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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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STRENGTHENING THE TECHNICAL AND MANAGERIAL CAPACITIES OF THE CARPENTRY COOPERATIVES IN MUKALLA AND SEIYUN

SM/YEM/92/035*

THE REPUBLIC OF YEMEN

Technical report: Introduction of production planning and improvement of production methods.**

Prepared for the Government of the Republic of Yemen
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of: Radmilo Malis,
Expert in Furniture and Joinery Production

Backstopping officer: Antoine V. Bassili
Agro-based Industries Branch

United Nations Industrial Development Organization
Vienna

* Previously SM/PDY/87/005.
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EXPLANATORY NOTES

- A full stop (.) is used to indicate decimals.

- A comma (,) is used to distinguish thousands and millions.

- Reference to dollar ($) is to United States dollars, unless otherwise stated.

- The monetary unit of the Republic of Yemen is the Yemeni Dinar (YD) and Rial (R). During the period covered by this report the official exchange rates were: US$ 1 = 0.461 Yemeni Dinar and 12 Rials, and 26 Rials to 1 Yemeni Dinar.

- The contraction CSCC has been used for the Coastal Strip Carpentry Cooperative in Mukalla and CC Seiyun for the Carpentry Cooperative in Seiyun.

- The Government body responsible for this project is the Ministry of Industry's Office in Mukalla, and the General Director of this office, Mr. Omar Badufary is the project's National Director.

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ABSTRACT

The Furniture and Joinery Production Expert's third mission to the Carpentry Cooperatives in Mukalla and Seiyun was carried out from 15 September to 15 December 1991.

Acting as the Project's Chief Technical Adviser, the expert worked closely with the counterpart staff and carried out the activities foreseen in the project's work plan.

The expert's work focused on implementing the production planning system, the improved workshop layouts, and improving the production methods. Considerable time has been devoted to the preparation of training manuals and to conduct training courses for machine operators and the counterpart staff.

The expert assisted the counterparts in installing and ensuring the proper use of the recently acquired woodworking and tool maintenance machines. New jigs and work benches have been constructed and are being used.

The correction of one workshop layout and the design of a dust extraction system for the new workshop in Seiyun has been done.

The project progress evaluation report has been prepared and submitted to UNDP Sana'a and UNIDO. The project's progress is deemed to be satisfactory.

I. INTRODUCTION

The UNIDO project SM/PDY/87/007 (renumbered in 1992 to SM/YEM/92/035), entitled "Strengthening the Technical and Managerial Capacities of the Carpentry Cooperatives in Mukalla and Seiyun", has been created to facilitate the transition of furniture and joinery manufacture in the cooperatives from a handicraft stage to more efficient industrial production methods.

The project document was signed by the Government of the People's Democratic Republic of Yemen, the United Nations Development Programme (UNDP) and the United Nations Industrial Development Organization (UNIDO) as executing agency, on 10 April 1989.

The Government agency coordinating the project is the Ministry of Industry, and the General Director of the Mukalla Office, Mr. Omar Badufary is, at present, the National Director of the project.

The furniture and joinery production expert, assigned to the project as its Chief Technical Adviser, undertook his third three month mission from 15 September to 15 December 1991.

According to the project document, the project's immediate objectives are:

(a) To introduce suitable management systems, techniques and methods to develop self-sustaining management capacities capable of formulating and updating simple marketing plans, cost analysis and cost accounting, applying new concepts of production planning, organization, quality and stock control to the Cooperatives and importing raw materials at the lowest possible cost.

(2) To introduce new technologies and techniques and train the technical cadres of the Carpentry Cooperatives in order to develop the human and technical capacities to independently introduce product and production improvements and innovations.

(3) To increase the labour productivity of the manual labourers of the Cooperatives, as well as their capacity to adapt to production improvements and innovations through training in basic woodworking skills, machine use and machine maintenance.

During this mission, the expert's work has been focused on the implementation of the production planning system, designed during his second mission, the implementation of improved layouts, the improvement of production methods and on training machine operators and staff in new, more efficient, production methods.

The dust extraction system for the new workshop in Seiyun has been designed.

Five training manuals have been prepared during this mission and training courses have been conducted separately in Seiyun and Mukalla.

Requisitions for the equipment to be purchased for the Cooperatives, from funds emanating from the counterpart cost sharing contribution to the project, have been issued and submitted to UNIDO for purchase.

Though the project site is in Mukalla, the expert has been requested to travel to Seiyun (two one-week trips), to Aden and to Sana'a.

2. BACKGROUND INFORMATION ON THE PROJECT

The first technical assistance to the woodworking sector in the People's Democratic Republic of Yemen was provided in 1978 through a review of the Aden Public Corporation for Carpentry. It was followed in 1981 by project PDY/81/006 "Training in Management and Efficiency Improvement in Industries". The survey team's findings indicated the urgent need for technical assistance to the Coastal Strip Carpentry Cooperative in Mukalla, Hadramawt Governorate, in order to consolidate the operation of its three production units. Thus, in 1983, during a three month mission, the blueprint for a central workshop in Mukalla was prepared, and the necessary technical assistance to implement the plan was advised on.

This project aims at following up on previous missions and providing necessary technical assistance to the Coastal Strip Carpentry Cooperative (CSCC) in Mukalla and the Carpentry Cooperative (CC) in Seiyun.

The CSCC in Mukalla was established in 1973 when 150 carpenters pooled their resources to form the Cooperative. The CC in Seiyun was established in the same way one year later.

These two Cooperatives operate in the Hadramawt Governorate. The CSCC has three production units located in Job Massa near Mukalla, Ghail Bawazer and Shahr. The CC Seiyun has four production units located in Seiyun, Tarim, Shibam, and Al Hawta.

With the exception of the Mukalla workshop located in Job Massa, the others are all small-scale production units maintaining typical artisanal manufacturing methods, and supplying their immediate surroundings with simple joinery and furniture production. Almost all items are produced on demand and according to the customers' specifications and designs. Production planning is totally dependent on the customers' orders on hand.

The CSCC in Mukalla has about 370 employees and the CC in Seiyun about 180 employees. The sales volume has not changed significantly during the last ten years, and currently, it ranges between US$ 8,000 and US$ 10,000 per year and per employee.

In general, both Cooperatives manufacture low quality products at high production costs. However, the products made in Mukalla are far better than those made in Seiyun. The low productivity and quality can be attributed mainly to poorly equipped workshops with old and worn-out machines, to inadequate design of products and to an extensive use of expensive raw materials.

The Cooperatives sell their products to local customers, rarely further than 25 km away, but they still cannot meet demand, and delivery times are extremely long.

The Republic of Yemen's present development strategy is focused on strengthening the industrial structure. It concentrates on increasing the utilization of existing production capacities through the rehabilitation of selected factories and on improving the production and managerial capacities in industrial enterprises. This project falls under these categories.

The original budget allotted to the project (from funds earmarked for Special Measures for Least Developed Countries) amounted to US$ 346,450, with an additional Government input (in kind) of YD 20,000.

The latest budget revision "E" dated 19 November 1991 shows a total amount of US$ 385,341 plus a Government cost sharing (Yemeni dinars converted to dollars by the UNDP) of US$ 61,945, and a Government input (in kind) of YD 43,589.

The project was planned for a duration of two years and aimed at changing the existing artisanal manufacturing process to an industrial production system. It was originally planned that the technical assistance be provided by three experts: a furniture and joinery production expert, a marketing consultant and a cost accounting consultant with a total duration of 18 man/months; and by two United Nations Volunteers: a wood processing engineer and a master carpenter, for a total of 48 man/months.

When the project started it was agreed between the parties involved in the project to replace the three-month marketing consultancy by a consultancy in the maintenance of woodworking tools of the same duration.

The project started in January 1990 when two UN Volunteers arrived in Yemen, and intensive work began in March 1990, when the Chief Technical Adviser and the Cost Accounting Consultant commenced their missions.

This was the third of four three-month missions for the Chief Technical Adviser. In the meantime, the Tool Maintenance Consultant completed his

mission, and the two-year contracts of the two UN Volunteers have also been completed.

It is expected that the project will be finished by the middle of 1992. Besides its late start, recently the Government took the decision to increase their cost sharing contribution for the purchase of new equipment for the project and this new equipment is just about to be ordered. Due to this, the last of the Chief Technical Adviser's missions will be undertaken during the second quarter of 1992, when newly purchased equipment should be delivered to the Cooperatives. It is indispensable that the expert assists the counterparts in their installation, and helpS in the introduction of the equipment into the production process. Taking into account delays caused by various factors, the accomplishments of the project are as laid out in the project's workplan.

3. FINDINGS

During the mission, covered by this report, the expert's work focused on the implementation of the improved workshop layouts, the introduction of the production planning system, the improvement of production methods and the training of machine operators. The findings that will be considered in this report refer mainly to these topics and activities. Some other observations will also be pointed out.

3.1 Workshop layouts

Improved workshop layouts for all three production units belonging to the CSCC Mukalla, and for the Central Workshop in Seiyun were designed during preceding missions. The counterparts, assisted by the UN volunteers, were supposed to recondition certain machines and place them in accordance with the new layouts. Unfortunately, due to insufficient maintenance capacities, lack of spare parts and some other obstacles, the machines were not reconditioned in time and the new layouts have not been implemented. Only four newly bought machines were placed, but not installed, in the workshop in Seiyun. Some of the machines bought for the project, and foreseen to be included in the new layouts, have not yet been delivered.

The realization of the new layouts, in the Mukalla and Seiyun workshops, are considered to be prerequisites for the further development of the project.

3.2 Production planning

A production planning system with all production documentation was designed during the expert's second mission in 1990. Also the production planning staff was trained and advised to apply the system on the existing products. The UN volunteers were requested to assist the counterparts in the implementation of the new production planning system. All that happened was that the CSCC Mukalla prepared forms for the production planning documentation. The people assigned to carry out production planning hesitated to start work without the expert's guidance.

Since the introduction of serial production depends on appropriate planning and production documentation this too was considered to be an urgent task.

3.3 Improvement of production methods

Improvement of production methods have been carried out on a continuous basis during the project's execution. The results depend mainly on the readiness of the Cooperatives to accept changes and to apply the expert's recommendations.

The improvements were directed to certain areas of production, such as:

- product design,
- quality of products,
- production planning,
- raw material utilization,
- selection of hardware and other components,
- selection and maintenance of tools,
- machining and assembling operations,
- safety and working conditions,
- organization.

In all these areas, a certain progress has been achieved. The counterparts were advised on how to introduce new better methods and were assisted by the UN Volunteers and the experts when recommendations were accepted.

The introduction of new methods always calls for certain changes which mostly depend on and require the cooperation of various organizational units in the Cooperatives. Lack of good coordination among units carrying out different functions, seems to be the main obstacle which slows down certain improvements proposed by the expert.

Though all the improvements proposed and accepted so far have proven to be not only successful but also useful, the counterparts ignore some of the recommendations, especially when a change calls for the recruitment of more people, or the creation of organizational units. The counterparts hardly comprehend that the improvement of production as a whole consists of numerous small improvements. Even the management is not always aware of this.

Improvements in the designs of the major furniture products resulted in better quality, higher productivity and savings of raw materials. It is highly appreciated, especially in Mukalla. But the Cooperatives are very hesitant to accept even more useful improvements in the designs of their joinery products. The root of the problem is that the country does not have standards for joinery products, so that almost every customer has his special requirements.

A meeting was proposed with the local institution which designs houses to discuss the establishment of some rudimentary joinery standards for this area, but for reasons unknown to the expert, the meeting was not arranged.

The quality control system was well established and controllers well trained in the Mukalla Cooperative and first results were very impressive. But later on the management reduced the number of controllers from eight to four for all three units, and cancelled the post of Chief Quality Controller, leading to the deterioration of the results achieved. Actually, the problem is one of lack of competition and customers have no choice but to accept any

quality. In such a situation, the management considers quality controllers as an unnecessary cost.

Numerous improvements aimed at better utilizing the raw materials have been proposed. For example, the counterparts were repeatedly advised on how to stack lumber correctly for air seasoning. Comparing the utilization of properly stacked lumber with that which was not stacked at all, the expert assessed that the difference in utilization is more than five percent. This saving is about three times higher than the cost of stacking the lumber. The quality of products made from correctly seasoned timber is far better than when products are made using cracked, twisted and mouldy boards which have not been properly seasoned. In addition to this the Cooperatives have long standing problems of providing hard currency for the import of timber. But in spite of all these facts, the Cooperatives are not willing to follow instructions on the proper seasoning of timber.

The counterparts were also advised to buy more appropriate standard sizes of plywood corresponding to the multiple widths of furniture parts, to reduce thicknesses of plywood where it was unnecessarily over-dimensioned, to purchase new types of hardware which allow savings of raw materials and simplify assembling. Though many of these recommendations were successfully introduced, it seems that the Cooperatives are reluctant to change the assortment of imported materials. They are under the strong influence of foreign suppliers and local middlemen, who obviously prefer to do business using already tested methods.

In general, the Cooperatives should have strong and competent buyers who will not play passive but active roles in the supply market.

The selection and maintenance of woodworking tools and tool grinding wheels is a problem that remains to be solved, especially in the Cooperative in Seiyun. Tungsten-carbide tipped tools are usually placed on metal plates, cleaned with metal brushes or sharp metal objects, or - more often - not cleaned at all. Sharpening is too late, using wrong angles and tools with many broken edges are used. Nobody pays attention to the geometry of cutting teeth.

No one knows how to select the appropriate tools or grinding wheels. Diamond grinding wheels are used for grinding metal parts of teeth and are quickly worn out. The Cooperative in Mukalla has selected one young man to be trained and to be responsible for sharpening of tools, while the Cooperative in Seiyun did not yet take such a decision.

The newly purchased universal tool grinders, delivered and installed in both Cooperatives, can be used for significant improvements in tool maintenance. First steps have been taken by establishing separate sharpening rooms in both Cooperatives.

Improvements in machining and assembling operations are noticeable, particularly in Mukalla. Some jigs are already used and more attention is paid to the accuracy of dimensions and shapes of machined parts. Some better machining methods, learnt during training courses, are accepted and used.

However, progress is far behind than what was proposed by the expert or taught during training courses. It is not a matter of rejecting improvements, but very slow adaptation to changes and work inertia. When discussing this

matter with carpenters, they usually blame the management, expecting from them orders for introducing a new method. Actually they want to bargain with the management and see how much money they could make by working according to a new method. Probably for the same reason, the management hesitates to issue any order which could interfere with the system of wages established long ago.

One example can illustrate the above statement. The Cooperative in Mukalla needs a rather big quantity of one side laminated solid wood laths for supporting wardrobe doors and fixing piano hinges. They cut them first in the machining section and laminate them separately with strips of melamine laminate in the assembly area. The expert advised the counterpart first to laminate solid wood boards and rip them into laths ready to be used for assembling wardrobes. A demonstration of the new method showed that laths made this way are of better quality, that less laminate and glue is used, and that the production time is less than half of that presently needed. The proposal was unanimously accepted but never applied in the production, despite many reminders from the expert. Simply, the problem is that a part of the work should be shifted from the assembly to the machining section and redistribution of wages should be done, and nobody likes to touch that problem. This example has been used in this report because it is typical and has been encountered very often in various forms.

There are also some objective obstacles impeding improvements. Namely, the Cooperatives' lack of some elementary production means, such as: woodworking machines, tools, controlling instruments and their having a very poor supply of hardware, jointing components etc.

The expert was impressed in seeing that some carpenters started proposing certain improvements. They usually come to the project office to show something that could be done in a better way. The expert appreciated and emphasized this innovative spirit in the Mukalla Cooperative as an invaluable asset, advising the management to support and to stimulate such initiatives.

The expert was planning to start with trial serial production in the Mukalla workshop, and then to introduce new methods where applicable. Documentation was prepared for the first series of windows, but delays in the finalization of the new workshop layout and still inadequate conditions for a batch production caused that this was postponed for the next mission, when it is expected that the workshop will be better equipped.

The next observation which deserves particular attention refers to the extremely severe working conditions in all the workshops of both Cooperatives. Processing tropical woods with woodworking machines, in the climatic conditions of Yemen, is extremely harmful for the health of the workers and for the machines. Under such conditions one can hardly expect high quality and productivity. Technical designs for the dust extraction systems for the Mukalla and Seiyun workshops have been designed by the expert, but the Cooperatives cannot acquire the hard currency to import the blowers and cyclones which are not produced in the country. This is an investment of about US$ 10,000 per workshop, plus the purchase of pipes which can be obtained for local currency.

It is doubtless that project results will be increased significantly if this problem would be solved and working conditions improved.

The situation with regard to the safety measures is very critical, especially in the machining sections. Most of the safety guards, and V-belt covers on the machines and all riving knives on circular saws have been taken off. Tools are not balanced and set correctly. All warnings and instructions on how to protect workers are ignored. The management is aware of this situation but seems to be helpless.

3.4 Maintenance of equipment

The CSCC in Mukalla has a small maintenance unit with a staff of eight who do repairing services for all three of the Cooperative's workshops, including vehicles. Taking into account that spare parts are not available, and that most of the woodworking machines are totally worn out, one can easily conclude that 2.2 percent of the employees working in maintenance are not enough.

In the CC Seiyun, maintenance for all four units is performed by only one man who is neither a mechanic nor an electrician. It is 0.5 percent of the amount of employees and should be between 3 and 5 percent for this type of manufacture and for adequate maintenance conditions. The majority of woodworking machines cannot work with any acceptable tolerances. Each machine needs a thorough overhaul, but there is no one who can do that.

A training manual for the basic elements of maintenance has been prepared by Mr. Echeng Eleng, United Nations Volunteer, and a mechanical engineer working in the CSCC Mukalla is supposed to conduct training courses. This has not yet been done.

3.5 Technical personnel

It is very hard to introduce a modern production system into a company where only a few people can understand simple drawings. Both Cooperatives have no technician specialized in wood processing. The Cooperative in Mukalla has one mechanical engineer who is subordinated to the Chief Mechanic. He is a very knowledgeable and capable person, but, it seems, pushed into the background and not utilized as he should be.

The carpenters must realize that they cannot make any significant development without technically educated people.

4. MAJOR ACTIVITIES AND SOLUTIONS

The activities carried out by the expert during the reporting period can be described as:

1. Assistance in production planning.
2. Assistance in establishing new layouts in Mukalla and Seiyun.
3. Instructions on how to use the universal tool grinder and other newly bought machines.
4. Preparation of training manuals.
5. In-service training.
6. Design of a dust extraction system for the workshop in Seiyun.
7. Improvement of production operations.
8. Other activities.

4.1 Assistance in production planning

Following the training course conducted by the expert in November 1991 in Mukalla, the counterpart prepared all the forms given in the training manual on production planning. This time, the expert assisted the counterparts in completing and using the production documentation. At present, all the documents are filled in by hand.

The main difficulties were experienced in connection with using the metric system which is not yet common in the country. Also, it was the first time that detailed drawings were made and used and the help of the expert was necessary to start the system. Experience from the Mukalla Workshop will be passed on to the Cooperatives' other units.

The Cooperative in Seiyun is still not able to apply such a production planning system. The training course on this subject was conducted there during this mission and they were asked also to prepare appropriate documentation to be ready for the expert's next mission.

Unfortunately, nobody will be there between the expert's missions to follow up on the proper use of the production planning documentation, and the counterpart will probably face some difficulties, causing unexpected delays.

4.2 Assistance in implementing the new workshop layouts

Improved workshop layouts for all three units in the Cooperative of Mukalla and for the Central Workshop in Seiyun were designed by the expert in 1990. During the reporting period, the layouts in Mukalla and Seiyun workshops were implemented and the expert supervised the correct positioning and bolting onto foundations of the machines. An attempt to instal on all the machines proper guards, covers and other parts that had been removed was only half-way successful because many parts have been lost since they were never used.

First, the machine operators were invited to a meeting where all the details of the new layout were explained, including all the changes that they should follow up. Though some resistance was expected, both the management and the expert were pleased to see that the carpenters appreciated the new arrangement of the workshop. They clearly expressed their satisfaction saying that the transport distances will be much shorter and that the work in general will be more comfortable and safer.

To reduce disruptions in the production process, the replacement of machines was organized in the evening hours.

In Seiyun the machines were moved to the new building, gradually one or two at a time. Since some wiring details have yet to be completed, the expert was not able to assist in the start-up of production at the new site.

Both workshops still lack some machines needed for the foreseen production, including some basic machines such as cross-cut saws, tenoners, routers, sanding machines, etc. After receiving the machines, to be purchased by the project, the situation will be improved, but not solved completely. However, the Cooperatives now know what types of additional woodworking machines are needed.

The technology introduced through the new layouts is tailored in accordance with the conditions in the Cooperatives, such as: available equipment, skills of labourers and financial situation in general. This could only be considered as the first step towards a modern technological solution. However, it is a big step forward in comparison with the previous practice.

Hopefully, results and experiences to be gained by making use of this technology will contribute to further improvements and progress in the Cooperatives.

4.3 Instructions on how to use a tool grinder and other newly bought machines

Each of the two Cooperatives received a universal tool grinder and a vertical single spindle drilling machine, bought through the project. The Cooperative in Seiyun also received four new woodworking machines which it imported using its own funds. All the machines have been received either without any operational manuals or technical data or with poor technical instructions referring only to the installation of a machine. The expert therefore had to explain in detail all the possibilities of the machines and correct ways of performing machining operations.

Since the tool grinders were received after the departure of the tool maintenance consultant the expert did not have a choice but to train the sharpener on how to use the machine correctly. Since all the tools used were ground by manual feeding, sawblade teeth and moulder cutters were deformed, thus it is necessary to spend quite some time to determine and adjust correct angles and other elements of the tools. Due to the limited time available, this instruction was only given in Mukalla. The Cooperative in Seiyun promised to send a man to be trained but he did not arrive.

Detailed instructions on how to select and order proper woodworking tools and grinding wheels were given, but the expert is not convinced that any of the staff of the Cooperatives is able to do this, or is even aware of how important it is.

4.4 Preparation of training manuals

During the expert's first mission to Mukalla and Seiyun a fact was clearly established. The level of knowledge of wood processing operations was very low. This finding resulted in designing a comprehensive training programme exceeding the requirements of the project document. Consequently a great deal of the expert's time was devoted to training activities: preparation of training manuals followed by theoretical and practical training of selected personnel from the Cooperatives.

During the reporting period, the expert prepared the following five training manuals:

8.[1] Inventory control and purchase decisions.
15. Cross-cutting and ripping of sawnwood.
18. Surface planing and thicknessing.

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[1] The numbers relate to the overall training programme given in Annex V of document DP/ID/SER.A/1526.

19. Tenoning, mortising and drilling.
20. Moulding and routing.

Bearing in mind a relatively low level of the trainees' literacy, the manuals have been well illustrated with many, easily understandable, pictures. Later on, during the training courses, this has proven to be very useful, since all the questions asked by the trainees were related to the pictures from the manuals and not to the text.

The manuals have been translated with the illustrations into Arabic and reproduced as well. The English version will be issued as separate technical reports of the project.

4.5 In-service training

During the reporting period the expert conducted six training courses in Mukalla and four in Seiyun. The manual for one of these, on safety measures in the secondary wood processing industries, was prepared by Mr. Echeng Eleng, the United Nations Volunteer on the project, but he left the project before conducting the training course.

Each course lasted two to four days with training given two to three hours a day. About half the time was used for theoretical explanations and the rest for practical demonstrations.

Two Cooperatives have different attitude towards the training. While the Cooperative in Mukalla wants to train as many people as possible, the one in Seiyun tries to only pay lip service to training. The interest for training among the carpenters is exceptional, some improvements in the quality of workmanship and in the production order is already noticeable.

Altogether, during the period covered by this report, 58 carpenters from Mukalla and 15 from Seiyun have been trained. The list of the trainees is given in Annex II.

4.6 Design of a dust extraction system for Seiyun

The General Manager of the Cooperative in Seiyun asked the expert if he could make a technical design for a dust extraction system for the new workshop in Seiyun, like the one done earlier for Mukalla. This was done, with all the necessary details for the purchase of equipment and for the production of the ducting.

The expert also gave several addresses of fan and cyclone producers and drafted a letter to be sent to them in order to get offers for blowers and cyclones for both Cooperatives.

The scheme of the dust extraction system designed for the central workshop in Seiyun with the table of calculations is given in Annex III.

4.7 Improving production operations

The expert visited production units one to two days each week to observe production and to suggest possible improvements. Some 18 improvements have been recommended by the expert, and a few of these have been implemented during his three-month assignment.

In the production of this level it is always easier to find a better working method than to implement the suggestion. One has to cope with two barriers: technical and human. Technical limitations are sometimes unsurmountable, even for very simple things. The human barriers are mainly related to skills and habits of employees, or to unregulated procedures. However, the expert is convinced that these improvements will gradually take roots.

It is also encouraging to note that the carpenters have been infected with the attempts to improve and they started taking the initiative of proposing some improvements. Combining the new skills attained during training and the carpenters' own experiences, they are able to make significant progress. All depends on how the management will evaluate and support such initiatives. On its side, management is willing to give all the necessary support.

4.8 Other activities

During this mission, the expert, acting as the Chief Technical Adviser, prepared the second project progress evaluation report and handed it over to UNDP in Sana'a and to UNIDO.

The requisition for the purchase of seven woodworking machines, financed by the counterparts cost sharing contribution prepared earlier was revised and partially changed in order to meet better the counterparts' needs.

The expert also had to type all his reports and training manuals because the counterparts were not able to provide typing services.

During his last assignment the expert travelled twice to Seiyun, each time for a week, and one day to Sana'a at the request of UNDP. Both on arrival and departure the expert stayed seven days in Aden, in order to contact the UNDP Office, to extend his visa and waiting for a flight connection.

Since the two United Nations Volunteers had left the project before the expert's arrival it was necessary to render more assistance to the counterparts in solving some practical problems in everyday work.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The project's achievements during the reporting period are satisfactory. Production planning has been further improved. New layouts have been introduced in Mukalla and Seiyun. Tool maintenance has been further improved and the Cooperatives have been provided with modern tool grinding machines. More in-service training was carried out than was foreseen in the project's work plan. New equipment has been selected for purchase. Some of the production operations have been improved.

Four out of the seven woodworking machines ordered in January had not yet been received. The Cooperatives did not recondition the old machines as planned. Consequently, the start of serial production had to be postponed until satisfactory conditions are assured.

Working conditions in the workshops are unbearable and because of that the workers lack motivation and their health is endangered.

Maintenance is extremely poor, particularly in Seiyun: the machines' precision can hardly satisfy industrial production methods.

The people from the Cooperatives, including management staff, did not have a chance to see any well organized and well equipped carpentry production abroad. This may explain their reluctance toward and suspicion of innovations.

In general, the management and employees in both Cooperatives recognize the project as being very useful for them and they are always ready to support and to cooperate in the project activities.

5.2 Recommendations

Some recommendations will be repeated anew because of their importance for the Cooperatives and for the results of the project.

The Cooperatives should take into serious consideration specialization of their Workshops for either joinery or furniture production. It is a prerequisite for successful production.

The Government should introduce the standardization of joinery products at the national level initially for constructions that it financed. That will permit production in larger series and facilitate entry on the markets of the entire country.

The Cooperatives should endeavour to employ some technically educated people who could better be able to carry out further developments.

The Cooperatives must solve the problems related to the reconditioning of the old machines to allow the introduction of serial production.

The Cooperatives should also find a way to obtain and install the necessary equipment for the dust extraction systems and improve the unbearable working conditions in their workshops.

In order to ensure lasting results, it would be very useful for the Cooperatives if the Government, UNDP and UNIDO could find additional funds to follow up on this project with some additional equipment and consultancy services.

ACKNOWLEDGEMENTS

The expert wishes to place on record that the counterpart's staff engaged in the project was very helpful and supportive. Mr. Alwi Aljifri, who worked closely and constantly with him as the counterpart, enthusiastically participated in all activities carried out during the mission. He translated the majority of the training manuals and deserves credit for the very attractive arrangement of their Arabic version. He also was very helpful in interpreting during most of the training courses.

A part of the translations and interpretation was done very ably by Mr. Awad Alkabry, who also did a very good job of making all the detailed drawings for the production planning exercises.

The other staff of the production planning unit, Messrs. Saleh Bayashoot and Khalid Mahfoud, as well as the project driver, Mr. Faraj Motran were very supportive in performing their jobs.

Thanks are also due to the most helpful person who supported the project very enthusiastically from its very beginning and who was actively involved in its work, Mr. Mahfoud Basawad, the General Manager of the Cooperative in Mukalla.

It was his great pleasure to work with such friendly and Cooperative people. To all the above he owes his warm gratitude.

ANNEX I

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Project of the Government of the People's Democratic Republic of Yemen

Strengthening the technical and managerial capabilities of the Carpentry Cooperatives in Seiyun and Mukalla

JOB DESCRIPTION

SM/PDY/87/005/11-01 (J-12209)

Post title	Furniture and Joinery Production Expert (CTA)
Duration	12 months - split mission (6, 3 and 3 months)
Date required	As soon as possible
Duty station	Mukalla with travel to Seiyun and Aden
Purpose of project	To strengthen the Technical and Managerial capabilities of the carpentry cooperatives in Mukalla and Seiyun.

Duties

The Furniture and Joinery Production Expert, the project's Chief Technical Advisor, will lead a team comprising a cost accountant, a marketing consultant (each assigned for three months) and two United Nations Volunteers (a woodworking technician and a master carpenter), each assigned for two years.

He will undertake his assignment in three phases, the first of six months, and the other two of three months each, over a period of two years. He will be responsible for initiating and supervising all technical activities in the project, the drafting of training manuals and reports, devising systems, procedures and mechanisms as well as providing training to middle and top management of the cooperatives.

Phase I (six months)

During this phase he will be expected to:

1. Review the different systems for production planning and control, organization, procurement and inventory control, quality control, machine and tool maintenance.

2. Advise on improvements, modifications, and, where appropriate, on the introduction of new systems of production - including modifications to products, plant layout, equipment and processing technology and draw up plans for implementing his recommendations.
3. Review the current designs and the capacities for design in both cooperatives and recommend changes to facilitate the introduction of serial production methods.
4. Recommend changes to the product development and production planning and control departments.
5. Identify bottlenecks and excess capacity and suggest a product range, or modifications to the products being made, to ensure a fuller use of the installed capacity.
6. Assess the current skills of operators and suggest methods for increasing skills and productivity.
7. Assess the need for training manuals and draw up the contents of these.
8. To the extent possible draft these manuals.
9. Draw up a work plan for the two UN Volunteers.
10. Survey the state of the equipment installed and draw up a plan for the rehabilitation of existing machines.
11. Draft a technical report covering his activities during the first phase.

Phase II (three months):

During this phase, he will be expected to:

1. Supervise the implementation of the systems recommended under iten 2 of Phase I.
2. Conduct short in-country training seminars on production planning, production control, inventory control, quality control.
3. Guide the UN Volunteers in their work and, if need be, modify their work plan.
4. Review the cooperatives' procurement policies and recommend changes.
5. Review the designs prepared as a result of the recommendations made under item 3 of Phase I and suggest a rudimentary system of testing these.
6. Review the progress in the rehabilitation of machines and, if need be, modify the plan.
7. Introduce safety at work procedures and train operators in this field.
8. Supervise, and if necessary modify, the implementation of changes in plant layout, machines, etc. suggested in Phase I.

9. Introduce a more rational use of jigs in production.
10. To the extent possible, draft additional training manuals.
11. Draft a technical report covering his activities during the second phase.

Phase III (three months):
During this phase, he will be expected to:

1. Review the progress of the UN Volunteers, and, if need be, modify their work programme.
2. Review the progress of all the activities undertaken so far and complement these if need be.
3. Complement the training manuals already issued by additional ones whose need has been felt.
4. Revise, and if need be, modify all the training manuals prepared by the project.
5. Draw up technical reports outlining follow-up by the management of the cooperatives, the government and international organizations.
6. Draft the project's terminal report.

Qualifications: Engineer or wood technologist with long experience at policy making level in the management of small to medium sized furnituire plants.

Language: Arabic preferred, English acceptable.

Background information:

The woodworking sector in the People's Democratic Republic of Yemen consists of the Public Corporation for Carpentry in the Aden Governorate and two carpentry cooperatives in the Hadramawt Governorate. It employs approximately 1000 people and its sales volume reached nearly YD 2.5 million in 1985. In general the woodworking sector produces low quality products at high costs. This can be attributed mainly to low utilization of equipment, poor maintenance of production facilities, low labour productigvity and extensive use of expensive raw materials. Factories are often run without a sound orientation on the market requirements and subsequent production planning and organization lack long term perspective.

The present strategy of the People's Democratic Republic of Yemen towards industrial development, as reflected in the Third Five Year Plan, focuses on strengthening the industrial infrastructure. It concentrates on three types of measures: (a) increase the utilization of existing productive capacities, through the rehabilitation of selected factories; (b) the

establishment of a limited number of new factories to cater for the growing needs for indigenously produced goods, with a view to saving hard currency through import substitution; and (c) improving the production and managerial capacities in industrial enterprises. This project in the woodworking sector falls under the first and the last categories.

The first technical assistance to the woodworking sector in the People's Democratic Republic of Yemen was provided in 1978 through a review of the Aden Public Corporation for Carpentry. The review indicated various areas for improvement of production and management. In 1981, project PDY/81/006 'Training in Management and Efficiency Improvement in Industries' provided a consultancy mission to conduct a survey of the manufacturing facilities of the Coastal Carpentry Cooperative. The survey team's findings indicated the urgent need for technical assistance in relation to the cooperative's plan to consolidate the operations of three of its member units. Thus, in 1983, a three month mission was fielded to review this issue. This mission drew up the blueprint for a central workshop in Mukalla and advised on the necessary technical assistance to implement the plan. As no funds could be secured for this purpose, no follow-up was given by UNDP.

Two cooperatives are active in the Hadramawt Governorate: one in the area around Seiyun and one in the area around Mukalla. Each cooperative consits of a number of small scale production units, which supply their immediate environment with construction woodworking items (doors, windows) and selected furniture (beds, tables, chairs, sofas).

The cooperative of Seiyun has workshops in Tarim, Al-Hauta, Shibam and Seiyun itself. It employs 173 persons in various capacities, compared to 166 in 1977. The volume of sales of this cooperative was YD 644.348 in 1987 compared to YD 455.007 in 1982. Production is at an artisanal level, relying mainly on the individual skills of the carpenters.

The Coastal Carpentry Cooperative has workshops in Ghail, Mukalla and Shahr. The total number of employees was 366 in 1977 and 376 in 1987. Most of the people are employed by the central workshop in Mukalla. The sales volume of this cooperative in 1987 was YD 1.245.842. Production in the central workshop in Mukalla has industrial characteristics, particularly in the furniture production, but the other workshops are of the same level as those in Seiyun.

All items are produced on demand and according to the specifications of the customer. Most workshops have waiting lists for certain items whch are much in demand. In Seiyun the construction woodworking items form about 72 percent of the sales volume, whereas this figure is 46 percent in Mukalla. As both cooperatives have hardly any capacity for cost accounting, it is impossible to assess which category of products has the highest added value of what the highest cost factor in production is. Prices are fixed based on global production costs and a traditional feeling of 'what the market will allow'.

Both cooperatives are weak in terms of human and physical resources and need strengthening in all aspects of their operations. With the exception of the workshops in Mukalla and Tarim, the production facilities of the workshops are cramped and poorly maintained. The machinery has reached the end of its technical life and breaks down frequently.

As most items are produced on demand, and according to customer specifications, production planning is totally dependent on the intake of orders. the Cooperatives are not producing any items for stock and so there is hardly any serial production. Therefore, production organization is geared towards meeting the consumer preferences, and relies heavily on the skills of the individual carpenters to produce the items required. Consequently, most production techniques used in the cooperatives are still at the artisanal level.

Given the lack of managerial capacities and technical knowhow, the cooperatives have only been able to achieve limited product and production innovation, thus retaining low levels of labour productivity. As the wage rates in both cooperatives are directly linked to the productivity of the individual workers, wages have hardly gone up in real terms over the last five years, and in Seiyun they have actually decreased considerably (21 percent).

Most of the cooperatives members are illiterate skilled labourers, who have either had small workshops of their own before the cooperative was established or they have been trained by their colleagues in the workshop. As both cooperatives are situated in rural areas, job opportunities are few and the well-being of cooperative members is dependent on the economic and financial position of the cooperative. The cooperative does not only provide jobs and wages, but it also provides pensions and guarantees bank loans. In this context, both cooperatives have started self-help housing schemes for their members.

ANNEX II

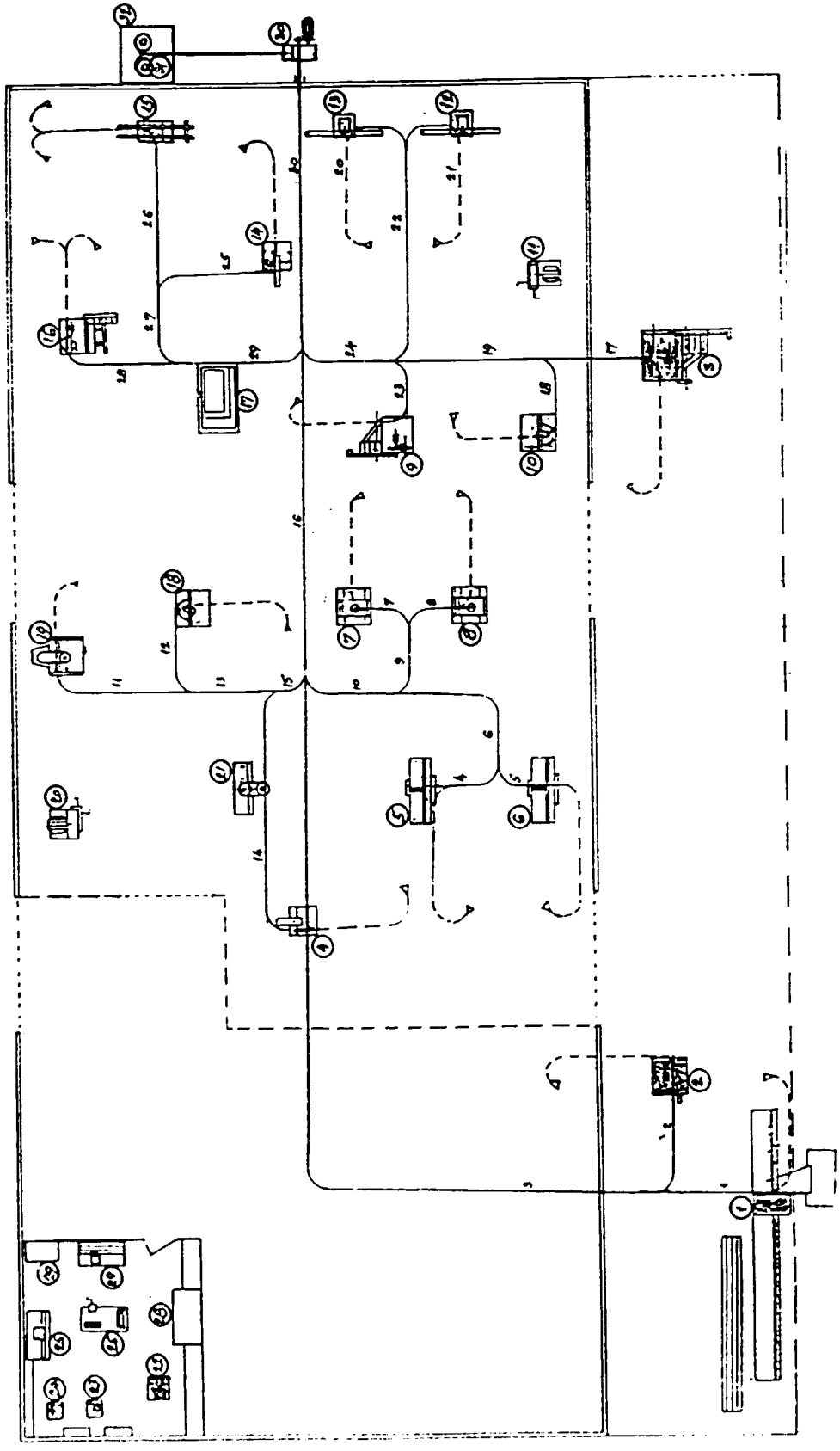
LIST OF TRAINEES

TRAINING COURSE	NAMES OF TRAINEES
1. Inventory Control and Purchase Decisions (in Mukalla)	- Jafer Salim Bahwirth - Salmeen Saeed Al Mahfeed - Saeed Joman Bagoret - Khalid Ali Barweished - Saleh Abdulla Bawazeer
2. Safety Measures in the Secondary Wood Processing Industry (in Mukalla)	- Nasser Salman ben Selman - Omer Abdulla Al Haddad - Mahmood Salem Alattas - Saeed Mubark Magtoof - Abdulla Awad Badreis - Nabeel Mohamed Masehwar
3. Production Planning (in Seiyun)	- Abdulla Salem Bashuaib - Omer Mohamed Bin Gadi - Sailan Mahfoud Abad
4. Safety Measuers in the Secondary Wood Processing Industry (in Seiyun)	- Saleh Saeed Elaywan - Ali Salim Bin Nassir - Baleed Ahmed Joban - Mobarak Obaid Dohaish
5. Wood Sawing (Cross-cutting and Ripping) (in Mukalla)	- Saeed Mobark Magtoof - Ahmed Ali Khomor - Abdulla Baques - Omer Bamoomen - Ali Barajeh - Hussein Bashreef - Saeed Toban - Saeed Nussar Saad - Saleh Babgy - Saeed ben Obeidallah - Hussein Al Shahaby
6. Wood Planing and Thicknessing (in Mukalla)	- Saeed Mubark Magtoof - Khaled Berek Mahfoud - Omer Mohamed Baghoom - Omer Abdulla Al Haddad - Muhamed Abdulraheem Bawazeer - Saeed Abdulla Bawazeer - Omer Karama Bayashoot - Salim Joman ben Saweed - Ahmed Ali Khomoor - Salim Obeid Garbal - Awad Muhamed Gahwan - Faiz Omer Balagdi - Abdulla Saeed Bamouzeh - Omer Ali Roweiy - Mubark Abdulla Basba - Muhamed Faraj Bamomen

TRAINING COURSE	NAMES OF TRAINEES
7. Moulding	- Muhammed Bekeir - Saeed Mubark Magrtoof - Ali Faraj Ashoor - Muhammed ben Jebeir - Omer Muyhamed Baghoom - Ahmed Ali Khomoor - Saeed Thoban - Saleh Salim Lahmar - Saleh Alhabshi - Khaled Bakhar Al Doba - Salem Abdulla Musalem
8. Tenoning, Mortising and Drilling (in Mukalla)	- Saeed Mubark Magtoof - Abo Elgader Al Akbari - Ali Hasim Ba Alwi - Shekhan Al Sqaff - Saeed Mohamed Bakutheer - Ahmed Jafeer Lurdi - Hussein Al Aydross - Ahmed Awadh Doeis - Abdulla Obeed - Mohamed Bin Obeed Ellh
9. Wood Planing and Thicknessing (in Seiyun)	- Maramah Mahbood Al Habshe - Saleh Saeed Elawan - Ahmed Mohammed Baraja - Ali Salem Bin Talib - Ali Salem Bin Nassir
10. Moulding and Routing (in Seiyun)	- Salem Mahfoud Obaid - Mobarak Obaid Dihish - Omer Salmeen Al Tarissa

ANNEX III

Layout for the dust extraction system of the Carpentry Cooperative in Seiyun indicating the position of ducts referred to in the table on the next page.



Calculations for the dust extraction system for the Carpentry Cooperative in Seiyun

[1] NO	POS.	MACHINE/BRANCH	v m/sec	d ø mm	Q m^3/sec	$\frac{v^2\gamma}{2g}$ kg/m^2	l m	ELBOWS R/D r_1	r_2	r_3	COEFICIENTS OF RESISTANCE ζ_1	ζ_2	ζ_3	$\Sigma\zeta$	ΔP kg/m^2	ΔPo kg/m^2	ΔPt kg/m^2	REMARKS
1	1	Radial cross-cut s.	18.8	180	0.213	21.57	8.0	2	2	–	1	1.00	0.30	2.70	58.3	58.3		
2	2	Ripping circular s.	18.0	180	0.204	19.82	8.5	2	2	2	1	1.49	0.45	2.94	58.3	58.3		
3	1+2	–	18.3	170	0.417	20.63	26.0	2	–	–	–	2.90	0.15	3.05	62.9	121.2	121.2	
4	5	Surface planer	19.6	130	0.260	31.13	7.0	2	2	2	1	1.13	0.45	2.58	80.3			
5	6	Surface planer	19.6	130	0.260	31.13	7.0	2	2	2	1	1.13	0.45	2.58	80.3			
6	4+5	–	22.9	170	0.520	32.07	5.5	2	–	–	–	0.61	0.15	0.76	24.4	104.7		
7	7	Thicknesser	25.2	130	0.334	38.84	5.0	2	2	–	1	0.81	0.50	2.31	89.7			
8	8	Thicknesser	25.2	130	0.334	38.84	5.0	2	2	–	1	0.81	0.50	2.31	89.7			
9	7+8	–	26.3	180	0.668	42.30	22	2	–	–	–	0.23	0.15	0.38	16.1	105.8		
10	6+9	–	26.3	240	1.188	42.30	3.3	2	–	–	–	0.23	0.15	0.38	16.1	121.9	121.9	
11	19	High speed router	23.2	110	0.220	32.99	8.0	2	2	–	1	1.64	0.30	2.94	97.0			
12	18	Single spindle moul.	24.2	120	0.274	35.79	7.0	2	2	2	1	1.26	0.45	1.71	97.0			
13	11+12	–	24.6	160	0.494	37.01	3.0	—	—	—	—	0.36	–	0.36	13.3	110.3		
14	4	Narrow bandsaw	21.5	110	0.204	28.28	12.0	2	2	2	1	2.45	0.45	3.90	110.3	110.3		
15	13+14	–	25.5	190	0.722	39.65	1.5	2	–	–	–	0.14	0.15	0.29	11.5	121.8	121.9	a corrected
16	3+10+15	–	25.6	340	2.327	40.03	10.0	–	–	–	–	0.45	–	0.45	18.4		140.3	
17	3	Panel sizing saw	24.3	120	0.274	36.24	6.5	2	2	2	1	1.53	0.45	2.98	108.0			
18	10	Single spindle moul.	25.9	120	0.293	41.22	6.5	2	2	2	1	1.17	0.45	2.62	108.0			
19	17+18	–	25.0	170	0.567	38.23	4.5	–	–	–	–	0.60	–	0.60	19.1	127.1		
20	13	Chain mortiser	23.0	110	0.218	32.46	6.0	2	2	2	1	1.23	0.45	2.68	87.0			
21	12	Chain mortiser	23.0	110	0.218	32.46	6.0	2	2	2	1	1.23	0.45	2.68	87.0			
22	20+21	–	24.6	150	0.436	37.01	7.0	2	—	–	–	0.93	0.15	1.08	40.0	127.0		
23	9	Circular saw el.tab.	27.0	110	0.256	44.57	6.5	2	2	2	1	1.33	0.50	2.83	127.0	127.0		
24	19+22+23	–	25.6	250	1.259	40.00	3.0	2	–	–	–	0.20	0.15	0.35	14.0	141.0	141.0	
25	14	Narrow bandsaw	22.1	110	0.210	29.78	9.0	2	2	2	1	1.84	0.45	3.29	98.0			
26	15	Slotting machine	21.5	110	0.204	28.70	10.0	2	2	—	1	2.05	0.40	3.45	98.0			
27	25+26	–	23.4	150	0.412	33.49	2.5	2	—	—	–	0.33	0.15	0.48	16.0	114.0		
28	16	Tenoning machine	26.5	120	0.300	42.85	7.0	2	2	—	1	1.26	0.40	2.66	114.0	114.0		
29	27+28	–	26.6	185	0.714	43.28	4.5	2	—	—		0.45	0.18	0.63	27.3	141.3	141.3	
30	16+24+29	–	25.0	450	4.300	44.59	9.0	—	—	—		0.30	–	0.30	13.4	154.7	154.7	
–	–	Resistance in joints ...				Addition		20%	on	Σ total					31.0		185.7	
31	–	From blower to cyclon(s)	450	4.300		44.59	5.0	2	–	–		0.17	0.10	0.27	12.0		197.7	
32	Est.	Resistance of cyclon(s)													80.0		278	

P_{total} = 278 kg/m^2

Q_{total} = 4.300 m^3/sec.

= 258 m^3/min.

= 15,480 m^3/h.

A blower should be selected from a producer's catalogue for:

$P_{tot.}$ = 280 kg/m^2, and

$Q_{tot.}$ = 15,500 m^3/h

Cycler(s) should be selected from a producer's catalogue for:

$Q_{tot.}$ = 15,500 m^3/h.

Design: R. Hallis, GTZ

[1] Numbers refer to ducts shown on the previous page.

WORKSHOP LAYOUT IN SEIYUN

Legend to numbers on the plan on page 22

1. Radial crosscut saw
2. Circular ripsaw
3. Panel sizing saw
4. Narrow bandsaw
5. Surface planer
6. Surface planer
7. Thicknesser
8. Thicknesser
9. Circular saw with sliding support
10. Single spindle moulder
11. Horizontal single spindle drill
12. Chain mortiser
13. Chain mortiser
14. Narrow bandsaw
15. Slotting machine
16. Tenoning machine
17. Preassembling bench
18. Single spindle moulder
19. High speed router
20 Horizontal single spindle drill
21. Vertical single spindle drill
22. Universal tool grinding machine
23. Bandsaw blade sharpener
24. Bandsaw blade tooth setter
25. Bandsaw blade welder
26. Bench with a bench grinder, vice and metal plate
27. Knife grinder
28. Bench for control and cleaning of tools
29. Tool sharpener's cabinet
30. Blower
31. Cyclones
32. Silo for dust

ANNEX IV

Names of the Expert's counterparts
and List of Persons met

Mr. Omar Badufari	General Director, Ministry of Industry, Office in Mukalla
Mr. Mahfoud Baswad	General Manager of the Coastal Strip Carpentry Cooperative in Mukalla
Mr. Ahmed Fogehan	General Manager of the Carpentry Cooperative in Seiyun
Mr. Ahmed Al-Dugeel	Production Manager of the CSCC in Mukalla
Mr. Alwi Al-Jifri	Mechanical Engineer, Counterpart in the project
Mr. Saleh Bayashoot	Production Supervisor, Counterpart in the project
Mr. Awad Al-Akbary	English Interpreter and draughtsman
Mr. Khalid Mahfood	Production Planning staff
Mr. Saleh Amber	Designer in the CSCC in Mukalla
Mr. Agil Segaf	English Interpreter in Seiyun
Mr. Mohammed Besheer	Counterpart in Seiyun
Mr. Faraj Motran	Driver

The expert also contacted and worked with the majority of production supervisors, quality controliers, maintenance staff and all the managerial staff in both Cooperatives.

ANNEX V

Substantive Officer's Comments

The report is a narrative of the work done, the problems faced and the successes achieved.

The expert was hampered by the fact that the two United Nations Volunteers, who were to assist him in implementing the changes he proposed, had left since it was not possible to find funds for their extension.

He completed the design and did calculations for the dust extraction system in Mukalla in a professional way. It now remains to find the funds for its purchase and installation.

It is unfortunate that the reconditioning of the existing machines could not be completed before his return on this assignment, as this prevented his making the change from craft to serial production.

The manuals he has written are of the appropriate level and clear. They will be issued as separate technical reports to permit their wider diffusion in the country.

We concur with his recommendations.