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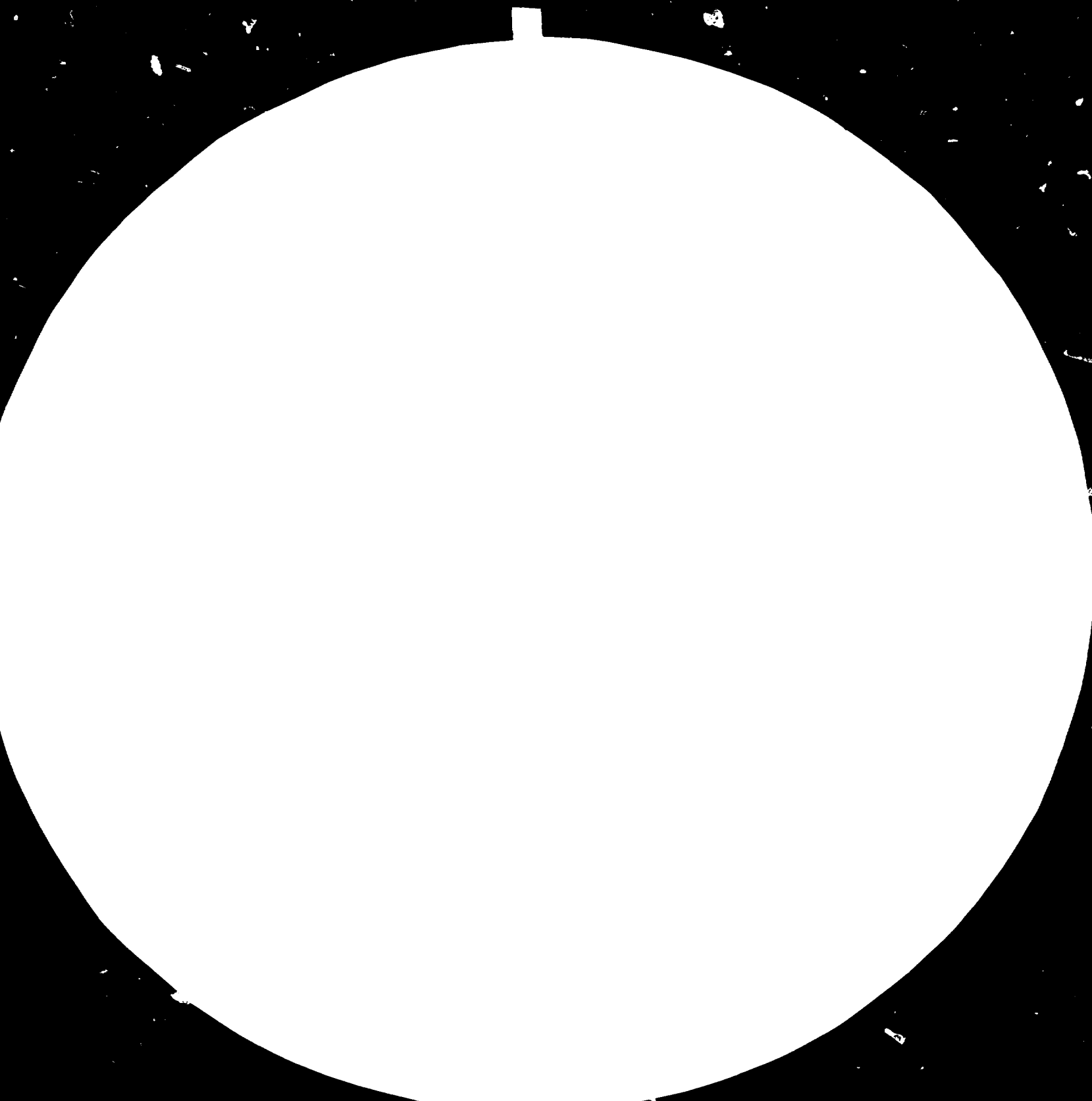
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PDR. Yemen.

TERMINAL REPORT ON THE PROJECT

ON

INDUSTRIAL ENGINEERING

IN

THE PEOPLES' DEMOCRATIC REPUBLIC OF YEMEN

(PROJECT DP/PDY/81/006)

BY

H.S. DWARAKANATH

UNIDO EXPERT

OCTOBER, 1984

This report has not been cleared with the UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION, which does not, therefore, necessarily share the views presented.

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U.N.I.D.O.

TERMINAL REPORT ON THE UNIDO PROJECT ON
INDUSTRIAL ENGINEERING
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(i)

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TERMINAL REPORT ON THE UNIDO PROJECT ON

INDUSTRIAL ENGINEERING

IN THE PEOPLES DEMOCRATIC REPUBLIC OF YEMEN

I. INTRODUCTION:

A six month Project was carried out in two Phases - the I Phase during Feb. - May '84 and the II Phase during Jul - Oct. '84 - in the People's Democratic Republic of Yemen. The activities and outputs during this projects, the extent of achievement of the objectives of the project, and the experts' recommendations with regard to the future course of action, are given in the following pages. The detailed report on the Industrial Engineering and Productivity Survey in the National Cigarette and Match Industries Co. Ltd., Aden, and the report on the General Diagnostic Study in the Leather Manufacturing Cooperative, Aden, are enclosed. The detailed report on the stud' in the Public Corporation for Carpentry was sent at the end of the I Phase in May '84.

This is the third project carried out by this expert in PDRY. During his first visit in '81, studies were conducted in the Martyr's Garment Factory, The Aden Emulsion & Paints Co. Ltd., and the Public Sector Flour Mill, all in Aden. During the second visit in '82, detailed studies were conducted in the Aden Textile Mills. During third visit in '84, detailed studies were conducted in the Public

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Corporation For Carpentry, Aden, and the National Cigarette & Match Industries Co. Ltd., Aden. Besides this, A General Diagnostic Study was conducted in the Leather Cooperative, Aden.

In addition during this current project, follow-up visits were made to the Aden Textile Mills, Aden Paints & Emulsion Co. Ltd., the Matfy's Garment Factory to observe the extent of implementation of the recommendations made by this expert. after his studies in these organisations and also to find out whether these organisations needed any further clarifications regarding the recommendations. Full assistance and guidance were given to the Public Corporation for Carpentry, Aden, to implement the recommendations made by this expert.

The Aden Textile Mills, which has implemented many of the recommendations made by this expert has achieved spectacular results. From a heavily losing organisation (the loss was YD.400,000 or US\$.1,200,000 in '81 and YD.250,000 or US\$.750,000 in '82) the textile mill was able to break-even in '83 and is expected to make a profit of YD.200,000 or US\$.600,000 in '84.

The study in the Public Corporation for Carpentry has shown that it is possible to raise the level of Productivity by around 150 percent. The corporation which has implemented many of the recommendations, with the assistance and guidance of this expert, has already started showing results. During the month of August '84, against the plan target for

the value of Production of YL.45,000, it was able to achieve a value of Production of YD.56,000/-, an increase of nearly 25 Percent. During the discussions, the management expressed its confidence to achieve still better results in the coming months.

The detailed study in the National Cigarette & Match Industries has shown the scope to increase the value of Production by nearly 100%, yielding YD.700,000 (US\$.2,100,000) profit. In addition, there would be a saving of around YD.310,000 (US\$.1,230,000) per year. The Match factory which has been losing heavily, will start earning profit.

The General Diagnostic Study in the Leather Manufacturing Cooperative Aden, has shown that it is possible to raise the level of productivity by around 100% and increase the profit margin by around 10%.

During the project, the two counterparts attached to this expert were given further training in the application of Industrial Engineering Techniques.

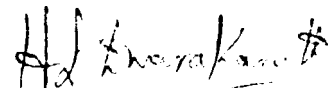
The author would like to take this opportunity to express his deep sense of gratitude to the Government of PDR Yemen in general and in particular, His Excellency Mr. Othman Abdul Jabbar, Deputy Minister of Industries, Mr. Abdul Rehman Daiban, Asstt. Dy. Minister, Mr. Fadal Nassar, Mr. Basabrain, Mr. Taha Shakir, Asstt. Dy. Ministers for all the facilities provided and guidance given; UNIDO Vienna for giving an opportunity to work in this project; Mr. S. Nanjundan, Dy. Director, Mr. Karlik, IDO UNIDC Vienna and all their colleagues for their help, guidance and

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encouragement; Mr. Wannop and all his colleagues in UNDP, Aden for all their help; Mr. Qasim, General Manager and Mr. Abdul Rahman, Deputy General Manager and all their colleagues in the Public Corporation for Carpentry for their whole hearted cooperation and help; Mr. Abdul Gabar General Manager, Mr. Hasson Saggaf, Dy. General Manager - Manufacturing Mr. Abdul Razak, Dy. General Manager, Finance & Administration and all their colleagues in the National Cigarette & Match Industries, Co. Ltd for their excellent help and whole hearted cooperation, Mr. Shahab, General Managers, Leather Manufacturing Cooperative and his colleagues for their help; Mr. Eduardo Vega Bayon, Project Manager, for his guidance and help; Mr. Mohamed Yehya Nasher, Mr. Ahmed Salem, & Mr. Mohamed Obaidi counterparts, for their excellent cooperation and help; Ms. Roshan Alimulla for typing this and the Technical report in an excellent way.

It is mainly because of all the above people, the project could be smoothly and successfully completed.

The expert wishes the Govt. of PDRY all success in it's effort to raise the level of overall productivity.



H.S. Dwarakanath

UNIDO Expert

PROJECT DF/PDY/81/006

II. OBJECTIVES OF PROJECT:

- A. Provide Industrial Engineering Consultancy Services (under Direct Assistance) to the Industrial undertakings selected by the Ministry of Industries, Govt. of P.D.R.Y. as follows;-
- 1) Study and critical examination of the present methods and practices.
 - 2) Suggest better methods and procedures of working which will raise the level of overall productivity, quality and safety.
 - 3) Analysis of capacity utilisation and assessment.
 - 4) Establishment of suitable production norms and performance standards,
 - 5) Design of suitable systems of payment based on productivity.
 - 6) Analyse and suggest suitable materials flow.
 - 7) Organisation analysis.
- B. Training - of counterparts in the above areas.
- C. Conducting training programme for the benefit of plant personnel.

The total duration of the project was 6 months - split into two missions of 3 months each.

III. ACTIVITIES AND OUT-PUTS OF THE PROJECT:

A. FOLLOW-UP WORK

Follow-up visits were made to the following factories to find out:

- i) the extent to which the recommendations made earlier by this expert have been implemented.
- ii) what further clarifications these factories need to implement the remaining recommendations.
- iii) other areas which need to be studied.

The findings during the follow-up visits and the discussions held with the respective management, are given below:

1. MARTYRS' GARMENT FACTORY, ADEN

The study was conducted in 1981 and the factory has implemented the recommendations in the following areas.

- a) Methods improvement
- b) Shop layout improvement
- c) Skill-based allocation of jobs / operations
- d) Working conditions and environment
- e) Line balancing
- f) Productivity based wage structure.

During the discussions, the General Manager expressed the difficulty he is facing in marketing. The General Manager has been advised to consider the following;

- 1) Entering into labour contract with the Defence Ministry for stitching of Military uniforms, made out of the cloth supplied by the Defence Ministry. This is expected to take care of around 50% of the available capacity.
- 2) Stitching and supply of School Uniforms - which is substantial.
- 3) Diversification in-to general mens' and womens' clothing.

2. ADEN EMULSION AND PAINTS CO. LTD.

The study was conducted in '81 and this company has implemented the recommendations in the following areas;

- a) Can Manufacturing
- b) Production and Packing of Paints.
- c) Raw Materials and Finished goods storage and Handling.
- d) Elimination of bottlenecks in Production
- e) Improved methods of weighing and packing.
- f) Effectiveness of supervision.

The company has eliminated the import of cans and has been able to achieve the Plan targets well. The management expressed that the result of implementation of the recommendation are very satisfactory.

3. ADEN TEXTILE MILLS

The study was conducted during Oct. - Dec. 1982. During the early part of '83 itself, the management team headed by Mr. Abdul Alim, General Manager, had implemented many of the recommendations made by the expert. The benefits achieved during '83 by the Mills as a result of the implementation of the recommendations, are as follows;

- a) Spinning department productivity increased by 42%. The production increased from 330,120 kg. to 469,200kg during '83.
- b) Production in the weaving department increased from 2,382,222 meters to 3,242,179 meters in '83, showing an improvement of 36.1% in the weaving productivity.
- c) There has been a saving (in the cost) of YD.0.379⁺ per kg. of of 34's yarn produced in the spinning department.
- d) There has been a saving (in the cost) of YD.0.101 per meter of cloth produced in the weaving department.
- e) There has been a saving (in the cost) of YD.0.028 per meter of cloth processed in the Finishing Department.
- f) Extra output and sales during '83 was YD.315,770/- (or US\$947,310) over and above the plan target.
- g) The company which had lost YD.400,000 (US\$1,200,000) during '81, and YD.250,000 (US\$.750,000) during '82, was in a position to break-even during '83 and is expected to earn a profit of YD.200,000 (US\$600,000) during '84.

+ 1 US\$ = YD.0.343.

Mr. Lubor Karlik, Industrial Development Officer, Factory Establishment and Management Section, Division of Industrial Operations, UNIDO Vienna, visited the Aden Textile Mills in February, 1984 and has mentioned in his report, about the improvements in Productivity and the benefits that has resulted, in the Aden Textile Mills.

B. STUDIES CONDUCTED DURING 1984

1. Productivity Survey in the Public Corporation For Carpentry.

An Industrial Engineering Study And Productivity Survey was conducted in the Public Corporation for Carpentry, Aden. This organisation has 280 employees, on it's rools, and had a sales of YD.550,000 (US\$1,650,000). The study indicated considerable scope for improvement in the following areas

- a) Methods Improvements.
- b) Plant Layout and Materials Handling.
- c) Utilisation of resources - Men, Machines and Materials.
- d) Quality.
- e) Organisation.
- f) Reduction in the overall cost of production.
- g) Increasing the value of Production by 100% with no additional major capital expenditure.

An appropriate Productivity Based Incentive Scheme has been designed for the entire organisation.

A suitable Management Information System has also been recommended.

The benefits that are expected as a result of the implementation of all the recommendations made by this expert, ^{are} as follows;-

- a) A saving of approximately YD.100,600 ^{or} (US\$301,800) per annum due to reduction in the cost of production.
- b) A saving of approximately YD.22,000 or (US\$66,000) per annum in the cost of materials due to better materials utilisation.
- c) A saving in the Employee Related Expenses of approximately YD.52,000 or (US\$156,000) per annum.
- d) Increase in the Productivity per man year from the present level of YD.1954 or (US\$5862) per man year to YD.5000 or (US\$15,000) i.e., by around 160% within the next few years and with no major capital investment.
- e) Increase in the value of Production from the present level of YD.550,000 or (US\$1,650,000) per annum with 280 employees to YD.1000,000 (or (US\$3,000,000) per annum with only 200 employees and with no major capital investment.

IMPLEMENTATION WORK DONE

The findings of the expert and his report were discussed in detail with the management and other concerned officers of the corporation. The management accepted the findings and recommendations of the expert and was keen to implement the recommendation. So, the expert and his counterpart Mr. Mohamed Yehya Nasher, assisted the corporation in implementing the

recommendations. The status regarding the implementation work is given below:

- a) Machine Shop - Most of the recommendations have been implemented. The machine shops are supplying finish machined components daily inspected, to a components stores, from where, the assembly sections draw their requirements of components. The practice of the assembly carpenters wasting their time in the machine shops has been eliminated. The unnecessary work of the carpenters in Sawing, Planing etc. of raw materials, which used be the practice earlier, has been minimised. Accurate records are being maintained for materials consumption in the machine shops and machined components consumption in the Assembly shops. Templates / Forms have been prepared and used. The strength has been reduced to 27. All operators are required to operate any machine where there is load. The practice of having one operator per machine, is discontinued.

- b) Production Planning - Systematic Production planning and control has been started. The Production planning and control section headed by a Senior Supervisor who coordinates among all the concerned departments and sections. The machine shops follow weekly plans while the assembly sections follow monthly plans. Daily and weekly production reports are being collected and reviewed. The materials movement is much better and the wastage of time of assembly carpenters waiting for materials, is reduced to the absolute minimum.

- c) Detailed dimensioned drawings and List of Parts have been prepared for all the commonly produced furniture. Many of the defects ^{in design} which were found during the preparation of the drawings, have been corrected. These drawings have been supplied to the Machine shops, Assembly shops and the Inspection Section. A Supervisor is now permanently looking after the "Design And Development" Section.
- d) The layout of the assembly sections - particularly the Furniture side - has been revised as per the recommendations. The implementation of the recommendation regarding the Machine Shop layout is under progress. And so is the case with Painting and Varnishing Section. The House Keeping has improved considerably.
- e) A beginning has been made in introducing Inspection and Quality Control. A senior shop supervisor is in charge of Inspection. According to the Head, Marketing, there has been a definite improvement in the quality of products as compared to earlier times, though there is still scope for improving the quality. Inspection tags / certificates have been introduced.
- f) Most of the recommendations made regarding the Methods Improvement in the Furniture assembly sections, have been implemented with good results.
- For example, the carpenters who used to take 8 - 10 days for a Sitting Room Set, now complete it within 2 to 3 days.

- g) The modified organisation recommended, is under implementation
- h) The proposed "Productivity Based Wages" has been discussed at all levels, and has been accepted. The management is in the process of completing the necessary formalities before introduction of the system.

The recommendations on other areas of operation are in different stages of Implementation.

An implementation committee (consisting of the General Manager and his colleagues) has been set up to supervise and direct the implementation programme. They are assisted in this by the UNIDO Project Manager, This expert and the counterpart, Mr. Mohamed Yehya Nasher.

The performance of August '84, shows that the results of implementation have already begun. Against a plan target of YD.45,000 for August 84, The Corporation was able to achieve a value of production of YD.56,000, i.e., an increase of nearly 25 percent.

2. Productivity Survey In The National Cigarette and Match Industries, Co. Ltd., Aden

The Industrial Engineering Study and Productivity Survey in the above Company has shown scope for improvement in the following areas.

- a) Utilisation of Machines, Man and Materials.

- b) Quality
- c) Waste Reduction
- d) Capacity utilisation
- e) Maintenance
- f) Organisation
- g) Plant Layout and Materials Handling
- h) Management Information System.

In addition, an appropriate Productivity Based Incentive ^{scheme} has been designed for all the categories of employees.

The findings during the study and the recommendations were discussed in detail with the Management, and the management has accepted the recommendations. The management of the company is very keen to implement all the recommendations.

Implementation of all the recommendations made is expected to result in:

- 1) An Additional Sales Income of YD.3,864,512 per year or (US\$11,593,536 per year) in the sale of cigarettes.
- 2) An Additional Profit of YD.703,341 or (US\$2,110,023) per year in cigarettes,
- 3) A total Savings of YD.271,047 or (US\$813,141) per year in the cigarette factory,
- 4) An Additional Sales Income of YD.266,944 or (US\$800,832) per year in the sale of matches,

- 5) A Saving of YD.40,000 or (US\$120,000) per year in the Match Factory, and,
- 6) The Match Factory will start Earning Profit.

- 3) General Diagnostic Study in the Leather Manufacturing Cooperative Aden.

The Diagnostic Study in the Leather Cooperative, which manufactures Shoes, Bags and undertakes upholstering of Furniture, and cars and other vehicles, has shown considerable scope for improvement in the following areas;

- a) Plant Layout and Materials Handling
- b) Utilisation of Men and Materials
- c) Methods Improvement
- d) Production Planning and Control
- e) Quality

Broad recommendations have been made after the implementation of which further detailed studies can be conducted.

Implementation of the recommendations made is expected to result in;

- 1) An Increase in the Sales Income by over 100% by over YD.300,000 or (US\$900,000) per year.
- 2) An Additional Profit of around YD.45,000 or (US\$135,000) per year.
- 3) Better Servicing of customers.

All the above benefits can be achieved without any major capital Investment.

C1. TRAINING OF PERSONNEL

1. Two Engineers were attached to this expert as local counterparts. In addition, one Engineer also worked with him in the Leather Cooperative. These counterparts were given detailed explanations regarding some of the major Industrial Engineering techniques.

During the detailed Industrial Engineering and Productivity Survey at every stage practical applications of Industrial Engineering techniques were demonstrated. The counterparts were made to conduct studies and investigations under the direction and guidance of the expert.

2. The Supervisory personnel in the Public Corporation for Carpentry, Aden, were exposed to a one-week part time programme on Productivity Supervisors' Duties and Responsibilities, and other related matters. They were given a detailed explanation as to how they can improve the performance of the corporation.

This programme was conducted in Arabic language by the counterpart Mr. Mohammed Yehya Nasher, under the guidance of the expert. This programme helped considerably, the smooth implementation of the recommendations made by this expert.

- 3) Two counterparts from the cigarette factory were associated during the study in the Cigarette and Match Factories.
- 4) A short term programme was planned for the Top Management Personnel on "Industrial Diagnosis" - using the case discussion method. Suitable and simple cases were prepared for discussions during the programme, which was to have been held in September '84. However as the Ministry officials felt that beginning of next year would be a better period when all the top management personnel would be available and free to attend, this programme has been postponed.

IV. ACHIEVEMENT OF PROJECT OBJECTIVES

- 1) Under the Direct Assistance Scheme, Detailed Industrial Engineering studies were conducted in 2 of the major manufacturing organisations in Aden and a General Diagnostic Study was conducted in a third company. Assistance and guidance were given to implement the recommendations made, in the Public Corporation for Carpentry. These have further demonstrated usefulness of Industrial Engineering Techniques in raising the overall level of Productivity in the manufacturing organisations.
- 2) Appropriate Productivity Based Wages have been designed for two more organisations, and these have been accepted by the respective managements.

- 3) Detailed Organisation Analysis were done in two of the major manufacturing organisations and recommendations were made which have been accepted.
- 4) Appropriate Management Information Systems, which are essential for planning and control, have been suggested to the Cigarette Factory and the Furniture manufacturing factory (carpentry corporation).
- 5) Norms for Production and for Performance Measurement have been scientifically established for the Carpentry Corporation and the Cigarette and Match Industries.
- 6) The counterparts attached to the expert have been given further training in Industrial Engineering.
- 7) Because of the results shown in the factories studied so far, more and more people are keen to implement Industrial Engineering Techniques, which is a very healthy and encouraging trend.

V. ACTIONS RECOMMENDED FOR THE FUTURE

The Govt. of PDRY has laid great emphasis on the following points in its policy of Industrial Development.

- 1) Optimum utilisation of Installed capacity.
- 2) Maximising the value Added in the Industrial Sector.
- 3) Broadening the Technological Base.
- 4) Improving the technological self-reliance.

Objectives (1) and (2) above can be achieved through optimum productivity in the utilisation of various resources, viz., Men, Materials, Plant and Machinery and capital. Optimum Productivity can be achieved through application of Industrial Engineering Techniques. This fact has been amply demonstrated by the studies and the implementation work done so far, by this expert in some of the industrial undertakings in Aden. Higher Productivity results in real and satisfactory growth.

Towards this end, the following actions are recommended.

A. Direct Assistance Through Consultancy Services

- i) In-depth Productivity studies have to be conducted in all the remaining manufacturing organisations to analyse the factors affecting their productivity and to suggest ways and means to raise their level of productivity.
- ii) Assistance and guidance should be given to implement the recommendations made. This is essential to achieve the desired results.

B. Productivity Cell

A recommendation was made in the Terminal Report of this expert in 1963 on this subject. A Performance Efficiency Unit has been established in the Ministry of Industries. This Unit consists of 9 persons in all -

4 Engineers and 5 non-technical persons.

As the expert feels that the idea has not been fully implemented, the recommendations made regarding this in '83 are reproduced again for the consideration of the government.

This Productivity cell or P.E.U. should have at least 15 qualified engineers. These engineers should be thoroughly trained in the application of Industrial Engineering Techniques. This cell / unit will consist of:

A. The consultancy wing - which will Provide Industrial Engineering and other related consultancy services to all the sectors.

B. The Training wing which will look after in-company, inter company, in-country and international training in Industrial Engineering and other related techniques.

After full establishment, this Productivity cell / Performance Efficiency Unit, will be responsible for;

- i) Assisting in improving, achieving and maintaining a high level of Productivity in all the sectors,
- ii) Assessment of Manpower requirement in different sectors/organisations.
- iii) Training and Development of Manpower in Productivity Techniques.
- iv) Setting of Performance standards on scientific basis and evaluating the performance.

- v) Establishment of Productivity based wage structure in all the remaining and new establishments!
- vi) Assist in Scrutiny, Assessment and Evaluation of new Capital investments sought for,
- vii) Capacity planning and utilisation at the Macro level.
- viii) Feed back on the performances of the various sectors and initiating prompt corrective action, wherever required.

It is again emphasised that the cell / unit may be provided with adequate number of qualified persons and it starts rendering service in the above mentioned areas under the guidance of UNIDO Experts.

C. TRAINING AND DEVELOPMENT

Maintenance of a high level of Productivity requires continuous efforts and this effort has to come from "within". Here again, the expert wishes to repeat the recommendations made by him nearly 2 years back.

- a) A minimum of 15 qualified engineers should be given intensive training in the application of Industrial Engineering techniques. Mere theoretical or classroom training will not be adequate. They should be made to apply the techniques in practice, in the Industrial undertakings in PDRY. So far, only 4 Engineers have been provided to the UNIDO team as counterparts. (Two of them have gone abroad for training). This number is too inadequate to be effective. Unless a batch of 15 - 20 Engineers are recruited and trained under the

guidance of UNIDO Experts, it will be difficult to sustain the tempo that has been built.

- b) All the top, Senior and Middle level Managerial personnel should be exposed to the application of Industrial Engineering Techniques
- c) Training of Supervisors and workers representatives in Arabic language will help to a good extent the Propagation of Productivity Techniques. This will also pave the way for easy implementation of the Productivity techniques.
- d) One of the areas which need to be attended to early, is the training of skilled workers in their respective trades. For example, many of the carpenters in the Furniture manufacturing organisation are not properly trained. This has affected their productivity. Proper "on the Job Training" is essential to raise the level of worker Productivity.

D. QUALITY

As the Industrial output increases, it becomes necessary to enter into export market. The competition in the international market is severe. Care should be taken to see that not only the price of the products produced are competitive, but the quality is also good. Then only, it will be possible to get a good share in the international market and retain it. Both Productivity and quality are essential to achieve and maintain prosperity. People at all levels should be quality conscious.

E. MOTIVATION

Some form of motivation is necessary to get the best out of people. Properly designed productivity based wages will go a long way in motivating people. Motivation can also be non-financial - like public recognition.

F. Each manufacturing organisation should develop its own Industrial Engineering / Productivity services department, consisting of qualified and experienced Industrial Engineers. This will help to a great extent in achieving and maintaining a high level of productivity. The presence of UNIDO experts may be made use of to establish such Industrial Engineering departments in different organisations.

G. Other outside areas which affect Industrial Productivity directly or indirectly, should also be improved to achieve high overall productivity. For example, the transport system. Because of the inadequacy of the Public Transport system, many employees reach late for work or leave early. This precious production time is lost.

H. There should be a proper Management Information System - both at organisational level and at the Ministry level. Suitable M.I.S. have been recommended to two of the major organisations studied this year.

An appropriate Management Information System will not only help in identifying various factors that influence the operational and financial performance of an organisation, but will also help in taking timely corrective action wherever necessary. Besides these, it will help in planning on a sound basis.

Thus, it can be concluded that considerable amount of work remains to be done. As the Govt. of PDRY is keen to raise the level of Industrial Productivity, with the continued assistance of UNIDO, this expert is confident that the main objectives of the UNIDO Project in PDRY would be achieved.

