a second-class or lesser asset, the Institute, (IAPMEI) as well the industry they are intended

to supply help, shall both suffer serious and depressing restrictions.

10. The recommended Executive Development Seminars for IAPMEI Personnel, are as follows:

New York University  
School of Continuing Education  
Division of Career and Professional Development  
326 Shimkin Hall, New York, 10003

(a highly recognized institution for its seminars)

subjects - (estimated cost each/person = \$550.)

- a. the achieving manager;
- b. creative problem solving for managers;
- c. interpersonal skills for supervisors and managers;
- d. managerial skills for the new manager;
- e. management of a Department;
- f. motivation: concepts and techniques;
- g. selection interviewing;
- h. structuring the complex organization.

11. Manufacturing management

- a. automation of manufacturing operations;
- b. estimating and controlling manufacturing costs;
- c. increasing productivity in manufacturing;
- d. negotiating the labor contract;

- e. maintaining union/non-union status;
- f. manufacturing management for small plant operations;
- g. understanding finance management for manufacturing.

12. Metals practices

- a. powder metallurgy;
- b. casting;
- c. machining
- d. welding;
- e. cleaning, coating and finishing metals;
- f. technology for corrosion prevention;
- g. vacuum metallizing of plastics.

22 seminars	x	550.	=	\$12 100.
22 transport	x	420.	=	9 240.
per deim est. 700	x	22	=	<u>15 400.</u>
				36,740.

13. The library at Lisboa, IAPMEI headquarters, has some materials available and subscribes to some journals. At the Porto and Coimbra offices there were only very sketch materials that could be useful to their relatively young personnel. If the IAPMEI centers, (now eight) are to improve and be alert to the best of technology, they must expand the central, as well the branch centers, with the most useful references. I highly recommend the following in several copies each.

14. RECOMMENDED TECHNOLOGY FOR LIBRARY(S)

John Wiley & Sons, Inc.,  
one Wiley Drive,  
Somerset, N.J. 08873

	<u>Cost</u>
a. modern engineering	\$40
b. systems engineering	\$42
c. solar heating design	\$21
d. reliability technology	\$45
e. J. & P transformer (10th Ed.)	\$47
f. transmission lines for communication	\$26
g. introduction to communications engineering	\$32
h. handbook of engineering fundamentals (3rd ed.)	\$38
i. computer storage systems and technology	\$36
j. new products and processes (1979 issue)	<u>\$65</u>
P.O. Box 424	\$392
Livingston, N.J. 07039	

RECOMMENDED PUBLICATIONS

for

IAPMEI - LIBRARY

	Cost US\$
15. Engineering & technical	
a. American Society for Metals (handbooks-12-) (Metallurgical slides) Metals Park, Ohio 44073  (Membership & monthly journal technology publications)	800.  25.
b. Society of Manufacturing Engineers (handbooks) 20501 Ford Road, Dearborn, Mich., 48128  (Membership & monthly journal & technical publications)	40.  25.
c. Society of Automotive Engineers (handbooks -4-) 400 Commonwealth Drive, Warrendale, Pennsylvania, 15096  (Membership & monthly journal, technical publications)	240.  60.
d. American Machinist (Technical publication, technology updating)	50.
e. Modern Plastics Magazine -Cost- 25. (Monthly technical journal with anual handbook)	25.
f. Construction Methods & Equipment - Cost- 25. (Technical publication & technology updating)	25.
g. American Foundrymens Society - Cost- 20. Golf & Wolf Road Des Plains, Illinois, 60016  (Membership publication - Monthly journal & Foundry technology)	20.

Mc. Graw Hill Pub. Co.  
P.O. Box 430,  
Hightstown, New Jersey,  
08520

	<u>Cost (US\$)</u>
h. American Welding Society 2501 N.W. 7th St. Miami, Florida (Technical publication & monthly journal)	25.
i. Ductile Iron Society Box 858, Cleveland, Ohio 44122 (Publication & technical updating technology)	20.
j. Foundry The Penton Pub. Co. Penton Building, Cleveland, Ohio 44113 (Publication & technical updating technology)	20.
k. AMM Metalworking News 7 E 12 St. New York, 10003 (Technical news weekly)	35.
l. Hommelwerke GMBh 6800 Mannheim-Kafertal Turbinenstrasse, 1-6 W. Germany (Technical information, tool, die & gage data) (free) (German & English language)	-
m. The Industrial Press Inc. 200 Madison Ave., New York, 10016 (Technical publications handbook of industrial reference)	80.



	<u>Cost (US\$)</u>
n. Gray & Ductile Iron Founders Society	40.
National City, East Sixth Bldg.	
Cleveland, Ohio 44114	
(Technical publication & technology updating)	
	<hr/>
Sub-total	\$1525.
Sub-total	<u>392.</u>
	\$1917.

---

NOTE: A summary of all estimated costs may be seen on page 13, of the report.

The addendum report, with

The appendix follows

IAPMEI - Project DP/POR/77/019

V. REPORT ADDENDUM - 26MAR - 26 APR 1979	
	<u>page</u>
Recommendations & Guidelines	25
Alternate option	32-33
Training Guidelines for Workshops	26-63
A. Management & Supervisory	30-34
B. Materials Science & Technology	35-36
C. Tool, Die & Mold Design	37-38
D. Quality Control	39-40
E. Heat Treatment	41-42
F. Motion Economy	43-44
G. Cutting Tool Selection & Application	45-46
MEMOS	47-63
	<u>APP</u>
APPENDIX	1-14

ONE MONTH ADDENDUM - REPORT 26 March/26April

To

Project DP/POR/77/019

V.

1. The two month project, began on 27 January, ending on 26 March, 1979. A one month extension was requested on 12 March. The request was granted in time for the expert to continue on the project to 26 April, with travel & a visit to Vienna, inclusive.

During the one month extension, discussions took place, relative to the specific training with which IAPMEI has immediate interest. The expert has outlined his recommendations, pages - 26 thru - 46.

2. Several memos were provided, to IAPMEI, via the director of New Projects, (called SPIAP) to furnish more data, on specific subject matter, as follows:

- a. subcontracting ( page: 47).
- b. welding service, mobile unit (page: 50).
- c. characterization of tool workshops (page: 52).
- d. potential of tool workshops for foreign markets (page: 54).
- e. feasibility study development & profiles therefore (page: 55).
- f. heat treat service center (page: 57-63).

3. It is my view that the tool, die & mold workshops are of vital importance to the country. They are basic to all industry who may have need for tooling, or fixtures, of any and all descriptions. These shops are also vitally important to common market reciprocal activity. But unless given improvement now, they would have severe difficulty to properly meet demands later. The end result would therefore mean import rather than to be able to export, since quality is seriously limited at present. A serious effort at this date toward improving tool workshop quality could realize only minimal benefits by 1982. Management and other specialized technology upgrading, falls into the same parallel, as for quality.

Note- The references - tool workshop, toolmaker, management, tool, die & mold shop, as used in this text, all relate to the workshops in the shop samples, as outlined elsewhere (page:5).

IAPMEI

TRAINING - UPGRADING - RECOMMENDATIONS - GUIDLINES

A. MANAGEMENT & SUPERVISION

1. In 1975 came a new Organization IAPMEI, (Instituto de Apoio às Pequenas e Médias Empresas Industriais, translated to - Institute for Help to Small & Medium Industrial Enterprises). The function of technological training, is not specifically assigned to IAPMEI. But help for the small & medium industry is non-the-less up to IAPMEI to pursue. They may assign this function to others, with some financial assistance. On the other hand, IAPMEI may choose to request UNIDO for assistance, at a later date. It is my judgement that expertise exists in Portugal for at least part of the technology needed. The management training needed by the small tool, die & mold shops, is of a highly specialized nature. Many managers are also the foreman, the chief of sales force, the purchasing department as well. A so-called, "jack-of-all-tool-shop", trades. With more than five employees, the manager has little opportunity to participate in any training program. If IAPMEI could produce a do-it-yourself reference, kit, for such type Organization, they would truly provide a magestic service for the tool workshops, similarly as well, many other industries. Indeed such a reference is badly needed. My judgement quite clearly is that, the tool workshop manager, simply is already too deeply involved in hourly production problems at his workshop to think of how he can spare time for upgrading.
2. I suggest this calls for specific help, designed for a specific industry type. There are many intriguing factors that differ considerably from the generalized type of metal product production. Tolerance, for example, are usually extremely precise, if one appreciates, that such tolerance really means dividing by  $\pm 50$ , a sheet of standard typing paper thickness. It is often said that tool, die & mold making, demands the precise workmanship of a high precision watch. Therefore it is normal for one to often consider owning his own workshop, after 10-15 years experience at his trade. It is not because he was a good manager, that he started such a business as toolmaking. It was most likely because he was a good toolmaker. Consequently management will be only secondary in his scope of the business learning process. Again it is not unusual for the workshop manager to realize, (perhaps late in most cases) that he needs some management training.

It is my view that IAPMEI, can and should, assume responsibility for upgrading the tool workshops.

3. In the visits to the tool shops, it was apparent that most managers were heavily burdened with details, non-compatible with his needs. To reorient this very undesirable situation, managers should request, accept, participate in and fulfill, a course of training that can upgrade his activity.

One way to accomplish this, would be for IAPMEI, to organize such a project for training of managers, assistant managers and the top technical supervision. To do this, I expect a certain amount of promotion by IAPMEI, will be required.

4. It has been my experience in many conversations and discussion with most managers, that:

- (1) He does not usually (psychologically) accept the idea that he, (personally) needs management training.
- (2) He resents, (psychologically) the suggestion that someone, "downgrades" his ability as a manager.
- (3) He feels it impossible to spare such time away from his shop.
- (4) He feels, "that he should be doing the training himself, with many years in the workshop, his knowledge of management is superior to that of any instructor teacher, or even a college professor". A consultant might be more acceptable, at least to some managers.
- (5) The first problem is to, convince a manager that he needs (training) help.
- (6) The next step is to, convince him that IAPMEI can really upgrade his ability, to operate his business.
- (7) The third step is to get him to relax and listen to some good case histories, examples of demonstrated help to other workshops, especially those selected with a similar type of business.

5. It is my judgement, that motion pictures, slides & diagrams, of a specialized subject matter, compatible to problems found in the workshops, can be very useful. These should be carefully selected. Product advertising is not useful, except that it may provide specific beneficial information, compatible with the training needs. They should be, rather of specific new processes, that are

designed to give aid to small tool, die and mold, metalworking shops. There are many such films. I suggest the following sources:

- a. The American Library, Lisboa
- b. The British Council, "
- c. UNIDO film library, (list requested)  
PO Box 707,  
A-1011, Vienna, AUSTRIA
- d. American Society for Metals (film & metal slides)  
Metals Park, Ohio, 44073 (list requested)
- e. The American Management Association (AMA)  
135 W. 50 St., (list requested)  
New York 10020
- f. National Tool, Die & Precision  
Machine Association (NTDPMA)  
1411, K St., (list requested)  
Washington, DC 20005

Some especially good films, considered very beneficial, have been produced by:

The Warner & Swasey Machine Tool Co.  
Euclid. Ave.  
Cleveland, Ohio

(tool management, use & geometry)

The Cincinnati Milling & Grinding Co.  
Cincinnati, Ohio

(Milling Machine use & tool applications)

(tools & the grinding machine)

The Norton Grinding Co.  
Worcester, Massachusetts

(technical process of the grinding wheel)

The General Electric Co.  
Schenectady, New York  
(The Managers approach)

The Kennecott Corp.  
161 E. 42 St.  
New York, 10017  
(metal crystals)  
(especially good for heat transformation)

The Aluminium Company of America  
1222 Alcoa Bldg.  
Pittsburgh Pa. 15219  
(The New Foreman)

Perhaps one of the more important prerequisites that goes with a good manager qualities, are his ability to plan ahead. To project with some accuracy the needs which are of critical importance to his enterprise success and well being. If his situation cannot be satisfactorily estimated for a minimum of one year ahead of time, then he must expect trouble. True he will have numerous day to day emergencies, that require fast judgement decisions. In making those decisions, his objectives, his schedules, his commitments, must not be reversed or modified, to conflict with, or retard, his long range program(s).

Another prerequisite for a good manager is his ability to train others properly. To do so requires patience, persistence and perseverance. It may serve a useful technique for one to memorize, a tried and true proverb - "if the learner hasn't learned --- then the teacher hasn't taught".

In other words a manager must learn to communicate successfully, (1) with his employees, (2) with his banker, (3) with his customers, (4) with IAPMEI & all others important to his business.

## MANAGEMENT TRAINING

### THE MANAGERS RESPONSIBILITIES

6. In the tool workshops, there are numerous details and work requirements that must be assigned to, (1) a supervisor, (2) other individual or, (3) the burden falls upon the manager, he must therefore, learn to delegate.

As soon as a manager delegates an assignment and can be reasonably sure of its successful completion, he must do likewise by other key personnel. When work actions can be properly completed according to a managers instruction, it is time then to expand the manager, permitting his effort to be further promoted by continued delegation of his own burdensome responsibilities.

The need for management to continually plan ahead, by months and better for years, in his own business must be continually emphasized. Unless he can delegate some daily responsibility to supervisor personnel, his time will be entirely consumed with details incompatible with his needs.

7. Management must provide responsibility for:

1. Selection of the best qualified personnel.
2. Respect each and all subordinates with honesty and sincerety, firm, but kind and courteous. He must communicate.
3. Provision that important facts with instructions must be written, as:
  - a. material specifications
  - b. drawings
  - c. processing sequence
  - d. machining
  - e. heat treatment
  - f. time expenditure for each step of the process
  - g. quality tolerance allowed
  - h. protection against damage and rust
  - i. authorized inspection approval
  - j. test-try-out



4. Frequent check-back as necessary, with supervision, (subordinate) to be assured the instruction has been effective and being explicitly followed.
  5. Set a good example by his own actions.
  6. The best leadership, without delay or hesitation.
  7. Full and complete instruction to supervision, with authority to act in his own best judgement.
  8. All due payments are made to employees accurately and promptly.
  9. A bulletin board for use by employees (avoids messages being written on walls, doors or floors).
  10. Complete work assignments to each and all employees.
  11. Productivity, care and operation of machinery and equipment.
  12. Desired quality control of in-process, as well final quality.
  13. Designs, drawings, (sketches) material and work process specifications.
  14. Time charges, material charges and other workshop accounts.
  15. Work flow of material and (receipts) shipments.
  16. Proper care and service of daily, (periodic) use tools, fixtures, equipment
  17. Plant equipment, building, grounds, servicing and care.
  18. Employee training, upgrading, classifying, advancement.
  19. New process developemnt, adv.
  20. Advance tools, jigs, fixtures.
8. Management (supervision) must avoid
1. Actions, or language, that can be misunderstood (resented) by subordinates and/or others.
  2. Any engagement, nor permit, jokes, tricks or clowning on company premises.
  3. Favoritism, or obvious partiality.

ALTERNATE OPTION

9. It is my judgement that it can be difficult to convince the small shop managers that they can salvage their enterprise by taking some training courses. Secondly they are already burried under endless daily problems to keep employees active and occupied effectively. They are simply not making any money. As such they cannot pay off their indebtedness.

I would therefore recommend, that IAPMEI provide a consultant, of dual capabilities, management and technical, having outstanding tool & die back-ground, for direct assistance to the tool,die & mold workshops.

10. The areas of expertise needed for upgrading emphasis, are the following:

M/M = 15

- 3 a. management and supervivion
- 2 b. materials science and technology
- 2 c. tool, die, mold design and application
- 2 d. heat treatment specifications (tool steels)
- 2 e. quality control, tolerance, dimensions
- (1) \* f. cutting tool selection, application of high alloys
- 2
- (1) \* g. machine tool/cutting tool utilization, effective geometry
- (1) \* h. machine tool retro-fits and evaluations
- 2
- (1) \* i. motion economy

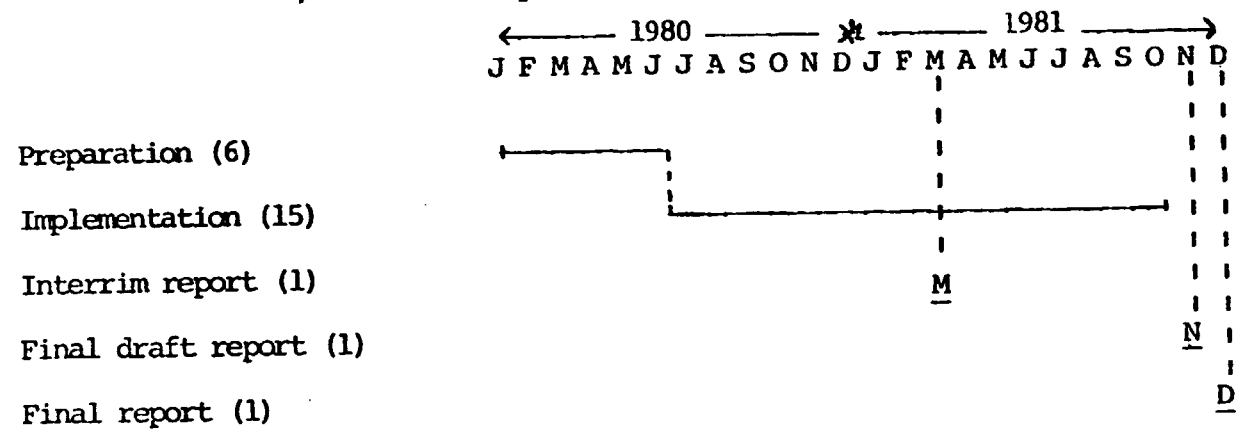
To the above, I would recommend that an initial six months minimum are needed, to prepare training materials that apply specifically, to the needs of the tool workshops. I would allow a three month evaluation, updating and reporting period, at the expiration of the 24 month team effort.

\* join inter related

There will be need for some support for reproduction needs of the team. The type such as REX-ROTARY (Denmark) or similar, with capabilities to reproduce sketches, designs, charts, etc. for use in the upgrading process. It is presumed such equipment time can be negotiated by IAPMEI, or the Ministry of Industry.

Some reproduction costs, with translation time, likewise are estimated for IAPMEI as follows:

Man/months for expertise = 24



Man/months for (2) counterparts = 48

The timing for counterparts will run parrallel to that of the expert.

Estimated cost for the expertise = ± 3 000 000\$00

Estimated cost for import equipment and technical materials = 324 000\$00

ESTIMATED ESCUDO COSTS = ± 5 325 000\$00

	<u>Escudos</u>
a. reproduction costs as apply to workshop upgrading	75 000\$00
b. translation time, (10 hrs x 24 mo.)	72 000\$00
c. secretarial assistance (40 hrs x 24 mo)	144 000\$00
d. per deim costs for team (1500\$ x 3 x 20 x 15 mo.)	1350 000\$00
e. expense of travel & vehicle maint. (2000 km x 12\$00 x 15 mo.)	360 000\$00

Consultation with managers should be previously arranged, to permit most effective use of the experts time and effort.

To be most effective with the upgrading process, it is further recommended, that two counterparts should be actively assigned with the expert, during the entire period. One counterpart should be a mechanical engineer with some considerable experience background. The second should also be a mechanical engineer with strong desire and interest in the specialty workshops, for tool making. Both counterparts should be bi-lingual, unless a well qualified Portuguese expert can be recruited.

## B . MATERIALS SCIENCE & TECINOLGY

1. In this area of expertise, there opens a wide range for the manager to expand his shop capabilities. Some serious considerations are usually open to the workshop, for materials specification, at the outset of work quotation. At that point and time, the specific best steel alloy, that can be satisfactory for the customer, while at the same time provide some advantages, for the tool workshop, such as:
  - a. specific application of tool materials VS product materials
  - b. machinability of selected alloy(s)
  - c. quality of finish, with tolerance limits
  - d. capability for heat treatment as needed (whether air-oil; or brine quench)
  - e. resistance to rust & corrosion
  - f. cost, (initial and ultimate) with estimated tool life and whether rehabilitation can be considered
  - g. options open to the customer for extending tool life

Normally the customer relays heavily upon the tool & diemaker, to suggest & advise him of the technology steels, (alloys, etc.) that the tool workshop will recommend. Unfortunately the workshop may sometimes recommend materials, (considered suitable) that are readily at hand. Material orders can take one to three months, at best. Depending upon distance and type of material needed. If and when a material is suggested as a substitute, it is most important that the tool workshop not jeopardize his reputation, with a customer loss as well. Simply by trying to squeeze some time while producing an inferior product.

2. In all cases of tool making a certificate must accompany the steel, (alloy) material, relating in detail the specific chemical certification. A required report that is demanded at the time the original analysis (steel) was made. If a certificate is lost, or fails to appear, then a new one is needed (certified) from a metallurgical laboratory. This means extra time & cost

added for a customer. Not a good business approach, unless the customer is so informed initially. If attempts are made & agreed upon, to supply substitutions of materials, worthwhile benefits can be the result, assuming the toolmaker is competent to provide most reliable service & advice on the technology. This is often where inefficient tools, dies & molds, are born. The materials science technology has never been sufficient and often neglected to upgrade. It is on the basis of having the best technology, that tool workshops establish their reputation, are viable, efficient and productive, with an orders backlog.

3. The area of training needs are:
  - a. good basic understanding of brand names & significant chemical compositions, of materials used for toolmaking - high & low carbon, high & low alloys, high speed steel, the high ductile irons, the carbides and plasma process.
  - b. necessary types of heat treatment to apply, heat conduction and heat induction, heat transfer.
  - c. understanding of transformation & the meanings of - to anneal, to draw, deep draw, to quench, to temper, to heat soak, (to kill the steel) to heat check, to chill.
  - d. knowledge of metal score & its prevention.
  - e. shrinkage VS expansion limitations, as related to similar, or to dissimilar metals.
  - f. technique of joining similar, as well as dissimilar metals.
  - g. understanding of molecular structure changes, in composition, grain structure, stretch qualities and impact resistance.
  - h. machinability characteristics.
  - i. design limitations, stresses.

C. TOOL, DIE & MOLD DESIGN - TRAINING NEEDS

1. This is a point of beginning. It is the one best opportunity available for the tool workshop - to help himself - to help his customer, thereby enhance his reputation. In the final analysis it is usually the reputation of the workshop, that becomes decisive in awarding an order to make. Repeat orders cannot be expected with a poor reputation in design, in workmanship, in quality & delivery schedule reliance.
  
2. The training basic needs are:
  - a. broad knowledge of materials for toolmaking.
  - b. ability to communicate ideas, to firm instructions on a drawing.
  - c. knowledge of standard design practise.
  - d. ability to interpret specifications for metal heat treatments, initial - intermediate and final, as will be required for the tool.
  - e. specifications for size changes, as process proceeds, i.e. blank, bend, fold, crimp, lap, shrinkage allowances, effects of temperature.
  - f. cutting angles & clearances - the meaning of rakeangle, clearance angle, helix angle, all as related to use, as applied at machine tool.
  - g. cutting tool types & materials, as applied to metal removal, formation and/or deformation.
  - h. characteristics of shrinkage in various plastic materials as molded. (mold shrinkage allowances VS: materials)
  - i. broad understanding of available means for fixturing and processing, in production, i.e. quick-clamps, jacks, leveling screws, spring adjustments to compensate for machining(process) deflexions.
  - j. understanding of motion economy and man/machine capabilities.
  - k. understanding of quality control & the ability to interpret ISO standards (Din-US- & others) and relate to process specifically, in workshop language for machine operators.
  - l. understanding of process tolerance and specifications relating to size, fits, finish standards and interpretation.

- m. understanding of plating, chemical treatments chrome plate, (hard and/or flash).
- n. applications beneficial by weld technique, plasma and applied materials.
- o. workshop economics & value analysis.
- p. designing for quality assurance.
- q. review of design failures & failure analysis.
- r. understanding heat treatment equipment, the hardening processes - case -  
-harden, cyanide harden, temper, draw, relieve stress, anneal, dead soft,  
salt bath & induction heat methods.
- s. knowledge of metals, such as those hardenable & non-hardenable, heat-  
-treatable & non-heat-treatable. To further classify tooling metals by type.
- t. understanding of laboratory methods of defining, chemical analysis & that  
for metallurgical analysis, sufficient to specify.
- u. understanding of plant layout, work flow symbols, electrical symbols, &  
other service line identifications.



D. QUALITY CONTROL IN TOOL, DIE & MOLD MAKING

1. The lack of quality control in tool making, is perhaps one of managements serious oversights. The production of quality products, that can stand as an example of standards applied at the workshop, are a most valuable asset to good management. The opposite can be classified by one word-carelessness. During our shop visits, instances of the lack of quality were numerous. In most instances I believe it is simply overlooked by management, therefore ignored by shop personnel.
2. Maintenance and direct improvement in quality is a simple tool of management. It is a tool that belongs with each & every group, collectively in each workshop. When the guard for quality fails, the workshop has lost its "secret weapon", for repeat orders.
3. The beginning for improvement in quality must start at the managers office. Thereafter the lines of communication must be clear to all employees. The lack of quality shall be identified as carelessness & poor workmanship".
4. Each workshop should begin by assignment of one or more personnel, to surveil and promote quality. Such personnel must be responsible only to top management. The chief of quality should be authorized to approve, or disapprove, the product shipment, until such defects in quality are corrected satisfactorily. Suitable gaging, and measuring tools must be provided, that will assure unquestioned understanding and comprehension for, tolerances, fits, limits, finish, surface condition, hardness, roundness, flatness, or angular configuration.
5. The training needs are:
  - a. realistic promotion for quality by management.
  - b. assignment of responsible quality control personnel.
  - c. provision for necessary tools & instruments.
  - d. specific instruction from top management relative to acceptable product quality. Likewise specific instruction for rejection of products.
  - e. review and familiarity with ISO standards, (International Standards Organization) data on machine finishes, plating specs, fits and limits, tolerance, hardness specs. and conversion data.

- f. dimension mathematics & blue print calculations.
- g. application of 4 x, 10 x, 30 x (4 power, 10 power, 30 power) microscope to analyse defects, in cutting tools, in machining, and in heat treatment.
- h. application of statistical quality analysis, with methodology, of X- & R- (X bar & R bar) charts.
- i. a study experiment in actual shop measurements, using a micrometer caliper to record to nearest, .000 (third decimal) 100 samples, by three or more separate individuals. Thereafter each specific unit identified, for final comparison & analysis of human error in measurement limits.
- j. set up X- & R- charts based upon data collected and computed in, i, (above).

E. HEAT TREAT SPECIFICATIONS - TRAINING

1. The value of a tool & its life, is almost entirely reflective upon its proper heat treatment, by the tool workshop. If the heat treatment is contracted to the steel service center, it is still the tool workshop responsibility to guarantee the steels specified hardness. This is usually provided as relevant to the standard scales, Brinnell hardness, or to the Rockwell (A-B) hardness. The Rockwell scale (RC) is normally used for the higher hardness ranges. The hardness, also known as temper of steels, is the direct result of the heat treatment process, for the specific steel.

- a. time-temperature - transformation (T-T-T).
- b. quench temperature and timing.
- c. draw temperature.
- d. reheat cycle, (when required) normalizing.

2. Great care and expertise must be exercised in the process, or the steel will be ruined. In the process, overheating, or multi-heating, will destroy (kill), the usefulness of the steel by rendering it useless to accept proper heat treatment. The several types of steel, i.e.

- a. high speed steel.
- b. high alloy steel.
- c. low alloy steel.
- d. high carbon steel.
- e. low carbon steel.
- f. ductile irons.

All require a variation in heat treatment processing, to meet certain specifications for the tool desired. Equipment for the heat treatment is also varying although modifications can be acceptable and may even be preferable, such as the use of induction heating & automatic quench for some carbons & alloys.

3. The tool workshop heat treat training needs are:

- a. introduction to chemistry.
- b. brief comprehension of metallurgy.
- c. ability to visualize material transformations, with temperature changes.

- d. use of microscope to study grain structure comparison in metals, porosity & soft spots.
- e. review of ISO (International Standards Organisation) data on hardness testing of high alloys, cobalt alloys & tungsten carbide.
- f. introduction to hardness testing methods & equipment, hardness scales, comparison data & conversions.
- g. introduction to heat treat methods for specific steel types.
- h. review of case history, "failure analysis," Bethlehem Steel Co. - Allegheny Ludlum - American Society for Metals, Metallurgical slides. Motion picture, "CRYSTALS" (in slow motion).
- i. a visit to a certified metallurgical laboratory.

## F. MOTION ECONOMY - TRAINING NEEDS

1. A need for, with broad application of, motion economy as a tool of management. Perhaps no other single training element, has more benefits to the tool workshops, than the savings of time on wasted motion. As a simple example; during a workshop visit it was observed, that two men were hard at work, first assembling & secondly disassembling, a tool fixture used on a press machine. The machine capacity in strokes per minute, equals not less than  $\pm 30$ , or let us say 30 pieces, can be made on the press each minute, with suitable tooling. The two men required 5 to 6 minutes, for the awkward arrangement of, (clamping & unclamping) fixturing. This therefore limits the machine in its capacity, to not more than 10 pieces per hour, assuming a 55 minute hour of work. But the machine capacity could produce,  $30 \text{ pieces per minute} \times 55 \text{ minutes} = 1650$ . Even though the machine could work only a 30 minute hour, or 825 pieces, it would certainly warrant changes in process tooling. A number of other incidences were noted, likewise in other shops.
2. The losses to management are indeed gross, relative to production volume and cost of production. Such losses could be quite simply recovered by:
  - a. satisfactory tooling design.
  - b. clamping and unclamping of fixture by simple, "quick action", mechanism. Machine time is costly, but management seems to be unaware of its losses (note chart. app. page 14).
3. The training needs:
  - a. awareness on the part of management and design of non recoverable motion losses, in each workshop.
  - b. case histories (at least 10) documented to show the extent of motion losses & how to correct them.
  - c. selected studies of specific workshop examples, (they are easy to find) noting present motion and recording new methods for motion savings.
  - d. arrangement of assembly hardware, (bolts, washers, nuts, rivets). Where they are handy for operators, to properly orient and assemble.

- e. fixturing of parts for welding, to properly position & clamp by a limited skill operator, allowing the more costly welder, to continue with welding, instead of stopping of welding to assemble personally.
  - f. providing two hands of an operator to become active in unison.
  - g. demonstrating the time & motion savings, of a one hand typist, VS: one using two hands.
  - h. demonstrating a machine operator carefully supplying all his, (5) workshop tools at one visit, VS: the same operator walking 100 meters for 5 times, to obtain necessary tools and instruments, for his assigned work.
4. In the recognition that many motions are lost each day and resolving to reduce some at least, is a wise decision for any workshop manager. It is his money, (profits, or more debt) that is being thrown away.

## G. CUTTING TOOL SELECTION - TRAINING NEEDS

1. "A workman is known best by his tools and how he uses them". This phrase should be posted on the entrance door of every workshop, especially a tool workshop. A good toolmaker becomes so, because he has learned over the years, how to care for & use tools. At the workshops visited it was immediately obvious that much basic toolmaking know-how, was lacking. The statement is in no way, intended to simply criticize the hard working shop management. But the fact remains so, and a serious effort is needed, if corrections are to be realized.
2. Apprentices are not being employed to any appreciable extent. The average tool maker has little opportunity to learn advanced technology in his chosen avocation. A very simple tool catalogue is difficult for him to obtain. The technology of specific types of carbides & cast alloys, is not freely available.
3. The needs for training and upgrading are extensive. Those considered immediately urgent are:
  - a. brief review of history of tool steels, i.e.: carbon tools, high speed steel tools, high cobalt tools.
  - b. brief review of carbide tools and their powder metallurgical process.
  - c. understanding of the term, "cutting tip build-up", why it does so & what will result.
  - d. reasons for tool failure, i.e.: power failure, result & remedy, operator failure & corrections.
  - e. learning the invisible triangle, between metal-tool-chip, formation.
  - f. value of machine power capability.
  - g. value of machine speed, RPM/M/M, (revolutions per minute meters/minute) ratios, to FPR, (machine feed per revolution).
  - h. review why cutting edges fail and analysis of failures.
  - i. understanding specific applications for specific tools, i.e.: materials and metallurgical factors favorable, or unfavorable, to the application.

- j. analyzing tool failures, applying corrective measures (small microscope needed for any demonstration).
- k. determination of effective clearance/rake/helix, (compound) angle.
- l. understanding threading tools, internal and external, drills, reamers, broaches, profile cutters.
- m. knowledge of proper grinding wheels for specific tool materials, especially cobalt alloys & carbide.
- n. value of super-finishing cutting tools.
- o. reasons for varying metallurgical composition & tool hardness limits.



30 March, 1979

Memo to: Dr. Henrique Marçal, Dir. N.P.

From: Orvis J. Fairbanks, UNIDO, Advisor *O.J.F.*

Subject: Sub-contracting

Further to our discussion yesterday on the above subject matter, I have outlined some additional comments, that I hope may be useful.

The sub-contracting of component parts, as used in a number of countries, is a very useful manufacturing practice. This practice has been used for many years by those companies, producing such as the following:

- automobiles - rail wagons
- aircraft - engines
- shipbuilders - electric motors
- hardware of all types
- agriculture machinery
- construction machinery

The above will only name a few, of the vast potential product families, available to sub-contracting their smaller piece-parts, to a specialty type workshop.

Let me give you an example that dates back to 1950-53 (with which I am very familiar).

The Pratt and Whitney Company of Hartford Connecticut - a well known and reputable machine tool manufacturer, at the time, was given a contract by the Boeing Airplane Company, to build (100) production models, of the turbine engine, that is now used on the Boeing 707 plane. At that time there were  $\pm$  1350, sub-contractors who were engaged to make the, "less significant" parts, for that type engine. The final assembly and the most critical parts to manufacture, were the only parts made, "in plant", by the P. & W Company. The practice continues to this date - some 28 years of existence.

Other companies manufacturing such as:

food machinery	- refrigerator
radio	- freezer
television	- air conditioner
sewing machine	- ventilator

All use subcontracting as their needs may demand. Emerson radio, as another example; started their business by only assembly of parts, made by other companies, then sub-contracting of some special designed parts, to fit the unit together.

Most of the office equipment makers that I am familiar with, use the practice of sub-contracting. They eliminate in that way, many manufacturing problems, with asset and equipment costs, which they can easily avoid. They simply look for the workshop that has the machinery and equipment already. They must however provide design part drawings, that clearly define materials, measurements, with tolerance and quality specified. To do this work, the company will look for a small design shop, who specialize in the making of prints that can be copied easily and supplied to a sub-contract bidder. Usually they (the manufacturer) look for three or more workshops, for bids to make their component parts, thereafter to be shipped to the assembly plant, when ready.

While I was at Coimbra, I visited, with Mr. Nogueira da Silva, at the IRAL factory. This company has a very good option open to them, by using the sub-contracting method for manufacture at some later date, when their market will be more assured. They must first complete their product development and improve quality, then specify exactly what they want, and put a few small tool shops to work, making specialty parts for them. The manager of IRAL, Sr. Castro, is a very alert and energetic man. I believe he will eventually go the sub-contract way, after his initial development work.

I should point out, that an important consideration in the sub-contract process, is suitable tooling. It is therefore often that small tool workshops look for and are selected to do, sub-contract work. They have the know-how usually, to make a suitable tool, jig, or fixture, that will properly and securely hold, as well, (if necessary) properly orient, (position) the part to eliminate errors,

in maintaining quality. The needs for tooling are inexhaustible. It seems timely and I believe appropriate to promote some of the larger manufacturers to make better use of sub-contracting to help the tool and die shops. This kind of work is often referred to, as, "Bread-and-butter", for the small workshop. In other words it gives him something "more to eat" and smooths out the "ups-and-downs", the "hills-and-valleys", (all phrases) as the trade often refers to its, "feast or famine", type of activity.

Please let me know if I may be further helpful, to expand upon questions which IAPMEI may have interest. If its metalworking, I believe I can offer some useful comments on the industry. I feel some larger manufacturers should be visited, to learn the actual potential that may exist, for promoting sub-contracting for benefit of the small tool shops.

30 March, 1979

To: Dr. Henrique Marçal, Dir. N.P.

From: Orvis J. Fairbanks, UNIDO Advisor *O.J.F.*

Subject: Welding service, specialty mobile unit business

As you requested yesterday during our talk on the above subject, I offer these further comments, that I trust may be helpful.

Welding, with metals fabrication has a very wide range of application. It is often less expensive to provide a good weldment that will replace a casting.

Indeed some equipment manufacturers have replaced expensive castings, by a welded configuration. The practice of welding pipes and valves, in the, water supply, oil refinery, petro-chemical, cement factory, brewery, or repair, simple hotel and office building construction & repair are every-day requirements.

To provide such service I recommended in my report that a mobile type welding service, was a potential for pre-feasibility study and analysis by IAPMEI staff.

The mobile unit is a specialty business, that belongs with a workshop having several good welders, one or two, would desirably be "certified welders". To be a certified welder he, or she, must take a required welding capability test, probably given by the metallurgical laboratory, or department of labor, or other government body. Then a certificate would be issued, permitting the individual a so-called license, for recognition as a qualified welder for reliable high quality welds, on such as high pressure steam, water, gas, etc..

The combination of a mobil unit equiped properly, and with a certified welder available have a wide variety of application. I should indicate that usually

a 1-1<sup>1</sup>/<sub>2</sub> ton truck chassis is basic. To that would be mounted the following:

	Est. Cost. - (US\$)
a. engine diesel generator, AC/DC 500 AMP, (MIN.) (reliable used is OK.)	6000.
b. tool box with welders tools (hammers, chippers, chisels, files, wrenches)	600.
c. bench vise 120-150 MM jaw width	120.
d. steel plate 12-13 MM thickness x 1M x 2M	80.
e. rack with frame and secure gate for 4 tanks, (2 oxy. x 2 acet.)	700.
f. truck (1-1 <sup>1</sup> / <sub>2</sub> ) chassis (diesel) (reliable used is OK.)	5000.
g. necessary labor and transport, for assembly and mounting	1000.
h. welding rod selection	200.
i. brazing wire selection	100.
j. registration of vehicle and certificate of welder	<u>200.</u>
	\$14000.

(conversion 50\$/700 000\$00-! .US dollar)

Please bear in mind, my figures need a good check-out for local prices, before a project is discussed with a potential sponsor.

It would not be surprising to me if you might already find such a mobile unit already somewhere. I have been told however that none are known to exist. A logical place for such units to be located would be close to a shipyard, petro-chemical, or refinery.

If I can be further helpful, please do not hesitate to call upon me.

1) Characterization of tool workshops

A tool workshop is one that specializes in construction of such as the following:

a. machine tools

lathes (manual & automatic, horizontal, or vertical

mills manual & automatic , " "

drills " "

grinders " "

planers " "

machining centers are others, (specials) (these are often made by retrofit, which means modifications by joining two or more older units, or adaptation of any special accessories).

b. Tools (workshop) (tool, die & mold)

molds, (for plastics)

molds, (for die casting)

molds, (for die forging) (also called die)

b<sup>1</sup>.dies, (for presswork) (forms, shapes)

dies (for punchwork) (single & multiple)

dies (for drawing) (deep forming)

b<sup>2</sup>.forming tools, such as spinning, compressing, expanding, sizing, burnishing, hobbing

b<sup>3</sup>.cutting tools, such as for metal, wood, minerals, etc.

bits, drill, tool-bit, reamer, milling cutter, chisel, broach,

forms, shear, shave

I did not visit any workshop making machine tools in the above "a" classification.

The "b" classification are the shops principally in the group of 20 which I have seen. However the only cutting tools, (b<sup>3</sup>.) were a broach and very little of any other.

We should bear in mind that the steels used in each of the b-b<sup>1</sup>-b<sup>2</sup>-b<sup>3</sup> group are not the same.

To recapitulate this:

"a" group will use large amounts of cast iron

"b" will use principally the air hardening alloy steels

"b<sup>1</sup>." will use a lower alloy having usually more carbon content and "oil hardening"

"b<sup>2</sup>." will be still higher carbon content with somewhat more alloy

"b<sup>3</sup>." will be generally, high speed steels, (oil or brine hardening) except the tools for wood cutting. Are more satisfactory if made of high carbon & can be "water hardening", but in this case cracking is a hazzard, to require carefully controled temperatures for steel & solution for hardening.

2) Potential for tool workshops in foreign markets

It is without question in my mind, that much work needs to be done to improve the tool shops. But if this can be a reality, then I would certainly feel that the tool workshops of Portugal would have a real competitive edge for all common-market countries.

I list the following as favorable:

1. labor availability
2. labor economics
3. training potential (could also be exported)
4. potential to export (especially my classifications, "a", "b", "b<sup>1</sup>", "b<sup>2</sup>")  
note - "b<sup>3</sup>" is much less labor intensive.

To those favorable classifications, I will add:

- a. jigs for drilling and/or reaming
- b. fixtures & accessory tooling, for lathe, for mills, for welding, for assembly
- c. cutting tool holders & adapters
- d. plasma process as a specialty

So far as I know none of this group has any emphasis at present. The same skills are required in practically all cases.



Pre-feasibility studies, how & where to develop

I consider this development should be a very prominent center for IAPMEI to improve its capabilities. Unfortunately such type expertise requires some real good practical training. I believe you have basically a real potential, at IAPMEI, to train, such expertise.

I feel sure this is an area where UNIDO might participate, if you are unable to provide locally.

At one time AID, (1958-1964) would provide quite useful 15-30 page books, on many industries. This activity was later contracted to a Springfield Virginia engineering Co., who made only brief folders, also micro-film, that I consider of little value. A book catalogue can be supplied on subject matter.

I do not recommend it at all, as being of value to IAPMEI. It might be of some interest to know that I spent three years in NE Brasil, on a (3 mon) contract, for the International Progress in Management. Some forty Brazilians were "field-trained", as well the theory, to make pre-feasibility studies. A wide variety of industry, metalworking, electro-mechanical, food processing, leather, asphalt, fish & lagosta processing & freezing. The cost at that time amounted to more than \$250,000 plus a substantial amount of cruzeiros. I relate this to IAPMEI, to imply only that considerable cost & time will no doubt be involved if you are seriously considering the development of pre-feasibility studies. I know of no substitute for the real field-type training. The United Nations has a book on feasibility studies. It covers many subjects from many countries. The information has been collected over a number of years. Methods & prices change rapidly, then too many different currencies are related. As a library reference I feel there may be some little use for such a book. I might suggest an interrim measure, for your consideration, as follows:

- a. use my guidelines on pre-feasibility study. "Notes for Seminar", pages, 1 thru 10, of my final report appendix.
- b. assign one of your staff, to review new projects, which you consider are reasonably well prepared.

- c. extract the data to set-up your own background (costs etc.) to compile a historical record.
- d. use a basic standard form, for your data collection.
- e. with time, patience & perseverance, you will establish a useful guide, for all personnel and in your own language, or it can be multi-lingual.
- f. with periodic updating you will provide suitable data in time, to use computerized technique, to supply rapid useful answers.

10 April 1979

To: Dr. Henrique Marçal, Dir. N.P.

From: Orvis J. Fairbanks, UNIDO *OFJ*

Subject: Heat treat service center

The problems with time delays, for small tool, die & mold workshops, to secure heat treat service is a rather complex one. The average workshop has only limited needs for such a facility. It becomes therefore a problem, for them to accept work which could be difficult to satisfactorily heat treat, outside their workshop. Normal workshop practice, is the following:

- a. to order a piece of steel, size and quality grade desired, from a steel supplier (service center) where large quantities of a variety of steels, are kept in stock;
- b. with steel delivery at the workshop, the tool, die, or mold is machined and processed. It is then returned to the steel service center for heat treatment. Following the heat-treatment process, the tool, die, or mold, is returned to the workshop, for final finishing. This process would consist of some finish-grinding, polishing, honeing and/or, lapping, when required. Finally it is desirable to mount the mold, or die, into a press for actual tryout results test, before shipment.

The present practice involving a steel service center is a delicate one. It becomes so, due to the high cost of maintaining an adequate supply of the wide variety of steels kept on hand. The high cost of interest money, to support supply with limited demand can soon make the supply business insolvent. It can on the other hand drive up the cost on all steels kept on hand. The greater the variety, the greater the loss to be absorbed by the more active turnover steels. If we can assume with some reliance, that the steel service centers will endure the high

cost of interest charges for steel replacements. It then seems most logical to continue the present practice, as it now stands, in spite of some added costs and time delays for the mold, die & tool workshops.

During our recent visits to the twenty (sample) Tool, Die & Mold, workshops, it came to my attention that several shops had heat treat furnaces on their premises. The furnaces were not used and in at least one instance, (at FAMA-COR) the manager was frank to state that he found the furnace problem too complicated. He therefore chose to continue heat treat service with the steel service center. I can well appreciate his explanation & I believe he has chosen the appropriate course of action. At least that is so, where only a limited heat treating requirement exists.

It is my feeling that many of the workshops managers do not take the time to compute the total costs involved before they decide to invest in a furnace. Thereafter they can soon learn of many more costs that they (temporarily) overlooked. Wishful thinking perhaps, that they could manage the heat treatment addition, without difficulty.

I have put together a list of equipment for a minimum heat treatment specialty workshop, that could service some tool, die & mold shops. To accomplish this I have made several assumptions, as follows:

- a. that a suitable building (150 m<sup>2</sup> min.) exists, being central to an,  $\pm$  80 km radius, of 6 to 10 workshops.
- b. being easily accesible to main highways.
- c. having close availability for 20 KVA, power lines & suitable transformer.
- d. ample space for trucks to load & unload.
- e. telephone connection.

f. available personnel

- 1. management-supervisor, fully knowledge of heat treatment
- 1. secretary-accountant-clerk
- 1. heat treat operator, (5 years experience heat treatment & laboratory)
- 1. heat treat operator (2 years experience) knowledge of heat treat laboratory
- 1. electro-mechanical maintenance (3-5 years experience)
- 1. helper-mechanic-operator (2 years experience)
- 1. helper general maintenance (1/2 to 1 year experience)

g. office equipment & supplies

h. operating expense budget (suitable for four month turnover)

i. usable vehicle (local needs)

j. transport will be by transport company

Should the steel service center cease to operate, then indeed the workshops are in serious trouble. The only options open to them would be the airline TAP, maintenance heat treat facility, or the military workshop, where some idle heat treat capacity, is known to be available.

To permit a more thorough analysis of this situation, I have prepared a cost estimate for reference purposes, by IAPMEI management, in the event problems later will arise, with the steel service centers heat treat procedure.

I trust you at IAPMEI, will find this to be of some use. My figures should be carefully reviewed and updated, at any future decision to pursue the matter further.

HEAT TREAT SERVICE CENTER EQUIPMENT

(estimated minimum costs)

for

a limited suitable capacity

<u>Qty</u>	<u>Item</u>	<u>Temp° C</u>	<u>Chamber mm</u>	<u>Cost (US\$)</u>
2	Electric Furnace	1350	100x150x200	9000.
1	Electric Furnace	1100	300x500x600	10000.
1	Gas Furnace	1100	500x750x1000	10000.
1	Gas Furnace (anneal & draw)	900	500x1000x1000	8000.
1	Salt Furnace (converter & controls) (dual)	1400	200 dia x 600 dp	15000.
1	Salt Furnace (controls dual)	1250	400 dia x 800 dp	9000.
1	Optical pyrometer	350/1800		700.
1	Contact pyrometer	100/600		300.

OPERATING MATERIALS (4 months) H.T.

a.	supply of heat treat salts	450.
b.	quenching oil (800 L)	500.
c.	degreasing solution (600 L)	800.
d.	furnace gas (2000 L)	300.
e.	electric power	2000.
f.	water, telephone, promotion & incidental for operating materials	<u>3000.</u> 69050.

## LABORATORY

<u>Qty</u>	<u>Cost</u> <u>(US\$)</u>
1 - Hardness tester for Brinnell test full scale range, with calibrated master plate and ball master. Two extra ball sets with conversion chart & instruction book	7000.
1 - Hardness tester for Brinnell test portable unit in case and accessories for iron and steels. Master plate & ball sets, conversion chart & instruction book	2500.
1 - Granite surface plate 500MM x 750MM with stand	900.
1 - Height gage (500MM) with stand	600.
1 - Gage Blocks, in range to 500MM with 0.0025 divisions x 10 and 0.025 divisions x 25, remainder by divisions of 0.10MM	700.
1 - Optical pyrometer 350/1800°C range	700.
3 - Hardness tester Rockwell "C" & "B" scales, diamond pyramid master plate and diamond with two extra diamonds. Conversion chart & instruction book	<u>8000.</u>
	20400.

ACCESSORY EQUIPMENT

<u>Qty</u>	<u>Cost</u> <u>(US\$)</u>
1 - Quench tank, 1 m <sup>3</sup> area, (oil) stainless steel & asbestos covered, placed on concrete block. Equipped with heating units to maintain a 200°C temperature. Equipped also with cooling water coils to maintain oil temperature maximum not exceeding 250°C. Temperature recorder & pyrometer	2000.
1 - Quench chamber, air cooling, 1 m <sup>3</sup> area, (tank) asbestos covered & on concrete block, equipped with circulating exhaust, for controlled temperature reduction provided with 250 kg capacity, "dolly" for transfer into & out of, cooling chamber. Tracks with rollers provided to accommodate "dolly" transporter.	3000.
1 - Degreasing tank, 1 m <sup>3</sup> area, stainless steel mounted on concrete block provided with pump & spray nozzle for cleaning tools, molds, dies etc. prior to heat treatment.	1200.
1 - Spray (preservative oil) tank, for control of rust conditions following heat treatment equipped with mixer valve to use preservative oil & compressed (dehydrated) air for spraying.	1200.
1 - Monorail unit, mounted over furnace and quench tanks, (min 750 kg load) to provide lift & transport (250kg) as required, in heat treatment process. Equipped with track switch, to allow for by-passing of work transport-in-process. Hoists (3) may be electric, or air motor operated. Should be accessible to loading/unloading platform.	3500.



<u>Qty</u>	<u>Cost</u> <u>(US\$)</u>
1 - Transporter, (pallet type) hand operated, (500kg) suitable for handling materials, movement, for in-process tools, dies & molds.	1200.
2 - Sets, steel work benches, 1M x 3M, with vise, (150MM) attached.	1000.
1 - Air compressor (30kg <sup>2</sup> C.M.) (150 psi ) with supply tanks, filters, necessary controls, ganges, valves, piping, etc.	11000.
1 - Reserve tank for furnace gas supply, regulator valves, control, safty valves, piping, etc.	<u>4000.</u>
SUB-TOTAL	28100.
Heat treat equipment and, operating materials for 4 months	69050.
Laboratory equipment	20400.
Accesory plant equipment	<u>28100.</u>
TOTAL	117550.
Transport and install + 20%	<u>23510.</u>
GRAND-TOTAL	141,060.

141,060 x 50\$00 = 7 053 000\$00  
 (US\$) (escudos)

## NOTES FOR SEMINAR

20 March, 1979

## NEW PROJECT APPRAISALS

1. What is the project
2. Why is it needed
3. When can it start
4. Where is its best location

- The four basic questions -

What

1.a Type of project & purpose

b large-medium-small

c the advantages

d the disadvantages

Why

2.a is there a need

b local

c export potential

d imports history

e present volume

f potential volume (5-10 years)

When

3.a.timing-make plans & schedule firm

b consider delays	{ materials	training period
	{ bldg	start-up period
	{ services	

c analyse options lease, on temp. basis, or sub-contract

d decide any alternates & usefulness of each

e discard all undesirable, or possible later value (hold)

Where

4.a best location to suit the project

b consider, build or lease VS: land area & cost

c location to indigenous service, electric power, water road, rail, port, labor, communications

d evaluate "b & c" as desirable, most-least or undesirable

e indigenous advantages of materials - labor skills - , schools universities - laboratories, tax holidays

Finance

5. The how - What money - which machinery

a who supports finances

b how much is needed

c can owners meet costs

d are banks willing to loan

e must shareholders be found

f are interest rates acceptable

g are interest costs fluid, viable for the project needs & timing

h what other options are available. Partners - mergers

## 6. Land & Buildings cost (or lease)

a area needed - cost/m<sup>2</sup>

b type building and cost/m<sup>2</sup>

c analyse all costs for needed services power - heat - cooling - water supply  
& sufficient reserves

d road(s) connections, Vehicles

e horse power needs - consider maximum (5 yrs) wire costs, size, transformers,  
lights.

## 7. Machinery & equipment

a which type, size, manufacturer

b get quotations & production capacity

c how many machines needed to satisfy production demands - now, next year -  
5 years

d necessary tooling - fixtures

specials - initial cost & tool life, & gaging - maintenance - replacement

e amortization rate - chart ref.  
machines & tools

f what service connections

power - light - water - waste oils - coolants - chips

g quality control & measuring tools

h patterns - molds - dies - templets

i pumps - chemicals - tanks, etc. - paints

j compute totals & estimate rate of amortized life

8. Man power

a total labor force prod. - management

b skills - non skills

c rates per class, hourly costs

d social benefits

9. Liabilities

a taxes - market diversification & promotion

b sales

c loss - period for profit

d human error & mechanical failure, allowance

e insurance, property & liability

IAPMEI

10. Problems in internal organization

- a. Define objectives carefully
- b. make schedules
- c. insist on timing effort with dates for completion
- d. communicate complete instructions & initiate training as needed
- e. trouble-shoot failures
- f. make changes only when beneficial
- g. most up-to-date information, very essential

11. IAPMEI - new enterprize projects

- a. committee 3<sup>to</sup> 5 

mgnt.
econ.
tech.
- b. review for sufficient data
- c. insist on full disclosure of necessary information
- d. analyse in detail & recommend any desired changes for cost benefits
- e. review estimates to advise changes
- f. consider labor intensive options, if quality & cost are not sacrificed
- g. set a date for final analysis & decision with the entrepreneur

12. Staff for pre-feasibility studies

- a. management (1) (machine-shop)
- b. engineer(s) (2-ME) (1) tool & die  
(1) production  
(1) electrical  
(1) civil  
(1) chemical
- c. economist (2) industrial  
(2) markets  
(1) industrial finance
- d. industrial analyst (1) shop background
- e. industry specialist (1) process industries
- f. statistical researcher (2)
- g. other disciplines (?) food-minerals-wood-leather

13. Serving new enterprises

- a. set up mailing list
- b. provide news letter (technical periodical)
- c. solicit specific advertising beneficial to tool & machine shops  
(helps defray costs)
- d. ask for technical problem feedback

- e. offer a limited service for metals prices & local sources for tools
- f. work toward offering a limited consultancy to the new enterprizes  
managerial - design - engineering - markets economics - finance

14. Clues for investment areas, with labor priority

- a. agricultural implements, (small hand tractors) & accessories
- b. food processing implements (new designs for export potencial)
- c. embassy's publish export figures of types of equipment

Lloyds Bank Ltd

U.S. Embassy figures &

U.S. Dept. of Commerce

France-Spain, WG, Italian Emb.

Note: the Lloyds Bank (1978), reports best opportunities, (for UK) are high tech. plant & equip. also agriculture.

Most dramatic increase was iron & steel + 232% (esc.) fruits & veg. ware + 86%.

Suggest review of 1978 report (has been requested)

- d. Suggest IAPMEI lookat areas for agriculture tools & service industry equip.  
near SINES project population increase will be rapid & demands high,  
prefeasibility studies NOW essential

15. Pre-feasibility study for small scale forge shop.

- a. data needed or specific products

- b. must research volume <sup>national</sup> import

1. hand tools

2. agri. tools



3. auto, motorcycle assembly items  
axels - gears - universal joints

4. dinner ware (new design needed) reduce weights

- c. survey present forge shops, learn practices & quality of work, technology & productivity
- d. establish possible materials (castings, etc.) for substitution & alternate methods (suggest use of consultant) (4-6 months)
- e. learn tooling needs & ability to provide
- f. study all options available & consider pit-falls errors, dangers, costs, profit, (loss) & period of red ink
- g. prepare document of costs & all findings, land, machinery services, etc.
- h. obtain sponsor(s)

16. Pre-feasibility study on heat treat shop

- a. survey (50) workshops to learn details of problems & complaints, costs, time, quality & types of alloys
- b. survey (5) heat treat shops, (steel supply centers) for practise in heat-treat service, learn their costs, capacity, capabilities & ability to supply job-certified guarantees on completion & shipment
- c. compile data to analyse, costs, equipment, quality of work supplied, technology provided, VS technology & quality needed

- d. study area needs for most useful locations
- e. estimate capacity needed for types of heat treatment required, furnace sizes, variety of furnaces most essential
- f. request cost & delivery quotations for all equipment, (local & imports)
- g. compute all costs - land, buildings, plant, power, materials, man-power & services. Taxes interest, profit, (loss), & period to amortize assets & balance for profit
- h. prepare document of all findings, show cost data for quotes, estimates, (or guess-timates)  
(suggest use of consultant, 4 months)

17. The Plasma process

- a. adequate preparation needed
- b. consists of roughing surface for spray process-turn, mill,blast with sand-steel shot - abrasives
- c. metal spray consists of wire coil or powders, dispersed by ionization (ion-gun) electrically charged & applied to blasted surface
- d. material compositions are pre-determined for wire or powder application
- e. Tungsten - Tantalum - Titanium Barium - Cobalt, or mixtures of these elements
- f. materials assure hard surfacing of tools, dies, gages.  
Forging dies, wear strips, etc.

g. similar useful application is cobalt alloy weld, used on forging dies, form & deep draw dies, wear resistant surfacing

h. use is for valve seats, (H. Press) steam-chemicals-abrasives-jigs-fixtures-  
-value seats & valve discs, auto-trucks-diesels

INDUSTRY CHECK-LIST FOR PRE-FEASIBILITY ANALYSIS

Name of sponcor \_\_\_\_\_

Adress \_\_\_\_\_

Phone \_\_\_\_\_

Product (s) desired \_\_\_\_\_

Similar products \_\_\_\_\_

Where \_\_\_\_\_

Portuguese (new)

Expansion

Joint Venture (new)

Expansion

Organization structure, explain details \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Is there a Market? \_\_\_\_\_

Local % \_\_\_\_\_

Export% \_\_\_\_\_

What competition?

Local % \_\_\_\_\_

National% \_\_\_\_\_

What Indiginous Conditions are favorably located?

Labor \_\_\_\_\_

Building \_\_\_\_\_

Power \_\_\_\_\_

Transport \_\_\_\_\_

Road

Rail

Port \_\_\_\_\_

Services \_\_\_\_\_

What are unfavorable conditions for the project(s) success?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PROJECT

What will it do? \_\_\_\_\_

Size area, land \_\_\_\_\_ m<sup>2</sup>

Building floor(s) \_\_\_\_\_

Floor area = \_\_\_\_\_ m<sup>2</sup>

Location, City \_\_\_\_\_

Rural \_\_\_\_\_

Electric power, KWh \_\_\_\_\_

Available \_\_\_\_\_ Not \_\_\_\_\_

Total personnel \_\_\_\_\_

Mgmt. \_\_\_\_\_ Tech \_\_\_\_\_ Mktg. \_\_\_\_\_

Labor \_\_\_\_\_

Local \_\_\_\_\_ Transit \_\_\_\_\_

Available rights of way \_\_\_\_\_

Road \_\_\_\_\_ Rail \_\_\_\_\_

Port \_\_\_\_\_

National \_\_\_\_\_

Materials local \_\_\_\_\_

National import \_\_\_\_\_

List of materials needed yearly \_\_\_\_\_

FUNDING

Total funds required \_\_\_\_\_

Year - 1, \_\_\_\_\_ 2, \_\_\_\_\_ 3, \_\_\_\_\_ 4, \_\_\_\_\_ 5, \_\_\_\_\_

Amount paid in \_\_\_\_\_

Number shares \_\_\_\_\_

" shareholders \_\_\_\_\_

Loans needed \_\_\_\_\_

Interest rate (short) \_\_\_\_\_ % (long) \_\_\_\_\_ %

Operating capital required \_\_\_\_\_ (month)

Year - 1, \_\_\_\_\_ 2, \_\_\_\_\_, 3 \_\_\_\_\_, 4 \_\_\_\_\_, 5 \_\_\_\_\_

Letters of credit needed \_\_\_\_\_

SUPPORTING INFORMATION

Explain history & present status of project

\_\_\_\_\_

Plans this year \_\_\_\_\_

\_\_\_\_\_

Schedule for legal entity \_\_\_\_\_

\_\_\_\_\_

Schedule for construction \_\_\_\_\_

\_\_\_\_\_

Schedule for production \_\_\_\_\_

\_\_\_\_\_

Orders on hand \_\_\_\_\_

\_\_\_\_\_

Orders pending \_\_\_\_\_

\_\_\_\_\_

RATE PER HOUR TO FULLY AMORTIZE

\$1 - 46\$00  
(US) (Escudos)

Base = 2000/hrs/year at 5 year machine life = 33 1/3% utilization (1 Shift)

PURCHASE COST or VALUE	HOURS = 10 000	HOURS = 20 000	HOURS = 30 000
	SHIFT - 1 - Per (8) hour	SHIFT - 2 - Per (16) hour	SHIFT - 3 - Per (24) hour
\$1000	.10	.05	.0333
46 000\$00	4.60	2.30	1.533
\$2000	.20	.10	.0666
92 000\$00	9.20	4.60	3.066
\$3000	.30	.15	.10
138 000\$00	13.80	6.90	4.60
\$4000	.40	.20	.1333
184 000\$00	18.40	9.20	6.133
\$5000	.50	.25	.1667
230 000\$00	23.00	12.50	7.667
\$6000	.60	.30	.20
276 000\$00	27.60	13.80	9.20
\$7000	.70	.35	.2333
322 000\$00	32.70	16.10	10.733
\$8000	.80	.40	.2667
368 000\$00	36.80	18.40	12.267
\$9000	.90	.45	.30
414 000\$00	41.40	20.70	13.80
\$10000	1.00	.50	.3333
460 000\$00	46.00	23.00	15.333
\$100000	10.00	5.00	3.333
4 600 000\$00	460.00	230.00	153.333

NOTE: Most machines, (tools, etc.) deteriorate by lack of full utilization. Therefore it is desirable, as well most economical, to utilize at the full rate of hours available each day.

