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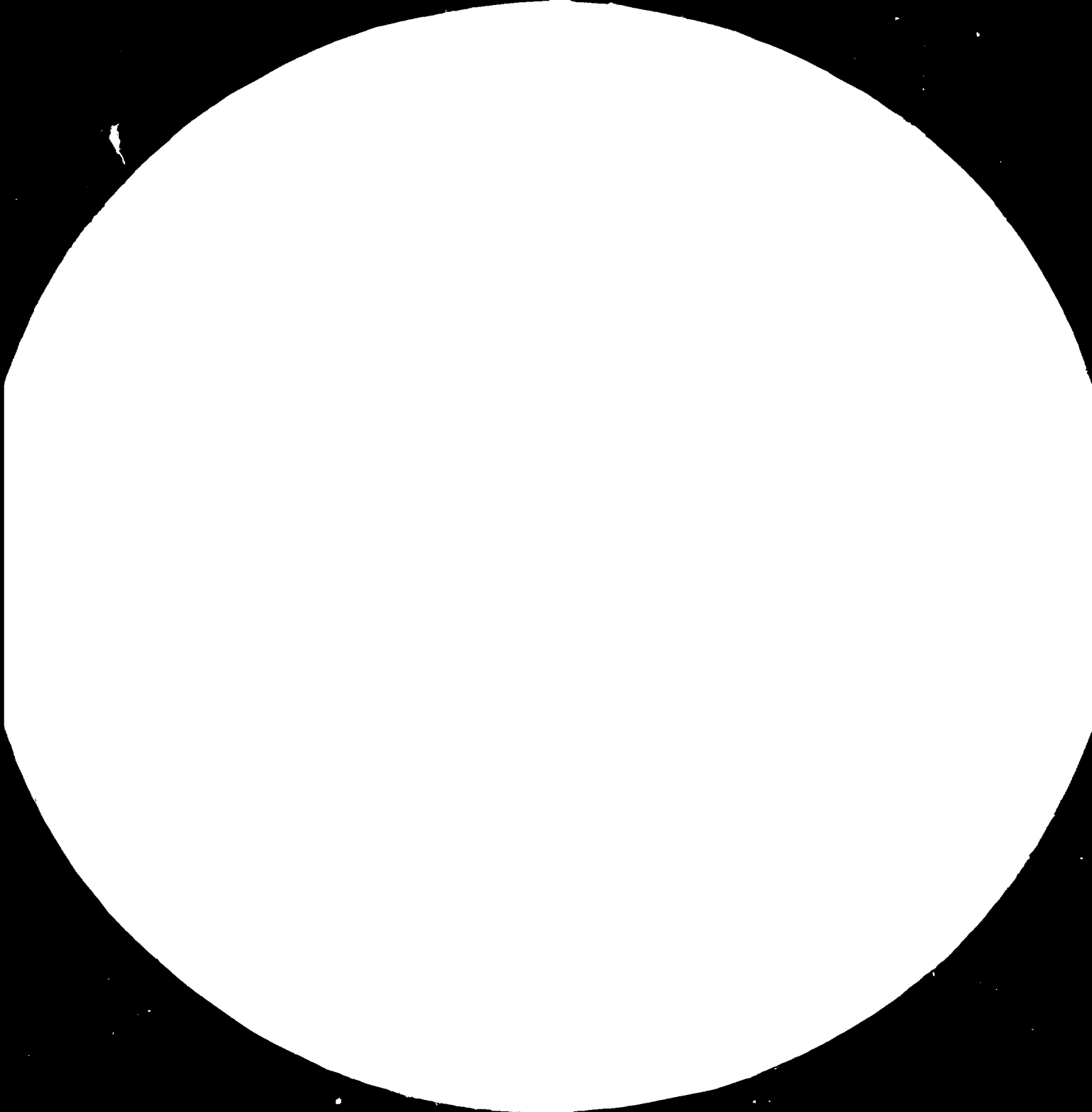
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Micro-Resolution Test Chart
Resolution Test Chart
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UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

ASSISTANCE TO THE FURNITURE INDUSTRY OF BANGLADESH
UF/BGD/78/175

Technical Report: Proposed Assistance to the
Furniture Industry of Bangladesh *

Prepared for the Government of the People's Republic of Bangladesh
by the United Nations Industrial Development Organization

Based on the work of Pietro Borretti,
Consultant in Secondary Wood Processing Industries

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ABSTRACT

The Bangladesh Forest Industries Development Corporation (BFIDC) covers the largest grouping of woodworking activities in the country. At the request of the Bangladesh Government, UNIDO provided a consultant for a period of three weeks to review the situation of FIDCO, BFIDC's leading furniture plant in Chittagong, and formulate a long term assistance programme.

It was found that FIDCO is confronted with serious problems, such as obsolete equipment, lack of furniture designs suitable for industrialized production, and consequent prevalence of inefficient artisanal working methods.

The situation calls for a radical restructure of the whole operation which would necessarily involve a lengthy and complex process. Thus, it would be impractical to discontinue the current operation to allow the existing facilities to be rehabilitated.

The report recommends that a small, parallel production/training unit be established in the existing furniture plant, with the objective of developing, on a pilot basis, the necessary capabilities for the efficient industrial production of low-cost furniture and joinery products.

The know-how and skills thus developed would then be utilized in the organic restructure of the existing facilities, allowing BFIDC to fulfill its catalytic role in the development of Bangladesh's secondary wood processing sector.

Included in the report are three project documents for technical assistance — involving a total UNDP contribution of US\$1.3 million — designed to help BFIDC attain the required development objectives.

ACKNOWLEDGEMENTS

The consultant is greatly indebted to the following organizations and individuals who assisted in the implementation of the project by providing information, advice and facilities:

- (a) UNDP : - Mr. A. de Raad, Junior Professional Officer, UNDP/UNIDO
- Mr. Berk Kocer, Senior Industrial Development Field Adviser, UNIDO
- (b) BFIDC : - Mr. M.A.M. Chowdhuri
Chairman
- Mr. Wailul Islam
General Manager, Planning & Development
- Mr. Ajmal Hossain
Project Director, Chittagong complex
- Mr. Sober Uddin Ahmed
Project Manager, FIDCO, Chittogong

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1. INTRODUCTION

1.1 Mission data

- Project number : BGD/78/175 (UNIDF Funding)
- Project title : Assistance to the furniture industry
- Duration of field mission : 20 October to 12 November 1982
- Main working contacts : UNDP: 1) Mr. A. de Raad, Junior Professional Officer, UNDP/UNIDO; 2) Mr. Berk Kocer, Senior Industrial Development Field Adviser, UNIDO
BFIDC: (1) M.A.M. Chowdhuri, Chairman; (2) Mr. Wailul Islam, General Manager, Planning & Development; (3) Mr. Ajmal Hossain, Project Director, Chittagong Complex; (4) Mr. Sober Uddin Ahmed, Project Manager, FIDCO, Chittagong
- Itinerary : 20 October, Dhaka:
Briefing at UNDP and BFIDC

21 - 31 October, Chittagong (with one day visit to BFIDC Lumber Processing Complex at Kaptai).
Survey of situation, preparation of outline technical assistance, discussions with Messrs Ajmal and Sober.

1 to 10 November, Dhaka, discussions of findings and recommendations with UNDP and BFIDC's Chairman, preparation and typing of draft submission of documents to BFIDC

13 to 16 November, Vienna, debriefing with Mr. A.V. Bassili

1.2 Terms of reference

- To review the status of the BFIDC's Wood-working Complex at Chittagong — and in particular of its furniture plant — and formulate recommendations for technical assistance.

-To make recommendations on the utilization of woodworking equipment originally purchased under Romanian supplier's credit for the establishment of an export-oriented furniture plant at Chittagong.

-Provide trouble shooting advise to BFIDC furniture plant at Chittagong.

1.3 **Unscheduled activity**
(by Mr. L. Drummond) : During the consultant's survey of the BFIDC complex at Chittagong, the need for assistance in the maintenance of the equipment installed in the various plants was also identified. UNDP arranged for Mr. Drummond, Maintenance Expert with a current UNIDO project in Dhaka, to review the situation on the spot and prepare a prodoc on necessary technical assistance (see project document, annex VII).

1.4 **Prodocs resulted from mission and submitted to BFIDC**

: Pilot project for the standardization of low-cost furniture and joinery
BGD/82/038 (annex V)

Estimated UNDP contribution: US\$503,000

Project for the establishment and operation of a Tool Servicing Centre (annex VI)

Estimated UNDP contribution US\$283,000

Project for the establishment and operation of a Machine & Equipment Maintenance Centre (annex VII)

Estimated UNDP contribution: US\$600,000

1.5 **Promotion of joint venture**

: With reference to item two of the terms of reference, the consultant has prepared a background paper (see annex VIII) to be utilized by UNIDO's Investment Co-operative Programme for the promotion of a joint venture for the establishment of an export-oriented furniture plant within BFIDC's complex at Chittagong.

2. BACKGROUND

2.1 General background

Bangladesh with a population of about 90 million is the most densely populated country in the world, and one of the poorest of the developing countries: its per capita income (US\$120) is the second lowest in Asia, after Laos (US\$89).

With an average annual population growth of 2.6 per cent, Bangladesh's projected population size is expected to double in 27 years and to reach a 155.7 million mark by the year 2000.

Despite worldwide economic recession and an adverse foreign aid climate, Bangladesh, which depends largely on foreign economic assistance to finance its development, achieved a satisfactory performance during the fiscal year 1981. The gross domestic product (GDP) rose by 7.6% compared to the targetted 7.2% for the year and the actual 3.4% in the fiscal year 1980. The GNP rose from US\$90 billion in 1977 to US\$140 billion in 1980.

The mainstay of Bangladesh's economy is agriculture with a 55.26% share of the GNP in 1981 which saw food production reach a record 15 million tonnes.

Industrial production in the fiscal year 1981 rose by 9.23% (diesel engines increase by 523%, TV sets 261%, sugar 52%; motor vehicles 43%, raw rubber 25%, etc..)

The Government is actively encouraging the development of the private industrial sector and has enacted a law to protect foreign private investment. With a view to channel the private sector's dynamism into public sector undertakings, the Government has decided to sell shares of major public sector industries. Efforts are also being made to involve public sector corporations in joint ventures with local and foreign private investors.

2.2 Requirements and scope for low-cost furniture and joinery products

Most of the public capital investment in the Physical Planning and Housing sector is allocated to the construction of essential public servants housing, offices and institutional buildings as

well as water supply work.

A requirement for 300,000 new housing units developed in the period 1974 - 1980 for the urban areas of the country. However, it is estimated that the private sector covered not even half of that requirement; while only 3,456 new housing units were built for Government employees in about the same period.

To date, a total of about 20,000 housing units are available for Government employees; which covers only 4.3 per cent of the requirements.

Because of the magnitude of needs in this respect, and to allow a substantial number of people to have a reasonable shelter with limited resources available to the Government, the development plans specifically call for the implementation of measures such as:

- (a) The construction of a large number of low-cost semi-permanent housing units requiring lesser time and resources, to ease the existing shortage of public servant housing.
- (b) The supplying by the Government of core houses for further development by the occupants.
- (c) The standardization of the residential accommodations of the Government and autonomous organizations.
- (d) The standardization of building structures, including joinery components such as windows and doors.

In this connection the Bangladesh Public Works Department Plans to build in the Second Five Year Plan a total of 30,000 semi-permanent low-cost housing units and 10,000 multi-storied flats at a cost of Tk 3,440 million - with a view to provide residential accommodation to public servants in the major cities.

In addition, the necessary accommodations are scheduled to be provided, at a cost of Tk 2350 million, for the basic administrative and development personnel in a number of new District, Subdivisional and Thana Headquarters expected to be created in the country.

Budgetary commitments have also been entered in the Second Five Year Plan for the construction of 15,500 additional classrooms for existing primary schools and 2,000 new schools as well as the development of 10,000 existing secondary schools and 48 primary teacher training institutions.

Most of the 40,000 existing primary schools lack adequate furniture for students and teachers. The five Year Plan provides for the supply of 960,000 low benches for children and 123,000 teacher chairs. In addition, 77,400 blackboards and 34,000 first aid boxes will be supplied.

In the health sector, a total of 2,727 new hospitals and clinics are expected to be built in the period 1980-85.

The need for low-cost housing, institutional facilities, and related wood products, is expected to grow by staggering proportions in the years ahead, considering that the population is expected to grow by 62.9 million in the period 1981-2000.

2.3 Forest resources

Bangladesh has about 3.3 million acres of forest under the management of the Forest Department, and 2.4 million acres of unclassified State Forests under the control of the District authorities in Chittagong Hill Tracts.

The country's richest forest resources occur in Chittagong and Chittagong Hill Tracts Districts, with other forest areas in Khulna, Tangail and Dinajpur Districts.

Plantation forests were established by the Forest Department as early as 1872, and today cover about 400,000 acres. The early inland plantations consist mainly of teak wood. Since 1974 emphasis has shifted towards valuable non-teak species and fast-growing local and exotic species. A number of "superior class" tropical hardwoods (See Annex I) are currently available for furniture making. Teak wood is at present being exported in sawn form to the People's Republic of China.

However, timber supply is inadequate to the needs of the wood working industry due to the quick depletion of more accessible flat-land forests. In fact, timber availability sharply declined from 0.61 cft to 0.30 cft per capita between 1965 and 1977. On the basis of minimum per capita consumption, the total requirement of quality timber in the country is estimated to be 70 million cft in 1984-85 but the supply is expected to reach only 24 million cft.

The projected increase in construction activities in the Second Five Year Plan is considered as being the main factor for the deterioration of the timber supply situation.

The Forest Department is undertaking an ambitious afforestation programme but, because of the nature of hardwood forest requiring long plantation cycle, future exploitation of forest resources will pose the problem of moving to more difficult terrain of the country in the east.

In the face of continued shortage of timber supply, the current development plan calls for the implementation of specific measures for the optimal utilization of forest resources both at extraction and wood processing levels in order to: (1) meet household and institutional needs for wood products and (2) develop the capability of earning foreign currency through export of furniture.

In particular, the current Five Year Plan calls for: 1) the modernization and restructuring of existing industries in order to maximize output and productivity, improve quality of products and reduce waste; 2) acquiring technical know-how necessary for the production of wood products for export markets.

3. FINDINGS AND RECOMMENDATIONS

3.1 The woodworking sector and the role of BFIDC

The history of mechanized woodworking in Bangladesh is relatively recent, if compared to other countries in the region.

Prior to the partition of the Sub-continent in 1947, practically no machinery was utilized in the processing of timber: the use of hand tools and artisanal techniques by small family-centered workshops was the rule.

The period 1947-60 marked the introduction of woodworking machinery and the beginning of the woodworking industry. In 1959 the autonomous body of the Forest Industries Development Corporation was set up under the Ministry of Industry to promote and spearhead the development of the forest industries.

The following year, the Central Forest Research Laboratory was established at Chittagong by FIDC. In the same year the first wood preservation unit and attached sawmill were established in Chittagong - the first nucleus of what today is the BFIDC Woodworking Complex. The Complex was gradually expanded over the years to include:

- (a) In 1962 the first mechanized furniture/joinery plant in the country, the Cabinet Manufacturing Plant (CMB) with attached sawmill and dry kiln, now only producing windows, doors and related sawn timber requirements;
- (b) In 1965 a new furniture plant, the Furniture Industry Development Company (FIDCO) and attached dry kiln - today the largest furniture factory in the country;
- (c) In 1966 the Chittagong Board Mill (CBM), today involved in the manufacture of flush doors;
- (d) Finally, a particleboard plant was added to the Chittagong Complex in 1981, which is also geared to the production of sliced veneer and ready-veneered particle board panels.

Woodworking facilities were established by BFIDC also in other parts of the country:

- (a) The Eastern Wood Works and the Cabinet Manufacturing Plant at Dhaka, today producing respectively furniture and joinery;
- (b) A wood treating plant and a doors and windows manufacturing unit at Khulna;
- (c) A plywood and tea chest plant with attached sawmill at Dohazari in the Sangoo Valley.

BFIDC's most modern wood processing facilities are those of the Lumber Processing Complex established in 1972 at Kaptai and including sawmilling, wood treatment, kiln drying. The Complex is also equipped with a self-contained moulding/planing unit which, however, is largely unutilized.

Thus, today the Bangladesh Forest Industries Development Corporation, under the Ministry of Agriculture, covers the largest grouping of forest industries activities in the country, spanning from log extraction to primary and secondary wood processing activities (see Annex II).

BFIDC's total manpower, including its rubber plantation project, is of about 4,000 of which 865 engaged in timber extraction and over 1200 in wood processing activities.

3.2 The furniture and joinery sub-sector

The majority of furniture and joinery making activities in the country are still carried out with hardly any machinery, and on artisanal and semi-artisanal basis, by an estimated 700 small workshops scattered around the country, with an employment of about 3,000.

The organized private sector, where some degree of mechanization exists, consists (according to a 1976 survey) of about 47 furniture/joinery units, with an estimated total annual sales value of Tk 21.6 million.

In the public sector, the BFIDC operates two furniture plants (at Chittagong and Dhaka); three windows and doors plants (at Chittagong, Dhaka and Khulna); one flush doors plant at Chittagong. BFIDC's sales volume in furniture and joinery products amounted to a total of 26.3 million Taka (about US\$ 1.16 million) in the fiscal year 1981-82.

The BFIDC's furniture/joinery plants are considered as being the largest in the country. In particular, the Corporation's furniture plants at Chittagong, FIDCO, is provided with the largest concentration of heavy-duty woodworking machinery and accounts for the largest share in BFID's furniture sales. The plant has a current manpower of 220.

However, the performance of BFIDC's secondary wood processing sub-sector, and in particular of the furniture operation, has been affected by serious problems and constraints, due mainly to the fact that since its inception it has not been given the means to operate on a truly industrial basis.

As a result, BFIDC could not provide a meaningful impact on the development of the furniture/joinery industry as a whole, as originally envisaged, and help fulfill the increasing needs of the country in terms of low-cost wood products.

The main constraints and envisaged remedial actions by the project are outlined in the following paragraphs.

3.2.1 Lack of standard furniture designs suitable for industrial production

The single major factor responsible for high cost and unsatisfactory quality of finished products is that furniture made with the aid of machines is not designed according to the capabilities, characteristics, requirements and limitations of mechanized production. In particular, when it comes to the assembly of machined components, construction and design details are such as to require superior cabinet-making skills and a time-consuming process involving substantial additional hand work.

Moreover, furniture construction ignores the standardization concept of minimizing number and sizes of component parts.

As a result, the advantage of using machinery is drastically reduced and the production process becomes more cumbersome rather than streamlined.

A further obstacle toward attaining the economic advantages of the industrial system is posed by the BFIDC's furniture and joinery plants mostly utilizing their considerable outlay of equipment for the production of custom-made furniture. This negates the concept and economy of line production.

In view of the above it is recommended that a pilot range of low-cost standard furniture and joinery products, and related production know how, be introduced at BFIDC as the first step towards satisfying on an efficient basis the demand for such products in the decade ahead.

3.2.2 Lack of trained furniture designers

The problem outlined above is in turn linked to what appears to be a total absence of trained furniture designers in Bangladesh.

Often the function of the furniture designer is mistakenly thought as dealing exclusively with the appearance and function of the product. In fact, the designer must also be trained to consider the requirement, possibilities, and limitation of truly industrial production when developing a design, in order to allow cost efficiency in production and appropriate performance of the product in use. These capabilities can only be acquired by going through the normal full four-year degree course.

This process of long-term training should certainly be started as soon as possible. It is recommended, however, that in the short and medium terms the needs of BFIDC in terms of appropriate furniture designs be fulfilled in the framework of the package technical assistance scheme indicated in the preceding paragraph.

3.2.3 Outdated machining methods

Productivity and operating costs are negatively affected by the complex and outdated jointing system of tenon-and-mortice in use in the furniture plants. The disadvantage of the system: 1) it requires precision matching of joints machined in two separate operations, and on two distinct machines; 2) it involves the maintaining in perfect working conditions of two different sets of cutting tools; 3) it involves high tool replacement and maintenance cost.

The drawbacks associated with tenon and mortice joints can be eliminated by the introduction of the modern and streamlined dowel jointing method, which allows easy processing as well as much lower investment and operating costs.

3.2.4 Obsolete equipment

Most of the woodworking equipment in use in BFIDC's furniture/joinery plants was acquired in the period 1962-1966, and only few machines are in condition to perform with an acceptable degree of accuracy and quality.

In this respect it is recommended that a basic range of up to date woodworking machines be introduced to pave the way for the renovation of production techniques in BFIDC's plants, as well as in the secondary wood processing industry as a whole.

3.2.5 Inefficient maintenance of cutting tools and equipment

Practically none of BFIDC's plants, but the Kaptai Sawmill, is equipped with machinery for the maintenance of cutting tools, except for sharpeners for planing and slicing knives.

At present, each plant in the Complex runs its own tool and equipment maintenance unit. However, the critical lack of appropriate maintenance equipment, specific tool maintenance know-how, and an effective preventive maintenance system, seriously affects the efficiency of the Complex as a whole. The problem is particularly serious for saw blades, including bandsaw blades utilized in the two small sawmill units, which are roughly and unevenly sharpened by hand; this also being the case with moulding knives, boring bits, router cutters, etc.

High operating costs are experienced in the use of expensive circular saws tipped with hard metal (carbide). These blades, which are also used in the manufacture of particle board and plywood by BFID, cannot be sharpened free-hand on account of the particularly tough nature of the tipping material; thus they quickly deteriorate in use and have to be disposed of after limited service.

The tool maintenance constraint affects not only the life span of tools, but also the quality of finished products and the wastage rate in the utilization of raw material. Furthermore, labour cost is inflated by the substantial hand work which has to be added in order to correct machining faults. In turn, machinery performance is affected by defective cutting tools, as these produce abnormal working stresses on the equipment.

Lack of an effective preventive maintenance programme for the equipment in use in the Complex, is a particularly serious drawback in view of the age of the machinery in use. In fact, the equipment at the recently established particle board plant is of reconditioned type. Uncontrolled machine breakdown has an adverse effect on the continuity

of production and, consequently, on delivery schedules. Moreover the quality of processed parts is often affected because the conditions of the equipment would not allow accurate machining adjustments and appropriate performance.

Cutting tools' performance and life span can be substantially improved by regular and appropriate maintenance. Machine breakdown can be reduced and continuity of production better assured through effective preventive maintenance that through costly and time consuming repair work on an ad hoc basis. Careful scheduling of periodic overhauls and renewals can minimize interruption of production; and systematic inspection of equipment can indicate probable failures that frequently can be prevented by timely repairs.

The strengthening of the maintenance function in the Complex on the basis of existing decentralization would require costly and unnecessary duplication of resources and efforts, and would deter standardization as well as call for the training of more personnel.

It is therefore recommended that two maintenance servicing centres — respectively for tool and equipment maintenance — be established for the benefit of all the plants in the complex.

3.2.6 Lack of economy of distribution

Inflated distribution costs are incurred by shipping the furniture produced by the BFIDC's furniture plant at Chittagong in assembled form by truck. Because of the bulky nature of furniture products, a considerable sales burden is accumulated, in that as much as 75 per cent of the furniture produced by the Chittagong plant is absorbed by the Dhaka market area. Moreover, much of furniture is damaged in transit, resulting in costly repair work.

The problem can be overcome by developing furniture designed in such a way as to allow the shipment of furniture in unassembled component parts. Once delivered to Dhaka, the furniture would then be assembled and finished by the BFIDC's furniture plant there.

3.2.7 Inefficient use of particle board

Major difficulties are encountered in the utilization of particle board both by the BFIDC's furniture plants and the private sector, because no due consideration is given in using the material according to its workability limitations as compared to plywood and solid timber. As a result, the advantages of using particle board as a substitute to more expensive material are largely lost, and its acceptance by the industry greatly hampered.

In order to offset this problem the project is expected to develop furniture items involving the efficient utilization of particleboard.

Moreover, the standardization under the project of furniture designs - and therefore of dimensions of particleboard furniture components - will add new marketing opportunities for BFIDC - produced particle board, in that it would make possible for the particle board plant itself to supply pre-cut lipped furniture panels for further processing by FIDOC as well as by the private industry.

3.3 BFIDC managerial asset

The main asset of BFIDC's woodworking plants is the outstanding caliber of its managerial staff - the executives being holders of university degrees in engineering, economics, etc., and key supervisors being technical school graduates. The only constraint in this respect is the lack of experience in fully industrialized production of furniture.

3.4 BFIDC's furniture export project

Since its inception the BFIDC has been seeking foreign participation in the development of an export-oriented furniture operation in Chittagong. Negotiations in this respect were conducted in 1962 by the then FIDC with the American company of Louis Berger, which had found such a project viable on the basis of a feasibility study. The project did not materialize.

More recently, a detailed engineering study was prepared by Romania for the establishment of a US\$4 million furniture project within the BFIDC Complex in Chittagong. The complexity and scale of the project would have necessitated the long-term involvement of an expatriate team of executives and technicians.

Under a bilateral agreement Romania would have contributed managerial, technical and marketing know-how in the implementation of the project. The required production equipment, worth over US\$ 2 million, has already been purchased from Romania and it is expected to be delivered in the near future. However, BFIDC has decided not to further its envisaged cooperation with Romania, and it is considering to scrap the furniture export project altogether because it could not afford on its own substantial investment in new building facilities and extensive technical assistance.

As an alternative, the BFIDC management has been considering the possibility of distributing the purchased equipment among its existing furniture/joinery plants. This, however, would not be a viable solution because, among other things, the equipment purchased, such as the sophisticated finishing line for panel components, would not fit in the lower technology level of those plants.

It is therefore strongly recommended that the equipment be utilized for the original intended purpose by seeking a joint venture agreement with alternative foreign partners if the originally envisaged cooperation with the Romanians cannot be resumed.

4. CONCLUSIONS AND PROPOSED FOLLOW-UP

The conditions of the furniture/joinery industry, and the magnitude of projected demand for low-cost wood products, call for radical changes in product engineering, manufacturing methods and marketing strategy.

The industry must operate at a meaningful level of efficiency if a rational utilization of forest resources is to be achieved, and if the Government is to contain its budgetary requirements for the supply in the decade ahead of low-cost wood products for institutional facilities and public housing projects.

On the other hand, the complexity of the task is such that the private woodworking sector could not mobilize sufficient resources on its own to carry out the required comprehensive and extensive development work.

The BFIDC, with its easy access to forest resources and its impressive managerial base, should be enabled to act as a catalyst in the development of the furniture/joinery woodworking sector as a whole.

BFIDC's woodworking facilities alone could certainly not meet the enormous projected demand for low-cost furniture and joinery; however, appropriate technical assistance could, inter alia, enable the Corporation to acquire the capability of producing efficiently furniture component parts for further processing by the private wood-working sector.

Thus, the additional social benefit of contributing towards the development of the small-scale industry and related employment opportunities would also be attained.

In order to enable BFIDC to fulfill effectively its catalyst role in the development of the secondary wood processing sector, it is recommended that the performance of the Corporation's plants be strengthened through the provision of three technical assistance projects financed by UNDP and executed by UNIDO :

1. Project document ref. 01 (annex V)

Pilot project for the standardization of low-cost furniture and joinery —
duration: 24 months

- proposed UNDP contribution: US\$ 506,800

2. Project document ref. 02 (annex VI)

Project for the establishment and operation of a Tool Servicing Centre
- duration: 18 Months

- proposed UNDP contribution US\$287,200

3. Project document ref. 03 (annex VII)

Project for the establishment and operation of a Machine and
Equipment Maintenance Centre

- duration : 24 months

- proposed UNDP contribution: US\$600,000

As for the appropriate utilization of the equipment which was purchased from Romania for the purpose of establishing a furniture export operation, it is suggested that the UNIDO Investment Centre provide assistance to BFIDC in identifying overseas partners for a joint venture project. A background paper is annexed herewith in this respect (See annex viii).

To enable BFIDC to take immediate rationalizing steps in selected areas, this report provides the following trouble shooting reference material:

1. Detailed data on standard dimension of chairs as to improve the functional performance of this furniture item and allow BFIDC to take initial steps towards furniture standardization (Annex IX, Appendix I);
2. Detailed data on a lubrication system for woodworking equipment as to allow a more efficient preventive maintenance, and reduce the occurrence of costly repair work (Annex IX, Appendix II);
3. Information on selected costing procedures as to facilitate the monitoring and control of production costs (Annex IX, Appendix III);
4. Data on the selection of appropriate carbide tipped circular saws for the cutting of veneered particle board. (Annex IX, Appendix IV).

CLASSIFICATION OF TIMBER SPECIES

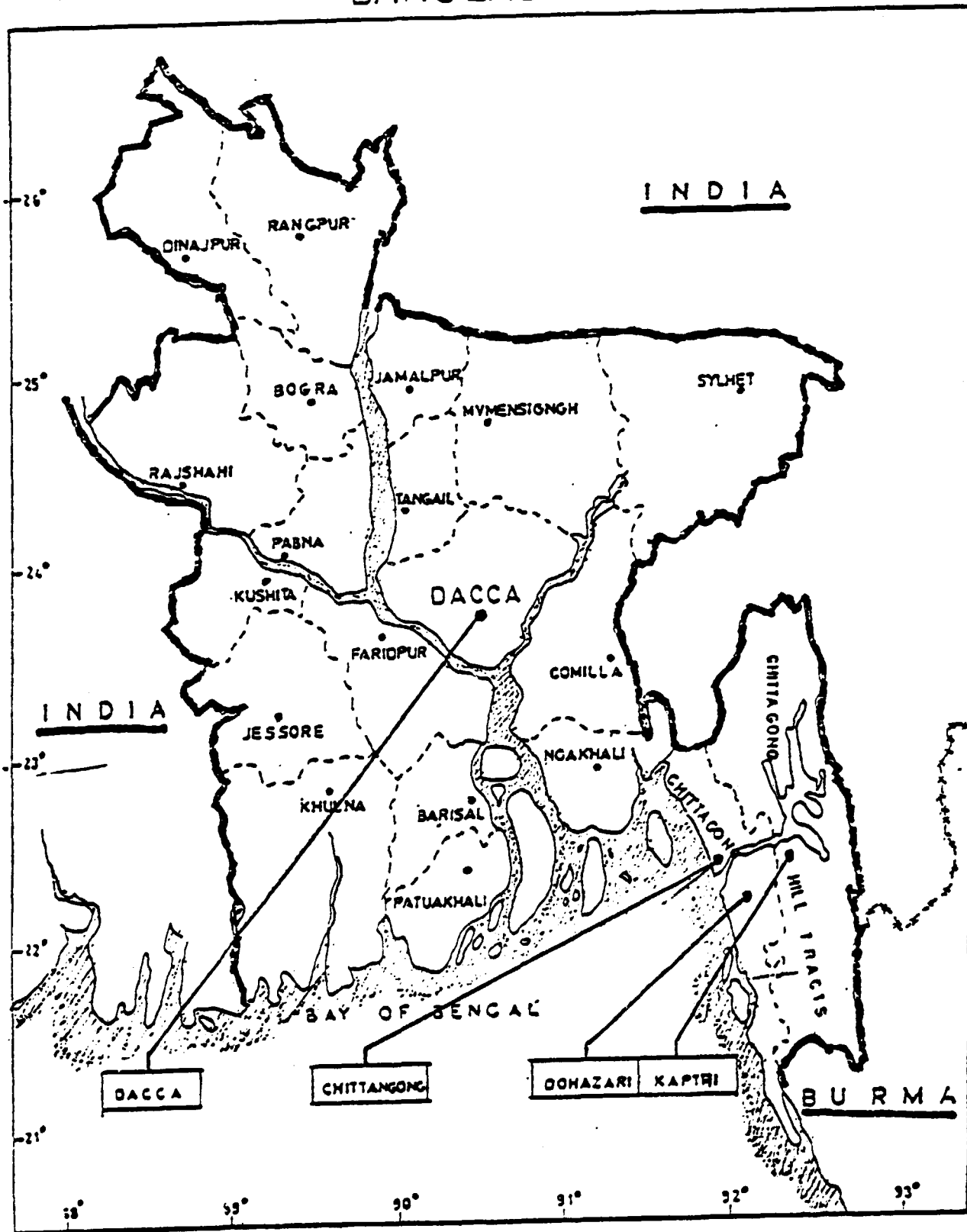
CLASS	X	LOCAL NAME	Y	SCIENTIFIC NAME
<u>Superior Tropical Hardwood</u>				
'A'		Champa		Michelia Champaca
'A'		Chapalish		Artocarpus Chaplasha
'A'		Chikrassi		Chukrassia Tabularis
'A'		Gamar		Gmelina arborea
'A'		Toon		Cedrela toona.
'A'		Jorul		Lagerstroemia Spp
'A'		Negeswar		Mesua ferrea
'A'		Boilam		Anisoptera
'A'		Condori		Cinnamomum ceoidodaphne
'A'		Telsur		Hopea odorata
'A'		Sikoroi		Albizzia P.berth
<u>Tropical Hardwoods</u>				
'A'		Garjan		Dipterocarpus Spp.
'B'		Kamdeb		Calophyllum Spp.
'B'		Tali		Dichepsis polyantha
'B'		Pitraj		Amoora rehituka Spp
'B'		Bandarhola		Duabanga sonneratioides
'B'		Kanjai		Bischofia javanica
'B'		Jam		Engenta Spp.
<u>Misc. Tropical Hardwood</u>				
'C'		Kanak		Schima wallichii
'C'		Haritaki		Terminalia Chebula
'C'		Banspata		Prodocarpus nerifolia
-		Ceda		Vitex peduncularies
-		Gutgutia		Bursera serrata
-		Kerol		Albissia Spp.
-		Shonalu		Cassia fistulla
-		Behara		Terminalia belerica

Class	LOCAL NAME	SCIENTIFIC NAME
-	Jalpai	Elaeocarpus Spp.
-	Batna	Castaropsis hystrix
<u>Tropical Semi-Hardwood</u>		
'C'	Civit	Swintonia floribunda
'C'	Uriam	Mangifera sylvatica
<u>Misc. Tropical Semi-Hardwood</u>		
'C'	Chatian	Alstonia scholaria
'C'	Raktan	Lophopetalum fimbriatum
'C'	Simul	Bombax malabaricum
-	Chandul	Tatrameles nudiflora
-	Pitali	Trewia nudiflora

OUTPUT OF BFIDC PROCESSING PLANTS
IN THE FISCAL YEAR 1981 - 1982

1. - Log extraction	: 976,570 cft (27.636 m ³)
2. - Sawn timber	: 135,950 cft (3,847 m ³)
3. - Furniture	: 12.65 million taka (US\$560.028)
4. - Solid wood doors & windows	: 211,900 sft (19,685 m ²)
5. - Flush doors	: 121,560 sft (11.293 m ²)
6. - Tea chests	: 143,600 sets
7. - Plywood	: 1,300,000 sft (120,798 m ²)
8. - Particle board	: 266,470 sft (24,755 m ²)
9. - Veneered particle board	: 319,130 sft (29,647 m ²)
10. - Wood preservation (Poles, Posts & Sleepers)	: 331,820 cft (9,390 m ³)

BANGLADESH



Annex IV

Officials met

- UNDP, Dhaka
- Mr. W.R. Holzhausen, Resident Representative
 - Mr. A. de Raad, Junior Professional Officer
 - Mr. B. Kocer, Senior Industrial Development Field Adviser
- BFIDC, Dhaka
- Mr. M.A.M. Chowdhury, Chairman
 - Mr. Wailul Islam, General Manager, Planning and Development
 - Mr. S.M.Z. Pasha, General Manager, Production and Sales Division
 - A.F.M. Nuru Islam, Deputy Chief Engineer
- BFIDC, Chittagong
- Mr. Ajmal Hossain, Project Director, Timber Extraction and Woodworking Complex
 - Mr. Sober Uddin Ahmed, Project Manager, FIDCO furniture Plant
 - Mr. M.A. Zaman, General Manager, Particle board and Veneering Plant
 - Mr. Swarnendu Bidash Chakma, Project Manager, Cabinet Manufacturing Plant (CMP)
 - Mr. M.A.R. Mollah, Project Manager, Chittagong Board Mill (CBM)
 - Mr. Azizur Rahman Chowdhury, Project Manager, Wood Treating Plant
 - Mr. Habibur Rahman Deputy Chief Accountant
 - Mr. Syed Wahidul Alam, Sales Manager
- BFIDC, Kaptai
- Mr. Nurad, General Manager, Timber Extraction and Processing Complex
 - Mr. M. Hussain, Project Manager, Sawmill plant

UNITED NATIONS DEVELOPMENT PROGRAMME

DHAKA

Project of the Government of Bangladesh

PROJECT DOCUMENT

1. Country: Bangladesh
2. Project Title: Pilot project for the standardization of low-cost furniture and joinery
3. Project No: BGD/82/038
4. Sector: (Govt. Class.)
(UNDP Class. and Code)
5. Government Implementing Agency: Bangladesh Forest Industries Development Corporation (BFIDC)
6. Executing Agency: United Nations Industrial Development Organization (UNIDO)
7. Duration: 24 months
8. Estimated Starting Date:
9. Government input:
10. UNDP input: US\$ 506,800

APPENDICES

I Classification of timber species occurring in Bangladesh

II Output of BFIDC's processing plants

III Furniture and joinery items to be developed under the project

IV Sample production flow chart

V Metric sizes of sawn timber

PART I - LEGAL CONTEXT

To be detailed in final project document

PART II - THE PROJECT

PART II A - DEVELOPMENT OBJECTIVES

The project aims at contributing towards the fulfilment of the following development objectives of the current Five Year Plan:

- a) To economize the use of forest resources and reduce waste in their utilization.
- b) To meet household and institutional demand for low-cost wood products.

PART II B - IMMEDIATE OBJECTIVES

The overall immediate objective of the project is to establish, within the furniture plant (FIDCO) of the Woodworking Complex of the Bangladesh Forest Industries Corporation (BFIC) at Chittagong, a Pilot Workshop for the Standardization of Low-cost Furniture and Joinery. The workshop is designed to provide a platform for the country-wide development of the secondary wood processing sector.

At the time of the completion of the project, a capability will exist at FIDCO to manufacture efficiently on an industrial basis a selected range of low-cost wood products, to serve as the first step towards restructuring BFIC's Furniture and Joinery sub-sector.

PART III C - SPECIAL CONSIDERATIONS

Not applicable.

PART II.D - BACKGROUND AND JUSTIFICATIONS

D.1 General background

Bangladesh with a population of about 90 million is the most densely populated country in the world, and one of the poorest of the developing countries: its per capita income (US\$ 120) is the second lowest in Asia after Laos (US\$39).

With an average annual population growth of 2.6 per cent, Bangladesh's projected population size is expected to double in 27 years and to reach a 155.7 million mark by the year 2000.

Despite worldwide economic recession and an adverse foreign aid climate, Bangladesh, which depends largely on foreign economic assistance to finance its development, achieved a satisfactory performance during the fiscal year 1981. The gross domestic product (GDP) rose by 7.6% compared to the targeted 7.2% for that year and the actual 3.4% in the fiscal year 1980. The GNP rose from US\$ 90 billion in 1977 to US\$ 140 billion in 1980.

The mainstay of Bangladesh economy is agriculture with a 55.26% share of the GNP in 1981 which saw food production reach a record 15 million tonnes.

Industrial production in the fiscal year 1981 rose by 9.23% (diesel engines increased by 523%; TV sets 261%; sugar 52%; motor vehicles 43%; raw rubber 25%; forestry 23%, etc..).

The Government is actively encouraging the development of the private industrial sector and has enacted a law to protect foreign private investment. With a view to channel the private sector's dynamism into public sector undertakings, the Government has decided to sell shares of major public sector industries. Efforts are also being made to involve public sector Corporations in joint ventures with local and foreign private investors.

D.2 Requirements and scope for low-cost furniture and joinery products

Most of the public capital investment in the Physical Planning and Housing sector is allocated to the construction of essential public servants housing, offices and institutional buildings as well as water supply work.

A requirement for 300,000 new housing units developed in the period 1974 - 1980 for the urban areas of the country. However, it is estimated that the private sector covered not even half of that requirement; while only 8,456 new housing units were built for Government employees in about the same period.

To date, a total of about 20,000 housing units is available for Government employees; which covers only 4.3 per cent of the requirements.

Because of the magnitude of needs in this respect, and to allow a substantial number of people to have a reasonable shelter with the limited resources available to the Government, the development plans specifically call for the implementation of measures such as:

- (a) The construction of a large number of low-cost semi-permanent housing units requiring lesser time and resources, to ease the existing shortage of public servants housing.
- (b) The supplying by the Government of core houses for further development by the occupants.
- (c) The standardization of the residential accommodations of the Government and autonomous organizations.
- (d) The standardization of building structures, including joinery components such as windows and doors.

In this connection the Bangladesh Public Works Department plans to build in the Second Five Year Plan a total of 30,000 semi-permanent low-cost housing units and 10,000 multi-storied flats at a cost of Tk 3.440 million - with a view to provide residential accommodation to public servants in the major cities.

In addition, the necessary accommodations are scheduled to be provided, at a cost of TK 2.350 million, for the basic administrative and development personnel in a number of new Districts, Sub-divisional and Thana Headquarters expected to be created in the country.

Budgetary commitments have also been entered in the Second Five Year Plan for the construction of 15,500 additional classrooms for existing primary schools and 2,000 new schools; as well as the development of 10,000 existing secondary schools and 48 primary teacher training institutions.

Most of the 40,000 existing primary schools lack adequate furniture for students and teachers. The Five Year Plan provides for the supply of 960,000 low benches for children and 123,000 teacher chairs. In addition, 77,400 blackboards and 34,000 first aid boxes will be supplied.

In the health sector, a total of 2,727 new hospitals and clinics are expected to be built in the period 1980-85.

The need for low-cost housing, institutional facilities, and related wood products, is expected to grow by staggering proportions in the years ahead, considering that the population is expected to grow by 62.9 million in the period 1981-2000.

D.3 Forest resources

Bangladesh has about 3.3 million acres of forests under the management of the Forest Department, and 2.4 million acres of unclassified State Forests under the control of the District authorities in Chittagong Hill Tracts.

The country's richest forest resources occur in Chittagong and Chittagong Hill Tracts Districts, with other forest areas in Khulna, Tangail and Dinajpur Districts.

Plantation forests were established by the Forest Department as early as 1872, and today cover about 400,000 acres. The early inland plantations consist mainly of teak wood. Since 1974 emphasis has shifted towards valuable non-teak species and fast-

growing local and exotic species. A number of "superior class" tropical hardwoods (See Annex I) are currently available for furniture making. Teak wood is at present being exported in sawn form to the People's Republic of China.

However, timber supply is inadequate to meet the needs of the woodworking industry due to the quick depletion of the more accessible flat-land forests. In fact, timber availability sharply declined from 0.61 cft to 0.30 cft per capita between 1965 and 1977. On the basis of minimum per capita consumption, the total requirement of quality timber in the country is estimated to be 70 million cft in 1984-85; but the supply is expected to reach only 24 million cft.

The projected increase in construction activities in the Second Five Year Plan is considered as being the main factor for the deterioration of the timber supply situation.

The Forest Department is undertaking an ambitious afforestation programme but, because of the nature of the hardwood forest requiring a long plantation cycle, future exploitation of forest resources will pose the problem of moving to more difficult terrains of the country in the east.

In the face of continued shortage of timber supply, the current development plans call for the implementation of specific measures for the optimal utilization of forest resources both at extraction and wood processing levels in order to: (1) meet household and institutional needs for wood products and (2) develop the capability of earning foreign currency through export of furniture.

In particular, the current Five Year Plan calls for: (1) the modernization and restructuring of existing industries in order to maximize output and productivity, improve quality of products and reduce waste; (2) acquiring technical know-how necessary for the production of wood products for export markets.

D.4 The woodworking sector and the role of BFDC

The history of mechanized woodworking in Bangladesh is relatively recent, if compared to other countries in the region.

Prior to the partition of the Sub-continent in 1947, practically no machinery was utilized in the processing of timber: the use of hand tools and artisanal techniques by small family-centered workshops was the rule.

The period 1947-60 marked the introduction of woodworking machinery and the beginning of the woodworking industry. In 1959 the autonomous body of the Forest Industries Development Corporation was set up under the Ministry of Industry to promote and spearhead the development of the forest industries.

The following year, the Central Forest Research Laboratory was established at Chittagong by FIDC. In the same year the first wood preservation unit and attached sawmill were established in Chittagong - the first nucleus of what today is the BFDC Woodworking Complex. The Complex was gradually expanded over the years to include:

- (a) In 1962 the first mechanized furniture/joinery plant in the country, the Cabinet Manufacturing Plant (CMB) with attached sawmill and Dry Kiln, now only producing windows, doors and related sawn timber requirements;
- (b) In 1965 a new furniture plant, the Furniture Industry Development Company (FIDCO) and attached dry kiln.
- (c) In 1966 the Chittagong Board Mill (CBM), today involved in the manufacture of flush doors;
- (d) Finally, a particle board plant was added to the Chittagong Complex in 1981, which is also geared to the production of sliced veneer and ready-veneered particle board panels.

Woodworking facilities were established by BFIDC also in other parts of the country:

- (a) The Eastern Wood Works and the Cabinet Manufacturing Plant at Dhaka, today producing respectively furniture and joinery;
- (b) A wood treating plant and a doors and windows manufacturing unit at Khulna;
- (c) A plywood and tea chest plant with attached sawmill at Dohazari in the Sango Valley.

BFIDC's most modern wood processing facilities are those of the Lumber Processing Complex established in 1972 at Kaptai and including sawmilling, wood treatment and kiln drying. The Complex is also equipped with a self-contained moulding/planing unit, which, however, is largely unutilized.

Thus, today the Bangladesh Forest Industries Development Corporation, under the Ministry of Agriculture, covers the largest grouping of forest industries activities in the country, spanning from log extraction to primary and secondary wood processing activities (see Annex II).

BFIDC's total manpower, including its rubber plantation project, is of about 4,000, of which 865 are engaged in timber extraction and over 1,200 in wood processing activities.

D.5 The furniture and joinery sub-sector

The majority of furniture and joinery making activities in the country are still carried out with hardly any machinery, and on artisanal and semi-artisanal basis, by an estimated 700 small workshops scattered around the country, with an employment of about 3,000.

The organized private sector, where some degree of mechanization exists, consists (according to a 1976 survey) of about 47 furniture/joinery units, with an estimated total annual sales value of Tk 21.6 million.

In the public sector, the EFDC operates two furniture plants (at Chittagong and Dhaka); three windows and doors plants (at Chittagong, Dhaka and Khulna); one flush door plant at Chittagong. EFDC's sales volume in furniture and joinery products amounted to a total of 26.3 million Taka (about US\$ 1.16 million) in the fiscal year 1981-82.

The EFDC's furniture/joinery plants are considered as being the largest in the country. In particular, the Corporation's furniture plants at Chittagong, FIDCO, is provided with the largest concentration of heavy-duty woodworking machinery, and accounts for the largest share in EFDC's furniture sales. The plant has a current manpower of 220.

However, the performance of EFDC's secondary wood processing sub-sector, and in particular of the furniture operation, has been affected by serious problems and constraints, due mainly to the fact that since its inception it has not been given the means to operate on a truly industrial basis.

As a result, EFDC could not provide a meaningful impact on the development of the furniture/joinery industry as a whole, as originally envisaged, and help fulfill the increasing needs of the country in terms of low-cost wood products.

The main constraints and envisaged remedial actions by the project are outlined in the following paragraphs:

Lack of standard furniture designs suitable for industrial production

The single major factor responsible for high cost and unsatisfactory quality of finished products is that furniture made with the aid of machines is not designed according to the capabilities, characteristics, requirements and limitations of mechanized production. In particular, when it comes to the assembly of machined components, construction and design details are such as to require superior cabinet-making skills and a time-consuming process involving substantial additional hand work.

Moreover, furniture construction ignores the standardization concept of minimizing number of sizes of component parts.

As a result, the advantage of using machinery is drastically reduced and the production process becomes more cumbersome rather than streamlined.

A further obstacle toward attaining the economic advantages of the industrial system is posed by the EFIDC's furniture and joinery plants mostly utilizing their considerable outlay of equipment for the production of custom-made furniture. This negates the concept and economy of line production.

This project is designed to introduce a pilot range of low-cost standard furniture and joinery products - and related production know how - as the first step towards satisfying on an efficient basis, the demand for such products in the decade ahead.

Outdated machining methods

Productivity and operating costs are negatively affected by the complex and outdated jointing system of tenon-and-mortice in use in the furniture plants. The disadvantage of the system: (1) it requires precision matching of joints machined in two separate operations, and on two distinct machines; (2) it involves the maintaining in perfect working conditions of two different sets of cutting tools; (3) it involves high tool replacement and maintenance cost.

The drawbacks associated with tenon and mortice joints will be eliminated by the project introducing the modern and streamlined dowel jointing method, which allows easy processing as well as much lower investment and operating costs.

Obsolete equipment

Most of the woodworking equipment in use in EFIDC's furniture/joinery plants was acquired in the period 1962-1966, and only few machines are in condition to perform with an acceptable degree of accuracy and quality.

This project will introduce a new generation basic woodworking machines to pave the way for the renovation of production techniques in BFIDC's plants, as well as in the secondary wood processing industry as a whole.

Inefficient maintenance of cutting tools

Practically none of BFIDC's plants (except for the Kaptai Sawmill) are equipped with machinery for the maintenance of cutting tools, except for knives sharpeners for planers and slicers.

Bandsaw blades, circular saws, moulding cutters and boring bits, etc., are sharpened entirely free-hand, resulting in defective quality of products, rejected components, limited working life of cutting tools, and abnormal stresses on the equipment.

Appropriate tool and equipment and maintenance techniques will be introduced under two separate UNDP/UNIDO Projects to serve the needs of all the plants in the BFIDC's Chittagong Complex.

Lack of economy of distribution

Inflated distribution costs are incurred by shipping the furniture produced by the BFIDC's furniture plant at Chittagong in assembled form by truck. Because of the bulky nature of furniture products, a considerable sales burden is accumulated, in that as much as 75 per cent of the furniture produced by the Chittagong plant is absorbed by the Dhaka market area. Moreover, much of furniture is damaged on transit, resulting in costly repair work.

The problem is expected to be overcome by this project developing furniture designed in such a way as to allow the shipment of furniture in unassembled component parts. Once delivered to Dhaka, the furniture would then be assembled and finished by the BFIDC's furniture plant there.

Inefficient use of particle board

Major difficulties are encountered in the utilization of particle board both by the BFIDC's furniture plants and the private sector, because no due consideration is given in using the material to its workability limitations as compared to plywood and solid timber. As a result, the advantages of using particle board as a substitute to more expensive material are largely lost, and its acceptance by the industry greatly hampered.

In order to offset this problem the project is expected to develop furniture items involving the efficient utilization of particle board.

Moreover, the standardization under the project of furniture designs - and therefore of dimensions of particle board furniture components - will add new marketing opportunities for BFIDC-produced particle board, in that it would make possible for the particle board plant itself to supply pre-cut lipped furniture panels for further processing by FIDCO as well as by the private industry.

D.6 Conclusions

The conditions of the furniture/joinery industry, and the magnitude of projected demand for low-cost wood products call for radical changes in product engineering, manufacturing methods and marketing strategy.

The industry must operate at a meaningful level of efficiency, if a rational utilization of forest resources is to be achieved, and if the Government is to contain its budgetary requirements for the supply in the decade ahead of low-cost wood products to institutional facilities and public housing projects.

On the other hand, the complexity of the task is such that the private woodworking sector could not mobilize sufficient resources on its own to carry out the required comprehensive and extensive development work.

The BFIDC, with its easy access to forest resources and its managerial base, should be enabled to act as a catalyst in the development of the furniture/joinery woodworking sector as a whole.

BFIDC's woodworking facilities alone could not certainly meet the enormous projected demand for low-cost furniture and joinery; however, this technical assistance project will, inter-alia, enable the Corporation to acquire the capability of producing efficiently furniture component parts for further processing by the private wood-working sector.

Thus, the additional social benefit of contributing towards the development of the small-scale industry and related employment opportunities will be achieved.

PART II. E OUTPUTS

	<u>Schedule</u> ^{1/}
1. Survey of product requirements	2
2. Complete manufacturing documentation of the range of low-cost furniture and joinery products listed in ANNEX III	7
3. Complete kits of sample component parts for each item in the range except joinery	9
4. Workshop in operation	9
5. Regular batch production	15
6. Manual on Basic production control procedures	19
7. Manual on Basic quality control procedures	22
8. Manual on Basic cost accounting procedures	18
9. Report on Wage incentive proposal	16
10. Attainment of proficient industrial skills, under actual production conditions, by two processing supervisors and fifteen production personnel	24

^{1/} Number of months after award of contract

PART II.F ACTIVITIES

The main activities of the project will be carried out in the form of a sub-contract by a specialized furniture research institution.

In addition, 4 m/m of ad-hoc consultancies are made available in the project to fulfill needs for short-term specialized assistance as the need arises. This will ensure an appropriate degree of flexibility to the project.

The sub-contract will include five activities:

- (a) Product requirement survey;
- (b) Product development;
- (c) Establishment and operation of pilot workshop;
- (d) Cost accounting;
- (e) Industrial engineering.

II.F.1 Activity No. 1

Survey product requirements (duty station: Dhaka)
- Furniture designer (3 weeks)

As a preparatory activity to the product development work, the contractor will delegate a furniture designer to identify in detail the requirements of end-users of low-cost furniture and joinery.

Under the activity the consultant will hold discussions on the subject with government departments concerned with institutional and residential building programmes, and determine desirable characteristics of the products in terms of appearance, performance, function and dimensions.

II.F.2 Activity No. 2

Development of product know-how kits

(Activity to be carried out at contractor's own facilities)
- Contractor's research team (5 months)

The activity is aimed at providing a body of designs, and related manufacturing know-how, for the introduction of low-cost standard furniture of institutional and residential type. The activity will include the development of basic door and window designs.

The contractor will provide complete Product Know-how Kits for each product item listed in Annex - III. The following tasks will be carried out in this respect:

- (a) Development of conceptual designs;
- (b) Preparation of product drawings to include:
 - Full-scale drawings (where chairs are concerned);
 - Scale drawings for products other than chairs;
 - Working drawings of each individual component part;
 - Isometric drawings giving an "exploded view" of all component parts in each product.
- (c) Preparation of an overall operation flow chart giving an overview of all processing steps required for the manufacture of a given product (See Annex - IV).
- (d) Preparation of operation sequence sheets for each individual component part, to include estimate operation time.
- (e) Preparation of the master bill of materials^{2/} for each product to include information such as: rough and finished sizes units of quantity, waste allowance, material requirements other than wood including hardware, glue, upholstery material etc..
- (f) Production of complete kits of sample components for each product.

Design and construction shall be such as to provide the high strength and durability required of institutional furniture (for offices, schools, public, housing projects, etc.); moreover, they shall minimize material cost content as well as the complexity and number of processing operations. For example, joints shall be set at a 90° angle, while time-consuming shaping and moulding operations shall be avoided.

^{2/} Finished sizes of furniture and joinery will be based on standard metric sizes of sawn timber, as listed in Annex V.

The aim of this approach is not only to contain to a minimum level production costs, but also to minimize investment costs in equipment and cutting tools.

Within this context, furniture components shall be jointed by dowels rather than the traditional tenon and mortice method.

The maximum use shall be made in furniture construction of veneered particle board - one of the products of the BFIDC wood-working complex at Chittagong.

II.F.2 Activity No. 3

Establishment and operation of the pilot workshop (Duty Station: Chittagong)

- Woodworking Expert Team Leader (24 m/m)
- Surface Finishing Expert (6 m/m)

The activity is aimed at developing, on a pilot basis, manufacturing skills typical of the factory system and relevant to the production of low-cost furniture and joinery items.

The activity will cover the performance of the following tasks:

1. To prepare the workshop's plant layout.
2. To assist in the installation of the equipment.
3. To produce processing aids, such as jigs, templates, quality control gauges, etc.
4. To organize and supervise production activities with the assistance of two counterparts.
5. To devise and implement an appropriate quality control System.
6. To introduce a basic production control system.
7. To introduce preventive maintenance measures^{3/}.

^{3/} Maintenance of cutting tools and equipment in use in the Workshop will be carried out under a separate UNIDO project.

II.F.3 Activity No. 4

Cost Accounting
(Duty Station: Chittagong)

- Cost Accounting Consultant (4 m/m)

The activity aims at developing the capability to estimate production costs accurately and compare them with estimated costs.

The following tasks are expected to be carried out under the activity:

1. To introduce simplified procedures and forms for the collection of data on all elements of costs (Direct material, direct labour, overheads).
2. To assist in preparing master cost sheets for each standard product.

II.F.4 Activity No. 5

Industrial Engineering
(Duty Station: Chittagong)

- Industrial Engineer (4 m/m)

The activity aims at developing the capability of determining standard time for processing operations as a basis for the establishment of manufacturing cost and wage-incentive schemes.

Tasks expected to be carried out under the activity:

1. To standardize, in co-operation with the experts in Activity 2, the operations to be timed.
2. To carry out, with the assistance of the counterparts, stop-watch timing.
3. On the basis of the above, revise if so required, the estimated time figures given in the operation sequence sheets (see Activities, task d)
4. To propose options of wage-incentive schemes for possible introduction in the pilot project.

II.G INPUTS

II.G.1 <u>Description of Government Inputs</u>	<u>Duration</u> <u>m/m</u>	<u>Taka</u>
10. <u>National Staff</u>		
11. <u>Counterparts</u>		
- 2 counterpart trainers (full-time)	45	
- 15 production workers/trainees (full-time)	270	
13. <u>Support Staff</u>		
- Indirect labour as required		
- Secretarial staff as required	43	
19. Total cost of Personnel Component		<hr/>
30. <u>Training</u>		
- Allowances for in-service training		
39. Total cost of Training Component		<hr/>
40. <u>Government-provided Building and Equipment</u>		
41. <u>Production/maintenance materials and general supplies</u>		
- timber, plywood hardboard, etc.		
- glue ^{4/}		
- upholstery material		
- hardware ^{4/} (knock-down fittings, hinges, etc.)		
- finishing materials ^{4/} (lacquers, varnishes, thinners, etc.)		
- sanding paper for hand sanding and sanding belts ^{5/}		
- standard hand tools ^{6/}		
- spares for equipment not supplied by the UNDP project		
- general operating supplies.		

^{4/} Except for glue, hardware and finishing materials which will initially be needed for testing and prototype purpose. Provision will be made for them under the UNDP budget.

^{5/} Except for twelve pieces each of sanding belts of grit 60,80 and 120 to be supplied with the sanding machine as above.

^{6/} Except for six complete sets of cabinet-making carpenter tools to be supplied as above.

42. Non Expendable Equipment

- Working benches
- Tool cabinets
- Lockers
- 3 factory trolleys
- Office furniture as required

43. Buildings

The government will provide workshop and office premises required for the proper implementation of the project, and will be responsible for any necessary addition to and/or modification of the existing FIDCO facilities, as required. The minimum covered size of the workshop will be 7840 sft (about 780 m²).

49. Total cost of Materials and Building Component

50. Miscellaneous

51. Operation and maintenance of equipment

The cost of maintenance of the UNDP supplied machinery will be borne by the UNDP budget for the duration of the project, with the exception of labour cost which will be borne by the Government.

The entire operation (fuel cost) and maintenance cost of the UNDP supplied vehicle will be borne under the UNDP budget.

The cost of utilities related to the use of project premises (workshop and office) and the operation of the UNDP-supplied equipment will be borne by the Government.

The cost of translating into Bengali and reproducing training material and reports will be borne by the UNDP budget.

53. Sundry

Sundry expenses related to the operation of the workshop will be borne by the government with the exception of those expenditures which would normally be borne under UNDP contributions.

59. Total cost of Miscellaneous Component _____

99. TOTAL GOVERNMENT CONTRIBUTION _____

II.G.2 Description of UNDP Inputs

10. Project Personnel

	<u>Duration</u> <u>m/m</u>	<u>US\$</u>
11.00 <u>Ad-hoc Consultants</u>	4	<u>28,600</u>
13.00 <u>Support Personnel</u>		
13.01 Typist/Secretary	24	3,000
13.02 Driver/Mechanic	24	4,300
13.03 Draughtman	18	3,600
13.99 Subtotal Support Personnel		<u>11,400</u>
15.00 Experts Travel		<u>600</u>
16.00 <u>Other Personnel Costs</u>		
16.01 Tripartite Review		<u>- 4,000</u>
19.00 Total Personnel Component		<u>44,600</u>

20. Subcontracts

Contract Requirements:

The contractor shall be a woodworking research body with specific experience in carrying out design and production development work in the furniture and joinery field

29.00 Total Subcontract Component 313,350

<u>40. Equipment</u>		US\$
<u>41. Expendable equipment</u>		
41.01	Two doz. <u>Clamp heads sets</u>	
	- Typical equipment:	
	- WOODCRAFT, mod. 01F20 - R	420
41.02	Two doz. <u>Reversible pipe clamps</u>	
	- Typical equipment:	
	- WOODCRAFT, mod. 15 403 - AR	456
41.03	Six <u>Double bar clamp fixtures</u>	
	- Typical equipment:	
	- WOODCRAFT, mod. 15 804 - AR	220
41.04	Two <u>Deep engagement clamps</u>	
	- Depth: 120 mm	
	- Open capacity: 300 mm	
	- Typical equipment:	
	- WOODCRAFT, mod. 17-FO2 - BJ	120
41.05	Two <u>Power drills:</u>	
	- Two speeds for wood and metal boring	
	- Typical equipment:	
	- BLACK & DECKER, mod. SPK-2513	500
41.06	One <u>Vernier caliper</u>	
	- Reading up to 150 mm	
	- Typical equipment:	
	- VOLLMER, mod. MW-10-U	35
41.07	One <u>Protractor</u>	
	- Range up to 180°	
	- Length of leg: 150 mm	
	- Typical equipment:	
	VOLLMER, mod. MW-13-U	33
41.08	One <u>Boring gauge</u>	
	- Adjustable centers	
	- Typical equipment:	
	FIRA	250
41.09	<u>Workshop supplies</u>	3,000
41.10	<u>Office supplies</u>	600
	- Sub-total Expendable Equip.Component	<u>5,634</u>

U' Prices are CIF and include spare parts for two-year operation.

42.00	<u>Non-expendable equipment component</u> ^{8/}		<u>US\$</u>
42.01	One <u>Surface planer</u>		
	- Capacity 500 mm		
	- Suitable for rebating work		
	- With side jointing and power feed roller attachment		
	- Sealed-for-life bearings		
	- Six sets spare knives		
	- Typical equipment: SCM, mod. F 52		9,200
42.02	One <u>Thicknessing planer</u>		
	- Capacity 500 mm		
	- Sectional infeed rollers and chip breaker		
	- Infinitely variable feed speed		
	- Six sets spare knives		
	- Typical equipment: WADKIN - BURSGREEN, mod. BT-500		13,700
42.03	One <u>Tilting arbor panel saw</u>		
	- Sliding table with dimensioning capacity - 2,440 mm		
	- Scoring unit with 2 spare blades (90 + 90)		
	- With 4 spare carbide blades (100 X 4)		
	- Adjustable crosscut and mitre fence		
	- HP: 7.5		
	- Typical equipment: SCM, mod. SI-15 WF		13,000
42.04	One <u>Multi-boring machine</u>		
	- Multiple-spindle head for panel construction		
	- Five spindle head for solid wood construction		
	- Manual eccentric clamping		
	- Manual feeding of boring heads		
	- With 3 sets spare boring bits 10 mm dia		
	- Typical equipment: EUGEN MAYER, mod. DBSH (FRG)		9,000

^{8/} All motors to be tropically insulated and with overload protection. Motors to be wired for 220-480 V, 50 cycles, 3 phases.

	<u>US\$</u>
42.05 One <u>Light duty spindle moulder</u>	
- Spindle speed up to 10,000 r.p.m.	
- Tenoning attachment	
- Show type guard	
- Universal adjustable guard	
- Corner locking attachment for boards up to 75 mm deep	
- With sample cutting tools	
- Typical equipment: WADKIN - HURSGREEN, mod. BEN	12,000
42.06 One <u>Shaving machine</u>	
- Variable shaving angle depending on the density of wood	
- Shaving width up 220 mm	
- Open-side table	
- Shaving thickness upto 180 mm	
- Typical equipment: SHINKO, mod. 8S-360 (Japan)	8,000
42.07 One <u>Stroke belt sander</u>	
- With disc and bobbin sanding attachments	
- With self-contained dust extraction unit	
- Belt width: 150 mm	
- With 6 spare belts each grit 80,120,150	
- Typical equipment: WADKIN - HURSGREEN, mod. BGD	9,000
42.08 One <u>Dowel making machine</u>	
- For spiral-grooved and compressed dowels of 6,8,10 and 12 mm dia.	
- Minimum length of square strip: 22 cm	
- Typical equipment: LOSER, mod. GNOM DK	2,000
42.09 One <u>Dowel cross-cut and chamfering machine</u>	
- For 6 to 12 mm dia, dowels	
- With spare cutters LOSER, mod. AA - 220	3,500

	<u>US\$</u>
42.10 One <u>set</u> <u>Spraying equipment</u>	
- Four spray guns suitable for experimenting with various types of wood finishes	
- One air compressor	
- One wall exhaust fan	
- Air line complete of accessories	
- Typical equipment: DE VILBISS	9,000
42.11 One <u>Sample carpenter's workbench</u>	
- 1800 mm length	
- Typical equipment: ULMIA, mod. 2	800
42.12 Six <u>Workbench fittings</u> (sets)	
- For wooden benches to be made locally	
- Typical equipment: ULMIA, mod. 2	3,500
42.13 Six <u>Cabinet-making hand tools sets with tool chests</u>	
- Typical equipment ULMIA, mod. 402	4,000
42.14 Two <u>Heavy-duty power router</u>	
- Typical equipment with standard attachments and spare HSS routing cutters sizes 4,6,8,10,12 and 15 mm dia.	
- Typical equipment: SCHEER, mod.HM 14	900
42.15 One <u>Typewriter</u>	
- English key board with extra long carriage	700
42.16 One <u>Air conditioner</u>	700
42.17 One <u>Photocopying machine</u>	3,500
42.18 One <u>Pick-up van</u>	13,000
	<hr/>
Sub-total non-expendable equipment	119,000
	<hr/>

	<u>US\$</u>
43.00 <u>Building</u>	
43.01 Electrical supplies for the installation of the workshop equipment (10% of the machinery cost US\$ 94,000)	
Sub-total building component	<u>9,500</u>
49.00 Total cost of Equipment and Building Component	<u>134,134</u>
50. <u>Miscellaneous</u>	
51.00 Operation and maintenance of UNDP-supplied equipment	6,600
52.00 Reporting cost	600
53.00 Sundry	<u>2,000</u>
59.00 Total cost of Miscellaneous Component	<u>9,200</u>
99.00 GRAND TOTAL UNDP CONTRIBUTION	<u>506,800</u>

PART II.H - WORK PLAN

ACTIVITIES/OUTPUTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
1. Award of contract																																						
2. Survey of product requirements																																						
3. Equipment procurement Equipment delivery																																						
4. Woodworking Expert/Team Leader																																						
5. Volunteer																																						
6. Wood Finishing Expert																																						
7. Product development and prototypes ^{1/}																																						
8. Workshop in operation																																						
9. Training of 2 supervisors and 15 workers																																						
10. Regular batch production																																						
11. Cost Accounting Expert																																						
12. Industrial Engineering Expert																																						
13. Manual on production control																																						
14. Manual on quality control																																						
15. Report on wage incentives																																						

^{1/} Activity to be carried out at contractor's facilities

PART II.I - PREPARATION OF THE FRAMEWORK FOR EFFECTIVE PARTICIPATION OF NATIONAL AND INTERNATIONAL STAFF IN THE PROJECT

The activities necessary to achieve the project's immediate objectives will be carried out jointly by the national and international staff assigned to it. The government will provide all the requisite facilities for the implementation of the project. The respective roles of the national and international staff shall be in accordance with the established concept and specific purposes of technical co-operation.

PART II.J - DEVELOPMENT SUPPORT COMMUNICATION

Not applicable.

PART II.K - INSTITUTIONAL FRAMEWORK

The Government Implementing Agency will be the Bangladesh Forest Industries Development Corporations (BFIDC) of the Ministry of Agriculture. The actual execution of the project will be the responsibility of the existing furniture plant FIDCO of the BFIDC Complex at Chittagong.

The following Government Departments are expected to cooperate with FIDCO in the implementation of the project:

- Bangladesh Standards Institutions
- Forest Research Institute
- Ministry of Education
- Bangladesh Small and Cottage Industries Corporation (BSCIC).

PART II.L - PRIOR OBLIGATIONS AND PREREQUISITES

1. Prior obligations

None.

2. Prerequisite

The Government Implementing Agency will take all the necessary steps to ensure that its inputs are timely provided in accordance with the work plan. In particular, upon the approval of the project the Government will:

- a) allocate the necessary funds and facilities for the establishment and operation of the project;
- b) assign the necessary technical and support personnel.

If one or both pre-requisite fail to materialize UNDP and UNIDO may, at their discretion, either suspend or terminate the project.

PART II.M - FUTURE ASSISTANCE

Future assistance, if any, will be determined by a review of the project three months before its scheduled completion.

PART III. SCHEDULES OF MONITORING, EVALUATION AND REPORTS

PART III A - TRIPARTITE REVIEW MEETING

The project will be subject to a mid-term technical review some twelve months after its starting date. A special review to consider the necessity for further assistance should take place three months before project completion.

PART III B - EVALUATION

The project will be subject to evaluation, in accordance with the policies and procedures established for this purpose by UNDP. The organization, terms of reference, and timing of the evaluation will be decided upon by consultation between the national authorities, UNDP and UNIDO.

PART III.C - REPORTS

1. Progress Reports

These will be submitted at six months' intervals according to the format prescribed by UNDP.

2. Technical Reports

These will be prepared by the contractor's project staff according to the titles listed in the Outputs (See Part II.E - Outputs).

3. Terminal Report

The terminal report will be prepared by the Contractor for UNIDO's review two months prior to the completion of the project. It will be submitted formally by UNIDO upon completion of the project.

The report will provide a comprehensive review of project activities, a detailed assessment of its results and long-term recommendations.

CLASSIFICATION OF TIMBER SPECIES

CLASS	LOCAL NAME	SCIENTIFIC NAME
<u>Superior Tropical Hardwood</u>		
'A'	Champa	Michelia Champaca
'A'	Chapalish	Artocarpus Chaplasha
'A'	Chikrassi	Chukrassia Tabularis
'A'	Gamar	Gmelina arborea
'A'	Toon	Cedrela toona
'A'	Jorul	Lagerstroemia Spp
'A'	Negeswar	Mesua ferrea
'A'	Boilam	Anisoptera
'A'	Condori	Cinnamomum ceoidodaphne
'A'	Telsur	Hopea odorata
'A'	Sikoroi	Albizzia P.berth
<u>Tropical Hard Wood</u>		
'A'	Garjan	Dipterocarpus Spp.
'B'	Kamdeb	Calophyllum Spp.
'B'	Tali	Dichepsis polyantha
'B'	Pitraj	Amoora rehituka Spp
'E'	Bandarhola	Duabanga sonneratioides
'B'	Kanjai	Eischofia javanica
'B'	Jam	Engenta Spp.
<u>Misc. Tropical Hardwood</u>		
'C'	Kanak	Schima wallichii
'C'	Haritaki	Terminalia Chebula
'C'	Banspata	Prodocarpus nerifolia
-	Ceda	Vitex peduncularies
-	Gutgutia	Bursera serrata
-	Kerol	Albissia Spp.
-	Shonalu	Cassia fistulla
-	Behara	Terminalia belerica

Class	LOCAL NAME	SCIENTIFIC NAME
-	Jalpai	Elaeocarpus Spp.
-	Batna	Castaropsis hystrix
<u>Tropical Semi-Hardwood</u>		
'C'	Civit	Swintonia floribunda
'C'	Uriam	Mangifera sylvatica
<u>Misc. Tropical Semi-Hardwood</u>		
'C'	Chatian	Alstonia scholaria
'C'	Raktan	Lophopetalum fimbriatum
'C'	Simul	Bombax malabaricum
-	Chandul	Tatrameles nudiflora
-	Pitali	Trewia nudiflora

OUTPUT OF BFIDC PROCESSING PLANTS
IN THE FISCAL YEAR 1981 - 1982

1. - Log extraction	: 976,570 cft (27.636 m ³)
2. - Sawn timber	: 135,950 cft (3,847 m ³)
3. - Furniture	: 12.65 million taka (US\$560.028)
4. - Solid wood doors & windows	: 211,900 sft (19,685 m ²)
5. - Flush doors	: 121,560 sft (11.293 m ²)
6. - Tea cests	: 143,600 sets
7. - Plywood	: 1,300,000 sft (120,798 m ²)
8. - Partical board	: 266,470 sft (24,755 m ²)
9. - Veneered particle board	: 319,130 sft (29,647 m ²)
10. - Wood preservation (Poles, Posts & Sleepers)	: 31,820 cft (9,390 m ³)

LIST OF LOW-COST FURNITURE & JOINERY ITEMS
TO BE DEVELOPED UNDER THE PROJECT

GROUP A - SCHOOL FURNITURE

- A.1 Desk for 3 age groups
- A.2 Benches for 3 age groups

GROUP B - OFFICE FURNITURE

- B.1 Junior executive desk
- B.2 Clerical desk
- B.3 Typical desk
- B.4 Filing cabinet

GROUP C - GENERAL PURPOSE FURNITURE

- C.1 General purpose table
- C.2 General purpose chair (with interchangeable cane or upholstered seat)
- C.3 General purpose easy chair and 3-seater sofa (with cane seat & back)
- C.4 General purpose easy chair and 3-seater sofa (with loose cushions)
- C.5 General purpose low table (two sizes)
- C.6 General purpose stool
- C.7 General purpose storage cabinet system, to include wardrobe function

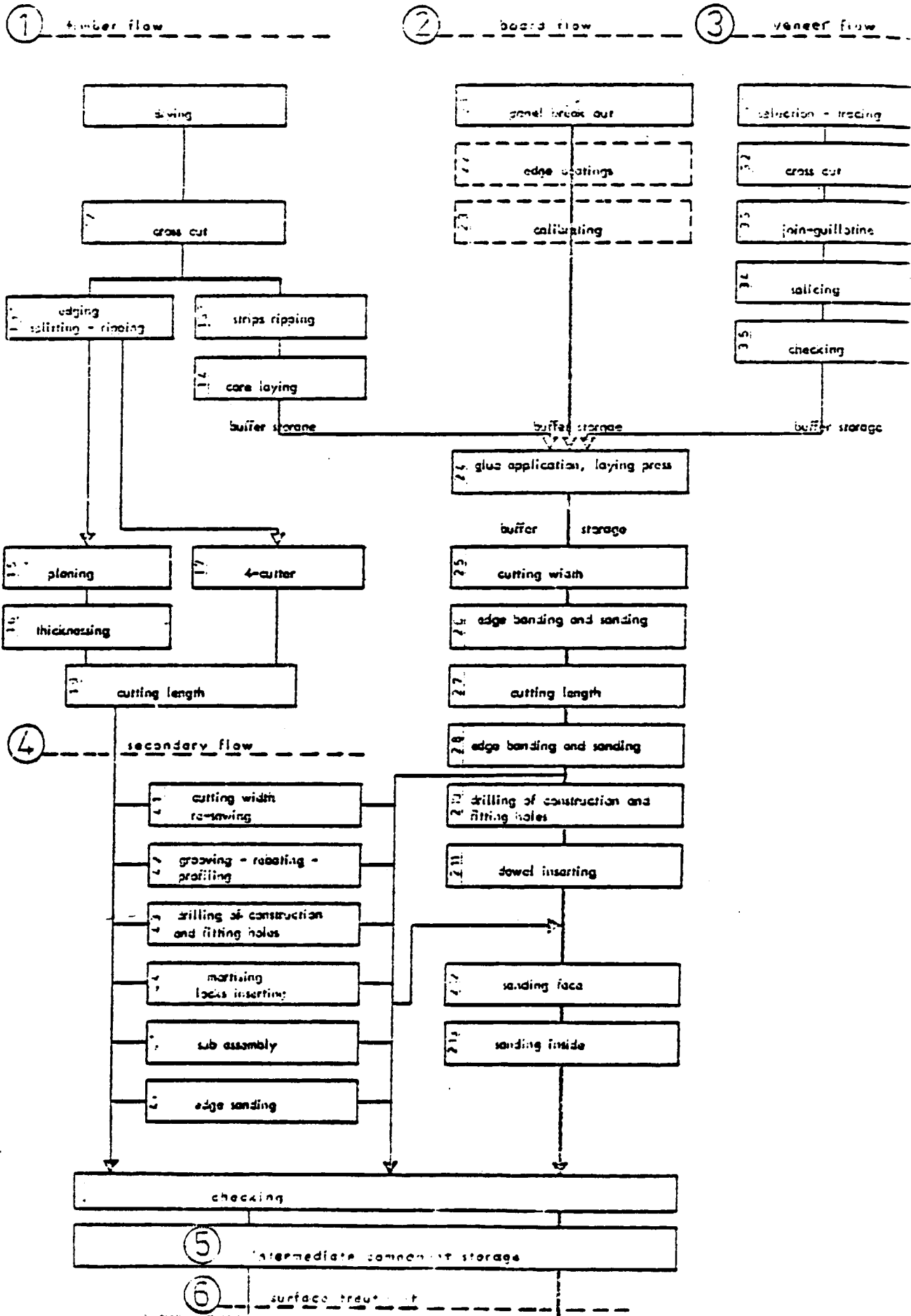
GROUP D - BEDROOM FURNITURE

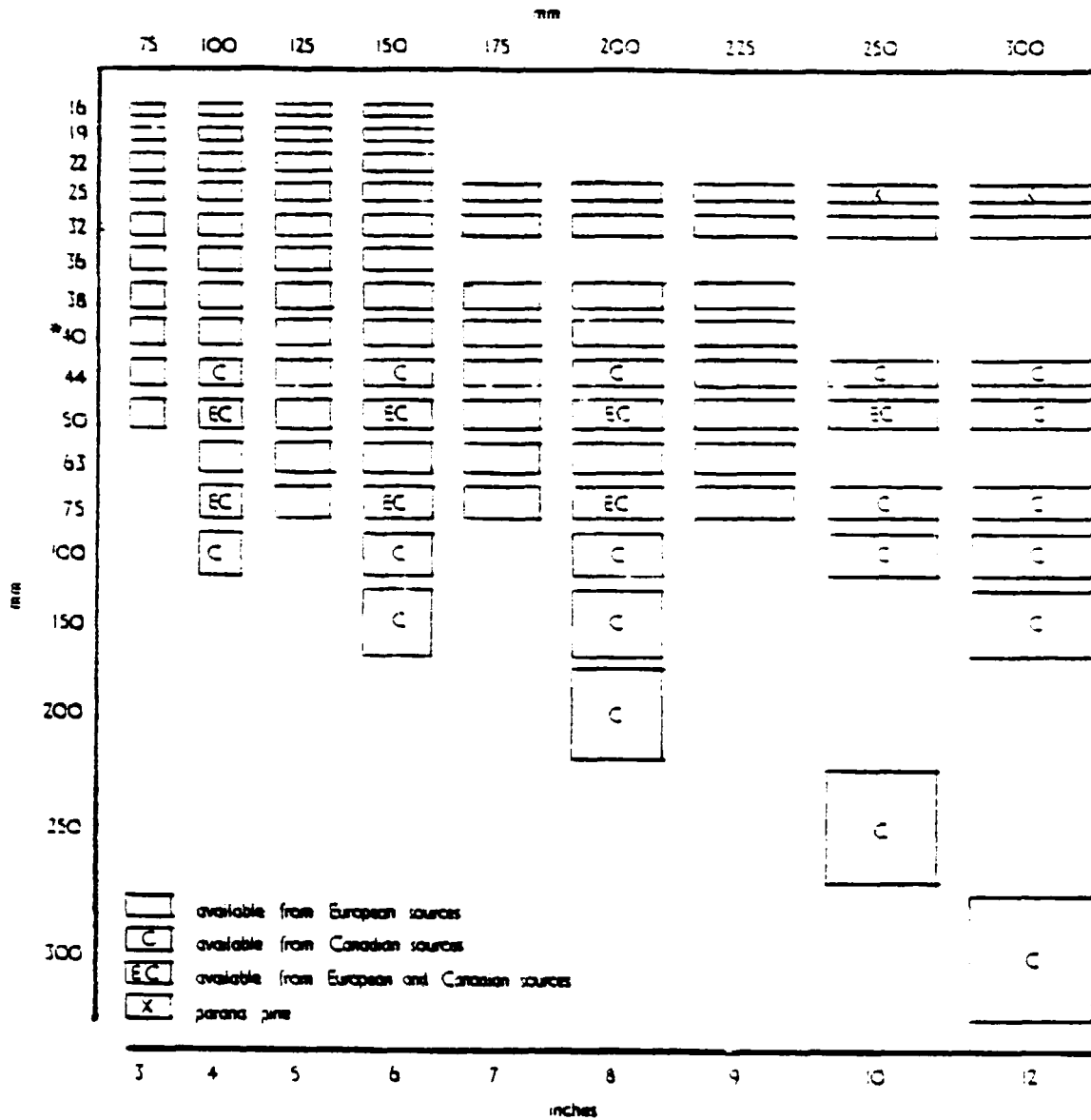
- D.1 Bed with attached side table

GROUP E - JOINERY

- E.1 External door with facing of vertical tongue & groove slats
- E.2 External window shutter with facing as above
- E.3 Window frame for glass or mosquito net

21 Production flow chart case good furniture





*see on list of standard sections agreed by importer/exporter conference check on availability before specifying

Table II Softwood sawn timber: new metric sizes
These also available in hardwood species listed

New metric sizes	Old comparable sizes*
16 mm	5/8 in
19 mm	3/4 in
22 mm	7/8 in
25 mm	1 in
32 mm	1 1/8 in
38 mm	1 1/2 in
44 mm	1 3/4 in
50 mm	2 in
63 mm	2 1/2 in
75 mm	3 in
100 mm†	4 in
150 mm	6 in
200 mm	8 in
250 mm	10 in
300 mm	12 in

*NOTE: These are not exact translations.
†Hardwood thicknesses above 125 mm (5 in) rise in increments of 25 mm.

Table III Cross-sectional dimensions (mm) above, lengths (m) below

7.000	
6.000	6.300
	6.000
	5.700
	5.400
5.000	5.100
	4.800
	4.500
4.000	4.200
	3.900
	3.600
	3.300
3.000	3.000
	2.700
	2.400
2.000	2.100
	1.800
1.000	

lengths of timber between 1.800 and 6.300 to be 300mm increments

Table IV Floor joist ceiling joists, joist flat roofs in mm

38 x 75
38 x 100
38 x 150
38 x 175
38 x 200
38 x 225
44 x 75
44 x 100
44 x 150
44 x 175
44 x 200
44 x 225
60 x 75
60 x 100
60 x 125
60 x 150
60 x 175
60 x 200
60 x 300
63 x 150
63 x 175
63 x 200
63 x 225
75 x 200
75 x 300

UNITED NATIONS DEVELOPMENT PROGRAMME

DHAKA

Project of the Government of Bangladesh

PROJECT DOCUMENT

1. Country: Bangladesh
2. Project Title: Project for the establishment and operation of a Tool Servicing Centre at the BFIDC Woodworking Complex, Chittagong
3. Project Number:
4. Sector: (Govt. Classification)
(UNDP Class. and Code) 0520 Manufacturing industries
5. Government Implementing Agency: Bangladesh Forest Industries Development Corporation (BFIDC)
6. Executing Agency: United Nations Industrial Development Organization (UNIDO)
7. Duration: 24 months
8. Estimated Starting Date:
9. Government input:
10. UNDP input: US\$ 312.400

Project Document ref.: 02

PART I - LEGAL CONTEXT

(To be detailed in final project document)

PART II - THE PROJECT

PART II A - DEVELOPMENT OBJECTIVE

The project aims at contributing towards the fulfilment of the main objective for the development of forest industries as set out in the Second Five Year Plan, that is: to economise use of forest resources and reduce waste in their utilization.

PART II B - IMMEDIATE OBJECTIVES

The overall immediate objective of the project is to set up within the Woodworking Complex of the Bangladesh Forest Industries Development Corporation (BFIDC), Chittagong, a Tool Servicing Centre to serve the needs of all the four plants in the Complex.

At the time of the completion of the project a capability will exist in the Complex to maintain efficiently cutting tools as to achieve better recovery of raw material, reduction of rejects in the manufacturing process, increased quality of finished products and saving in imported tools.

PART II C - SPECIAL CONSIDERATIONS

Not applicable.

PART II D - BACKGROUND AND JUSTIFICATIONS

The Bangladesh Forest Industries Development Corporation (BFIDC) of the Ministry of Agriculture operates at Chittagong the country's largest woodworking complex. The first unit in the Complex, a preservation plant, was established in 1959; while the latest addition, a particle board plant, was completed in 1981.

The complex covers the following activities (listed according to the volume of sales attained in the fiscal year 1981-1982):

- wood treatment (poles);
- doors and windows;
- furniture;
- particle board and veneered particle board panels;
- flush doors;
- cable drums;
- sawn timber;
- veneer.

A total employment of over 700 is provided by the Chittagong Complex. Its overall sales value in the fiscal year 1981-1982 amounted to about Tk 44.7 million (approx. US\$ 2 million).^{1/}

The following plants are included in the Complex:

1. Furniture Industry Development Co. (FIDCO)

Established in 1965, FIDCO is today the largest furniture set-up in the country. The plant has a manpower of 220 and sales attained a total of Tk 4.6 million in the fiscal year 1981-82. Most of its production (95%) is absorbed by the public sector. Kiln drying facilities are attached to the plant.

^{1/} Exchange rate: Taka 22.6 to a US dollars (Dec. 1982).

2. The Cabinet Manufacturing Plant (CMP)

The plant, established in 1962, is today manufacturing exclusively solid wood doors and windows. The largest of its kind in the country, CMP employs 123 and it is also equipped with a small sawmill unit and kiln drying facilities. CMP's sales in 1981-82 amounted to over TK 5 million.

3. The Chittagong Board Mill (CBM)

Established in 1966, the plant is involved in the production of flush doors. It employs 28 persons and its sales in 1981-1982 attained TK 2.4 million.

4. The Particle Board and Veneering Plant (PB & VP)

The plant commenced operations in 1981. It produces plain particle board, sliced veneer, and ready-veneered particle board panels. The plant employs 135 persons and sales attained TK 2.9 million in 1981-1982.

5. The Wood Treatment Plant (WTP)

This is the plant in the complex with the largest turnover, being involved in providing treated poles and cable drums for a major foreign-financed electrification programme. Its manpower is 185; its sales volume in 1981-82 amounted to TK 29.7 million, of which treated poles accounted for TK 24 million. The plant also runs a small sawmill.

At present, each plant in the complex runs its own tool and equipment maintenance unit. However, the critical lack of appropriate maintenance equipment, specific tool maintenance know-how, and an effective preventive maintenance system, seriously affects the efficiency of the Complex as a whole.

There is a nearly total absence of equipment for the maintenance of cutting tools, except for knife grinders. The problem is particularly serious for saw blades, including bandsaw blades utilized in the two small sawmill units, which are roughly and unevenly sharpened by hand, this also being the case with moulding knives, boring bits, router cutters, etc..

Moreover, high operating costs are experienced in the use of expensive circular saws tipped with hard metal (carbide). These blades, which are also used in the manufacture of particle board and plywood by BFIDC, cannot be sharpened free-hand on account of the particularly tough nature of the tipping material; thus they quickly deteriorate in use and have to be disposed of after limited service.

The tool maintenance constraint affects not only the life span of tools, but also the quality of finished products and the wastage rate in the utilization of raw material. Furthermore, labour cost is inflated by the substantial hand work which has to be added in order to correct machining faults. In turn, machinery performance is affected by defective cutting tools, as these produce abnormal working stresses on the equipment.

Lack of an effective preventive maintenance programme for the equipment in use in the Complex is a particularly serious drawback in view of the age of the machinery in use. In fact, the equipment at the recently established particle board plant has been bought reconditioned. Uncontrolled machine breakdown has an adverse effect on the continuity of production and, consequently, on delivery schedules. Moreover, the quality of processed parts is often affected because the conditions of the equipment would not allow accurate machining adjustments and appropriate performance.

Cutting tools' performance and life span can be substantially improved by regular and appropriate maintenance.

Machine breakdown can be reduced and continuity of production better assured through effective preventive maintenance than through costly and time-consuming repair work done on an ad hoc basis. Careful scheduling of periodic overhauls and renewals can minimize interruption of production; and systematic inspection of equipment can indicate probable failures that can frequently be prevented by timely repairs.

The strengthening of the maintenance function in the Complex on the basis of existing decentralization would require costly and unnecessary duplication of resources and efforts, and would deter standardization as well as call for the training of more personnel.

This project is designed to provide the necessary expertise and additional equipment for the establishment and operation of a Tool Servicing Centre for the benefit of the Complex as a whole. In addition, an Equipment Maintenance Centre is expected to be established under a separate UNIDO project.

The two projects are expected to bring about the following gains:

1. Contribute towards minimizing operating costs.
2. Help meeting delivery dates by reducing down-time.
3. Improvement in the quality of finished products by maintaining machines and cutting tools in efficient operating conditions.
4. Minimize inventory costs by standardizing cutting tools and allow their exchange among the processing units in the Complex.
5. Reduce outlays and foreign exchange for tools by extending their life.

PART II E - OUTPUTS

	<u>Schedule</u> ^{1/}
1. Installation and operation of UNDP - provided tool maintenance equipment	6
2. Regular tool maintenance services commenced	16
3. Manual on <u>Standardization of Woodworking Cutting Tools</u>	18
4. Three tool maintenance counterparts trained	24
5. Eight tool maintenance workers trained	24

PART II F - ACTIVITIES

The project will include two activities:

- (1) organization and supervision of maintenance work and
- (2) on-the-job training.

The aim of the activities is to promote self-sufficiency in the efficient utilization of cutting tools at the Chittagong Complex and, on a complementary basis, at the Dohazari Plymill/Sawmill plant.

The activities will be carried out by the following personnel:

- Tool Maintenance Technician (24 m/m)
- Volunteer (24 m/m)

Duty station will be Chittagong with travel to Dohazari as required.

^{1/} Months after the start of the project based on the reporting date to duty station of the Sawdoctoring Technician.

The following tasks are expected to be carried out:

1. To draw up technical specifications of the equipment to be provided by UNDP/UNIDO.
2. To prepare the plant layout of the tool maintenance workshop.
3. To prepare drawings and specifications of ancillary workshop equipment (tensioning bench, work benches, storage cabinets, etc.), to be made locally, and supervise their construction.
4. To supervise the installation of the equipment and commission it.
5. To inventorize woodworking machinery in the Complex which is to be provided with tool maintenance services.
6. To standardize cutting tools geometry according to the working properties of timber and wood-based panels processed in the Complex.
7. To design and supervise the introduction of a system for scheduling, recording and costing tool maintenance work.
8. To standardize cutting tools types to minimize inventories and allow their exchange among the plants in the Complex.
9. To develop an appropriate system for the store-keeping, requisition, procurement and stock-level control of cutting tools and have it translated into Bengali.
10. To prepare basic reference material on cutting tools technology and maintenance.
11. To conduct on-the-job training for counterparts and workers, to include informal theoretical training on basic principles of cutting tools technology.

PART II G - INPUTS

Duration

m/m

Taka

II.G.1 Description of Government Inputs

10. National Staff

11. Counterparts

- Three counterparts/trainers
to the tool maintenance expert
(full-time)

72

13. Support Staff

- Indirect labour as required
(storekeepers, draughtsman, etc.)

30

19. Total cost of Personnel Component

30. Training

- Allowance for in-service training

39. Total cost of Training Component

40. Equipment

41. Expendable equipment

- Material for ancillary equipment that will be produced locally
(See II F.1, no. 3 above).

43. Building

BFIDC will provide workshop and office premises for the proper operation of the project, and will be responsible for any necessary addition to and/or modification of the existing facilities. The minimum covered area of the Servicing Centre will be about 215 m².

49. Total cost of Equipment and Building Component

50. Miscellaneous

Taka

51. Operation and maintenance of equipment

The cost of maintenance of the UNDP supplied machinery will be borne by the UNDP budget for the duration of the project, with the exception of labour cost which will be borne by the Government. The entire operation (fuel cost) and maintenance cost of the UNDP supplied vehicle will be borne under the UNDP budget.

The cost of utilities related to the use of project premises (workshop and office) and the operation of the UNDP supplied equipment will be borne by the Government.

The cost of translating into Bengali and reproducing training material and reports will be borne by the external budget.

53. Sundry

Sundry expenses related to the operation of the Servicing Centre will be borne by the government with the exception of those expenditures which would normally be borne under UNDP contribution.

59. Total cost of miscellaneous component

99. TOTAL GOVERNMENT CONTRIBUTION

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II.G.2 Description of UNDP Inputs

	<u>Starting</u> <u>date</u>	<u>Duration</u> <u>m/m</u>	<u>US\$</u>
10. <u>Project Personnel</u>			
11. <u>Experts</u>			
11.01 Tool maintenance			
Technician		24	171,600
Job requirements:			
Considerable industrial			
experience in the maintenance			
of woodworking tools.			
Familiarity with working			
characteristics of tropical			
timber desirable.			
13. <u>Support Personnel</u>			
13.01 Typist/Secretary		24	3,000
13.02 Driver/Mechanic		24	4,800
15. <u>Expert Travel</u>			3,600
16. <u>Other Personnel Costs</u>			
- Tripartite review			3,000
17. Tool maintenance volunteer ^{1/}		18	25,200
19. Total cost of Personnel Component			<u>221,200</u>

1/ Post to be financed under UN Volunteer Programme.

40.	<u>Equipment</u>	US\$
41.	<u>Expendable Equipment</u>	
41.01	One <u>Power Drill</u> :	
	- Two speeds for wood and metal boring	
	- Typical equipment:	
	BLACK & DECKER, mod. SPK - 2513 (FRG)	250
41.02	One <u>Dial type set gauge</u> (for measuring tooth set metric)	
	- Typical equipment:	
	VOLLMER, mod. MU-10-U (FRG)	53
41.03	One <u>Vernier caliper</u>	
	- Reading up to 150 mm (dial type)	
	- Typical equipment:	
	VOLLMER, mod. MW-10-U	35
41.04	One <u>Micrometer</u>	
	- Reading up to 25 mm	
	- Typical equipment:	
	VOLLMER, mod. MW-11-U	47
41.05	One <u>Protractor</u>	
	- Range up to 180 ^o	
	- Length of leg: 150 mm	
	- Typical equipment:	
	VOLLMER, mod. MW-13-U	33
41.06	Two <u>Setting tools</u> (for circular saws) ^{1/}	
	- Single handled lever-type setting tool with slots for 12 - 18 gauge blades or similar range	
	- Double handled lever-type setting tool with slots for 9-11 gauge blades or similar range	
	- Typical equipment:	
	VOLLMER	20

^{1/} In addition to existing setting machine, VOLLMER, mod. Adn/v.

- 41.07 One Ancillary tools and supplies US\$
Set
- 6 Silicon carbide dressing sticks, size approx, 25 x 25 x 150 mm
 - 12 Mill saw files with rounded edges, 300 mm long
 - 12 Slim taper 12 mm or 15 mm square files second cut 250 mm length
 - 2 Metric feeler gauge set. Reading 0.05 - 2 mm
 - 6 Grinding goggles with safety lenses
 - 4 Tins (500 grams) Brazing flux "Easyflow"
 - 4 Tins (35 grams) Silver solder size 12mm x 0.08mm
 - 4 Tins (35 grams) Silver solder size 16mm x 0.08mm
- Typical equipment:
VOLLMER (FRG) 350
- 41.08 One Angle grinder
(lightweight, single phase, 220 volts, 50 cycles)
- Spares:
- a) 24 pcs, 100 mm dia resin-bonded grinding disks suitable for grinding steel
 - b) 2 pcs, rubber backing pads for use with abrasive paper discs
 - c) 100 pcs, abrasive paper disks 80 grit aluminum oxide
- Typical equipment:
BLACK + DECKER, BOSCH, MITSUBISHI (FRG, JAPAN) 350
- 41.09 One Chain saw grinder (manual)
- With 12 spare files
 - Typical equipment:
DOLMAR (FRG) 250

	<u>US\$</u>
41.09 <u>Motorized chain grinder</u>	
- Typical equipment:	350
DOLMAR, mod. 314	
41.10 <u>Other tools and supplies</u>	
for tool maintenance workshop	1,000
41.11 <u>Office supplies</u>	500
Sub-total Expendable Equipment Component	<u>3,238</u>
42. <u>Non-Expendable Equipment</u>	
42.01 <u>One automatic sharpening machine for wide bandsaw blades</u>	
- For blades 60 to 200 mm	
- Tooth pitch 20 to 60 mm	
- Tooth height up to 25 mm minimum	
- Hook angle from 10° to 30° minimum	
- Easily interchangeable cams for different tooth profiles	
- Feeding speeds of 30 and 45 teeth per minute	
- 12 spare grinding wheels 10 mm thick	
- 12 spare grinding wheels 12 mm thick	
- Typical equipment:	
LOROCH, mod. JLM - V/C	
(with cam combination 1,3,4,5)	10,900
42.02 <u>One stretch roller machine</u>	
(Excluding stretching bench which is to be made locally)	
- Driven top & bottom rollers	
- Driven rollers with 2 speeds	
- Typical equipment:	
VOLLMER, mod. VWM	4,900

42.03	One	<u>Levelling plate</u>	US\$
		- Minimum size: 200 x 900 x 75 mm	
		- Maximum size: 250 x 1200 x 100 mm	
		- Typical equipment: ARMSTRONG (USA)	627
42.04	One	<u>Anvil for wide bandsaw blades</u>	
		- In solid cast steel with hardened face	
		- Minimum size: 200 x 150 x 100 mm deep	
		- Typical equipment: ARMSTRONG	580
42.05	One	<u>Tensioning bench</u>	
		- To be manufactured locally on the expert's specifications	200
42.06	One	<u>Combination straightedge and tension each gauges for wide bandsaw blades</u>	
		- Size: 4" x 26 ft.	
		6" x 28 ft.	
		6" x 32 ft.	
		6" x 36 ft.	
		8" x 32 ft.	
		8" x 36 ft.	
		8" x 40 ft.	
		- Typical equipment: SANDVIK or Spear & Jackson (Sweden, UK)	190

		<u>US\$</u>
42.07	One <u>Tensioning & levelling hammers for each wide bandsaw blades</u>	
	- Dog head hammer 1 1/2 lb	
	- Cross face hammer 1 1/2 lb	
	- Twist fact hammer 1 1/2 lb	
	- Typical equipment: SANDVIK or Spear & Jackson	250
42.08	One <u>Swaging tool for wide bandsaw blades up to 18 gauge (1.2 mm) thick</u>	
	- With 8 mm swaging die	
	- Spares required: 2 spare dies 2 spare anvils 2 stationary clamp screws 2 moving clamp screws	
	- Typical equipment: ARMSTRONG, mod. No. 2	660
42.09	One <u>Swaging tool for wide bandsaw blades up to 17 gauge (1.47 mm) thick</u>	
	- With 12 mm swaging die	
	- Spares required: 2 spare dies 2 spare anvils 2 stationary clamp screws 2 moving clamp screws	
	- Typical equipment: ARMSTRONG, mod. No. 4	660
42.10	One <u>Side dressing tool for wide bandsaw blades</u>	
	- Spares: 2 spare dies 2 spare tooth stops	
	- Typical equipment: ARMSTRONG, mod. 5500 - B	660

	<u>US\$</u>
42.11 One <u>Welding clamp for wide bandsaw blades</u>	
- Forging anvil must be easily raised and lowered by foot or hand lever	
- Capacity: blades up to 200 mm minimum	
- Typical equipment: ARMSTRONG, mod. No. 62 (USA)	670
42.12 One <u>Lightweight oxy-acetylene welding equipment (set)</u>	
- For: 1) Repairing of cracked bables; 2) Weld-jointing of blades instead of brazing.	
- One lightweight torch with nozzle sizes 1 - 10, complete with nozzle cleaners, spanners and storage box	
- One red lightweight connecting hose approx. 5 meters long	
- One acetylene regulator, range up to 15 lb/in ²	
- One oxygen regulator, range up to 15 lb/in ²	
- One gas economiser and all necessary connectors	
- Two spark lighters	
- Two sets spanners and keys	
- Six welding goggles	
- Five kg 3% nickel steel welding rod 1.6 mm dia.	
- Typical equipment: B.O.C. Ltd., (UK)	1,060
42.13 One <u>Lap grinding machine for wide bandsaw blades</u>	
- Capacity: up to 200 mm minimum blade width	
- Adjustable grinding angle	
- Typical equipment: ELECTRO-APPARATUS-SAU "IDEAL", mod. SM 201 (FRG)	4,340

		<u>US\$</u>
42.14	One <u>Bandsaw swaging clamp</u>	
	- Capacity: 50 up to 200 mm minimum blade width	
	- Clamping jaws: 800 mm long minimum	
	- Blade height adjustment	
	- Typical equipment: VOLLMER, mod. No. 1302	420
42.15	One <u>Electric muffle furnace</u>	
	- Infinitely adjustable temperature up to 1000° C	
	- Built-in pyrometer & protective fuses	
	- Typical equipment: VOLLMER, mod. No. 3300	3,375
42.16	One <u>Brazing clamp for W.B. blades</u>	
	- Minimum blade capacity: 200 mm	
	- Brazing irons of non-scale type	
	- Equipped with 4 clamping points	
	- Typical equipment: VOLLMER, mod. 3121	1,650
42.17	One <u>Saw tooth punch press for W.B. blades</u>	
	- For wide bandsaw steel up to 2 mm thick	
	- Tooth pitch up to 60 mm	
	- Drawing of tooth profile to be provided by the expert	
	- Typical equipment: ISHIDA or FUJI, or SHODA (Japan) VOLLMER	1,700
42.18	One <u>Bandsaw shears</u>	
	- For blade width up to 200 mm	
	- Typical equipment: VOLLMER, mod. No. A-360	300

	<u>US\$</u>
42.19 One <u>Butt welding machine</u>	
- For blade width up to 50 mm	
- Typical equipment: VOLLMER, mod. BS 2	1,800
42.20 One <u>Automatic sharpening machine for circular saws and narrow band saws</u>	
- For circular saw dia. 100 to 600	
- Band saw width up to 60 mm	
- Bevel and straight grinding	
- Hook angle from -10° to + 30°	
- Tooth pitch: 5 to 60 mm	
- Feeding speeds: 30 to 80 teeth/min	
- Tooth height adjustment: from 3 mm upward	
- Built-in cams for standard and hooked tooth types	
- With indexing device size I ^{1/}	
- Grinding wheels for two-year operation	
- Typical equipment: VOLLMER, mod. CNE	9,000
42.21 One <u>Circular saw blade tensioning equipment (set)</u>	
- For blade dia. up to 500 mm	
- One dog hammer	
- One cross-face hammer	
- One set straight edges	
- One anvil block	
- Typical equipment: VOLLMER	800

1/ Indexing plate will be purchased when project being implemented.

		<u>US\$</u>
42.22	One <u>General purpose bench grinder</u> - For off-hand grinding - Sliding attachment for precision sharpening of chisels, and knives of hand planers - Grinding wheels supply for two-year operation - Typical equipment: VOLLMER, mod. No. 2310	1,000
42.23	One <u>Universal tool grinder</u> - With attachments for grinding following HSS and carbide cutters: 1. Moulding cutters (bore dia. 30 mm) 2. Routing cutters 3. Boring and slotting cutters with plain and threaded shank (thread M 10) 4. Straight knives of length up to 120 mm - Six sets of standard and diamond grinding wheels - Typical equipment: GRIFO, mod. U-10-N with following assessories: ref. Nos. J-B-E-EI-E3-E (for thread M 10) -F-GG-GP-I-Y-IA-IR	7,700
42.24	One <u>Automatic grinder for carbide tipped circular saws</u> - For grinding of tooth front & back - Six of each type grinding wheels - Typical equipment: STEHLE, mod. 600 T	3,150
42.25	One <u>Manual side grinder for carbide tipped circular saw</u> - Six of each type grinding wheels - Typical equipment: VOLLMER DORNHAN, mod.VODO MF-600	3,225
42.26	One <u>Brazing equipment for carbide tipped circular saws:</u> - Typical equipment: VOLLMER DORNHAN, mod. VODO L-600	2,325

	<u>US\$</u>
42.27 One <u>Automatic knife grinder</u>	
- For knife length up to 600 mm	
- Simultaneous grinding of up to 4 knives	
- Wet grinding	
- Typical equipment: LORCH, mod. V6/C	3,500
42.28 One <u>Manual bandsaw setting machine</u>	
- Bandsaw blade width up to 45 - 50 mm	
- Tooth pitch 3 to 24 mm	
- Centering adjustment for blade thickness	
- Additional raker set equipment	
- Typical equipment: VOLLMER, mod. AN-S-1A	370
42.29 One <u>Device for setting and balancing cutter blocks:</u>	
- Typical equipment: WACO (Sweden), mod. SIBA	900
42.30 One <u>Knife balancing stand:</u>	
- For balancing loose knives in pairs before mounting on cutterblocks	
- Typical equipment: ROBINSON, mod. ZX	400
42.31 One <u>Pick-up van</u>	13,000
42.32 One <u>Air conditioner</u>	700
42.33 One <u>Typewriter</u>	
- English keyboard	700

	<u>US\$</u>
42.34 <u>Four Overhead fans</u>	800
Sub-Total Non-Expendable Equipment	<u>81,712</u>
43.00 <u>Building</u>	
43.01 Electrical supplies for the installation of equipment (10% of equipment value)	<u>5,711</u>
49.00 Total cost of Equipment and Building Component	<u><u>90,661</u></u>
50. <u>Miscellaneous</u>	
51.00 Operation and maintenance of UNDP-supplied equipment	4,500
52.00 Reporting cost	4,000
53.00 Sundry	2,000
59.00 Total cost of Miscellaneous Component	<u><u>10,500</u></u>
99.00 GRAND TOTAL UNDP CONTRIBUTION (Rounded figure)	<u><u>312,400</u></u>

II H - WORK PLAN

A preliminary work plan will be attached to the final project document and will be considered as part of it.

A detailed, final work plan will be prepared by the expert at the start of the project and updated periodically.

II I - PREPARATION OF THE FRAMEWORK FOR EFFECTIVE PARTICIPATION OF NATIONAL AND INTERNATIONAL STAFF IN THE PROJECT

The activities necessary to achieve the project's immediate objectives will be carried out jointly by the national and international staff assigned to it. The government will provide all the requisite facilities for the implementation of the project. The respective roles of the national and international staff shall be in accordance with the established concept and specific purposes of technical co-operation.

II J - DEVELOPMENT SUPPORT COMMUNICATION

Not applicable.

II K - INSTITUTIONAL FRAMEWORK

The Government implementing Agency will be the Bangladesh Forest Industries Development Corporation (BFIDC) of the Ministry of Agriculture. The execution of the project will be the responsibility of the Project Manager of the BFIDC Complex at Chittagong.

II L - PRIOR OBLIGATIONS AND PREREQUISITES

1. Prior obligations

None.

2. Prerequisites

The Government Implementing Agency will take all the necessary steps to insure that its inputs are provided on time in accordance with the work plan. In particular, upon the approval of the project the Government will:

- a) allocate the necessary funds and facilities for the establishment and operation of the project;
- b) assign counterpart staff, as indicated in the project document (see Part II G.1), and other required personnel.

If one or both prerequisites fail to materialize UNDP may, at its discretion, either suspend or terminate the project.

II M - FUTURE ASSISTANCE

Further assistance, if any, will be determined by a review of the project three months before its scheduled completion.

PART III, SCHEDULES OF MONITORING, EVALUATION AND REPORTS

III A - TRIPARTITE REVIEW MEETING

A special review to consider the necessity for further assistance should take place three months before project completion.

III B - EVALUATION

The project will be subject to evaluation, in accordance with the policies and procedures established for this purpose by UNDP. The organization, terms of reference and timing of the evaluation will be decided upon by consultation between the national authorities, UNDP and UNIDO.

III C - REPORTS

1. Progress Reports

These will be submitted at six months' intervals according to the format prescribed by UNDP.

2. Technical Reports

These will be prepared by the project staff according to the titles listed in the Outputs.

3. Terminal Reports

A terminal report will be prepared by the expert in the project for UNIDO's review three months prior to the completion of the project. It will be submitted formally by UNIDO upon completion of the project.

The report will provide a comprehensive review of project activities, a detailed assessment of its results, and long-term recommendations.

UNITED NATIONS DEVELOPMENT PROGRAMME

DHAKA, BANGLADESH

DRAFT PROJECT DOCUMENT

COUNTRY	BANGLADESH
LOCATION:	Bangladesh Forest Industries Development Corporation, Kalurghat Complex, Chittagong
PROJECT TITLE:	Establishment and Operation of in-plant Machine and Equipment Maintenance Facility
PROJECT NUMBER:	
DURATION:	Two years
PRIMARY FUNCTION:	Direct support
SECONDARY FUNCTION:	Institution Building
SECTOR GOVERNMENT CLASS:	
UNDP CLASS:	
CODE:	
GOVERNMENT IMPLEMENTING AGENCY:	Bangladesh Forest Industries Development Corporation (B.F.I.D.C.)
EXECUTING AGENCY:	United Nations Industrial Development Organization (UNIDO)
GOVERNMENT INPUT:	
UNDP INPUT:	US\$ 507.250

PART I - LEGAL CONTEXT

To be detailed in final project document.

PART II - THE PROJECT

PART II A - Development Objectives

The project aims at contributing towards the fulfilment of the following development objectives of the current five year plan:

- a) To economize on the use of forest resources and reduce waste in their utilization.
- b) To meet household and institutional demand for low-cost wood products.

The continuing contribution of BFIDC, Kalurghat Woodworking Complex is of vital importance in respect to the foregoing objectives. To this end, maintenance of the machinery and plant in this complex must be instituted and continuously applied.

Immediate Objectives

The immediate objectives of this project are:

1. To establish and make operational a maintenance workshop which will ensure mobilization of plant, machinery and manpower within the BFIDC complex.
2. To provide "hand on-the-job" training to BFIDC personnel in specialized maintenance activities such as:
 - a) Rehabilitation of worn and damaged machines and plant;
 - b) Rewinding of electric motors;
 - c) Repair of electrical equipment;
 - d) Improvement of machine capacity and capability;
 - e) Boiler plant operation, safety and repair;
 - f) Manufacture of required spare parts;
 - g) Introduction of repair and preventive maintenance system;
 - h) Repairs to hydraulic and pneumatic systems;
 - i) Repairs of gauges, instruments and recorders;
 - j) Preparation of maintenance manuals;
 - k) Institutionalization of the maintenance concept;
 - l) Introduction of proper records of machine break-downs, information on equipment, stocks of spares, re-order levels, etc.
 - m) Introduction of simple costing systems for the maintenance of operations in the whole plant.

3. On completion of this project, the capability should exist to maintain the complete manufacturing facility of the Complex in good working order; this capability will apply to personnel in addition to equipment.

PART II C - Background and Justification

The population of Bangladesh is estimated at 90 (ninety) million with an annual population growth of 2.6 percent. This makes Bangladesh one of the most populous countries in the world with an average net income of only US\$ 120 per annum.

Bangladesh has a predominantly agricultural economy, but in recent years, industrialization has increased substantially. Industrial production rose by more than 9.2 percent in the fiscal year 1981. In the forestry sector, the increase has been recorded as 23 percent.

Requirement for low-cost furniture and wood products

Much of public capital investment in the physical planning and housing sector is allocated to the construction of essential public servants' housing, offices and institutional buildings. To date, the supply of housing for government employees has only satisfied 4.3 percent of the requirements. To meet this demand for basic shelter, the government, mindful of its limited resources, has called for implementation of remedial measures; this will include such projects as:

- a) Large scale production of low-cost semi-permanent housing units;
- b) Production of core unit housing;
- c) Standardization of residential housing for use by Government employees;
- d) The standardization of building structures which will be compatible with joinery components such as windows and doors.

With the objective of providing residential accommodation to public servants in major cities, the Bangladesh Public Works Department has planned to build, in the second five year plan, a total of 30,000 semi-permanent low-cost housing units and 10,000 multi-storied flats at a cost of Taka 3,440 million (US\$ 152 million at Tk 22.6 = US\$ 1).

In addition, necessary accommodation is scheduled to be provided, at a cost of Tk. 2,350 million for the basic administrative and development personnel in a number of new District, Sub-divisional and Thana Headquarters expected to be created in the country.

Budgetary commitments have also been entered in the second Five Year Plan for the construction of 15,500 additional classrooms for existing primary schools; 2,000 new schools, development of 10,000 existing secondary schools and 48 primary teacher training institutes.

Most of the 40,000 existing primary schools lack adequate furniture for students and teachers. The five year plan provides for the supply of 960,000 low benches for children and 123,000 teacher chairs. In addition 77,400 blackboards and 34,000 first aid boxes will be supplied.

In the health sector, a total of 2,727 new hospitals and clinics are expected to be built in the period 1980-1985.

The need for low-cost housing, institutional facilities, and related wood products, is expected to grow by staggering proportions in the years ahead, considering that the population is expected to grow by 62.9 million in the period 1981-2000.

Forest resources

Bangladesh has about 3.3 million acres of forests under the management of the Forest Department, and 2.4 million acres of unclassified state forests under the control of the District authorities in the Chittagong Hill Tracts.

The country's richest forest resources occur in Chittagong and the Chittagong Hill Tracts Districts, with other forest areas in the Khulna, Tangail and Dinajpur Districts.

Plantation forests were established by the Forest Department as early as 1972, and today cover about 400,000 acres. The early inland plantations consist mainly of Teak. Since 1974, emphasis shifted towards valuable non-Teak species and fast-growing local and exotic species. A number of "superior class" tropical hardwoods are currently available for furniture making. Teak is at present being exported in sawn form to the People's Republic of China.

However, the timber supply does not cover the needs of the wood-working industry due to the quick depletion of more accessible flatland forests. In fact, timber availability sharply declined from 0.61 cubic feet to 0.30 cubic feet per capita between 1965 and 1977. On the basis of the minimum per capita consumption, the total requirement of quality timber in the country is estimated to be 70 million cubic feet in 1984-1985, but the supply is expected to reach only 24 million cubic feet.

The increase in construction activities in the second five year plan is considered as being the main factor for the deterioration of the timber supply situation.

The Forest Department is undertaking an ambitious afforestation programme but, because hardwood forests have a long plantation cycle, future exploitation of forest resources will pose the problem of moving to more difficult terrain in the east of the country.

In the face of continued shortage of timber supplies, the current development plans call for the implementation of specific measures for the optimal utilization of forest resources both at extraction and wood processing levels in order to: (1) meet household and institutional needs for wood products and (2) develop the capability of earning foreign currency through export of furniture.

In particular, the current five year plan calls for: (1) the modernization and restructure of existing industries in order to maximize output and productivity, increase the quality of products and reduce waste; (2) acquisition of the technical know-how necessary for the production of wood products for export markets.

The Woodworking Sector and the Role of BFIDC

The history of mechanized woodworking processing in Bangladesh is relatively recent, if compared to other countries in the region.

Prior to the partition of the Sub-continent in 1947, practically no machines were utilized in the processing of timber and small family-centered workshops simply used hand tools and artisanal techniques.

The period 1947 - 1960 marked the introduction of woodworking machinery and the beginning of the woodworking industry. In 1959, the autonomous body of the Forest Industries Development Corporation was set up under the Ministry of Industry to promote and spearhead the development of the forest industries.

The following year, the Central Forest Research Laboratory was established at Chittagong by FIDC. In the same year, the first wood preservation unit and attached sawmill were established in Chittagong - the first nucleus of what today is the BFIDC woodworking complex.

The Complex was gradually expanded over the years to include:

- a) In 1962, the first mechanized furniture and joinery plant in the country, the Cabinet Manufacturing Plant (CMP, with attached sawmill and dry kiln, now only producing windows, doors and related sawn timber requirements.
- b) In 1965, a new furniture plant, the Furniture Industry Development Company (FIDCO) and attached dry kiln - is today the largest furniture factory in the country.
- c) In 1966, the Chittagong Board Mill (CBM), today involved in the manufacture of flush doors.

- d) Finally, a particle board plant was added to the Chittagong Complex in 1981, which is also geared to the production of sliced veneer and ready-veneered particle board panels (PB + VP).

Woodworking facilities were established by BFIDC also in other parts of the country:

- a) The Eastern Woodworks and the Cabinet Manufacturing Plant at Dhaka, today producing furniture and joinery;
- b) A wood treating plant and a door and window manufacturing unit at Khulna;
- c) A plywood and tea chest plant with attached sawmill at Dchazari in the Sangoc Valley.

BFIDC's most modern wood processing facilities are those of the Lumber Processing Complex established in 1972 at Kaptai and include sawmilling, wood treatment and kiln drying. The Complex is also equipped with a self-contained moulding/planing unit, which, however, is largely unutilized.

Thus, today the Bangladesh Forest Industries Development Corporation, under the Ministry of Agriculture, covers the largest grouping of forest industries activities in the country, spanning from log extraction to secondary wood processing activities.

BFIDC's total manpower, including its rubber plantation project, is about 4,000 of which 865 are engaged in timber extraction and over 1200 in wood processing activities.

The Furniture and joinery sub-sector.

Most furniture and joinery is still produced in the country with hardly any machinery, on an artisanal and semi-artisanal basis, by an estimated 700 small workshops scattered around the country, employing about 3000 persons.

The organized private sector, where some degree of mechanization exists, consists (according to a 1976 survey) of about 47 furniture and joinery units, with an estimated total annual turnover of Tk. 21.6 million.

In the public sector, the BFIDC operates two furniture plants (at Chittagong and Dhaka); three plants for the production of doors and windows (at Chittagong, Dhaka and Khulna) and one flush doors' plant at Chittagong. BFIDC's sales volume in furniture and joinery products amounted to a total of 26.3 million Taka (about US\$ 1.16 million) in the fiscal year 1981-1982.

The BFIDC's furniture and joinery plants are considered the largest in the country. In particular, the Corporation's furniture plant at Chittagong, FIDCO, is provided with the largest concentration of heavy duty woodworking machinery, and accounts for the largest share in BFIDC's furniture sales. Current manpower of the plant is 220.

Problems of maintenance in the Kalurghat Complex

The Complex has five distinct units; namely: 1. CBM, Chittagong Board Mills; 2. PB + VP, Particle Board and Veneering Plant; 3. WTP, Wood Treatment Plant; 4. FIDCO, Furniture Manufacturing Plant and 5. CMP, Cabinet Manufacturing plant.

No planned maintenance system exists within the complex. There are no facilities to manufacture spares, carry out motor rewinds, or to make exhaust duct and blowers. Preventive maintenance is not in force. Engineers have no specific responsibility or knowledge of maintenance practice. Many instruments, recorders, gauges are unusable due to lack of attention. Machines and plant run until broken down, resulting in loss of production until the required action is taken. Production in the Particle Board Plant stops at least once per shift due to breakdown.

Many of these machines could give useful service for many years if proper maintenance actions were effected. The Wood Treatment Plant comprises a large steam generation facility with attendant pumps, condensers, chambers, valves and pipe runs. Also included are vacuum chambers, steam receivers and injection pumps. In conclusion, the entire complex requires, as a priority, concentrated mechanical and electrical attention to ensure continuing operation as well as training of personnel to perform these functions.

Summary of problems

Whilst the complex consists of five distinct units, some of these units utilize similar types of machines. Thus, the areas may be classified into three groupings.

- a) Wood cutting and shaping machines;
- b) The particle board and veneering plant;
- c) The wood treatment plant.

Group A

The main area of difficulties can be defined as follows:

1. Lack of skilled personnel.
2. Machines have been in operation since 1960 and few spare parts are available for them now.
3. Machine accuracy has deteriorated over the years due to wear and tear and lack of preventive maintenance.
4. Electric motors and control circuits require rewinding and repairing.
5. No in-plant facility exists for the production of the components required to maintain the machines.
6. Manuals and documentation are not available.
7. Most important, there is no centralized maintenance control.

Group B.

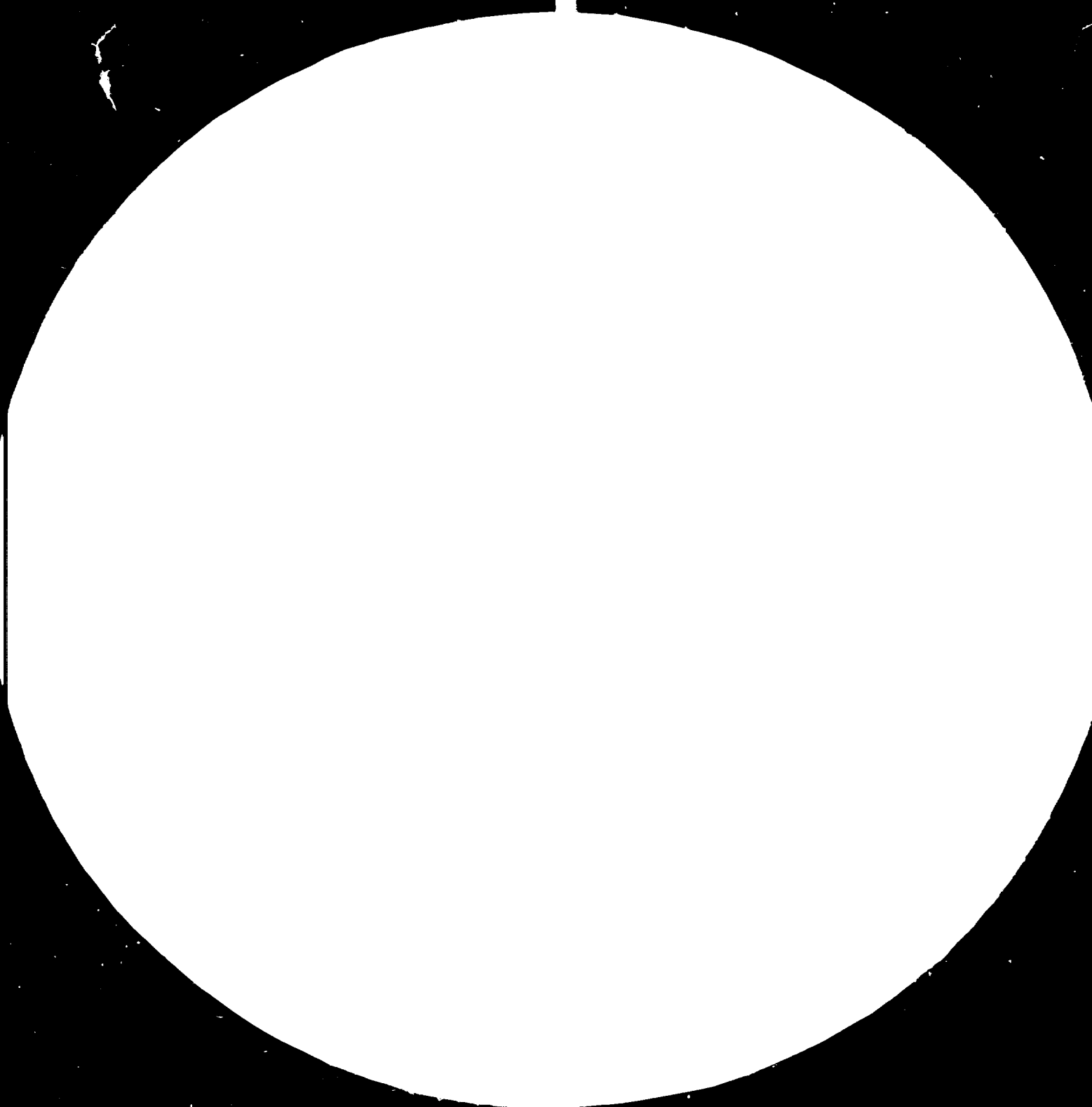
This plant began operations in 1981, but the machines in use date from 1970. Many electrical, hydraulic and mechanical failures have occurred since commissioning. These failures cause untold loss of production, and again no centralized maintenance control, or system is in operation.

Group C.

This plant presents many problems: untreated water is used and has resulted in hard scale formations within the valves and pipe runs. No facilities exist to repair valve seats or to manufacture stems, glands, and other components. No capability exist for pipe fabrication and no documentation or drawings are available, and again no planned maintenance or control is exercised.

Conclusions

The maintenance facilities and functions of the complex require urgent and intensive corrective measures. Failure to do so will affect the capability of the complex to meet the existing and projected demand for low-cost furniture and joinery. Indeed the situation at present is greatly affecting the profitability of the complex. This Technical Assistance Project will enable the BFIDC Kalurghat Complex to meet much of this demand with existing machines and plant. There is at present in the complex one centre lathe which is not operational and is so worn out that repair is not possible. One shaper which can be made operational and one pedestal drill which is in working order. No vices or tools exist. No main area has been utilized for a workshop. Various small areas throughout the complex with a few tools in each constitute the existing maintenance facility.



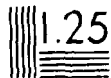


1.0 2.5

2.2



2.0



Resolution Test Chart
1.0 1.1 1.25 1.4 1.6 1.8 2.0 2.2 2.5

PART II D - Outputs

1. Maintenance workshop installed and operational.
2. Manufacture of spares and components for in-complex repair and maintenance operations.
3. Rehabilitation of worn, unused and damaged machines and plant.
4. Operational repair and preventive maintenance system.
5. Electric motor rewinding capability and effective electrical repair capability.
6. Attainment of proficient maintenance skills, by counterparts and technical personnel ensuring continuity of the maintenance function on completion of the project.
7. Manuals on repair procedures (electrical and mechanical).
8. Manuals on preventive maintenance schedules and procedures.
9. Improved output and productivity within the complex.
10. Increased quality of products and reduced waste.

PART II E - Activities:

1. UNIDO Recruitment:

UNIDO will ensure timely recruitment of suitably experienced and qualified experts for the posts.

2. Establishment and operation of the Maintenance workshop:

Duty station Chittagong with travel as required within the country.

Machine/Mechanical Maintenance and Repair Expert (24 m/m)

Instrumentation/Electrical Maintenance and Repair expert
(24 m/m)

The activity is aimed at developing, within the complex, the facilities and personnel capability to ensure repair and preventive maintenance operations, relevant to the needs of the complex.

The activity will cover the following tasks:

- a) Design and preparation of workshop layout.
- b) Assistance in the installation of the equipment.
- c) Supervision and training of counterparts and technicians in the use of the workshop equipment.
- d) Establishment, organization and supervision of an efficient breakdown repair function.
- e) Devising and implementation of an appropriate preventive maintenance function.
- f) On-the-job training of counterparts and technicians.
- g) Preparation of manuals on repair methods.
- h) Preparation of preventive maintenance schedules and instruction manuals.

These activities are specified in detail in the duties section of the job descriptions which form an integral part of this project document.

The Experts, in collaboration with the Managing Director and with the assistance of the Project Managers will have the required managerial and technical authority to implement and maintain their recommendations. The engineers and other technical personnel will report to the experts.

PART II F - Inputs

A. Government Inputs

Counterpart personnel (all to be located at the BFIDC Kalurghat Complex)

	<u>Proposed duration</u>
Chief engineer	24 months
Deputy Chief Engineer	24 months
Assistant Engineer Mechanical	24 months
Assistant Engineer Mechanical	24 months
Assistant Engineer Electrical	24 months
Assistant Engineer Electrical	24 months

Other personnel:

Foremen - as necessary	24 months
Technicians as necessary	24 months

The Government will ensure that counterparts are always assigned to experts. BFIDC will ensure recruitment of engineers and other technical personnel as necessary.

Training:

BFIDC will ensure support to on-the-job training efforts of UNIDO personnel as and when required.

Government provided building and equipment:

- a) Maintenance materials and supplies
- b) Cutting tools
- c) Spares as required for non-UNDP supplied machines
- d) General operating supplies
- e) Office area for experts and furniture
- f) Work benches
- g) Tool cabinets
- h) Lockers
- i) Trolleys

Buildings:

The Government will provide the workshop area and office premises required for the proper implementation of the project and will be responsible for any necessary addition to and/or modification of the existing FIDCO facilities, as required. The minimum covered area will be 1,600 square feet.

Total cost of materials and building component US\$

Miscellaneous:

Operation and maintenance equipment:

The cost of maintenance of the machinery supplied by UNDP will be borne by the UNDP budget for the duration of the project, with the exception of labour cost which will be borne by the Government.

The entire operation (fuel cost) and maintenance cost of the externally supplied vehicle will be borne under the UNDP budget.

The cost of utilities related to the use of project premises (workshop and office) and the operation of the externally supplied equipment will be borne by the Government.

The cost of translating into Bengali and reproducing training material and reports will be borne by the external budget

Sundry:

Sundry expenses related to the operation of the workshop will be borne by the Government with the exception of those expenditures which would normally be borne under UNDP contributions.

Total cost of miscellaneous components US\$

Total Government contribution: US\$

B. Description of UNDP inputs:

	<u>Duration</u>	<u>US\$</u>
1. <u>Project personnel</u>		
(1) Machine and mechanical maintenance expert	24 m/m	168,000
(2) Instrumentation and electrical maintenance expert	24 m/m	168,000
Total	48 m/m	336,000

2. Support Personnel

(1) Administrative Assistant cum secretary	24 m/m	4,500
(2) Typist/Clerk	24 m/m	1,700
(3) Driver mechanic	24 m/m	3,200
(4) Other personnel costs		5,000

Total 14,400

3. Expert travel

7,200

4. Non Expendable equipment

One pick-up van 4-wheel drive	7,000
One airconditioner for office	700
Two typewriters	600

Centre lathe

With all options 1,900 mm between centres 20,000

Universal milling machine

With all options, Bridgeport type 25,000

Surface grinder

With all options, Jones and Shipman type 28,000

Hearth and anvil 1,500

Pedestal grinder 450

Mechanical saw 1,500

Ram Hydraulic press 2,000

Set gauge blocks 2,000

Height master and riser 3,000

Cast iron surface table 2,000

Sub-total non-expendables 93,750

EXPENDABLE EQUIPMENT

US \$

<u>Cast Iron Angle Plates</u>	300
<u>Parallel Slips</u>	200
<u>Spirit Level</u>	200
<u>Sine Bar</u>	200
<u>Engineers square (Control)</u>	150
<u>Micrometres (Set)</u>	1,500
<u>Vernier and Calipers (Set)</u>	700
<u>Steel and Tape Rules</u>	400
<u>Feeler, Radius and Thread Gauges</u>	300
<u>V Blocks</u>	300
<u>Vernier Height Gauges</u>	700
<u>Dial Test Indicators</u>	350
<u>Bevel Protractor Comb. Set</u>	300
Calipers, Dividers, Oddlegs	
Trammels, Scribes, Punches	
<u>Marking Dye, Clamps Jacks</u>	500
<u>Six Sets of Hand Tools in Wheeled Boxes</u>	4,000
Mallets Hack Saws Allen Keys Tap Wrenches	
Wrenches, Pipe Wrenches, Socket Wrenches,	
<u>Hammers Chisels, Screw Drivers Clamps, Files</u>	3,500
<u>Try Squares</u>	100
<u>Vices + Pipe Vice</u>	1,500
<u>Pipe Threaders</u>	1,000
<u>Ratchet Cable or Chain Hoist</u>	400
Drills Taps Dies Lathe Tools	
<u>Hacksaw Blades Centre Drills</u>	4,000
Thread Sealants, Ptfе Tape, Loctite	
<u>1/2" Ring Manufacturing Kits</u>	300
Made up Kits, Springs, Terminals, Fuses	
<u>Washers, Dowels, Screws, Nuts, Cap Screws</u>	1,000
<u>Drawing Office Board + Supplies</u>	3,000
Supplies + Tools for Electrical Repairs +	
<u>Motor Rewinding Shop</u>	3,000

Subtotal expendable equipment = 27,900

<u>Building</u>	<u>US \$</u>
Electrical Supplies for Installation of Machines and Plant (10% of Machinery Cost)	12,000
Sub-total Building Component	<u>12,000</u>

Miscellaneous

Consumption of fuel, servicing/maintenance of vehicle, drivers uniforms etc.	5,000
Tripartite Review Meetings	3,000
Reporting Cost	3,000
Other unforeseen expenditures	5,000
Sub-total cost of Miscellaneous component	<u>16,000</u>

GRAND TOTAL OF UNDP INPUTS

1. Project Personnel		336,000
2. Support Personnel		14,400
3. Experts Travel		7,200
4. <u>Equipment</u>		
(a) Non expendable	\$ 93,750	
(b) Expendable	<u>27,900</u>	
		121,650
5. Building		12,000
6. Miscellaneous		16,000
		<u>507,250</u>

PART II G - Work plan

A preliminary work plan will be attached to the final project document and will be considered as part of it.

A detailed, final work plan will be prepared by the experts at the start of the project and brought forward periodically.

PART II H - Preparation of the Framework for Effective Participation
of National and International Staff in the Project

The activities necessary to achieve the project's immediate objectives will be carried out jointly by the national and international staff assigned to it. The Government will provide all the requisite facilities for the implementation of the project. The respective roles of the national and international staff shall be in accordance with the established concept and specific purpose of technical cooperation.

PART II I - Development support Communication

PART II J - Institutional framework

The Government Implementing Agency will be the Bangladesh Forest Industries Development Corporation (BFIDC) of the Ministry of Agriculture. The actual execution of the project will be the responsibility of the existing furniture plant FIDCO of the BFIDC Complex at Chittagong.

PART II K - Prior Obligations and prerequisites

1. Prior obligations

2. Prerequisites

The Government Implementing Agency will take all the necessary steps to ensure that its inputs are provided in time according to the work plan. In particular, upon the approval of the project the Government will:

- a) allocate the necessary funds and facilities for the establishment and operation of the project;
- b) assign the necessary technical and support personnel.

If one or both prerequisites fail to materialize, UNDP may at its discretion either suspend or terminate the project.

PART II L - Future assistance

Future assistance, if any, will be determined by a review of the project three months before its scheduled completion.

PART III SCHEDULES OF MONITORING, EVALUATION AND REPORTS

PART III A - Tripartite review meetings

The project will be subject to a mid-term technical review some twelve months after its starting date. A special review to consider the necessity for further assistance should take place three months before project completion.

PART III B - Evaluation

The project will be subject to evaluation, in accordance with the policies and procedures established for this purpose by UNDP. The organization, terms of reference and timing of the evaluation will be decided upon consultation between the national authorities, UNDP and UNIDO.

PART III C - Reports

1. Progress reports

These will be submitted at six monthly intervals according to the format prescribed by UNDP.

2. Technical reports

These will be prepared by the experts and project staff according to the titles listed in the outputs.

3. Terminal Reports

The terminal report will be prepared by the experts for UNIDO's review two months prior to the completion of the project. It will be submitted formally by UNIDO upon completion of the project.

The report will provide a comprehensive review of project activities, a detailed assessment of its results and long-term recommendations.

UNITED NATIONS



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

BFIDC Kalurghat project

JOB DESCRIPTION

Post title **Machine and mechanical maintenance expert**

Duration **Two years**

Date required **As soon as possible**

Duty station **Chittagong/Kalurghat with travel as required.**

Purpose of project **To provide technical assistance to the Bangladesh Forest Industries Corporation (BFIDC) Kalurghat Woodworking Complex in the establishment of a maintenance workshop and to impart on-the-job training to BFIDC personnel.**

Duties **The expert will be stationed in Chittagong and will be required to:**

- 1) Design the layout of the maintenance workshop and supervise the installation of the machines and plant.
- 2) Supervise and ensure maintenance of all machines and plant within the complex.
- 3) Devise and implement an effective maintenance system in the complex.
- 4) Supervise and train counterparts to carry out maintenance activities independently.
- 5) Develop the capability to manufacture spare parts and train counterparts and technical personnel in the operation of the workshop machines.
- 6) Develop and prepare a preventive maintenance system.
- 7) Devise and implement proper recording systems for control of spares and re-order levels.
- 8) Introduce simple costing systems for maintenance operations in the whole plant.
- 9) Prepare a report summarizing his activities and recommendations.

.... / ..

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria

QUALIFICATIONS: Diploma or trade certificate in mechanical engineering. Certificate of competence in the maintenance and running of boilers and ancillary plant. Experienced in the maintenance and repair of pneumatic and hydraulic systems and circuits. Experienced in the installation of plant machines and equipment. Experienced in establishing and commissioning maintenance workshops and systems. Must be capable of imparting technical training and on-the-job training to national staff. Experience in developing countries is essential. Should be an experienced supervisor and be capable of instituting simple cost controls

LANGUAGE: English.

UNITED NATIONS



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

BFIDC Kalurghat project

JOB DESCRIPTION

Post title Instrumentation and electrical maintenance expert.

Duration Two years.

Date required As soon as possible

Duty station Chittagong/Kalurghat with travel as required.

Purpose of project To provide technical assistance to the Bangladesh Forest Industries Corporation (BFIDC) Kalurghat woodworking complex, in the establishment of an electrical workshop and to impart on-the-job training to BFIDC's personnel.

Duties The expert will be stationed in Chittagong and will be required to:

- 1) Supervise and design the installation of the electrical workshop equipment.
- 2) Prepare designs for specialized tools and equipment to be manufactured in the workshop for use in motor rewinding and specialized electrical repairs.
- 3) Supervise and ensure electrical maintenance of all machines and plant within the complex.
- 4) Devise and implement an effective maintenance system in the complex.
- 5) Supervise and train counterparts to carry out maintenance activities independently.
- 6) Develop capability in the electrical workshop for motor rewinding, control coils rewinding, instrument calibration, rectification and modification of existing power distribution and protective devices as required for safe operation of plant and machinery.
- 7) Devise and implement proper recording systems.
- 8) Introduce simple costing systems for maintenance operations.
- 9) Develop and prepare a preventive maintenance system.

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria

- 10) Develop and prepare simple manuals for machine maintenance and repair to serve as operating guides.
- 11) Assist counterparts with managerial and technical advice, as appropriate.
- 12) Prepare a report summarizing his activities and recommendations.

QUALIFICATIONS:

Diploma of competence, or trade certificate in electrical technology with 10 years practical experience in the repair and maintenance of pneumatic, hydraulic and electrical controls system and circuits associated with the woodworking machineries and plant power distribution. Actual experience in rewinding of electric motors such as split phase motors, capacitor motors and polyphase motors from fractional to 200 horsepower. Should be able to interpret and work from machine specifications and drawings and to be able to impart on-the-job training. Experience in developing countries would be essential. Should be an experienced supervisor and be capable of instituting simple cost controls.

LANGUAGE:

English.

UNIDO INVESTMENT CENTRE

Investment Promotion Data Sheet

A joint venture is sought by Bangladesh in the establishment of an export-oriented furniture plant.

The history of mechanized woodworking in Bangladesh is relatively recent if compared to other countries in the region. Since 1959 the development of the forest industries in the country has been spearheaded by the Forest Industries Development Corporation, an organization originally set up under the Ministry of Industry and currently operating within the Ministry of Agriculture.

Today the BFIDC covers the largest grouping of forest industry activities in the country, spanning from log extraction to primary and secondary wood processing (see annex I).

BFIDC's total manpower, including a rubber plantation project, is of about 4,000, of which over 800 engaged in log extraction and over 1200 in wood processing activities. The bulk of the Corporation's woodworking plants is located in the districts of Chittagong and Chittagong Hill Tracts close to the country's largest forest resources.

The Corporation is now in the process of establishing an export-oriented furniture plant at the port city of Chittagong on the basis of three favourable factors:

1. The availability in the area of high quality tropical hardwood (see annex II).
2. The Corporation runs its own logging facilities and produces particle board as well as veneer.
3. The port of Chittagong is located midway between the major market outlets of the Gulf States and Japan.

A complete detailed engineering study has been prepared by a foreign consulting firm on the project. The plant is geared to produce annually 5,000 bedroom suites and 5,000 sets of office furniture. The total investment is estimated at US\$ 4 million, which includes over US\$ 2 million worth of equipment. At full capacity the plant is expected to absorb an annual input of about 2,600 m³ sawn timber, 2,600 m³ particle board, 415 m³ plywood, etc..

The Corporation had originally planned to implement the project under a bilateral agreement with a foreign government. However, a joint venture is now being sought instead whereby EFIDC would provide most of the required capital investment, while the foreign partner would contribute the necessary managerial, technical and marketing know-how.

The Government is actively encouraging the development of the private industrial sector and has enacted a law to protect foreign private investment. With a view to channel the private sector's dynamism into public sector undertakings, the Government has decided to sell shares of major public sector industries. Efforts are also being made to involve public sector corporations in joint ventures with local and foreign private investors.

Appendices

- I. Current outputs of EFIDC.
- II. Classification of timber species occurring in Bangladesh
- III. Plant layout of proposed furniture factory
- IV. Map of Bangladesh

Ref. FIAC - P.B

30/1/83

OUTPUT OF BFIDC PROCESSING PLANTS
IN THE FISCAL YEAR 1981 - 1982

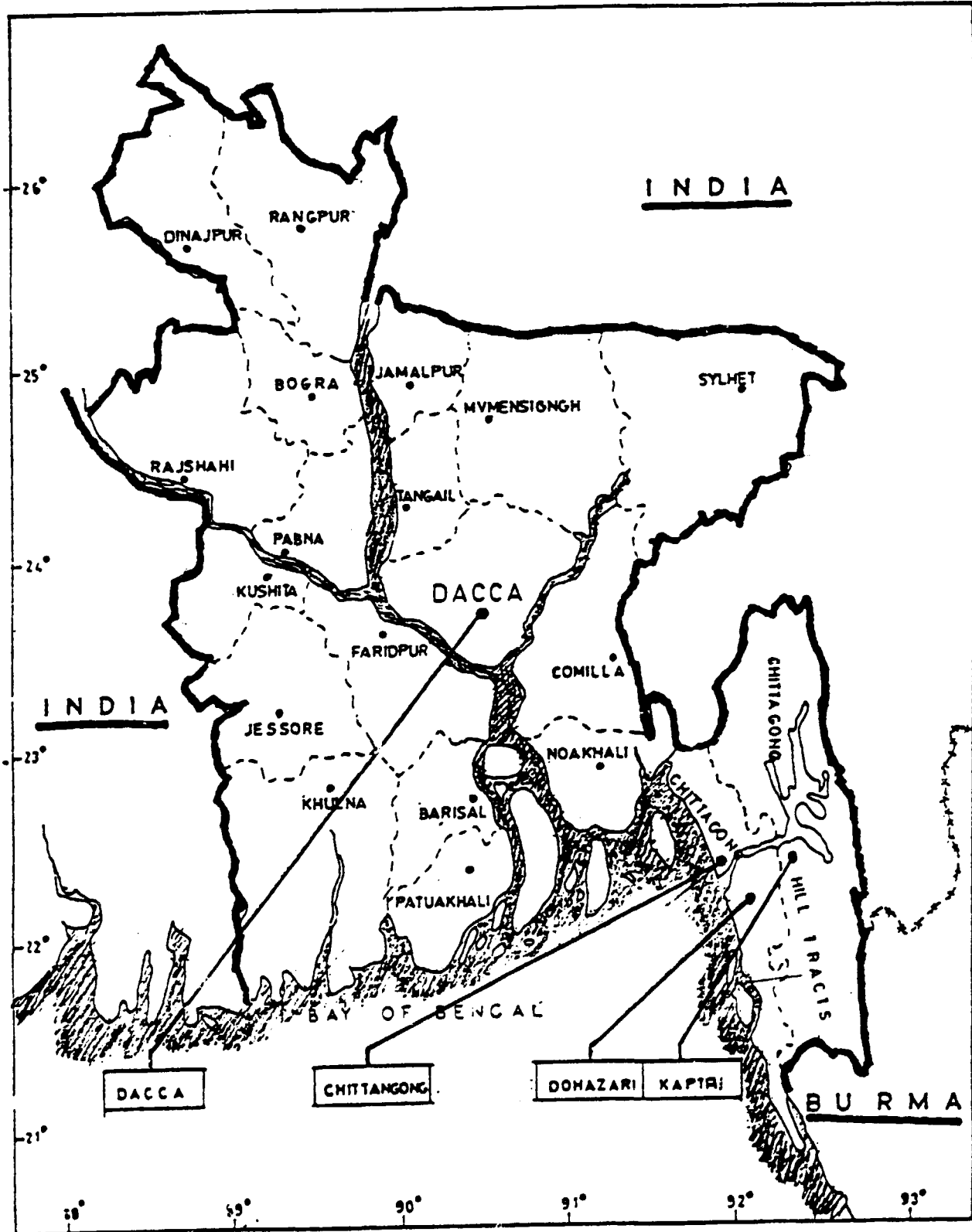
1. - Log extraction	: 976,570 cft (27.636 m ³)
2. - Sawn timber	: 135,950 cft (3,847 m ³)
3. - Furniture	: 12.65 million taka (US\$560.028)
4. - Solid wood doors & windows	: 211,900 sft (19,625 m ²)
5. - Flush doors	: 121,560 sft (11.293 m ²)
6. - Tea cests	: 143,600 sets
7. - Plywood	: 1,300,000 sft (120,798 m ²)
8. - Partical board	: 266,470 sft (24,755 m ²)
9. - Veneered particle board	: 319,130 sft (29,647 m ²)
10. - Wood preservation (Poles, Posts & Sleepers)	: 331,820 cft (9,390 m ³)

CLASSIFICATION OF TIMBER SPECIES

CLASS	LOCAL NAME	SCIENTIFIC NAME
<u>Superior Tropical Hardwood</u>		
'A'	Champa	Michelia Champaca
'A'	Chapalish	Artocarpus Chaplasha
'A'	Chikrassi	Chukrassia Tabularis
'A'	Gamar	Gmelina arborea
'A'	Toon	Cedrela toona
'A'	Jorul	Lagerstroemia Spp
'A'	Negeswar	Mesua ferrea
'A'	Boilam	Anisoptera
'A'	Condori	Cinnamomum ceoidodaphne
'A'	Telsur	Hopea odorata
'A'	Sikoroi	Albizzia P.berth
<u>Tropical Hard Wood</u>		
'A'	Ga	Dipterocarpus Spp.
'B'	Kamdeb	Calophyllum Spp.
'B'	Tali	Dichepsis polyantha
'B'	Pitraj	Amoora rehituka Spp
'B'	Bandarhola	Duabanga sonneratioides
'B'	Kanjai	Bischofia javanica
'B'	Jam	Engenta Spp.
<u>Misc. Tropical Hardwood</u>		
'C'	Kanak	Schima wallichii
'C'	Haritaki	Terminalia Chebula
'C'	Banspata	Prodocarpus nerifolia
-	Ceda	Vitex peduncularies
-	Gutgutia	Bursera serrata
-	Kerol	Albissia Spp.
-	Shonalu	Cassia fistulla
-	Behara	Terminalia belerica

Class	LOCAL NAME	SCIENTIFIC NAME
-	Jalpai	Elaeocarpus Spp.
-	Batna	Castaropsis hystrix
<u>Tropical Semi-Hardwood</u>		
'C'	Civit	Swintonia floribunda
'C'	Uriam	Mangifera sylvatica
<u>Misc. Tropical Semi-Hardwood</u>		
'C'	Chatian	Alstonia scholaria
'C'	Raktan	Lophopetalum fimbriatum
'C'	Simul	Bombax malabaricum
-	Chandul	Tatrameles nudiflora
-	Pitali	Trewia nudiflora

BANGLADESH



ANNEX IX

TROUBLE - SHOOTING

REFERENCE MATERIAL

APPENDICES

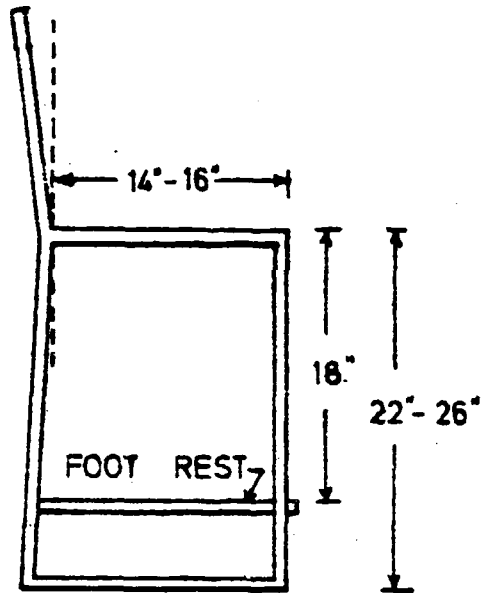
Appendix I Standard dimensions of chairs

Appendix II Lubrication of woodworking equipment

Appendix III Costing procedures

Appendix IV Carbide tipped saws for particle board

ERGONOMIC DATA
ON
CHAIRS, ARMCHAIRS AND LOUNGE CHAIRS



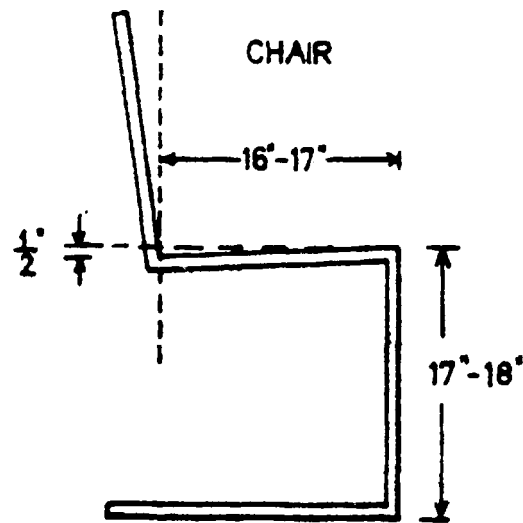
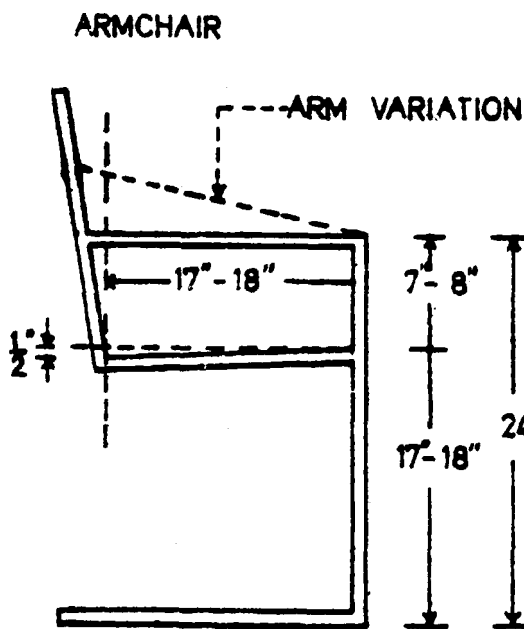
HIGH SEAT STOOL

Seat and Arm Dimensions

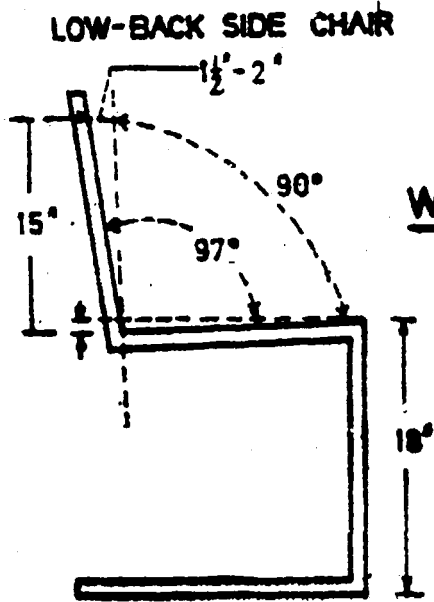
The most crucial measurements of a seat are its height (distance from the floor) and its depth. Too often chairs with improper dimensions, and therefore uncomfortable, are manufactured and marketed.

To be comfortable, a seat should be 18" from the floor, at the most. This height will be satisfactory to possibly 90% of the people and will not cause any undue pressure or discomfort to the back leg muscles. Another important factor is, of course, the relation between the height and the depth of the seat: the lower the seat, the greater the depth. A good illustration of this principle is the comparison between a chair and a sofa.

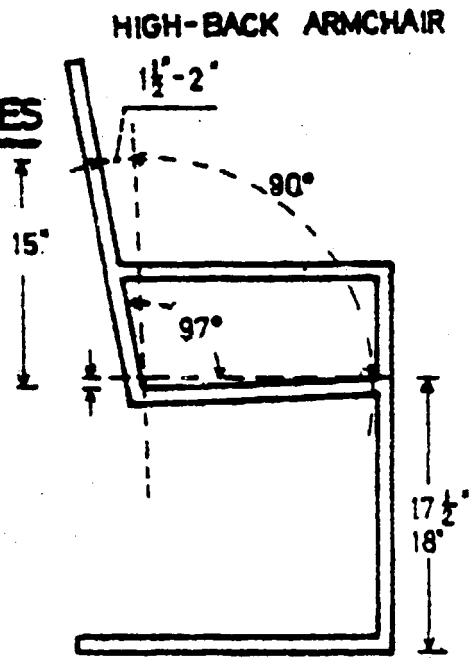
With respect to the arms, one could say that a distance of about 20" between arms is generally accepted as the minimum dimension. The height of the arms varies, and it is often determined by the taste of the individual designer. Generally speaking, the most comfortable arms are between 7 and 9" in height.



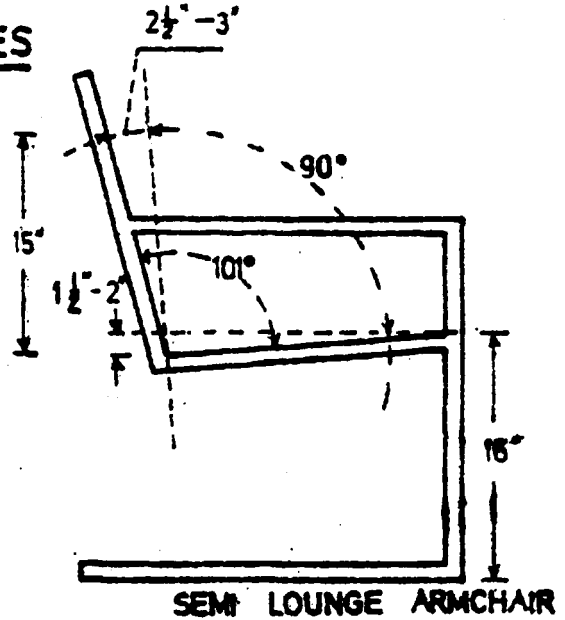
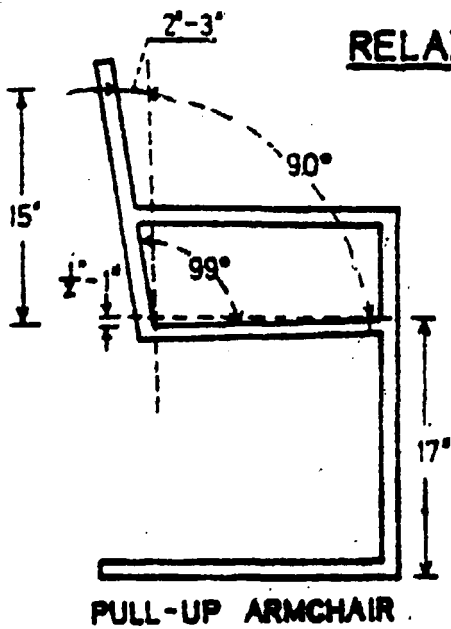
DIMENSION TO FIT UNDER TABLE OR DESK WITH DRAWER

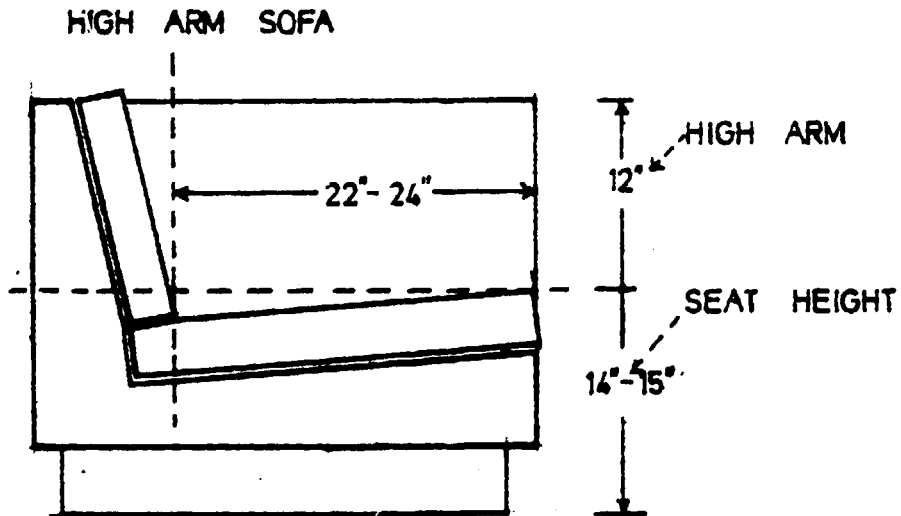
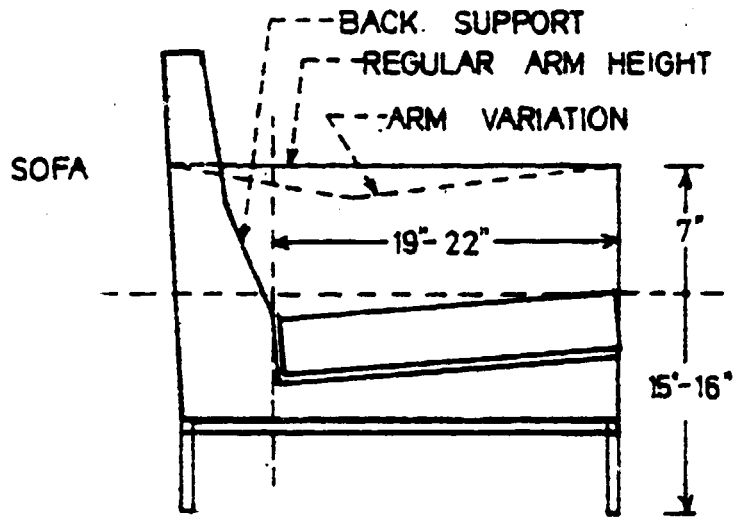
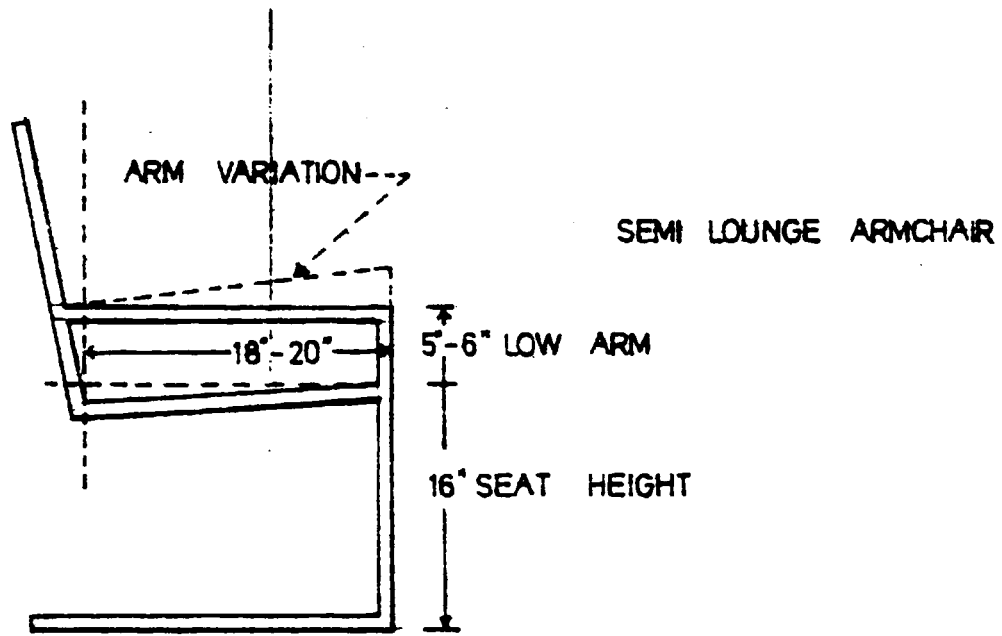


WORKING ANGLES

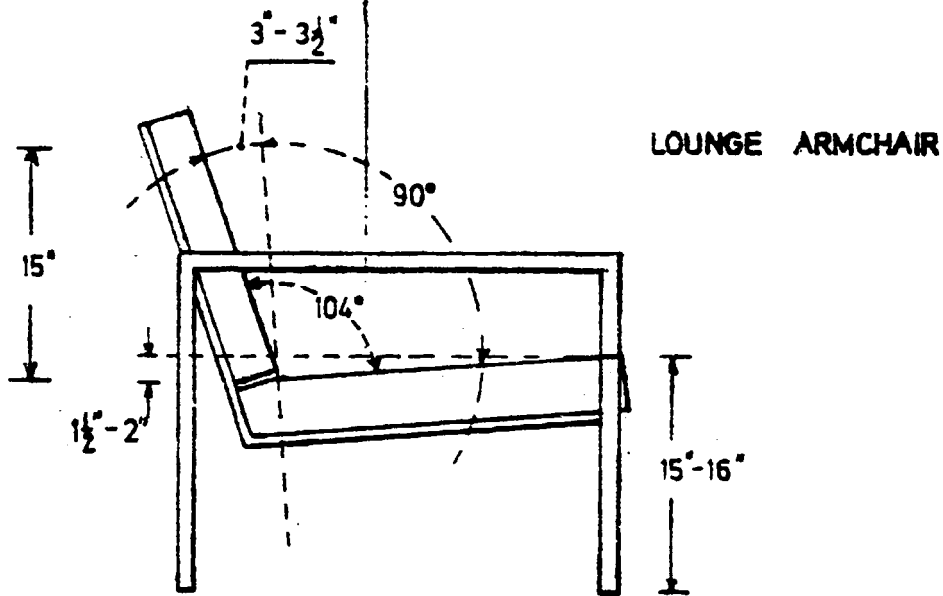


RELAXING ANGLES



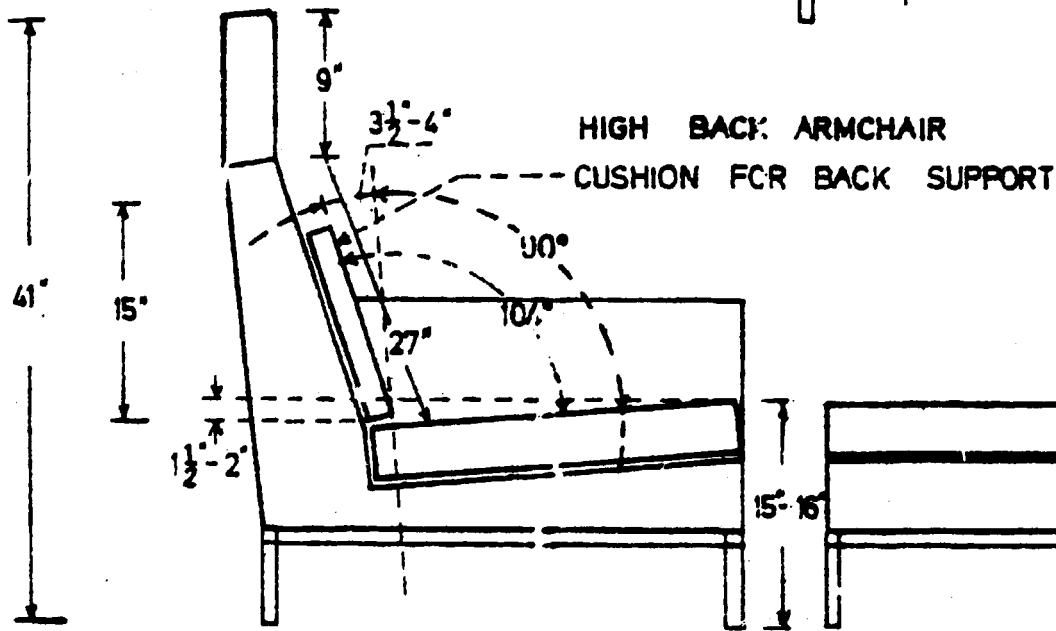
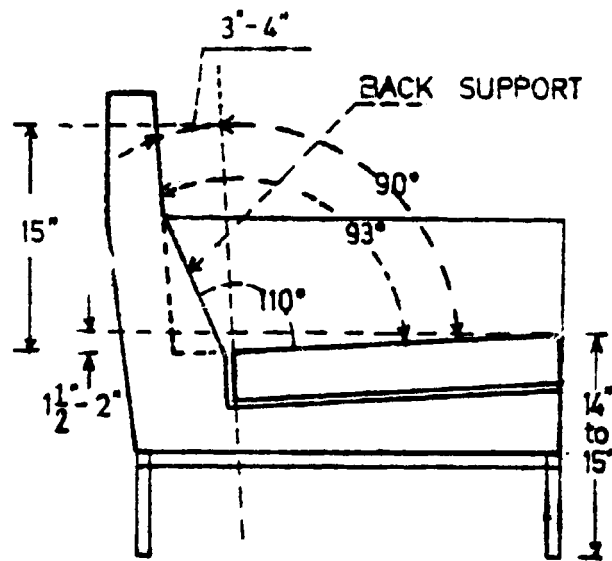


RELAXING ANGLES



LOUNGE ARMCHAIR

ARMCHAIR OR SOFA



HIGH BACK ARMCHAIR

CUSHION FOR BACK SUPPORT

ANNEX IX - APPENDIX II

LUBRICATION OF WOODWORKING EQUIPMENT

LAO PEOPLE'S DEMOCRATIC REPUBLIC

Direction of Forestry Direction of University and Technical Education

UNDP / UNIDO Integrated Woodworking Project LAO/74/010

REFERENCE MANUAL FOR THE WOODWORKING INDUSTRY

Group G MACHINERY MAINTENANCE

Section I SELECTION OF LUBRICANTS

Based on a study prepared by the Technical Dept. of Shell Singapore

Translated by : Counterpart staff from Vientiane Technical College

Drawings by N. Da UNIDO project

The views expressed in the manual are those of the authors and are not necessarily shared by UNIDO

Extracts from the manual may be reproduced provided the source is acknowledged

October 1979

Foreword

The selection of lubricants presented in this manual is based on a study which was made by the Technical Department of Shell Singapore in connection with the assignment of a UNIDO woodworking expert in that country.

The selection takes into account average operating temperature prevalent in South East Asia countries.

The Manual is meant to provide users of woodworking equipment with a general orientation on the selection of lubricants in those cases where no specific lubrication instructions can be obtained from the equipment manufacturers.

Although the manual has been prepared having in mind the maintenance of woodworking equipment, it might also prove to be a useful guide in the lubrication of general type of equipment.

Pietro Borretti
Coordinator
UNDP/UNIDO Integrated
Woodworking Project

Thongleua Southavilay
Deputy Director of
Forest Department

Khamtanh Chanthala
Director of
University & Technical
Education Department

Vientiane, October 1979

ກົດ ລະຫວ່າງໝາຍຂອງນໍ້າມັນ
Lubricant Code & Symbol

ລະດັບທຽບເທົ່າຕ່າງໆຂອງນໍ້າມັນເຄື່ອງ
Equivalent Lubricant Grades



ນໍ້າມັນເປືອງເກັຽຕົວໝອນ
(Worm Gear Oil)

1. Shell Macoma 82
2. Mobil 600W Cylinder Oil
3. BP Energol AC 600-C
4. Esso Cylesso TK 140
5. Castrol Cresta Va
6. Caltex Meropa Lubricant No. 6

ຄຸນສົມບັດລະລຶກຈະນະຂອງນໍ້າມັນເຄື່ອງ

Lubricant Description & Properties

໑. ນໍ້າມັນສຳລັບເປືອງເກັຽຕົວໝອນ ຈຸງ ໃນການອຸດສາຫະກຳ ສາມາດຫຼີກຖີ່ ການກົດດັນຊູງ
໒. ຄວາມຊຸ່ນ: 140-180 SSV @ 210° F
໓. ມີສ່ວນປະກອບໄອມັນສິດ ແຕ່ ໕ ຫາ ໑໐%

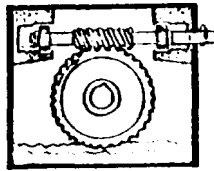
1. A high quality industrial gear oil capable of withstanding extreme pressure conditions
2. Viscosity : 140 - 180 SSV @ 210° F
3. Contains 5 to 10% animal fat

ນໍ້າມັນໃຊ້ສຳລັບ :

Lubricant to be used for :

໑. ເປືອງເກັຽຕົວໝອນ

1. Enclosed worm gears



ການລີ້ນເປືອງເກັຽຕົວໝອນ
Enclosed worm
Gear Lubrication

ບົດທີ ໑

ການລີ້ນເປືອງເກັຽຕົວໝອນ

ອຸດສາຫະກຳໄນ

ອີງຕາມ

TOPIC 1

Selection of oil

ກົດລະບຽບ

໐: 1
ໝາ ໔

ກົດ ແລະ ເຄື່ອງໝາຍຂອງນໍ້າມັນ
Lubricant Code & Symbol

ລະດັບໜຽບເທົ່າຕ່າງໆຂອງນໍ້າມັນ
Equivalent Lubricant Grades



ນໍ້າມັນໜຽວສໍາຫລັບເມັດຂັບ
(Gear Grease)

1. Shell Simia Grease 'O'
2. Mobil Grease 480
3. BP Energrease HTO
4. Esso Deacon EP 1
5. Castrol Impervia KMO Grease
6. Caltex Marfak No. 0

ຄຸນສົມບັດແລະລັກຊະນະຂອງນໍ້າມັນໜຽວ

Lubricant Description & Properties

໑. ນໍ້າມັນໜຽວມີລັກຊະນະຍູນ ແລະຄຸນນະ
ພາບສູງ ເຄື່ອງລັກຊະນະຍູນ ເປັນນໍ້າ
ແລະໜຽວຫລືວ່າມີຄວາມຊຸນ "0"

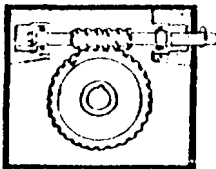
1. A high quality long fibre
soda soap grease of semi-
fluid or '0' consistency

ນໍ້າມັນໜຽວໃຊ້ສໍາຫລັບ :

Lubricant to be used for :

໑. ເມັດຂັບຂັບແອັດໝາກກາຍ
໒. ເມັດຂັບຂັບຕົວໝາກກາຍ

1. Enclosed spur gears
2. Enclosed worm gears



ເມັດຂັບຂັບຕົວໝາກກາຍ
Enclosed Worm gears



ເມັດຂັບຂັບແອັດໝາກກາຍ
Enclosed Spur gears

ບົດທີ ໓

ການເລືອກນໍ້າມັນໜຽວ

TOPIC 3

Selection of Grease

ຄຸນສາດຕະກຳໄມ້

ມິດຮຽນ

ອົງການ

໑. 1
໒. ໒

ກົດ ແລະເຄື່ອງໝາຍຂອງນໍ້າມັນເຄື່ອງ
Lubricant Code & Symbol

ລະດັບທຽບເທົ່າຕ່າງໆຂອງນໍ້າມັນເຄື່ອງ
Equivalent Lubricant Grades



ນໍ້າມັນເຄື່ອງສໍາລັບແກນເມົາ
(Spindle Oil)

1. Shell Tellus Oil 15
2. Mobil Velocite Oil 6
3. BP Energol HLP 40
4. Esso Spinesso 34
5. Castrol Hyspin 34
6. Caltex Spindura AA

ຄຸນສົມບັດ ແລະລັກຊະນະຂອງນໍ້າມັນເຄື່ອງ

Lubricant Description & Properties

໑. ນໍ້າມັນເຄື່ອງທີ່ມີຄຸນນະພາບດີ
໒. ຄວາມຊຸມ : 60-70 SSV @ 100° F
໓. ມີເຄມີປ້ອງກັນຂັ້ນຮຽງ ແລະປ້ອງກັນການເກີດເປັນມັນ ແລະເປັນຢາງ

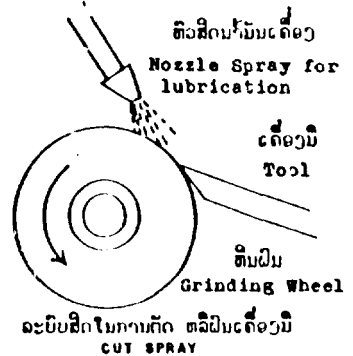
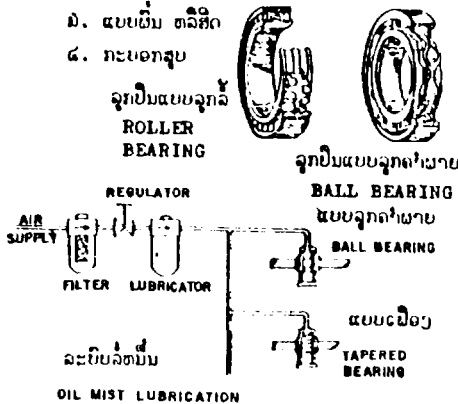
1. A good quality mineral oil
2. Viscosity : 60 - 70 SSV @ 100° F
3. Contains oxidation inhibitors to prevent gum and varnish formation

ນໍ້າມັນເຄື່ອງໃຊ້ສໍາຫລັບ :

Lubricant to be used for :

໑. ຈຸກປິນແບບລູກລໍ່າພາຍ ແລະແບບລູກລໍ່າປືນສູງກວ່າ 4000 ຮ/ນາທີ
໒. ລະບົບລໍ່າມັນ
໓. ແບບມັນ ຫລືສິດ
໔. ກະບອກລຸບ

1. Ball & roller bearings over 4000 RPM
2. Oil Mist Lubrication
3. Cut spray
4. Air Cylinder



ບົດທີ ໑

ການເລືອກນໍ້າມັນເຄື່ອງ

ຈຸດສາຫະກຳໄມ້

ອົງການ

TOPIC 1

Selection of oil

ບົດຮຽນ

ຫນ້າ ໑

ກົດ ແລະ ເຄື່ອງໝາຍຂອງນ້ຳມັນເຄື່ອງ
Lubrication Code & Symbol

ລະດັບໜຽບເໝັດກ່າວຂອງນ້ຳມັນເຄື່ອງ
Equivalent Lubricant Grades



ນ້ຳມັນເຄື່ອງລົ່ມໜ່ວຍ
(Lubricating Oil)

1. Shell Tellus Oil 33
2. Mobil Vactra Oil Heavy Medium
3. BP Energol HLP 100
4. Esso Teresso 52
5. Castrol Hyspin 100
6. Caltex Regal Oil PC

ຄຸນສົມບັດແລະລັກຊະນະນ້ຳມັນເຄື່ອງ

Lubricant Description & Properties

໑. ນ້ຳມັນຊະນິດທີ່ມີທາດແອດີສຳລັບລະບົບຕວກບິນ
໒. ຄວາມຊຸນ : 290-300 SSU, 100° F
໓. ມີສານເຄມີເພື່ອປ້ອງກັນການເກີດເປັນມັນ ແລະ ເປັນຢາງ

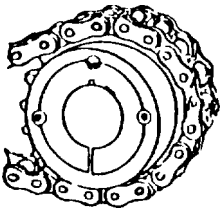
1. A good quality turbine type mineral oil
2. Viscosity : 290 - 300 SSU @ 100° F
3. Contains oxidation inhibitors to prevent gum and varnish formation

ນ້ຳມັນເຄື່ອງໃຊ້ສຳລັບ :

Lubricant to be used for :

໑. ລູກປືນແບບເປັນຕ້ອນ ແລະ ລູກຄຳຜາຍ ປືນຕ່ຳກວ່າ 4000 ຮ/ນຕ
໒. ແບບປ່ອກປືນຕ່ຳກວ່າ 400 ຮ/ນຕ
໓. ແຂວໄສ້
໔. ຈຸດທີ່ມີການສຽດສີ່ດ່າງ

1. Ball & roller bearings under 4000 RPM
2. Plain bearings under 400 RPM
3. Roller Chains
4. Friction points, ways, slides, etc.



ແຂວໄສ້
Roller chain



ແບບລູກຄຳຜາຍ
Ball bearing



ແບບລູກລໍ້
Roller bearing



ລູກປືນແບບປ່ອກ
Plain bearing

ບົດທີ ໑

ການເລືອກນ້ຳມັນເຄື່ອງ

TOPIC 1

Selection of oil

ຈຸດສາທະກຳໄມ້

ບົດຮຽນ

ອີງຕາມ

໑. 1

ໜ້າ ໒

ກົດ ແລະເຄື່ອງໝາຍຂອງນໍ້າມັນເຄື່ອງ
Lubricant code & Symbol

ລະດັບທຽບເທົ່າຕ່າງໆຂອງນໍ້າມັນເຄື່ອງ
Equivalent Lubricant Grades



ນໍ້າມັນເຄື່ອງໃຊ້ທົ່ວໄປ
(GENERAL PURPOSE OIL)

1. Shell Tellus Oil 33
2. Mobil Vactra Oil (Heavy Medium)
3. BP Energol EM 125
4. Esso Coray 50
5. Castrol Magna ED
6. Caltex Aleph Oil

ຄຸນສົມບັດ ແລະລັກຊະນະຂອງນໍ້າມັນເຄື່ອງ

Lubricant Description & Properties

໑. ຖ້າຫາກໃຊ້ເຄື່ອງຈັກເຮັດວຽກໃນເວລາຍາວນານ ບໍ່ຈຳເປັນຈະໃຊ້ນໍ້າມັນເຄື່ອງທີ່ມີຫາດແຮ, ໃຊ້ນໍ້າມັນເຄື່ອງທຳມະດາກໍໄດ້
໒. ຄວາມຊຸມ: 290-330 SSU @100° F

1. A straight mineral oil where long periods of continued use is not required and an inexpensive oil is desired
2. Viscosity : 290 - 330 SSU @ 100° F

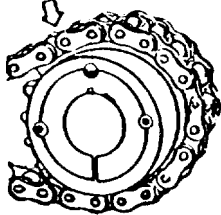
ນໍ້າມັນໃຊ້ສຳຫລັບ :

Lubricant to be used for :

໑. ແຂວໂສ້
໒. ຈຸດທີ່ມີການສຽດສື່ຕ່າງໆ

1. Roller chains
2. Friction points, ways, slides, etc.

ການລໍ່ລືມ
LUBRICANT



ແຂວໂສ້
ROLLER CHAIN

ບົດທີ ໑

TOPIC 1

ການເລືອກນໍ້າມັນເຄື່ອງ

Selection of oil

ຈຸດສາທະນາໂມ້

ບົດຮຽນ

ອົງດາມ

໑. 1
໓. ໓

ກົດແລະເຄື່ອງໝາຍຂອງນ້ຳມັນ
Lubricant Code & Symbol

ລະດັບທຽບເທົ່າຕ່າງໆຂອງນ້ຳມັນ
Equivalent Lubricant Grades



ນ້ຳມັນໂຮໂຊລິກ
(Hydraulic Oil)

1. Shell Tellus Oil 27
2. Mobil D.T.E Oil Light
3. BP Energol HLP 65
4. Esso Terresso 43/WUTO H44
5. Castrol Hyspin 70
6. Caltex Rando Oil A

ຄຸນສົມບັດແລະລັກສະນະຂອງນ້ຳມັນ

Lubricant Description & Properties

໑. ມີຄຸນນະພາບ ໂຮໂຊລິກສູງ
໒. ຄວາມຊຸມ: 140-160 SSU @ 100 °F
ລະດັບຄວາມຊຸມສູງນີ້ມີຄວາມຈຳເປັນທີ່ສຸດ
໓. ມີສ່ວນປະກອບເຄມີສູງຊຶ່ງຢັ້ງຢືນການເຮັດໜັງ
໔. ຫຼີກການເກີດເປັນອຸນຫະພູມ ມີສານເຄມີ
ປ້ອງກັນອຸນຫະພູມ

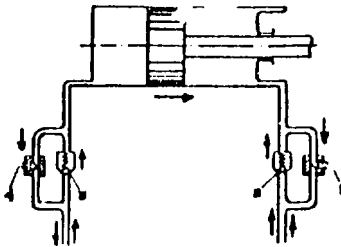
1. A high quality hydraulic oil
2. Viscosity: 140-160 SSU @ 100 °F
A high viscosity index is essential
3. High Chemical stability -
contains anti-oxidation agents
4. Foam resistance - contains
anti-foam agents

ນ້ຳມັນທີ່ໃຊ້ສຳຫລັບ :

Lubricant to be used for :

ລະບົບໂຮໂຊລິກທີ່ມີຄວາມກົດດັນຕ່ຳ

Low pressure hydraulic systems



ຈັງຫວະເດີນໜ້າແລະຖອນສິ່ງຂອງລະບົບໂຮໂຊລິກ

FORWARD & REVERSE STROKE
HYDRAULIC SYSTEM

ບົດທີ ໒
TOPIC 2

ການເລືອກນ້ຳມັນ ໂຮໂຊລິກ
Selection of hydraulic oil

ຄຸນສາທະກຳໄມ
ບົດຮຽນ

ອີງຕາມ
໑. 1
ໜ້າ ໔

ກີດ ແລະ ເຄື່ອງໝາຍຂອງນໍ້າມັນ
Lubricant Code & Symbol

ລະດັບທຽບເທົ່າຕ່າງໆຂອງນໍ້າມັນ
Equivalent Lubricant Grades



ນໍ້າມັນໝຽວສໍາຫລັບລູກປືນ
Bearing grease

1. Shell Alvania Grease 2
2. Mobilux grease 2
3. BP Energrease LS2
4. Esso Multi-purpose Grease H
5. Castrol spherol APL Grease
6. Caltex Marfak Multi-purpose

ຄຸນສົມບັດແລະລັກຊະນະຂອງນໍ້າມັນໝຽວ

Lubricant Description & Properties

໑. ມີຄຸນນະພາບສູງທົນທານຕໍ່ນໍ້າໄດ້ດີ ແລະມີຄຸນສົມບັດຫລາຍຢ່າງ
໒. ນໍ້າມັນໝຽວປະກອບດ້ວຍທາດລີຕີອອມ ມີຄວາມຊຸນ ນໍ້າໄບ ໒

1. A high quality water-resistant multi-purpose grease
2. A lithium soap grease of No. 2 consistency

ນໍ້າມັນໝຽວໃຊ້ສໍາຫລັບ :

Lubricant to be used for :

໑. ລູກປືນຊະນິດລູກຄໍາຜາຍແລະລູກລີ້ປື້ນ ຕົວກວ່າ ໔໐໐໐ ຮ/ນຫ
໒. ແບບໃຊ້ປອກຄັດ
໓. ກຽວແລະເລືອງເຄື່ອງຕັ້ງຕົວໄດ້ຖືກຊຸມທໍ ຫລືປິດບັງ

1. Ball & roller bearings over 4000 RPM
2. Plain bearings
3. Exposed screws & gears



ລູກປືນແບບລູກຄໍາຜາຍ
BALL BEARING



ລູກປືນແບບລູກລີ້
ROLLER BEARING



ເລືອງເຄື່ອງຕັ້ງແຂວງ
SPUR GEAR & PINION



ລູກປືນແບບໃຊ້ປອກຄັດ
PLAIN BEARING

ບົດທີ ໓

ການເລືອກນໍ້າມັນໝຽວ

ຄຸນສາທະກຳນໍ້າມັນ

ອົງຕາມ

TOPIC 3

Selection of grease

ບົດຮຽນ

໑ - 1
ຫມາ ກ

ກົດ ແລະ ຕິດຂອງໝາຍຂອງນໍ້າມັນ
Lubricant Code & Symbol

ລະດັບທຽບເທົ່າຕ່າງໆຂອງນໍ້າມັນ
Equivalent lubricant grades



ນໍ້າມັນໝຽວ
(General Purpose Grease)

1. Shell Alvania Grease 3
2. Mobilux Grease 2
3. BP Energrease LS 2
4. Esso Fibrax 280
5. Castrol spherol S Grease
6. Caltex Marfak 2 HD

ຄຸນສົມບັດແລະລັກຊະນະຂອງນໍ້າມັນໝຽວ

Lubricant Description & Properties

໑. ນໍ້າມັນໝຽວທີ່ໃຊ້ລົງໃນເຄື່ອງມືຄຸນນະພາບສູງ ໃນການຕາມຫາມນໍ້າ
໒. ນໍ້າມັນໝຽວທີ່ມີຄວາມຈຸນດີ ລະຫວ່າງ ເວລາ ໒ ຫາ ໓

1. A high quality water-resistant multi-purpose grease
2. A fibrous type grease between Nos. 2 & 3 consistency

ນໍ້າມັນໝຽວໃຊ້ສໍາຫລັບ :

Lubricant to be used for :

໑. ຈຸກປົນຊະນິດຈຸກຄໍາຜາຍແລະຈຸກລີ້ປົນ ບໍ່ເກີນ ໔໐໐໐ ຮ/ນາ
໒. ແບບໃຊ້ປອກ
໓. ກຽວແລະເມືອງກຽວທີ່ບໍ່ໂຕກຸມ

1. Ball and roller bearings under 4000 RPM
2. Plain bearings
3. Exposed screws & gears



ຈຸກປົນແບບຈຸກຄໍາຜາຍ
Ball Bearing



ຈຸກປົນແບບຈຸກລີ້
Roller Bearing



ເມືອງເຄັກຽວແຂ້ວໝາຕາຍ
Spur gear and pinion



ຈຸກປົນແບບໃຊ້ປອກ
Plain Bearing

123

ບົດທີ ໓

ການເລືອກນໍ້າມັນໝຽວ

ຈຸດສາຫະກຳໄມ້

ອີງຕາມ

TOPIC 3

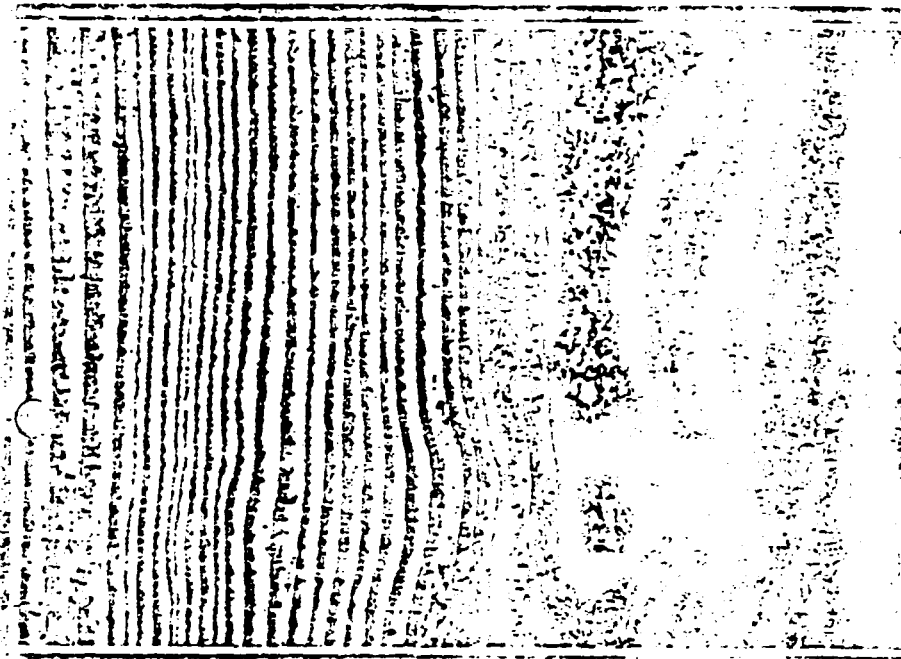
Selection of grease

ບົດຮຽນ

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ANNEX IX - APPENDIX III

COSTING PROCEDURES



INDUSTRIAL
TRAINING AIDS IN
WOODWORKING INDUSTRY

REF. TA/1/02

MAY 1980.

COSTING AND ESTIMATING
OF WOOD PRODUCTS

BY PIETRO BORRETTI
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ESTIMATING AND COSTING OF WOOD PRODUCTS

Introduction

Regardless of size, every furniture manufacturer should have an adequate cost accounting system, with adequate means for determining material and labour cost and overheads set up in such a way that basic cost data will be accumulated for ready reference in setting wage payment, bonus and other incentives, comparative cost of production runs, and to provide a sound basis for estimating new jobs and pricing new products.

The primary objective of any production cost accounting system is to establish accurate data for control of the business. Accurate cost must be determined to establish a selling price, or to determine the amount of profit that is possible (or loss that is probable) from a furniture product whose selling price is set by competition or consumer demand.

The job order cost accounting is easy to understand and operate and it gives a complete record of all costs that are charged to each job. Direct labour is usually reported by job orders on time sheets. Consumption and cost of direct material for each production order is reported on bill of materials. Both direct labour and direct materials costs are then accumulated on a manufacturing cost sheet. Overhead, or burden, is usually applied to each production order at a percentage of the direct labour.

Estimating for manufactured wood products calls for a close study of the material used and the types of labour and machines available. Efficient estimating demands a knowledge not only of machining operations involved in the article to be produced, but also a knowledge of all the operations possible on the individual machines in order to be able to select alternative methods on the basis of cost saving.

Objectives of Estimating

1. Estimating is a special type of forecasting with the prospective cost of manufacturing. The main objective of the estimating function is to arrive at "Pre-established Cost" which are referred as "Cost Estimates" or as "Cost Standards". The distinction between the two consists in the degree of effort which goes into their determination.
2. "Cost Estimates" are generally the result of the estimator's projections based on past experience and a minimum amount of product and process specifications. This is especially the case of Non-Standard Furniture to be made in limited quantities to customer's Order, in which instance the cost preparing detailed product and process specifications would be prohibitive.
3. The term "Standard Costs", on the other hand, usually refers to a set of pre-established costs which have been arrived at by means of a thorough study of maximum utilization of materials, of time motion studies, of labour operations, and of equipment.
4. For the purpose of this Manual, the term "Estimated Cost" has been adopted together with the term "Actual Cost" which refers to the cost of products accumulated at the completion of the manufacturing process. Here the term "Estimated Cost" is taken to stretch to the purpose of "Standard Cost" as well.
5. Cost Estimating is basically the computation of Direct Material, Direct Labour and Overhead Costs for a particular Order or product. In practice, however, Standard Furniture ^{1/} also calls for an analysis of specifications, determination of parts to buy and parts to make, consideration of batch quantity to be produced and the competitive situation. In fact, under competitive conditions, estimating goes beyond mere Cost Estimating and extends into product design and processing alternatives in order that competitive prices may be offered.

^{1/} Standard Furniture

made for stock in batch quantity.

The basic manual on Estimating and Costing of Wood Products was prepared for the Regional Technonet Asia/UNIDO Seminar on the Woodworking Industry held at Bangkok, in April 1979. Two Papua New Guineans entrepreneurs took part in the Seminar.

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the estimator shall have to determine how a product can be made within a predetermined cost. The design of new Standard Products and their quality standards shall be set in accordance to the expected selling price. Should production costs exceed expectation, serious loss could result even when sales are satisfactory.

5. For Non Standard Furniture 2/, it is necessary to estimate costs ahead of time in order to set prices because price bids must be submitted to customers before getting Orders. In fact, 'Sales Orders' for Non Standard Furniture are seldom placed unless a price is quoted. When a 'Sales Offer' is accepted by the customer, the price is already set and the company profit or loss depends on whether the actual costs run below or above the estimate.

Estimating Procedure

7. The first criteria to determine pre-established costs, when first introducing new Standard Furniture or estimating for Non Standard Furniture, depends heavily on past experience. For this purpose it is important that records be kept on past performance of costs of existing products. Whenever possible a tabulation should be maintained of cost of past periods broken-down by elements, processes and products. Basic records to this respect include 'Operation Sheets', 'Bill of Materials' and 'Cost Sheets' related to products similar to proposed new furniture items.
8. If cost records of past operations are not sufficient to provide basis for determination of Estimated Costs, then the procedure shall consist of relating systematically Direct Materials and Labour to processes applying the current prices. Whenever practicable and economically feasible, assistance shall be sought to make time and motion studies of labour tasks.
9. A thoroughly and methodical Estimated Cost is imperative when studying the possibility of launching new products involving the purchasing of expensive specialised equipment.

2/ Non-Standard Furniture
(or custom-made furniture)
made to specific customer's requirement.

This will serve to determine whether the anticipated machine load for the new product is substantial enough to justify investment. Similarly, detailed estimating studies should be carried out for large contract jobs for Non-Standard Furniture.

10. Periodic examination should be made of Estimated Costs of Standard Furniture. If materials, prices, and overhead costs have changed substantially, pre-established costs shall be revised. Revisions shall be made if the accuracy of established standards has proved incorrect or if production techniques have changed to make existing standard inappropriate.
11. Estimated Costs of a given Standard Product will generally increase in accuracy after several batches have been manufactured, until they will reflect with high approximation the true cost of producing the product. Because of this, the estimates will be increasingly useful in the control of Actual Costs and in planning future production and selling policies.

Relationship between Estimating and Actual Costing

12. While product estimating is concerned with the anticipated cost of products, product costing (actual cost) consists of accumulating and studying the Actual Cost incurred in the manufacture of the product. If the actual cost of the product is rising compared to Estimating Cost, detailed cost information may indicate poor production planning, excessive wastage of material or machine, time etc.

Responsibility for Estimating & Costing

13. In large plants, estimating is either assigned to a special department or is a part of the Engineering Department. In small plants however, estimating shall be conducted under the responsibility of the Production Supervisor working closely together with the Foremen and the Accounts. Because estimating of new Standard Furniture is closely related with Sales forecast close co-operation is also required between Production, Sales and top management.

14. With the exception of pre-determined overheads, practically all data needed to arrive at the "Estimated Cost Sheet", prepared by the Accounts, are supplied by the Production Supervisor. Again, the Actual Cost incurred in the manufacturing of products is accumulated by the Accounts on the 'Cost Sheet' with the relevant data on actual cost of material and labour provided by the Production Department.

"Estimated Cost" Reference

15. When estimating new Standard Products the following documents covering, product and process specifications shall be prepared by the Production Department:
- a) Various types of drawings as required.
 - b) 'Bill of Materials' showing breakdown of Estimated Costs and quantity of materials required.
 - c) 'Operation Sheets' showing estimated processing times of various tasks, that is, machining, assembly, upholstery and finishing.
16. For Non-Standard Furniture, the item above shall usually be omitted-unless the Order is of substantial volume-and replaced by a plain tabulation of man-days requirements estimated on past experience.

"Actual Costs" Reference

17. Reference in determining Actual Costs of given Standard and Non-Standard Products consists of:
- a) 'Bill of Materials' showing break-down of quantities and costs of materials actually issued from the stores.
 - b) 'Day Rate-Labour Schedule & Report' showing the time spent on the job by Day Rate Workers.
 - c) 'Job Assignment' showing cost of Price-Rate and sub-contract work.
 - d) 'Sales/Production Order' 1-2 copy of the storekeeping showing quantity of semi-completed Standard Furniture issued for further processing of customer's requirements.

18. Cost data derived from the above documents will be accumulated on the "Actual" column of the 'Cost Sheet' together with various overhead charges.

Elements of Cost

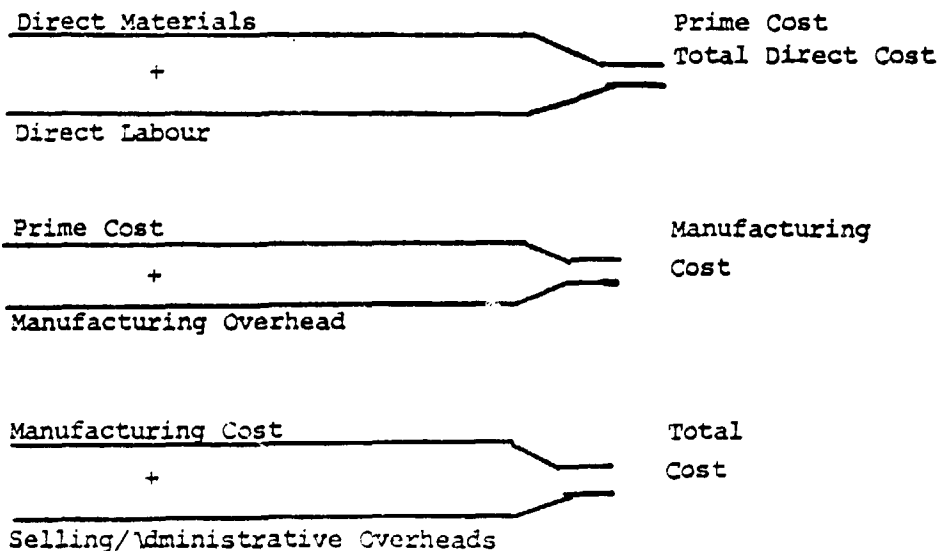
19. Objectives & Classification of Cost Elements:

- a) Enables management to know the different types of cost by elements that have entered into the Finished Products.
- b) Serves as basis for meaningful comparison.
- c) Useful for purpose of cost analysis and reporting.
- d) Provides proper classification of cost items in the 'Cost Sheet'.

For the purpose of this Manual the total cost is divided in four elements :

- a) Direct Materials
- b) Direct Labour & direct expenses (Sub-contract equipment tool hire etc).
- c) Manufacturing Overheads
- d) Selling and Administrative Overheads and Distribution.

The elements are listed in the above sequence on the 'Cost Sheet' and their costing relationship is presented diagrammatically as follows:





Direct Materials

11. Direct materials comprise of all materials which become an integral and permanent part of the Finished Product. For the furniture industry, Direct Materials can be classified as follows:

- 1) High grade Wood
- 2) Other Timber (includes all types and sizes of timber other than teak wood)
- 3) Veneers
- 4) Composite Board (plywood, block board, chip board etc.)
- 5) Plastic Laminates
- 6) Fittings (brass, mirrors, handles, hinges, castors etc.)
- 7) Finishes (lacquer, shellac, varnish etc.)
- 8) Glues
- 9) Upholstery Cover (cotton, vinyl, leather etc.)
- 10) Upholstery Fillings and Foams (cotton, rubber and plastic foams, hair and rubberised hair etc.)
- 11) Upholstery Spring and Webbing (metal, rubber or plastic springs).
- 12) Purchased Component Parts (ref. paragraph 01.1.2-3)
- 13) Semi-Finished Goods from Stores
- 14) Others (all other Direct Materials not classified in the above list).

Foot Notes

- 1/ PRODUCTION ORDER is issued to replenish stock of Standard Furniture
- 2/ SALES/PRODUCTION ORDER is issued for Non-Standard Furniture (Custom-made Furniture) to be made on customer's requirements.

Direct Labour

22. This element refers to the Cost of Direct Labour, that is, all workers directly involved in the manufacturing process (refer paragraph 41) Direct Labour is classified according to the various processing tasks as follows:

- 1) Machining
- 2) Assembly
- 3) Finishing
- 4) Upholstering
- 5) Metal Work
- 6) Factory Sub-contracting (refer paragraph 52)

Overheads

23. The term "Overheads" or "Burden" are used to refer to the many types of Manufacturing, Selling and Administrative Costs which unlike Direct Materials and Direct Labour are not directly related to manufacturing processes.

In order that the products manufactured may absorb the Overhead Costs, these are charged to individual 'Cost Sheets' on the basis of pre-determined rates. (ref. par. 28.29.30.)

Overhead Cost are divided into two categories : Manufacturing Overhead and Selling and Administrative Overhead.

Manufacturing Overhead

24. This category refers to costs involved in production activities. Small plant must recognise the significance of Manufacturing Overhead Costs and the importance of keeping a tight control over them. Plant Foremen are inclined to be conscious of the control of Overhead Costs (use of Indirect Labour, tools and other supplies). The accounting system should provide cost figures which show the accumulation of these costs.

25. Manufacturing Overheads can be classified as follows:

Indirect Materials (refer paragraph 36 - 37)

- 1) Supplementary Material Cost
- 2) Consumable Tools Cost
- 3) General Supplies

Indirect Labour (ref. par.)

- 1) Salary and Indirect Wages
- 2) Medical and Annual Leave
- 3) Payroll Tax, Provident Funds
- 4) Bonuses and Allowances

Factory Expenses

- 1) Factory Rent
- 2) Factory Repairs and Maintenance
- 3) Power, Lights and Water Rates
- 4) Insurance (fire, Workmen Compensation etc.)
- 5) Depreciation (factory building, plant, equipment etc.)
- 6) Other Expenses

Selling and Administrative Overheads

26. The fourth element of cost classification is the Selling and Administrative Overheads. The costing procedure is similar to that of the Manufacturing Overheads (ref. par. 28. 29. 30.)

27. This element of cost can be classified as follows:

- 1) Salary and Wages of Selling and Administrative Personnel
- 2) Bonuses and Allowances
- 3) Medical and Annual Leave
- 4) Payroll Tax and Provident Funds
- 5) Delivery Expenses
- 6) Advertising and Publicity Expenses
- 7) Sales Commission
- 8) Loss and Bad Debts
- 9) Travelling and Entertainments
- 10) Discounts Allowed
- 11) Insurance (fire, vehicles, etc.)
- 12) Printing and Stationery
- 13) Telephone, Telegram and Postage
- 14) Audit, Secretarial and Legal Fees
- 15) Bank Charges and Commission
- 16) Depreciation (building, vehicles, equipment etc.)
- 17) Tax and Assessments
- 18) Other Expenses

Calculation of Overhead Rates

28. There are many methods for the recovery of Overhead Costs and the most appropriate ones should be determined according to the requirements of each individual plant.

29. The Direct-Labour Cost method has gained wide popularity because of its simplicity. It is generally adopted by Labour-intensive small plants where labour constitutes a constant and large proportion of the fixed cost of the product. In the Direct-Labour Cost method the overhead is charged to the product as a percentage of the Direct-Labour Cost.

30. The various steps necessary in the calculation of the overheads are shown in the following example :

- 1) The following costs are obtained from the accounting records of the previous year.
 - Manufacturing Overhead (par. 24 - 25.)
for 12 monthsK 8,000
 - Selling and Administrative Overhead (par. 26-27)
for 12 monthsK 5,000
 - Direct-Labour (par. 22)
for 12 monthsK14,000

2) The percentage rate of Overhead costs to Direct Labour cost is then obtained :

- Ratio of Manufacturing Overhead to
Direct Labour Cost = $\frac{8,000}{14,000} \times 100\% = 57.14\%$
- Ratio of Selling and Administrative Overhead to Direct
Labour Cost = $\frac{5,000}{14,000} \times 100\% = 35.71\%$

31. Finally the above percentage rates will be applied in the cost Sheet of each particular product as follows:

Assumed that the Direct Labour cost of a given product is K 10, then its share of Manufacturing overhead will be equal to the 57% of K 10. While its share of Selling and Administrative overhead will be equal to the 36% of K10.

MATERIAL CONTROL

Material Classification

32. Materials may be grouped according to their nature, use or condition within the following classes :

- 1) Direct Materials
- 2) Indirect Materials
- 3) Work-in-Progress
- 4) Finished Goods

Direct Materials

33. Direct Materials comprise of all materials which become an integral and permanent part of the finished product. This class can be sub-divided into :

- 1) Raw Materials
- 2) Component Parts

34. Raw Materials include materials such as timber, finished materials and upholstery materials which are purchased to be converted into component parts, finally, into finished products.

35. Component Parts, that is, parts of finished products, can be purchased direct from the vendor (Purchased Parts) in completed form, e.g. moulded plywood parts, swivel bases for office chairs, etc. Alternatively, they are produced in the plant from raw materials.

36. Usage of Direct Materials is related to specific 'Sales/ Production Orders' and their cost is charged in its entirety to the relevant 'Cost Sheet'. (Appendix 03).

Indirect Materials

37. Indirect Materials (also known as Supplies or Expense Materials) include all materials other than Direct Materials. This class can be sub-divided into.

1) Supplementary Materials

Various materials which are used on the product but do not become a substantial or permanent part of it, such as nails, paint, diluents, screws, sanding paper etc.

2) Consumable Tools

Materials which are used in connection with the operation of production and maintenance equipment, or materials other than direct used in the production process. They include : cutting tools (saw blades, knives, drilling bits) grinding wheels, spare parts, lubricant oils, painting brushes, hand tools etc.

3) Factory General Supplies

Materials used for general operation of the factory such as kiln fuel and maintenance materials.

4) Selling and Administrative General Supplies

Materials used for general purpose not strictly related to plant operation, such as office supplies, vehicle fuels, prototypes and materials related to general delivery expenses.

38. Items (1), (2) and (3) are charged to 'Cost Sheets' on a percentage basis as part of the manufacturing overhead. (ref. 10-7-5). Item (4) is charged as part of the selling and administration overhead.

Work-in-Progress

39. Work-in-Progress (or Work-in-Process) include all materials, parts, sub-assemblies which are being processed or assembled into finished products. These items are actually undergoing productive operations or in temporary storage between processes.

Finished Goods

40. Finished goods comprised of products carried in stock in various degree of completion (such as semi-completed furniture ready without upholstery and/or finishing) and complete furniture ready for delivery to customers. They are items which have been manufactured by the company (Standard Furniture) or items purchased in completed conditions (e.g. Imported Goods) for the purpose of resale.

DIRECT LABOUR CONTROL

Personnel Classification

41. Personnel include all persons engaged in factory and office work. For costing and control purpose they are divided into three categories :

- i) Direct Labour
- ii) Indirect Labour
- iii) Administrative and Sales

This Manual is concerned only with the Control of Direct Labour, nevertheless a description of all three items is given because it is relevant to the computation of 'Cost Sheets'

Direct Labour

42. Direct Labour include all workers directly involved in the manufacturing process of materials into Finished Goods. It consists of workers such as Wood Machinist Assemblers, Finishers, Upholsterers, etc. The working time spent by Direct Labour is related to specific jobs and its cost is charged in its entirety to the relevant 'Cost Sheets.' Payment made to Direct Labour are known as Direct Wages (re. par. 10.7.3:).

Indirect Labour

43. Indirect Labour comprises of all factory personnel, who is not directly necessary in the manufacture of Finished Goods. This category include personnel such as Timber Yard and Shop Labourers, Dry Kiln Operators, Store Keepers, Maintenance Workers, Inspectors, Production Supervisors, Foremen, Draftsmen, etc. The working time spent by Indirect Labour cannot be charged to any particular job and is entered on 'Cost Sheets' on a percentage basis as part of the Manufacturing Overhead. Payments made to Indirect Labour are known as Indirect Wages and Salaries (ref. par. 24 - 25).

44. There are some workers who spend most of their time working directly on the product, and part of it as Indirect Labour on task such as maintenance, packing etc. In this case, it is necessary to split the total time and charge only the time spend on processing activities as Direct Wages.

Administration and Sales Personnel

45. This category include personnel concerned with management, selling or occupied in an executive or a clerical capacity such as Manager, Salesmen, Accounts Clerk etc.

The expenses related to this category of personnel are charged on the 'Cost Sheet' on a percentage basis as part of the Administrative and Selling Overheads (ref. par. 26 - 27).

Classification of Direct Labour

46. Wages are the earnings by employees for the performance of services.

Direct Labour is classified in two main groups according to wage systems :

- Day-Rate Labour
- Piece-Rate Labour

Day-Rate Labour

47. This is the most common method of compensation whereby employees are paid a definite wage-rate per hour or day regardless of their output. Wages, in this case, are equal to the product of an hourly rate times the number of hours worked.
48. There is very little incentive in this method of wages payment since the workers will be paid just as much for the time they are at work regardless of whether they work or merely idle about.
49. The use of time payment is satisfactory where close supervision is practical, as in small shops. It is generally recommended for machining operations where the rate of output is generally determined by the machine.

Piece-Rate Labour

50. This payment system compensates on the basis of output, that is, of units of work product. In this case, wages are equal to fixed rate per piece times the number of pieces produced.
51. The employee gains or loses in direct proportion to his performance, hence the incentive impetus is very strong. Piece-Rate payment is recommended for processing tasks such as Assembly Finish-in and Upholstery.

Factory Sub-Contractors

52. In addition to Piece-Rate Workers, who are individually employed by the company, there is another category of Piece-Rate employees typical of the wood-working industry of South East Asia. This category may be called Factory Sub-Contractors to whom the company assigns jobs on a Piece-Rate basis.
53. The Sub-Contractors employs his own group of workers to whom he distributes the jobs assigned to him by the company. The company has no control on the Sub-Contractors' workers. For the purpose of this Manual, it is assumed that Sub-Contract work is limited to the machining and assembly tasks of Non-Standard Furniture made to customer's requirements.
54. The peculiarity of this arrangement is that Sub-Contractors' work is carried out within the company's plant, making use of the company's equipment and with raw materials supplied by the company.

Combination Time-Piece Payment

55. A combination Time-Piece Payment may be adopted through Wage Incentive Systems whereby the rate of pay is based on the combination of time and output e.g. a guaranteed hourly rate plus a bonus ordinarily based on the amount of extra work put out (or time saved beyond a standard requirement).
56. Maximum employee efficiency is achieved where men are assigned a definite task for a given time and are stimulated financially by compensation according to their performance. Incentive plans are not discussed here as they fall outside the scope of this Manual.

ITEM:

STANDARD ITEM - 142 -

QTY.:

SPECIAL ITEM

ORDER NO.

CUSTOMER

DUE DATE

SALES/PRODUCTION ORDER NO. DATE

FORM NO UN/B 6-1-70

DIRECT MATERIALS		ESTIMATE			ACTUAL		
		Qty	Unit Cost	Total Cost	Qty.	Unit Cost	Total Cost
LUMBER	Teakwood						
	Other wood						
	Plywood						
	Other wood-board						
	Formica						
UPHOLSTERY MTLs.	Foam rubber						
	Other padding Mtls.						
	Covers (cotton, vinyl, leather)						
	Lining, Burlap, Buttons						
	Springs & other uph. hardware						
	Contact glue						
	Others						
ASSEMBLY MTLs.	Glue						
	Screws, Nails, Staples						
	Hinges						
	Locks						
	Pulls						
	Plastic & Rubber Fittings						
	Others						
FINISH MTLs.	Lacquer, Shellac, Varnish						
	Others						
MISCEL. MTLs.	Glass & Mirrors						
	Purchased Furniture Parts						
	Others						
METAL WORK MTLs.	Aluminium						
	Steel Tubing						
	Others						

TOTAL MATERIAL COST

DIRECT LABOUR	ESTIMATE		ACTUAL		TOTAL COST	EST.	ACTUAL
	Hours	Cost	Hours	Cost			
Machining					Material		
Assembly					Labour		
Finishing					Prime cost		
Upholstering					Fact. overhead		
Hand-Making					Factory cost		
Metal Work					Selling & admin. exp.		
					Total cost		
TOTAL LABOUR COST					SELLING PRICE		

DATE

LIGHT INDUSTRIES SERVICES ECONOMIC DEVELOPMENT BOARD

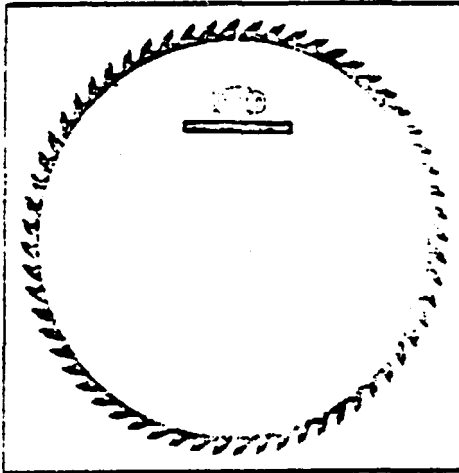
UNIDO WORK ORDER ASSIGNMENT 064-D/SIS

CARBIDE TIPPED SAWS
FOR PARTICLEBOARD

Art. No. Präzisions-Platten-Format-Kreissägeblatt
Precision Panel Sizing Saw Blade

11603

Disco de sierra de precision para el escuadrado de tableros



Für Rohspanplatten und furnierte Spanplatten.

Ausführung: LEUCODUR hartmetallbestückt. Wechselzahn großer Schneidanüberstand. Kreissägeblätter ab ≥ 400 mm werden mit Kühlelementen ausgeführt.

Die Ausrichtung und Anordnung der Kühlelemente ermöglicht das Schneiden großer Schnitt-höhen (ohne Kühlelemente).

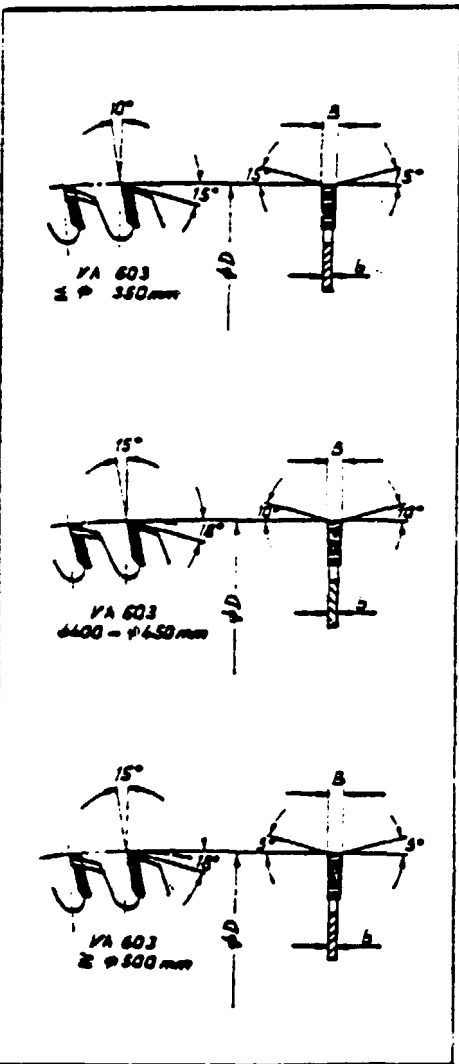
Anwendung: Zum Aufteilen und Formatschneiden von Spanplatten, einzeln oder in Paket, roh und furniert sowie Hartfaserplatten und Schicht-preßholz. Für den Einsatz zur Platten-Aufteil-sagen.

For raw and veneered chipboard.

Execution: LEUCODUR tungsten carbide-tipped. alternate top-bevel tooth, large tooth projection.

Saw Blades 400 mm dia. and over are furnished with cooling elements for large cutting heights (w/without cooling elements).

Applications: Dividing and sizing raw and veneered chipboard, single panels and stacks, hardboard and presswood. To be used in panel sizing saws.



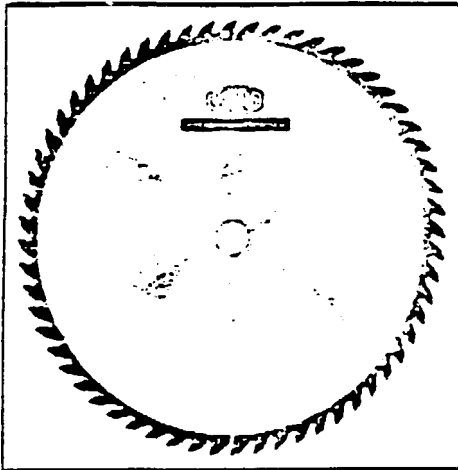
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001 157	300	4,4	2,8	60	60
001 158	350	4,4	2,8	30	72
056 680	350	4,4	2,8	60	72
056 681	350	4,4	2,8	75	72
001 159	350	4,4	2,8	80	72
001 160	400	4,4	2,8	30	72
056 682	400	4,4	2,8	60	72
160 919	400	4,4	2,8	75	72
001 161	400	4,4	2,8	80	72
162 673 *	430	4,4	2,8	80	72
001 163	430	4,4	2,8	80	72
018 138	450	4,4	2,8	80	72
163 971 *	450	4,8	3,8	60	66
018 139	500	4,4	3,0	80	60
056 684	500	4,4	3,0	85	60
162 475	550	4,8	3,2	80	60

Art. No.

Präzisions-Platten-Format-Kreissägeblatt
Precision Panel Sizing Saw Blade

11601

Disco de sierra de precisión para el escuadrado de tableros



Für Rohspanplatten und furnierte Spanplatten.

Ausführung: LEUCODUR hartmetallbestückt, Wechselzahn, großer Schneidenüberstand. Kreissägeblätter ab Ø 400 mm werden mit Kühlelementen ausgeführt.

Die Ausführung und Anordnung der Kühlelemente ermöglicht das Schneiden großer Schnitthöhen (± ohne Kühlelemente).

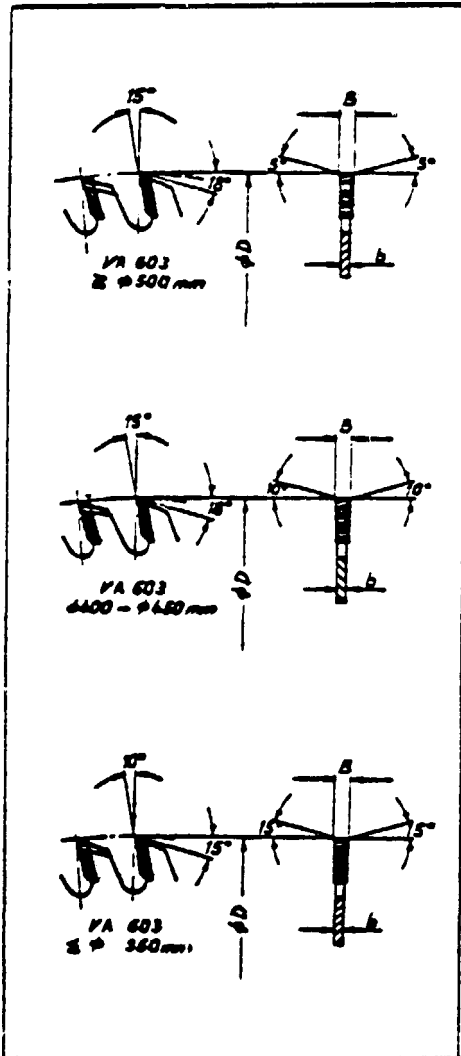
Anwendung: Zum Aufteilen und Formatschneiden von Spanplatten einzeln oder im Paket, roh und furniert sowie Hartfaserplatten und Schichtpreßholz. Für den Einsatz auf Platten-Aufteilsägen.

For raw and veneered chipboard.

Execution: LEUCODUR tungsten carbide-tipped, flat tooth, large tooth projection.

Saw Blades 400 mm dia. and over are furnished with cooling elements for large cutting heights (± without cooling elements).

Applications: Dividing and sizing of raw and veneered chipboard, single panels of stacks, hardboard and presswood. To be used in panel sizing saws.



Ident No.	Ø D mm	B mm	b mm	Ø d mm	Z
001 355	300	4,4	2,8	60	48
160 743	300	4,4	2,8	75	48
001 356	350	4,4	2,8	30	54
056 677	350	4,4	2,8	60	54
001 357	350	4,4	2,8	80	54
163 849	400	4,4	2,8	30	48
001 358	400	4,4	2,8	30	60
056 678	400	4,4	2,8	60	60
056 679	400	4,4	2,8	75	60
001 359	400	4,4	2,8	80	60
001 462	430	4,4	2,8	80	54
160 744	500	4,4	3,0	80	36
160 745	500	4,4	3,0	80	48
164 469	630	6,0	4,0	40	60
163 920	650	6,0	4,0	100	60

Cutting MDF and particleboard



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Cutting MDF and particleboard is different. It is different from cutting regular woods simply because these are man-made substances rather than naturally grown. It is important that we understand it is *different*. Over the years the industry has begun to think of the cutting of MDF and particleboard as more difficult than machining natural wood materials. This is simply not the case if tools are properly designed and maintained and if saw feeds and speeds are properly set for the cutting operations.

blade design for particleboard

The thing that makes one saw blade cut differently from another is the clearance angles designed on the cutting teeth. Clearance angles have an important effect on blade design and on its cutting characteristics. In cutting MDF and particleboard, high clearance angles are needed due to the abrasiveness of the resin binders used in these materials.

The resin binders tend to build up rapidly on cutting teeth resulting in dulling of the cutting edge and shorter tool life. Tool life can be increased by designing the proper tip-to-body clearance, O.D. clearance angles, side clearance angles and radial angle clearances into the blade when it

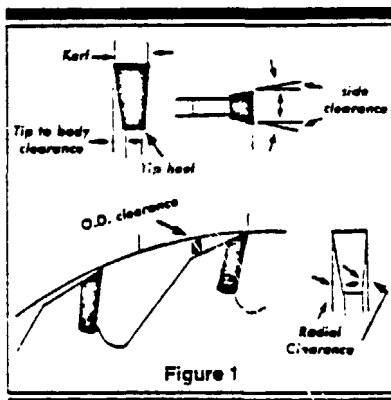


Figure 1

is built. All of these angles are described in Figure 1.

It is also important that these angles be properly maintained when the saw is serviced. It makes no sense to carefully design our critical clearance angles onto the cutting teeth of the saw blade only to have them changed when the blade is reconditioned. If the clearance angles are increased the productive life of the saw blade will be substantially reduced.

If, on the other hand, the clearance angles are decreased the resin binders will tend to build up rapidly on the cutting teeth and you will burn the material, leaving reject edges. This is why it is important that the company servicing your cutting tools has the know-how to do the job. If they don't you may get a lower price on the front end but you will wind up paying for it in poor tool life and rejected materials.

Tooth designs

The triple-chip grind design (Figure 2) will definitely give the best cutting tool life on abrasive MDF and particleboard. The reason: this tooth design is extremely blocky and, therefore, strong. This particular tooth style is particularly effective in boards of lesser density.

Some dense, hard materials are, however, so brittle that the rake tooth on the triple chip design nicks the edges of the material. This will also occur when the MDF or particleboard is covered with laminates or decorative paper coated with acrylic or melamine.

When this occurs an alternate face angle can be added to the rake teeth to provide a slicing or shearing action which will eliminate the side chipping (Figure 3). This design does somewhat change the style of the blade but is effective in improving side finishes.

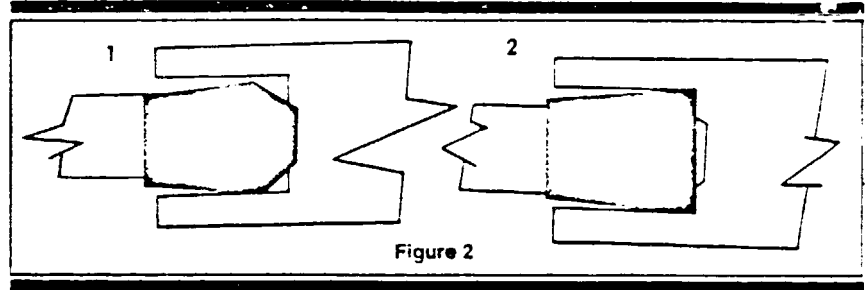
Some of the decorative finishes put on MDF and particleboard are so brittle that even the alternate face shear blades still result in some undesirable chipping. In these instances you will have to go to the alternate top bevel design (Figure 4). I recommend this blade only in those cases where chipping cannot be eliminated with alternate face shear because the alternate top bevel design can substantially reduce the cutting tool life between sharpenings and this can get fairly expensive.

There are, however, those in-

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stances where the tradeoff in order to get a smooth cut necessitates the application of the alternate top bevel saw blade. One thing that can be done to increase tool life on the alternate top bevel design is to include a raker tooth between each alternate top bevel combination. This combination, shown in Figure 4, will pro-



vide a finer finish with a reasonably extended tool life.

Blade design can sound rather complex. If your cutting tool supplier knows his business, however, he will

be able to supply you the proper blade to cut whatever material you're using.

You're probably cutting too slowly

Most manufacturers of MDF and particleboard are aware of the importance of properly designed cutting tools in their production process, but many are not aware of the fact that they can neutralize the positive effect of good cutting tools by feeding the material too slowly.

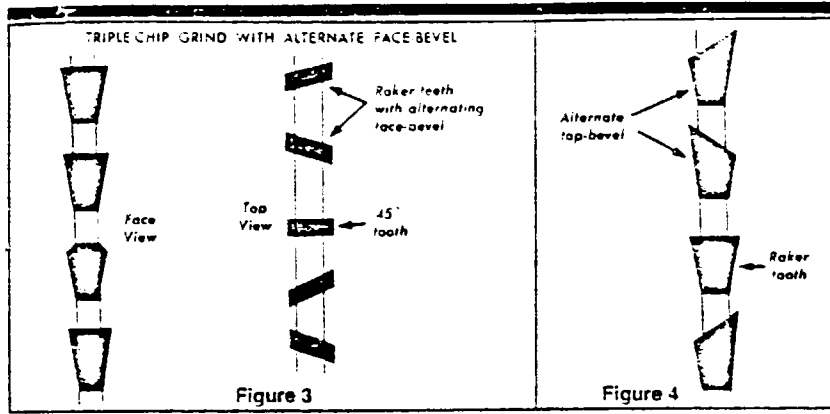
Many people have the impression that the slower the material is fed, the more the quality of the cut will improve. This simply is not true with many materials. Often slower feed rates will cause burning or glazing in the material.

Many times when cutting MDF or particleboard the cut edges are not important as they will be hidden in the material's final application. Even in these instances, however, a fuzzy, burred or glazed edge on the material is a good indication that you are getting shortened tool life.

Feeding MDF or particleboard too slowly into the cutters will not allow the cutting tool to take a proper bite. The result is that the tooth crushes and pushes the material out of the way rather than cutting it. When material is separated by being crushed and pushed away, it is moved by sheer force. That causes heat and pressure to build at the point of contact between the cutting tooth and the material.

Heat and pressure are the enemies of both the material and the cutting tools. In the material, heat and pressure cause fuzzing and glazing. In the tool, heat and pressure cause rapid tool wear. As the tool wears, it builds more heat and pressure, causing the disastrous cycle to accelerate.

Therefore, I stress that you should probably increase the feed rate at which you are now cutting your MDF or particleboard. Cutting tools are designed to cut—to bite into the material, to separate a chip, and to



efficiently and coolly remove it. So push your cutting tools. They will normally handle increased feed rates with ease. A chip load of 0.010" to 0.012" should be considered minimum for MDF and particleboard.

In most cases, these recommendations will not be necessary for the mills who are producing MDF and particleboard. They are generally running at rapid feed rates. But if you find that you're not running your material in the 0.010" to 0.015" chip-load-per-tooth range and getting excellent cuts and tool life something is wrong. Either the tools you are using are not properly designed and maintained to cut your material or you have simply fallen victim to the theory that "to cut slowly is to cut well."

I realize that in these recession times there is not a tremendous amount of pressure in most plants to increase material feed rates through the cutting operations. That is not the point. The point is that cutters need to be fed at certain rates to perform properly.

One of the things I do know is that during an economic slowdown you want to reduce costs. If you want to shape MDF and produce clean, smooth edges that require little if any sanding the trick is smooth-running cutter heads. That means they must not vibrate at all. They have to be perfectly balanced—no high teeth.

In insert knife heads, the knives and the gibs must be perfectly balanced to the head and to each other. Even though the heads, knives and gibs are balanced perfectly, you can eliminate all the benefits that effort will produce if the head is mounted on a worn-out or beat-up sleeve.

Properly balanced heads, knives and gibs running on good mounting sleeves can double the efficiency at which most plants run MDF and par-

ticelboard. We can say this with confidence because we are familiar with the feed rates of most users of MDF and particleboard.

With just a bit more attention to the cutting tools that machine those materials, a substantial increase in productivity could be normal operating procedure. Your cost will be further reduced because smooth cuts produced right on your machines require fewer secondary finishing operations. The saving in sandpaper alone due to good machining processes will more than offset your efforts. □

